

**Maricopa Association of Governments**

**ARIZONA**



**REGIONAL BIKEWAY  
MASTER PLAN**

2007



# MAG Regional Bikeway Master Plan

**2007**

Prepared for the  
**Maricopa Association of Governments**  
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3. All those who took time to contribute their personal knowledge and priorities of Regional bicycling concerns through the *Bicycle Use Questionnaire* thereby providing critical information to this *Master Plan*.
4. The Maricopa County Department of Transportation and Valley Metro for their partnership on the production and administration of the *Bicycle Use Questionnaire*.





## Executive Summary

The Maricopa Association of Governments (MAG) *Regional Bikeway Master Plan* serves as a guide for improving, expanding, and connecting the MAG Region's bicycle facility network. MAG's member agencies collectively recognize the importance of bicycling to the Region's long-term mobility, livability, and air quality. Improving bicycling conditions leads to a better quality of life with economic and health benefits as a direct consequence. The provision of bikeways will support the concept of active transportation and will help residents get the exercise they need to maintain a healthier lifestyle. Improved quality of life will also create an attractive Regional community that will lure the employers and people who choose to live in locations who highly value bikeability, walkability, numerous travel options, clean air and water, and parks and preserves. Ultimately, the recommendations made in this *Plan* will support positive attitudes of the general public and elected officials toward supporting bicycling. The *Plan* can be used by MAG jurisdictions to act on behalf of all bicyclists' interests.

The *Regional Bikeway Master Plan* begins with a summary of Regional needs as derived from two sources:

- Web-based Questionnaire and
- MAG Bicycle Task Force input.

**“Provide an interconnected Regional system of bikeways that contributes to a vibrant, healthy, livable community.”**

Together, they identified numerous general and specific bicycle facility and program needs from improvements at mid-block path/trail crossings to better maps and brochures.

The Trends chapter discusses the current movements in land-use and transportation planning which place a greater emphasis on bicycle infrastructure and mobility, including “Smart Growth” and “Active





Transportation,” and identifies bicycle practices locally and throughout the country. Special emphasis is placed on mid-block crossing treatment options that are being used within the MAG Region.

The Direction Chapter discusses the MAG Region’s bicycle connectivity context and introduces the *Plan’s* mission and goals. The *Plan’s* mission states: “Provide an interconnected Regional system of bikeways that contributes to a vibrant, healthy, livable community.” Based on this mission, a series of goals related to Access, Safety/Health/Education, Connectivity, User-Friendliness, and Implementation have been developed. These goals, combined with emerging trends, recommendations from previous documents, and the public input received throughout the planning process, provide focus for the remainder of the *Plan*. The goals are listed below:

### **Access**

Access: Provide a convenient, easily accessible, and visible bicycle transportation system comprised of connected on-street and off-street

facilities within neighborhoods and jurisdictions.

Complete Streets: Design and maintain all streets to accommodate bicycles.

### **Safety/Health/Education**

Safety: Develop a bicycle transportation system that increases user safety along routes and crossings by incorporating the American Association of State Highway Transportation Officials (AASHTO) bicycle facility design standards and the principles of CPTED (Crime Prevention through Environmental Design).

Health: Increase the proportion of citizens who engage in physical activity by making bicycling facilities easily accessible from their homes and linked to desired destinations.

Enforcement: Encourage law enforcement agencies to increase levels of enforcement of traffic laws most often violated by roadway users that affect bicycle use and to improve tolerance and courtesy among all roadway users.





Education: Encourage and support new and existing bicycle safety and education programs that promote bicycle use, user group compatibility, and enforcement of traffic rules.

Promotion: Provide user-friendly maps, brochures, and websites that clarify routes and encourage bicycle riding.

Encouragement: Promote bicycling as a means of personal mobility for local and daily travel trips for all purposes, and as a form of healthy recreation and exercise.

### **Connectivity**

Connectivity: Inter-connect a system of on-street bike lanes and off-street shared-use paths/trails to origins, destinations, and transit routes and, as a consequence, make bicycling a viable option for daily travel trips for all purposes.

### **User-Friendliness**

User-Needs: Provide a user need-based bicycle transportation system that is safe, convenient, well-maintained, well-signed, and attractive. The system should accommodate the various skills and

confidence levels of bicycle users and minimize potential conflicts with other users and vehicles.

End-of-Trip Provisions: Encourage bicycle riding by providing end-of-trip facilities that include bicycle parking, drinking water, toilets, showers, and lockers.

### **Implementation**

Implementation Plan: Outline specific steps, timelines, policies, programs, and criteria for project selection to implement this *Plan*, thereby encouraging large-scale to spot-improvement projects.

Bicycle Friendly Policies: Institute bicycle-friendly policies in the systematic, everyday work of agencies at all levels of government.

Integrated Planning: Integrate bicycle transportation facilities into ongoing and future transportation, land use, and economic development plans created by public jurisdictions and private development.





Techniques and Tools: Develop techniques and tools that will assist MAG member agencies in implementing and prioritizing bicycle projects.

Maintenance & Operations: Develop guidelines for long-term local and Regional bikeway maintenance and operations programs.

External Funding: Increase bicycle facility development by exploring alternative funding and partnership opportunities with external organizations within the business and health communities among others.

Internal Funding: Increase bicycle facility development by developing alliances and integrated funding strategies between various public agencies such as transportation, flood control, parks and recreation, and health.

The treatments and solutions . . . are comparatively economical solutions that are relatively inexpensive and simple to implement.

The goals have also been re-created in a visual format to produce “Goals Illustrated,” which are stylized representations of ideal bicycle environments that portray the potential results of effective implementation. The treatments and solutions shown, which illustrate the true potential for bicycling in the Valley, are comparatively economical solutions that are relatively simple to implement.

Because of the *Plan’s* purpose of directing local jurisdictions as they seek to improve bicycling conditions in their communities, Chapter 6 of the *Plan* consists of site-specific improvement examples. The core of the *Plan* is the recommended policies and programs section in Chapter 7: Action, which also includes the Action Plan and associated timetable. Within the Action Plan, the following policy and program recommendations are made:

- Incorporate the concepts of routine accommodation and complete streets into the planning of all roadways.
- Connect all on-street and off-street bicycle and pedestrian facilities within and between jurisdictions.





- Develop and adopt restriping policies for roadway segments where excess pavement is available.
- Create space for grade-separated shared use path crossings where streets intersect washes and other similar features.
- When grade-separation is not feasible, provide appropriate at-grade mid-block crossing treatments that will alert and enable motorists to fulfill their obligation to yield to bicyclists and pedestrians resulting in a greater sense of security, comfort, and convenience to the path user.
- Accommodate bicyclists with facilities at freeway interchanges and create new connections at freeways where feasible.
- Accommodate bicyclists along freeway corridors.
- Require end-of-trip bicycle facilities (e.g., parking, lockers, and showers) at all new commercial developments or implement developer incentives to conduct such facilities.
- Develop and promote bicycle events to increase awareness of bicycling as a viable mode of transportation.
- Create a Regional interactive bike route mapping website.

- Gather citizen input on bicycle related planning, programs, and projects through a web-based interactive questionnaire.

The *Plan* concludes with recommendations related to project funding. A new bicycle project evaluation form has been developed to assist the MAG Regional Bicycle Task Force to make funding decisions for submitted bicycle-related projects. This form may also be helpful to local jurisdictions as they seek to develop and evaluate their own potential projects. In addition, numerous potential funding sources (Federal, State, Regional, local, and private) have been identified to ensure that as many bicycle projects as possible can ultimately be funded and implemented.

The Appendix includes bibliographies and information sources, more detailed information on the Plan's public questionnaire, and a discussion on Travel Demand.





## Chapter One: Introduction

This Maricopa Association of Governments (MAG) *Regional Bikeway Master Plan* serves as a guide for the expansion and interconnection of the Phoenix metropolitan Region's bicycle facility network. MAG's member agencies collectively recognize the importance of bicycling to the Region's long-term mobility, livability, and air quality.

This recognition is evident through previous bicycle-related documents including the *MAG Regional Bicycle Plan* (1999), the *Alternative Solutions to Pedestrian Mid-block Crossings at Canals* (1999), and the *MAG Regional Off-Street System (ROSS) Plan* (2001). This *MAG Regional Bikeway Master*

*Plan* melds elements of the important prior work to illustrate policy and program recommendations and physical improvements that will create a convenient and efficient transportation system where residents and visitors alike can bicycle safely and comfortably throughout the Region.

The *Regional Bikeway Master Plan* has been developed against the backdrop of emerging national and Regional trends, including smart growth and active transportation, complete streets, traffic calming, bicycling encouragement programs, and events. Elements of these trends are already being expressed in the many master planned

Communities that support “active living” and a multi-dimensional transportation system gain health benefits, improved quality of life, greater economic development opportunities, and increased property values.



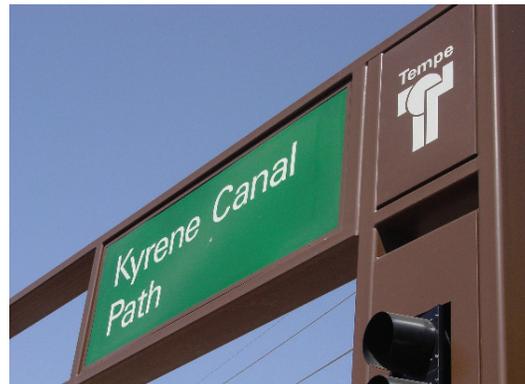


communities and local jurisdictions that integrate both on-street and off-street bicycle facilities into their overall transportation infrastructure. The bicycling public is growing and has needs for both personal transportation and for recreation.

This *Plan* has several distinct purposes. Above all, it is designed to help the Region develop an interconnected bikeway system of on-street and off-street facilities. One particular focus is to demonstrate the importance and viability of relatively short bicycle trips that allow neighborhoods to be linked, thereby making connections that enable all cyclists to

get where they want and/or need to go. Another important aspect of the *Plan* is to provide examples of several mid-block trail crossings options, a common difficulty in the area that inhibits both Regional and local off-street bicycle travel.

The *Plan* additionally illustrates and describes numerous types of improvements that can be made to enhance bicycle riding experiences in the Valley. Once implemented, the *Plan* will stimulate livable communities and their resulting numerous benefits throughout the Region.





## Chapter Two:

# Needs (Community Involvement)

Bicycling conditions in the MAG Region have improved dramatically in the past decade. More communities have paved pathways along canal banks and utility corridors. More and more bike lanes are seen on collector streets (those that provide access and traffic circulation within residential, commercial, and industrial areas) and arterial streets (those that primarily serve through traffic and that secondarily provide access to abutting properties). Traffic calming projects have helped to narrow vehicular travel lanes and add bike lanes. Bicycle and pedestrian grant

programs offered by MAG have resulted in an increased number of projects accommodating bicyclists.

Two significant examples of a growing bicycle-friendly ethic are the comprehensive incorporation of bicycle facilities into new master planned community developments and retrofitting streets with bike lanes. In all corners of the MAG Region, collector and arterial street bike lanes and separated paved pathways have become the norm, largely because most MAG member agencies have included bike lanes as a component of their standard street cross-sections. All types of bicycle riders are being considered in these facilities. Grade-separated crossing design has been integrated with drainage and open space design to allow for longer distance bicycle travel largely removed

**Two significant examples of a growing bicycle-friendly ethic are the comprehensive incorporation of bicycle facilities into new master planned community development and retrofitting streets with bike lanes.**





from vehicular travel. On-street and off-street bicycle facilities smoothly flow together providing direct linkages to schools, parks, employment and shopping areas. Recreational activity has increased and public health has improved.

In many already developed areas of the Valley, however, bicycling is still a challenge. Many needs still exist to truly make bicycling an easy and integral part of everyday life. The needs may be physical, like the completion of a paved path along a canal; a policy, like the adoption of bicycle parking regulations; or programmatic, like an educational program for drivers about the legal rights and obligations of vehicular traffic and bicycle riders. Arterials, along which are located many travel destinations, are frequently intimidating to people wanting to bicycle.

The purpose of the community involvement portion of the *Plan* was to gain a better understanding of the specific needs and priorities of the public and of those who manage bicycle programs in the Region. The results of this input helped guide the *Plan's* organization and recommendations.

Community involvement for the *Bikeway Master Plan* was focused primarily on a web-based questionnaire. Additionally, members of the MAG Bicycle Task Force representing MAG's member agencies provided input on specific bicycle improvement needs in their communities. The questionnaire and results of the Bicycle Task Force input are summarized in this Chapter.





## The Questionnaire

The Maricopa Association of Governments partnered with Valley Metro and the Maricopa County Department of Transportation to develop a questionnaire that addressed input on favored bicycle facility types and desired improvements that would increase respondents' bicycle riding. Questions were both directed and open-ended. The open-ended questions elicited more feedback about bicycling in general and needed improvements in the MAG Region. Respondents were requested to provide specific site locations for their prioritized list of needed improvements. See the Appendix for a copy of the questionnaire.

The questionnaire elicited 2,160 responses during its availability on the Valley Metro website from February 17 to May 16, 2006.<sup>1</sup> The questionnaire was made available in both English and Spanish. Email lists at the three partnering agencies and MAG member agencies formed the basis of notification for the questionnaire, ensuring that it was made available to a large number of interested citizens. Emails were sent to the individuals on these lists with a link to access the questionnaire.

This questionnaire, though not a statistically valid random sample of the MAG Region, illustrates opinions of people who have shown an interest in bicycling and alternative modes of transportation in the Region.

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<sup>1</sup> The summaries of questions 2 through 4, discussed further in this chapter, represent a total of 2,277 responses given over an extended period of time through September 8, 2006.





## Questionnaire Summary

Question #1 asked for the respondent's zip code. The responses were representative of the entire MAG Region.

Question #2 sought to determine the type of people who were taking the questionnaire.

The vast majority of the questionnaire respondents (89%) were bicycle riders as opposed to people who either professionally plan for bicycle riding or consider themselves advocates (Figure 2-1).

### Question #2

How do you classify yourself, in terms of your interest in bicycling? Check all that apply.

### How Respondents Classify Themselves

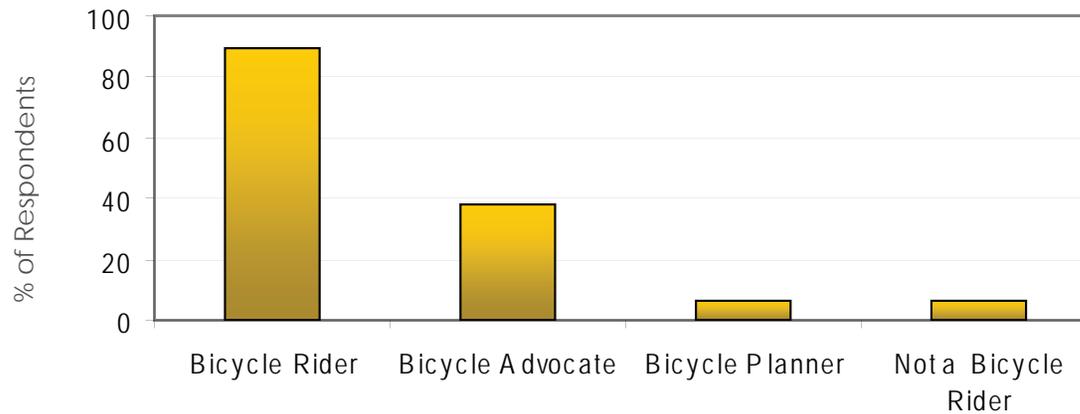


Figure 2-1





To better understand what the most used bicycle facilities are in the MAG Region, Question #3 asked respondents to identify and rank bicycle facilities from their most to least frequently used.

**Question #3**  
From the following list, please RANK ALL the facilities you ride a bicycle in Maricopa County.

Not surprisingly, the most frequently ridden facilities in Maricopa County are neighborhood streets (Figure 2-2). This most common type of facility is closest to homes and typically is associated with low traffic volumes and speeds, thereby creating a greater sense of safety and comfort among bicyclists. Once outside of neighborhood streets, on-street bicycle lanes are the second most ridden facility type. Other major streets and off-street facilities are also well-used, reflecting the need for interconnectivity in order to travel to most destinations on a bicycle.

Facilities Ridden in Maricopa County

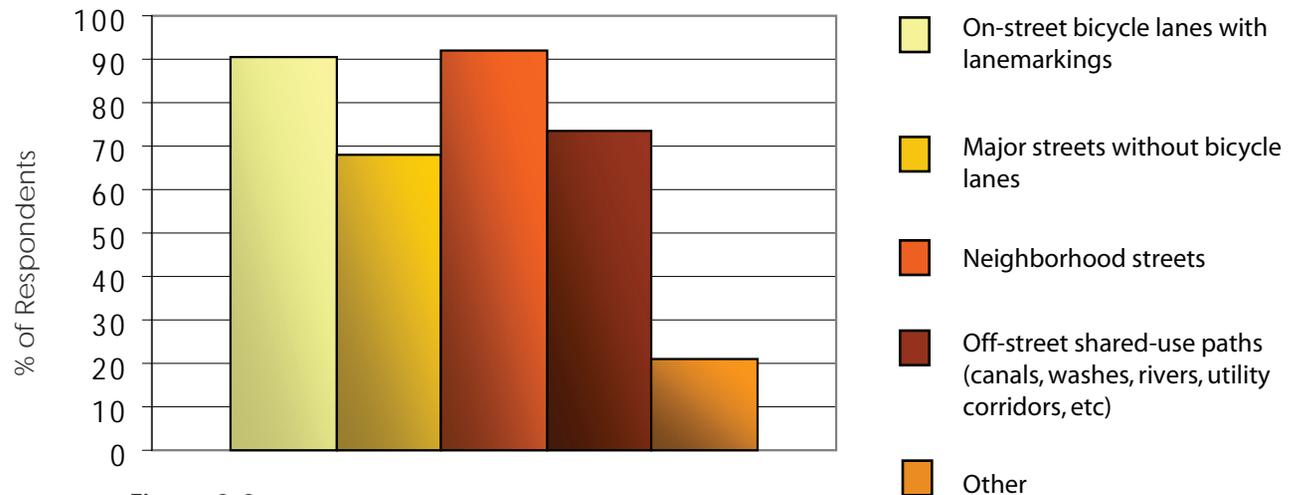


Figure 2-2





To better understand the motivation of bicycle riders, Question #4 addressed the reasons people ride a bicycle in Maricopa County.

**Question #4**  
From the following list, please RANK ALL the REASONS you ride a bike in Maricopa County.

Though the most often cited reasons for riding a bicycle are for health and recreation (Figure 2-3), the more utilitarian or destination-based reasons (ride to work, school and errands) in combination (90%) are roughly equivalent to the percentage of people who ride for health (89%) or recreation (95%). Bicycle riding for any reason, however, will have a beneficial health effect.

Reasons Respondents Ride their Bicycles

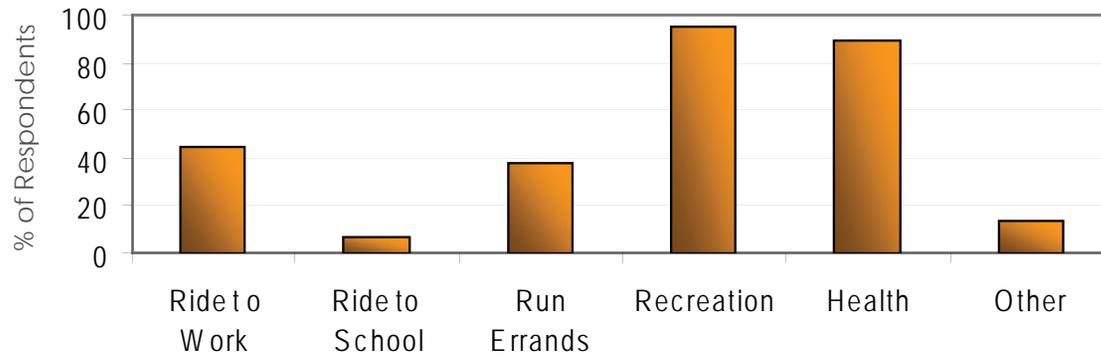


Figure 2-3





Question # 5 addressed the importance of various types of bicycle facilities to the respondent.

Eleven facility types/items were identified (Figure 2-4). Choices for each included “Extremely,” “Very,” “Somewhat,” “Not Very,” and “Not at All” important.

**Question #5**  
**Please indicate HOW IMPORTANT the following facilities/items are to your household.**

The responses shown in Figure 2-4 reflect the total percentage of respondents who felt that a particular facility/item was “Extremely,” “Very,” or “Somewhat” important (all positive responses).

The highest percentage total or greatest importance is shown on the far left: “On-street Bike Lanes” with 99% of the respondents giving a positive response. Interestingly, all identified facilities/items were considered at least somewhat important by almost two out of three respondents.





### Ranked Importance of Bicycle Facilities

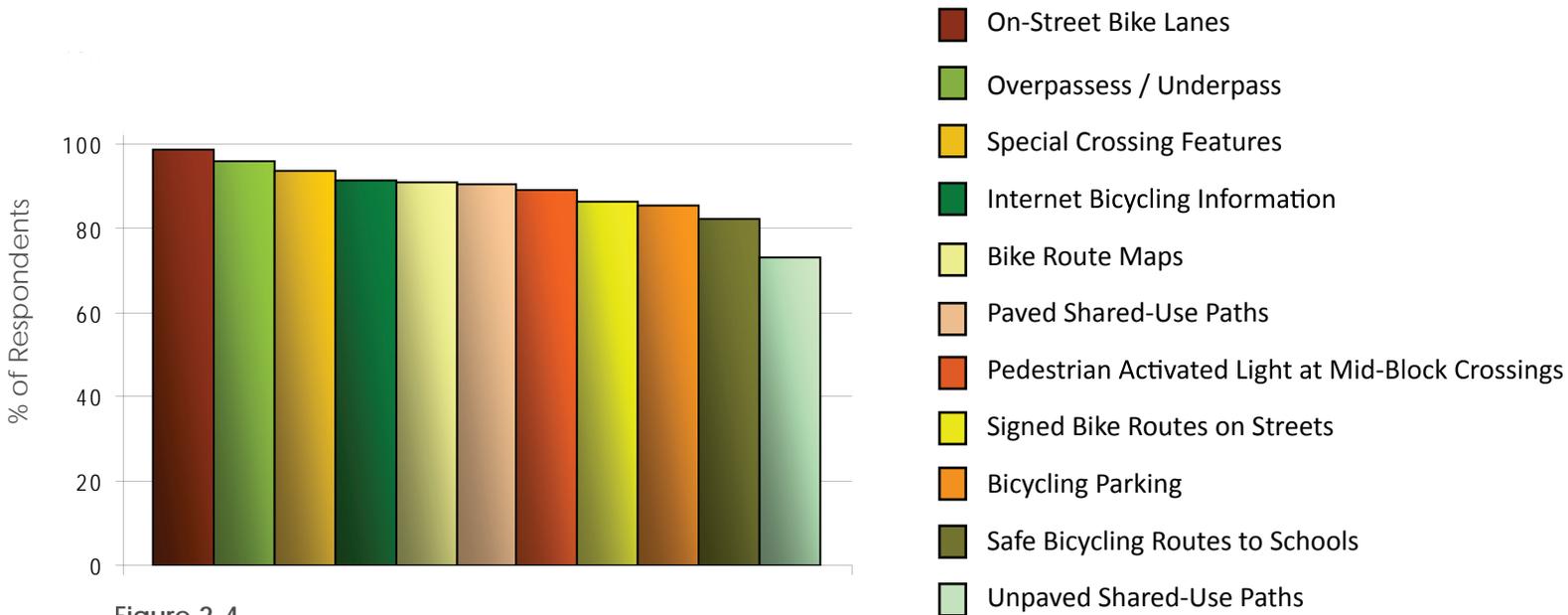


Figure 2-4

The second (Overpass/Underpass), third (Special Crossing Features), and seventh (Pedestrian Activated Light at Mid-Block Crossings) ranked facilities address various types of crossings, reflecting perhaps the difficulties encountered when trying to travel long distances off-street or to cross streets

when connecting between on-street and off-street bicycling facilities. The lack of quality crossings negatively impacts the ability and quality of bicycle riding whether on an on-street or off-street facility.





Two questions addressed the potential demand of bicycle riders in the MAG Region. Question #6 asked whether improved bicycle facilities would make respondents more likely to ride and Question #7 asked what types of facility improvements would increase bicycle riding.

**Question #6**  
**If bicycling facilities were improved, would you be more likely to ride a bicycle in Maricopa County?**

Respondents were given only a “yes” or “no” option with the vast majority (96%) of respondents saying they would be more likely to ride if bicycle facilities were improved (Figure 2-5).

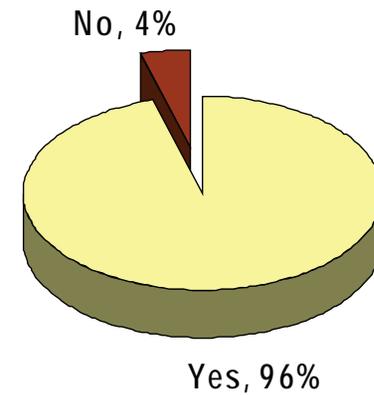


Figure 2-5





**Question #7**  
**If the following conditions or facilities were improved, would you be likely to ride a bicycle more often in Maricopa County?**

The question identified nine conditions or facilities for evaluation. Choices for each included “Definitely,” “Possibly,” and “Probably Not.” The responses shown in Figure 2-6 reflect the ranking of facility/condition improvements that would “Definitely” increase bicycle riding. A follow-up question allowed respondents to identify other improvements that would encourage them to ride more.

Improvements that would DEFINATELY Increase Riding

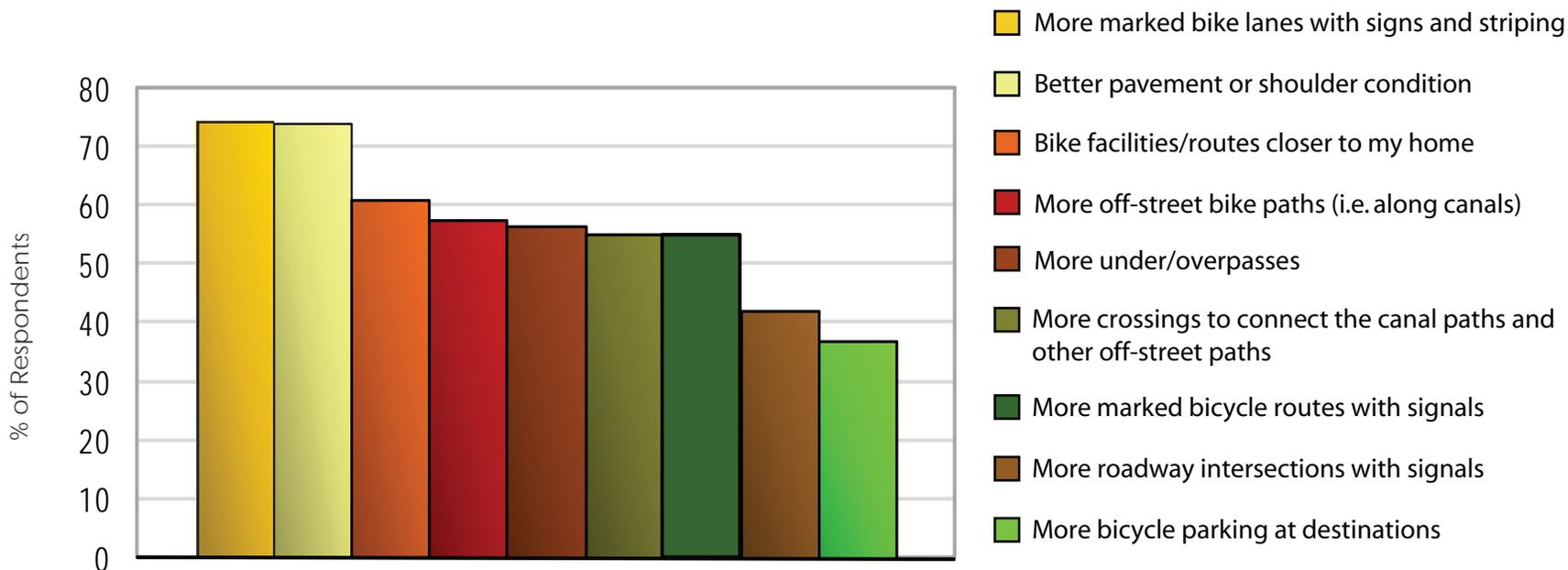


Figure 2-6





These other improvements were organized into the following general topics in order from most often to least often cited:



- Network Connectivity
- Motorist and Bicyclist Education and Maps
- Bike Lanes and Wide Shoulders with Markings
- Maintenance & Operations: policy, operations, speed, safety, theft prevention, enforcement, allowable uses
- Facilities: lights, signals, signs, mile markers
- Intersections: streets, off-street, railroad
- Trails/Off-Street Paths
- Other: air quality, issues not in jurisdictional control

These results support the types of answers given previously in that they stress the importance of the many components of a well-connected network of on-street and off-street bicycle facilities. The fact that many open-ended responses addressed maintenance, operations, education, and enforcement issues illustrates that the comfort, safety, and convenience of bicycle riders relies as much on these features as the facility network.





Question #8 allowed respondents to identify and prioritize up to six specific locations in the MAG Region that need bicycle improvements. Responses were extensive and accounted for approximately 66 pages of site improvement and general needs in virtually every MAG jurisdiction.

**Question # 8**

Various jurisdictions within Maricopa County are planning projects that will improve opportunities for bicycle riding throughout the Region. This will include improvements on facility types including bicycle lanes/routes; shared use paved and unpaved paths, and crossings at washes, canals, and major streets. Creating new facilities and/or maintaining or enhancing existing facilities are being considered.

From your personal knowledge, please identify, at least, the THREE MOST NEEDED specific project improvements along these types of facilities. Then, indicate your preferred order or priority in the box.

Though the question asked for specific site locations, some of the answers were more general such as maintenance and operations recommendations. Figure 2-7 organizes the various responses into five general gap categories which are inclusive of the following:

- **Missing Link:** along arterial road bike lanes, along secondary road (collector) bike lanes, on an off-road bike facility, park and ride lots, and bicycle parking.
- **Barrier:** along a freeway, canal, river, wash, or railroad.
- **Non-Standard Facility:** such as a bike lane being too narrow or non-continuous, lighting, signage/signals, and more bicycle capacity on bus bike racks.
- **Missing or Inadequate Crossing:** with a solution suggested as either an at-grade or grade separated crossing improvement.
- **Maintenance and Operations:** roadway or bicycle facility condition improvement, safety concerns, and design standard improvement suggestions.





### Gap Categories Identified by Requested Specific Improvements

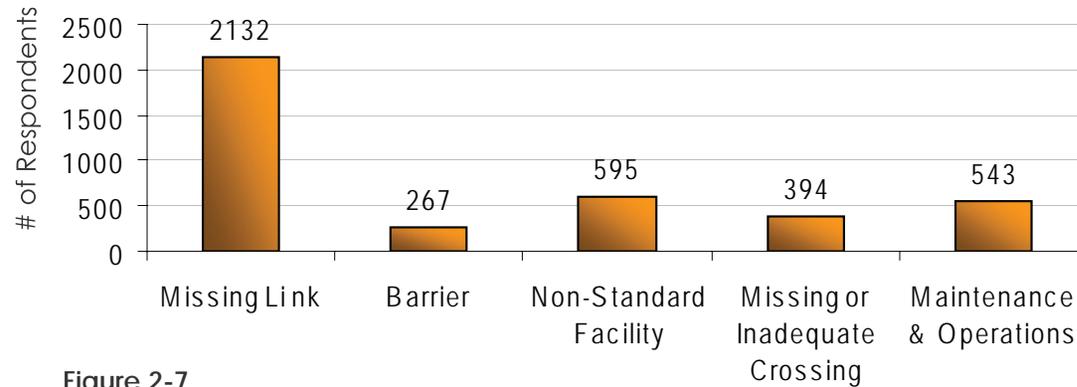


Figure 2-7

The completion of “missing links” is the most often cited specific improvement need in the Region reflecting gaps in the interconnected Regional bicycle network. Bike lanes on arterial roads are the most frequently requested specific improvement within the missing links category (1405), perhaps reflecting the Region’s past emphasis of bike lanes on collector streets. These specific responses are generally supportive of the needs identified elsewhere in the *Questionnaire*,

namely a development and planning emphasis on completing the interconnected system of both on-street and off-street bicycle facilities.

Specific locational responses for this question are available by calling the Maricopa County Department of Transportation at 602-506-8600 or the Maricopa Association of Governments at 602-254-6300.





## MAG Bicycle Task Force Input

To supplement the data derived from the *Questionnaire* described above, members of the Bicycle Task Force, who represent jurisdictions from throughout the MAG Region, were asked to identify gaps within their jurisdictions. The term “gap” was broadly defined as a physical feature that causes an inability for bicyclists to continue safely on a bicycle journey. Respondents were asked to categorize gaps in their jurisdiction using the following categories:

1. Missing Link: can be a short distance or the lack of a facility along a heavily used or needed corridor, a missing connection from an on-street facility to an off-street facility.
2. Barrier: is a physical barrier across a path such as a gate, wall, or fence.
3. Nonstandard: can be inadequate pathway widths, overly meandering paths, narrow bike lanes, steep paths, etc.

### 4. Missing or Inadequate Crossing:

- At-Grade: the lack of or inadequate facilities at a mid-block crossing or at a signalized crossing, etc.
- Grade Separated: the lack of a needed grade separation over/under a freeway, canal, road, wash or river or inadequate width, height, lighting, air or steep approaches, poor sight lines within an existing facility.





Figure 2-8 tabulates the number of each type of gap identified. Missing links were by far the largest gap type identified with a total of 118 sites. Gaps created by missing or inadequate crossings, both at-grade and grade separated, accounted for the second largest group of gap types.

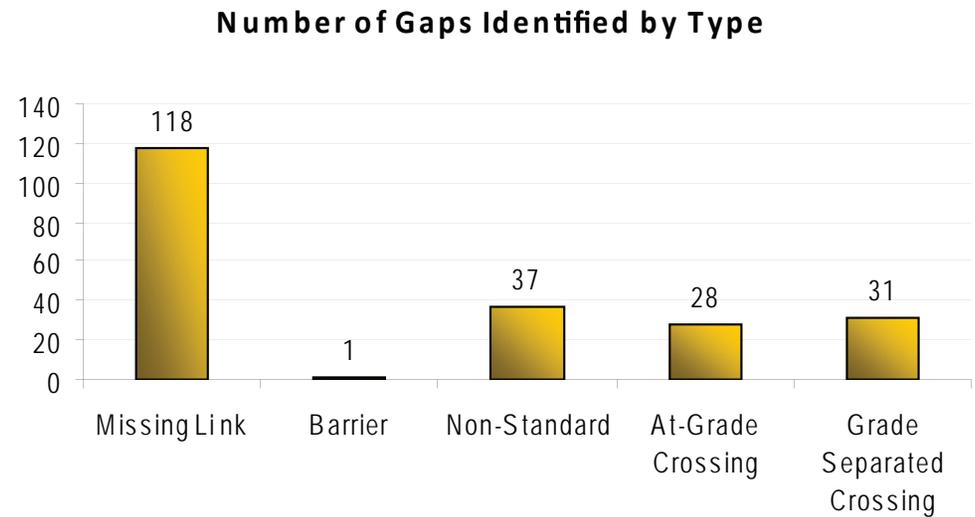


Figure 2-8





Additionally, the respondents were asked to identify the relative priority of each identified gap by ranking them from 1-5 with 1 being an immediate need/priority and 5 being a long term need/priority. Figure 2-9 illustrates the relative priorities by gap type.

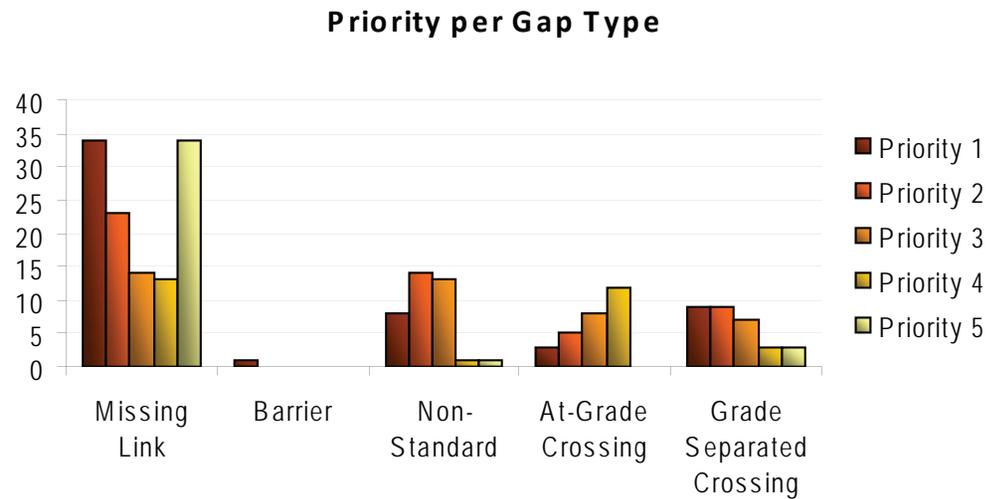


Figure 2-9





## Summary

The survey results indicate that links need to be completed between on-street and off-street bicycle facilities. The interface of off-street paths with major arterial streets, a significant challenge along nearly every canal path in the Region, needs to be addressed for these corridors to meet their recreational and transportation potential. All respondents seem to recognize that completing construction of paved paths, painting additional bike lanes, and improving all types of crossings will greatly improve the comfort, convenience, and safety of bicycle riding in the MAG Region.

Many jurisdictions have already made substantial progress in developing their bicycle infrastructure. Subsequent chapters of this *Plan* will discuss specific policy, program, and physical improvements that can be implemented that will continue to improve the Region's bicycling conditions.





## Chapter Three: Trends

It is important to link the public input received through the questionnaire and the Task Force to emerging trends related to bicycle travel. By relating the desires of the Region's citizens to concepts that have significant local and national momentum, the stated desires can more easily be realized. Perhaps the most significant of these trends is the active transportation movement, which espouses the numerous benefits of nonmotorized travel as a viable travel option. Such advantages of bicycling and walking can be categorized into several categories of benefits: air quality, economic, health, and mobility. Another emerging trend is the profusion of bicycle-related policies and programs adopted by communities throughout the country. Various policy and program categories are discussed and specific case studies are offered in this chapter. Finally, the trend of better accommodation of bicyclists and other shared use path users at mid-block crossings is explored. This is

a growing issue in communities everywhere, and is especially relevant in the Valley because of the Region's unique geography, and its path/trail system which often parallels the extensive canal system. No Regional guidance currently exists that covers this issue in depth, so various options are described.





## Active Transportation

Active transportation (also sometimes called nonmotorized or human powered transportation) refers to walking, bicycling, and their variants such as in-line skates, scooters, etc. These active modes play an important but often overlooked role in an efficient, equitable, and healthy transportation system. They are used for both recreation and utilitarian transportation, alone and in conjunction with other modes such as public transit and automobile travel.

### *Benefits*

#### Air Quality

Because bicycling and walking tend to replace short trips which have high energy consumption and

pollution emission rates, their environmental benefits tend to be proportionately large. For example, shifting 1% of mileage from driving to nonmotorized modes is likely to reduce energy consumption and emissions by 2-4%, which directly leads to economic savings from saved fuel consumption.

#### Economic

Increased bicycling and walking provides benefits to motorists and businesses when it substitutes for automobile travel (both directly and in conjunction with public transit), by reducing traffic and parking congestion, road and parking facility costs, and the need for motorists to chauffeur non-driving family members and friends. These benefits can be significant. For example, increased bicycling and walking to schools can reduce traffic congestion on neighborhood roads, reduce parking problems at schools, and reduce school busing costs. Similarly, businesses can save hundreds of dollars a year in avoided parking costs for each employee who uses an alternative mode rather than driving to work.

**Shifting 1% of mileage from driving to non-motorized modes is likely to reduce energy consumption and emissions by 2-4%.**





Nonmotorized transportation improvements provide economic development benefits by supporting tourism and retirement industries. Such improvements are popular community amenities that tend to increase the value of nearby properties (NBPC, 1995). Pedestrian-friendly, “new urbanist” community design tends to increase property values as well (Eppli and Tu, 2000).

Active transportation is generally associated with a higher quality of life perception among residents. Improved quality of life in turn creates an attractive Regional community that lures the employers and people who choose to live in locations who highly value bikeability, walkability, numerous travel options, clean air and water, and parks and preserves. By attracting these people and their businesses, the Region’s economic vitality will be improved.

### Health

Physical activity and fitness are important for public health. In recent years, public health officials have become increasingly alarmed at declining physical fitness, excessive body weight, and resulting increases in diseases associated with a sedentary lifestyle among the general population (US Surgeon General, 1999).

There are many ways to be physically active, but many, such as sports or exercising in a gym, require special time, money and skill, which discourages most people from participating regularly. Many experts

**“Regular walking and cycling are the only realistic way that the population as a whole can get the daily half hour of moderate exercise which is the minimum level needed to keep reasonably fit.” (Physical Activity Task Force, 1995)**





**Medical Problems Associated With Inadequate Physical Activity**

- Heart disease
- Stroke
- Obesity
- Depression
- Hypertension
- Diabetes
- Osteoporosis
- Some types of cancer

believe that more active transportation is the most practical and effective way to improve public fitness (WHO, 2003). One major study concluded “regular walking and cycling are the only realistic way that the population as a whole can get the daily half hour of moderate exercise which is the minimum level needed to keep reasonably fit” (Physical Activity Task Force,

1995). Residents of automobile dependent communities are found to have health risks increased obesity and increased hypertension (Ewing, et al, 2003; Frumkin, Frank and Jackson, 2004).



Transportation and health surveys indicate that during the last few decades Americans have been cycling and walking less, driving more, exercising less, and gaining weight. Figure 3-1 illustrates (in color) how the portion of residents considered obese (Body Mass Index  $\geq 30$ ) in Arizona has dramatically risen from less than 10-14% to 20-25% during the last 14 years.

According to a survey conducted in 2004 by the Centers for Disease Control, 23.1 percent of adults nationwide were obese. Slightly lower percentages of adults in Arizona and in Maricopa County were obese (21.1 percent and 21.3 percent, respectively). The same survey found that 22.8 percent of adults nationwide did not exercise within the past 30 days. Slightly higher percentages of adults in Arizona and in Maricopa County did not exercise (24.2 percent and 25.8 percent, respectively) (CDC, 2004).



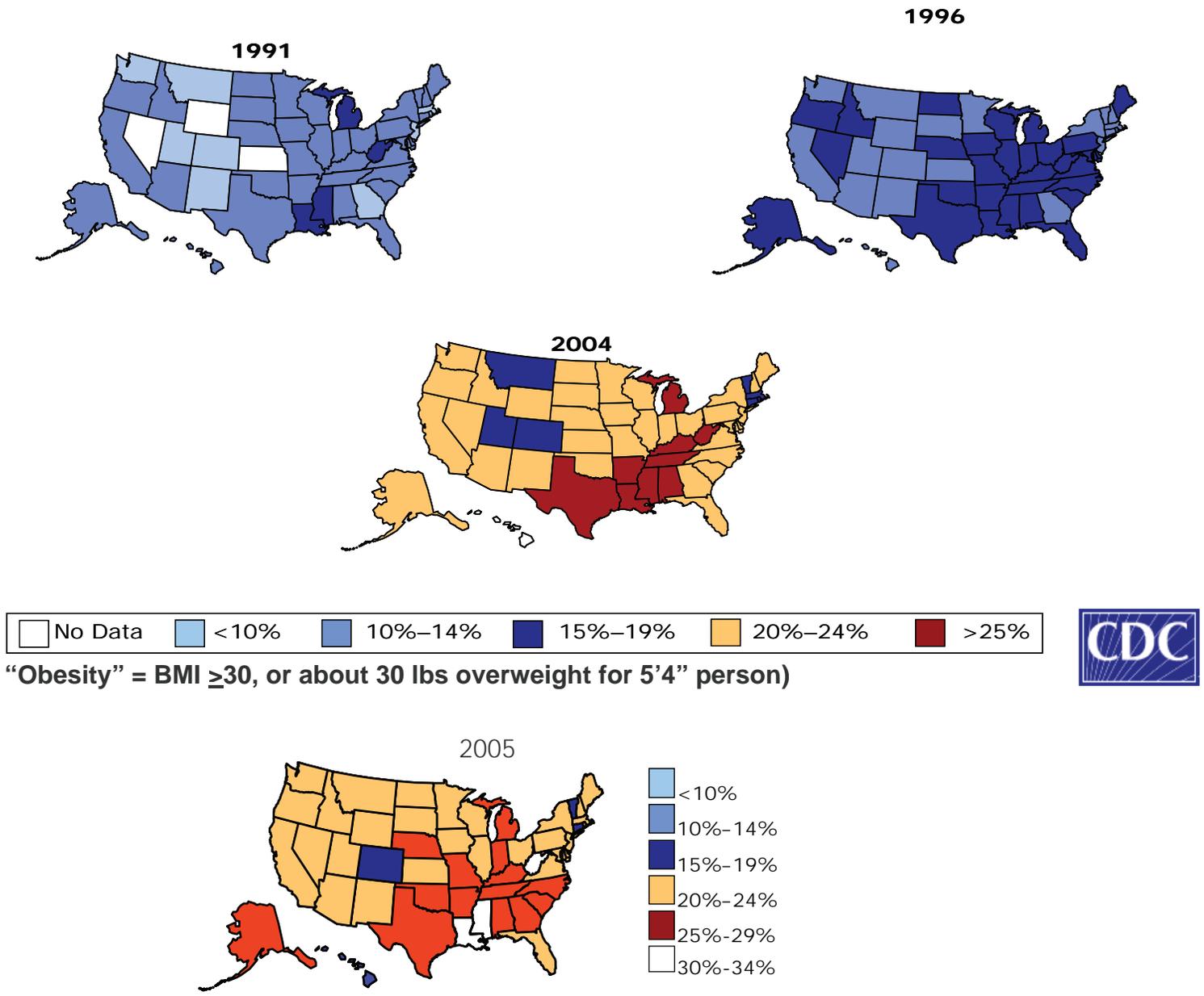


Figure 3-1 National Obesity Rates





The health care costs attributable to obesity amounted to \$752 million in Arizona alone and to \$75 billion nationally in 1998-2000 (Finkelstein et al., 2004).

Increased grant opportunities are now available for bicycle-related projects because of their associated health-related benefits (see the Funding Sources section of this *Plan*).

#### Basic Mobility for Nondrivers

Currently, the MAG Region is relatively automobile dependent, meaning that there are relatively poor alternatives to automobile travel. In such a situation, improving nonmotorized travel options provides

significant benefits beyond air quality, economics, and health.

Cycling and walking are particularly important for people who are physically, socially, and economically disadvantaged. These modes provide basic mobility, that is, they provide access to essential activities and services such as medical clinics and stores, education and employment (ICMA, 2005).

Improved walking and cycling provide affordable transportation, which is particularly important for lower-income households. Households in “smart growth” communities with a variety of transportation options and more accessible land use patterns tend to spend less money on transportation on average per capita than comparable households in more automobile-dependent communities (Bernstein, Makarewicz and McCarty, 2005).

**Households in “smart growth” communities with multi-modal transportation systems and more accessible land use patterns tend to spend less money on transportation on average per capita than comparable households in more automobile-dependent communities (Bernstein, Makarewicz and McCarty, 2005).**





## Progressive Policies and Programs

A variety of progressive policies, planning reforms, and special programs are helping to improve walking and bicycling conditions and encourage active transportation. Some examples are described below.

### *Policies*

#### Smart Growth Land Use Policies

Smart growth (also called New Urbanism) is a general term for policies that integrate transportation and land use decisions by encouraging more compact, mixed-use development within existing urban areas, and discouraging dispersed, automobile dependent development at the urban fringe. Smart Growth is an alternative to urban sprawl. Major differences between these two land use patterns are compared in Table 3-1. Smart growth seeks to increase walking and bicycling activity by creating more origins and destinations within walking and bicycling distances, by creating streetscapes and traffic management practices that are more supportive of alternative transportation modes, and by explicitly incorporating

policies and programs that support use of alternative modes.

Sprawl tends to decrease bicycling and walking activity through low-density or dispersed land development. Typical design accommodates high motor vehicle speeds and volumes. Low-density development disperses activities, resulting in greater travel distances, often rendering bicycling and walking impractical. High motor vehicle speeds and volumes negatively affect nonmotorized users' perceptions of safety/comfort while bicycling or walking in the roadway or roadside environment. Sprawl ends up discouraging many people from bicycling and walking.

Thus, the success of efforts to increase levels of bicycling and walking will depend on the degree of "smart growth" for active living and transportation in the MAG Region. Statewide, the *Arizona Nutrition and Physical Activity Plan* is evidence of this intent. At the Valley's Regional and local levels, a number of initiatives, both formal and informal, are underway.





Table 3-1. Comparing Smart Growth and Sprawl (“Smart Growth,” VTPI, 2005)

	<u>Smart Growth</u>	<u>Sprawl</u>
<b>Density</b>	Compact development.	Lower-density, dispersed activities.
<b>Growth pattern</b>	Infill (brownfield) development.	Urban periphery (greenfield) development.
<b>Land use mix</b>	Mixed land use.	Homogeneous (single-use, segregated) land uses.
<b>Scale</b>	Human scale. Smaller buildings, blocks and roads. Careful detail, since people experience the landscape up close, as pedestrians.	Large scale. Larger buildings, blocks, wide roads. Less detail, since people experience the landscape at a distance, as motorists.
<b>Public services (shops, schools, parks)</b>	Local, distributed, smaller. Accommodates walking access.	Regional, consolidated, larger. Requires automobile access.
<b>Transport</b>	Multi-modal transportation and land use patterns that support walking, bicycling and public transit.	Automobile-oriented transportation and land use patterns, poorly suited for walking, bicycling and transit.
<b>Connectivity</b>	Highly connected roads, sidewalks and paths, allowing relatively direct travel by motorized and non-motorized modes.	Hierarchical road network with numerous loops and dead-end streets, and unconnected sidewalks and paths, with many barriers to non-motorized travel.
<b>Street design</b>	Streets designed to accommodate a variety of activities. Traffic calming.	Streets designed to maximize motor vehicle traffic volume and speed.
<b>Planning process</b>	Planned and coordinated between jurisdictions and stakeholders.	Unplanned, with little coordination between jurisdictions and stakeholders.
<b>Public space</b>	Emphasis on the public realm (streetscapes, pedestrian environment, public parks, public facilities).	Emphasis on the private realm (yards, shopping malls, gated communities, private clubs).





One potential growth initiative that shows promise provides seed money for new or redeveloping community plans. Communities use these monies to develop plans for smart growth within, for example, town centers, other activity centers, and existing and emerging high-density corridors. An existing example of such a Regional initiative is the Atlanta Regional Commission's Livable Centers Initiative (LCI), which provides \$1 million per year in seed money for planning studies. Recipients are local governments and non-profit organizations that are working to enhance livability and mobility. The Atlanta Regional Commission has also committed \$500 million for transportation projects resulting from completed LCI studies (Atlanta Regional Commission, 2006).

#### End of Trip Facilities Policies

End of trip facilities (bike parking and changing rooms) help encourage active transportation, particularly utilitarian bicycling (Browning, 1999; APBP, 2002). Some communities have incorporated bicycle parking and clothes changing facility requirements into their parking standards, including several prominent ones in the Valley ("Bike Parking," VTPI, 2005).

#### Roadway Planning and Maintenance Policies

Road and pathway design and operational practices can be changed in various ways to improve walking and bicycling conditions. For example, it can become standard practice to increase the width of outside traffic lanes on multi-lane arterials to provide more space for bicycles. Similarly, rural road shoulders can be paved and maintained to provide a suitable space for bicycling. Sidewalk construction, repair, and maintenance warrants and standards can be modified to improve walking conditions.

**End of trip facilities (bike parking and changing rooms) help encourage active transportation, particularly utilitarian bicycling (Browning, 1999; APBP, 2002).**





### Provision of Nonmotorized Facilities Policies

Considerable research indicates that bicycling and walking activity is affected by roadway conditions and the quality of sidewalks, crosswalks, bike lanes, and paths (Petritsch, 2005). Road and pathway connectivity has a major impact on bicycling and walking activity (Dill, 2005). A road system with smaller blocks and connected streets (rather than numerous dead-ends and cul-de-sacs) tends to encourage nonmotorized travel. Wide roads with heavy, high-speed vehicle traffic tend to discourage nonmotorized travel, which is sometimes referred to as the barrier effect or severance (“Barrier Effect,” Litman, 2004).

Phoenix metropolitan area surveys reflect these national findings. For example, the Chandler Bike Survey in 1998 showed that respondents generally

ride where they perceive there to be minimal conflicts with motor vehicles; the top two facility types used by the survey respondents were 1) quiet, low traffic streets and 2) off-road trails, paths, and canal banks (*Chandler Bicycle Plan – Update 1999*).

Communities that improve nonmotorized travel conditions often experience significant increases in nonmotorized travel and related reductions in vehicle travel. Morris (2004) found that residents living within a half-mile of a bicycling trail are three times as likely to bicycle commute as the country average. Dill and Carr (2003) found that residents of a new urbanist neighborhood, which has sidewalks and more mixed land use, made significantly fewer vehicle trips and more bicycling and walking trips than residents of more conventional, automobile-oriented neighborhoods.

Several studies indicate that providing more bike lanes and paths tends to increase the amount of bicycling that occurs in a community. Several North American communities with extensive bikeway systems (Palo Alto, Madison, Boulder, Eugene) have bicycling rates five to ten times higher than the national average.

**Communities that improve nonmotorized travel conditions often experience significant increases in nonmotorized travel and related reductions in vehicle travel.**





A 1991 survey found that 46% would bike to work if designated trails were built (Guttenplan and Patten, 1995).

Researchers Dill and Carr (2003) found that “higher levels of bicycle infrastructure are positively and significantly correlated with higher levels of bicycle commuting.” Table 3-2 lists the cities studied in the Dill and Carr 2003 study with their bike/walk percentages and their respective bike lanes and paths per square mile.

Studies comparing bicycling activity before and after bikeways were implemented provide evidence of their impacts on travel. Examples are summarized below (Contra Costa, 2003):

- City of Portland, OR. The City of Portland is widely recognized as being one of the most progressive large cities in the United States in terms of promoting bicycle commuting and developing bikeways. The research and findings support

the contention that the investment in bikeways contributes to an increase in bicycle commuting and ridership. A 137% average increase in bicycle ridership was measured after bike lanes were constructed at eight locations in the city, despite conditions that are considered detrimental to bicycling, such as hilly geography, a cold, wet climate, and increasing roadway vehicle traffic.

- City of San Francisco, CA. An increase in bicycle ridership was also witnessed at eight locations in San Francisco after bike lanes were installed, ranging from 23% to 83%. The consistency of these increases appears to support the connection between the improvements and increases in usage.

**“Higher levels of bicycle infrastructure are positively and significantly correlated with higher levels of bicycle commuting”**





Table 3-2. Nonmotorized Commuting In Large U.S. Cities (2000 Census; Dill & Carr, 2003)

City	Walked	Biked	Total Bike & Walk	Bike Lanes & Paths
	Percent	Percent	Percent	Per Square Mile
Philadelphia, Pa.	10.4	0.63	11.03	1.3
San Francisco, Ca.	8.8	1.8	10.6	0.87
New York, N.Y.	9.3	0.42	9.72	0.64
Chicago, Ill.	5.6	0.51	6.11	0.35
<b>Tucson, Ariz.</b>	<b>3.4</b>	<b>2.22</b>	<b>5.62</b>	<b>1.76</b>
<b>Mesa, Ariz.</b>	<b>2.1</b>	<b>1.64</b>	<b>3.74</b>	<b>0.37</b>
Los Angeles, Calif.	2.9	0.63	3.53	0.34
Houston, Tex.	2.6	0.35	2.95	0.43
San Diego, Calif.	2.3	0.48	2.78	0.92
<b>Phoenix, Ariz.</b>	<b>1.9</b>	<b>0.87</b>	<b>2.77</b>	<b>0.48</b>
Indianapolis, Ind.	2.5	0.18	2.68	0.5
Dallas, Tex.	2.2	0.2	2.4	NA
Detroit, Mich.	2.3	0.1	2.4	NA
Columbus, Ohio	2	0.22	2.22	0.13
San Jose, Calif.	1.7	0.42	2.12	1.02
Jacksonville, Fla.	1.5	0.4	1.9	NA
<b>Total for U.S.</b>	<b>2.7</b>	<b>0.5</b>	<b>3.2</b>	<b>NA</b>

Note: NA = Not available.





- City of Seattle, WA. Research published in the FHWA document *Guidebook on Methods to Estimate Nonmotorized Travel* indicates the potential bicycle commuter mode share of about 8% in Seattle for areas within reasonable distance of a Regional bikeway system. This study is based on extensive surveys and other research tools designed to establish the potential bicycle ridership for specific corridor improvements.
- University communities. Studies of five university communities (Davis, Madison, Gainesville, Boulder, and Eugene) also showed a link between the quality of a bikeway system and ridership.





## *Programs*

### Education and Encouragement Programs

A variety of education and encouragement programs can support nonmotorized transportation (“Walking and Bicycling Encouragement,” VTPI, 2005):

- Education programs that teach bicycling skills.
- Bicycling and walking events and activities, particularly on paths/trails and bicycling routes.
- Bicycling and walking commute campaigns. These often involve contests as to which workers and worksites commute most by nonmotorized modes.
- Bicycling maps showing recommended bicycling routes and facilities, roadway conditions (shoulders, traffic volumes, special barriers to bicycling, etc.) hills, recreational facilities, and other information helpful to cyclists.
- Reimbursement of employee bicycling mileage expenses.

- Individual marketing campaigns which encourage and help residents to use alternative modes.
- Tourist promotion materials highlighting bicycling and walking.

Such programs have proven successful at increasing bicycling and walking activity, although their effectiveness varies depending on the type of program, the incentives it includes, and the program goals. Bicycling and walking promotion programs are often targeted at specific groups, such as commuters to a particular destination, or a demographic group that could particularly benefit from more active transportation or better skills. For example:

- Public health programs have encouraged overweight residents to walk regularly for fitness. These may include a combination of education materials, group walking events, and having participants record how much they walk.





- Bicycling law enforcement programs, which encourage police to cite bicycle traffic law violators, with a “diversion” program by which cyclists who are cited can choose to take a bicycle traffic safety course instead of paying a fine.
- Contests can see which worksites or schools have the highest rates of bicycling and walking during a particular time period.

### Traffic Calming and Speed Control Programs

Traffic Calming, Traffic Management, and Speed Control programs apply various design features and strategies intended to reduce vehicle traffic speeds and volumes on a particular roadway. These programs can range from minor modifications of an individual street to comprehensive redesign of a road network.

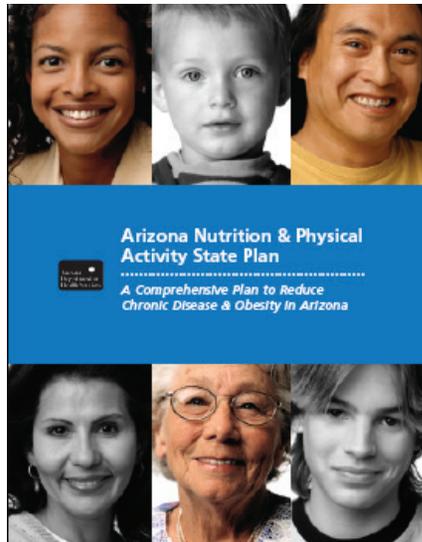
Such programs tend to reduce traffic accident risk, particularly for walking and bicycling, and increase nonmotorized travel (Morrison, Thomson and Petticrew, 2004; “Traffic Calming,” VTPI, 2005).

### School-based, Campus-based and Worksite-based Programs

School, campus and worksite transport management programs encourage commuters to reduce automobile trips and use alternative modes. They can include a variety of encouragement activities, incentives and physical improvements (VTPI, 2005).

These programs can have significant impacts on travel, typically reducing automobile trips by 5-15% for programs that rely only on promotion campaigns, and 10-30% for programs that include financial incentives, such as parking pricing (charging for parking) or parking cash out (allowing commuters to choose cash instead of parking subsidies). In urban areas, most travel typically shifts to walking and public transit, while in suburban areas more travel shifts to bicycling and ridesharing.





### Arizona Programs

The following Arizona-specific examples describe successful programs that result in bicycle-friendly, active and healthy communities. References to additional MAG Region policies and programs are included in the “Recommended Policies and Programs” section in Chapter 7 of this *Plan*.

#### *Arizona Public Health Association*

The Association adopted a Resolution at their annual meeting September 2005 called: “Support for Land Use and Transportation Policies to Promote Public Health.” It states, “require builders to plan for mass transit, sidewalks and bicycle paths in new residential development,” among other broader statements. This resolution is based upon the American Public Health Association Resolution 2004-4.

“Active community environments is a term used to describe communities where people of all ages and abilities can easily enjoy walking, bicycling, and other forms of recreation. These communities support and promote physical activity with adequate sidewalks, bicycle facilities, paths, trails, parks and recreational facilities.”

#### *Arizona Nutrition and Physical Activity State Plan*

This five-year action plan seeks to reduce the burden of chronic disease and obesity in Arizona through nutrition education and physical activity. Chapter 6 of the document addresses the physical environment and healthy community design. Excerpts pertaining to active community environments and active transportation are given below.





“Active community environments is a term used to describe communities where people of all ages and abilities can easily enjoy walking, bicycling, and other forms of recreation. These communities support and promote physical activity with adequate sidewalks, bicycle facilities, paths, trails, parks and recreational facilities. These communities also have implemented mixed-use industrial and residential areas using a linked network of streets that allow for easy walking between homes, work, schools and stores (U.S. Department of Health and Human Services, 2003).”

“Active transportation” is a term used to describe purposefully getting from point A to point B by walking, bicycling or using any other sort of active mode of transportation. The capability for physical activity is partly determined by how communities are designed and built. With the increase in and expansion of suburbs, residents are using active modes of transportation less and less and using their motorized modes of transportation more. Specifically, since 1977, trips made by walking have declined 40%.

Currently, 90% of all adult trips and 70% of all children’s trips are made in vehicles. Furthermore, 25% of all trips are within a mile or less and 75% of these short trips are made by car (Schmidt, 2003).

### Program Case Studies

#### *Bicycle Commuting Contest*

([www.climatesolutions.org](http://www.climatesolutions.org))

The Thurston County, Washington Bicycle Commuter Contest encourages individuals to bicycle to work, school, and to run errands throughout the month of May. The contest has been a participatory event for Thurston County residents and employees since 1988. The goal of the Bicycle Commuter Contest is to promote bicycling as an efficient, non-polluting method of travel. Participants keep track of how often and how far they commute by bicycle, and win prizes in a variety of categories. In 1999 574 participants rode a total of nearly 15,000 miles. Individuals and teams compete to see who can:

- Ride the most miles.





- Ride the most number of days in their age category.
- Tally more total miles than any other team.
- Ride the most days per team-member (advantage to smaller teams).
- Compile the most days ridden by all members (advantage to larger teams).
- Compile the most days ridden by first-time participants (advantage to teams that recruit first-time riders).
- Free bicycle skills training workshops for employees who want to learn more about bicycle commuting.
- An elementary school literary competition between bikes and cars. Bicycling and driving parents leave the school at a specified time, travel to the downtown public library, check out a book and return to the school while following all the rules of the road. Students that estimate the closest time differences between the two modes are eligible to win bike prizes.
- A Bike-to-Work-Week non-profit organization that plans and coordinates activities.

#### *Bike To Work Week Campaign*

([www.biketoworkvictoria.bc.ca](http://www.biketoworkvictoria.bc.ca))

A Bike-to-Work-Week campaign is held annually in Victoria, British Columbia. In 2000 it included:

- A bicycle commuting contest with more than 200 teams at different worksites competing in various classes to see which can achieve the most bicycle commuters. All participants are eligible for prizes and drawings.
- A friendly contest between drivers and cyclists determines who gets the first cup of hot coffee at a downtown coffee shop without violating traffic rules.

#### *Go For Green*

([www.goforgreen.ca](http://www.goforgreen.ca))

Go for Green is a national non-profit, charitable organization encouraging Canadians to pursue healthy, outdoor physical activities while being good environmental citizens. It encourages active transportation (walking and bicycling). It sponsors the Commuter Challenge and school transport management programs. Go For Green provides information and materials, including newsletters, reports, case studies and merchandise (logo shirts and hats).





*Bikestation Seattle*

([www.bikestation.org/seattle](http://www.bikestation.org/seattle))

Since 2003, Bikestation Seattle has provided commuters with secure bicycle parking, bicycle repair, bicycle rental, car-sharing, and convenient connections to bus lines and other modes of travel. Commuters pay an annual administrative fee of \$20 and an annual service plan fee of \$96 to use the Bikestation's services. Other Bikestations are located in Berkeley, Long Beach, Palo Alto, and San Francisco.

*Bethlehem, PA Bicycle Commuter Facility*

([www.car-free.org](http://www.car-free.org))

The Bethlehem Bicycle Commuter Facility affords its members access to bicycle tools, a shower facility, work sink, bathroom, washer/dryer unit, secure bicycle parking, and a bike wash. There is a \$400 annual fee for membership, half of which is payable by 20 hours of community service. There is a \$100 security deposit for the keys.

*Loaner Bicycles*

The Downtown Management Commission of Boulder, CO, has made available 100 bicycles and 50 helmets for residents and tourists; all that's required is a credit card as a deposit. Champlain College in Burlington, VT, gives bikes to students who agree not to keep a car on campus.

*Employer-Funded Commuter Bikes*

The Nabisco bakery in Buena Park, CA, gives new bicycles to employees who commute to work three out of five days for a six-month period. Those who commute on their own bikes are given \$300, the cost of a moderately priced new bike. Ten percent of the plant's 480 workers now commute regularly by bicycle, helping Nabisco satisfy the Los Angeles area's anti-pollution rules. "These commuters have become biking enthusiasts," reports Nabisco transportation coordinator Byron Kemp. "For them, biking is now an important social activity, and they regularly participate in fun rides on weekends."





Apple Computer provides free use of mountain bikes for employees at its Cupertino, CA, facility, as part of a Commuter Alternatives program. The chemical company Ciba-Geigy was able to avoid building a new garage at a facility in Switzerland by encouraging its employees to ride to work. Any worker willing to give up his or her parking space was given a new bicycle, an option 230 employees chose.

*National Bike to Work Month*

([www.bikeleague.org](http://www.bikeleague.org))

The League of American Bicyclists has declared May to be National Bike Month since 1956. The League also promotes Bike to Work Week and Bike-to-Work Day. They invite communities, corporations, clubs, and individuals to join in sponsoring bicycling activities during the month of May in order to increase awareness and acceptance of bicycling. The League produces a National Bike Month Event Organizer's Kit to help individuals and organizations that promote these events.

*Eugene Encourages Bicycle Transportation*

([www.ci.eugene.or.us/PW/bike](http://www.ci.eugene.or.us/PW/bike))

Eugene, OR has a well-planned and well used bicycling network that includes 28 miles of off-street paths, 78 miles of on-street bicycle lanes, and four bicycle/pedestrian bridges spanning the Willamette River. These result in 8% of commute trips by bicycle.





## Mid-block Roadway Crossing Treatments

The MAG Region contains numerous shared use pathways and trails that supplement the area's on-street bicycling network. Many of these pathways and trails parallel canals, washes and utility corridors, and intersect collector and arterial streets at mid-block locations away from intersections and traffic control. Given the widths and traffic volumes on many of these roadways, as well as the fact that the motor vehicle traffic is uncontrolled as it approaches the pathway crossing, making a safe crossing on foot or on bicycle can be a challenge. This challenge creates frustration among bicycle riders, thereby lessening bicycle riding in the Region (see Questionnaire summary in Chapter 2). This condition further prevents the Region from having a comprehensive interconnected bikeway system decreasing both health and economics benefits as discussed earlier in this chapter.

Individual jurisdictions are experimenting with mid-block crossing treatments, though no Regional guidance exists including whether they should be

designated and, if so, what the appropriate crossing treatments should be. At mid-block locations, a crosswalk must be striped if it is to be a legal crosswalk at which motorists are required to yield to pedestrians/path users. While it is legal to cross at most mid-block locations, pedestrians/path users must yield to motorists unless they are crossing inside a legal crosswalk. Other cities throughout the country have also begun to address this situation with a variety of crossing treatments. Several of these treatments are discussed below.

### *Grade-Separated Crossings*

One available mid-block crossing treatment is the grade-separated crossing, usually consisting of a pathway underpass or overpass of an arterial or collector roadway. When designed properly with adequate height, width, lighting, sight-lines, and approaches, grade-separated crossings are generally safe, convenient, and comfortable for all users.





When constructed exclusively for path and trail users however, these crossings are costly. The opportunity exists though, particularly in new development, to build a grade-separated crossing for path and trail use that is already needed for drainage or other infrastructure needs. Master Planned communities such as DC Ranch, Verrado, Desert Ridge, and many others throughout the Region recognize the many economic, health, and quality of life benefits of a comprehensive path and trail network. They have routinely included path and trail grade-separations in their infrastructure planning at minimal incremental cost by use of over-sized culverts or creative bridge designs. The Maricopa County Department of Transportation has been successful in requiring grade-separated crossings in new developments planned west of the White Tank Mountains. Other jurisdictions have successfully negotiated the phased development of grade-separated crossings with phase one being construction of a properly designed culvert and phase two being construction of the path and/or trail approaches, lighting, signage, and other needed facilities.

For evaluation of existing mid-block crossing conditions, Federal Highway Administration has developed a warrant for grade-separated crossings based on pathway and roadway volumes, as well as the proximity of the crossing to nearby alternative crossings. Numerous publications provide specific guidance on the design of grade-separated crossings that will successfully accommodate all types of path and trail users.

It is important to note that grade-separated crossings are not well-utilized if they cause a significant diversion to users. However, grade-separated trail crossings usually continue along the same longitudinal alignment, and therefore do not create a diversion. Nonetheless, the installation of barriers at at-grade trail/roadway crossings may be worthwhile to ensure that the grade-separated crossing is appropriately utilized.





### ***Signalized At-Grade Crossings***

In the absence of a grade-separated crossing, signalized crossings should be considered if warranted. These would include both full and half pedestrian signals, and could potentially incorporate split pedestrian phasing. The *Manual on Uniform Traffic Control Devices (MUTCD)* provides warrants for the installation of traffic signals. Any of the warrants described in the *MUTCD* can be used for pathway/roadway intersections. When using the vehicular warrants, however, only bicyclists should be considered as volume on the path. Alternatively, bicyclists can be counted as pedestrians for the application of the Pedestrian Volumes warrant.

### ***Unsignalized At-Grade Crossings***

In many locations and for many reasons, grade-separation and signalization may not be feasible options. There are several specific treatments that can be incorporated at designated crossings that will give path and trail users a greater sense of security, comfort, and convenience. These treatments are

considerably less costly than grade-separated crossings and provide a greater opportunity to be used more frequently.

Two primary criteria are used to determine if a designated mid-block pathway crossing may be appropriate at a given location:

- Roadway geometric characteristics:
  - sight distance
  - proximity to intersections
- Pathway user volumes (converted to pedestrian delay as represented by the additional distance the pathway user is required to travel to an intersection crossing)

If a designated mid-block pathway or trail crossing is therefore determined to be the appropriate solution, specific intersection characteristics must be further evaluated to determine the appropriate crossing treatment(s). The intersection characteristics include:

- the number of lanes
- presence of a median
- motor vehicle travel speed
- traffic volume





Streets with many lanes, higher traffic speeds, and higher traffic volumes would better accommodate bicyclists and pedestrians with the use of a greater number of design treatments such as:

- raised median
- ladder or continental style marked crosswalks
- staggered crosswalks or Danish offsets
- pedestrian crossing warning signs
- advanced pedestrian crossing warning signs
- yield to pedestrian signs
- advance yield lines
- appropriate pedestrian scale lighting
- experimental treatments and devices (e.g., PXO and HAWK)



Figure 3-2. HAWK Signal in use

### ***Additional Treatments***

The HAWK and PXO treatments discussed below offer additional methods to improve the sense of safety, comfort, and convenience of bicyclists and pedestrians when crossing roadways at mid-block locations. They are considered experimental treatments and although not currently fully approved by the MUTCD, a “Request to Experiment” can be obtained from FHWA for all installations of non-street standard treatments, such as the HAWK and PXO. The HAWK and PXO are described in detail below.

#### The “HAWK”

The “HAWK,” (Figure 3-2) a pedestrian activated beacon used at otherwise unsignalized crossings, was approved by Committee at the MUTCD annual meeting in January 2007. This committee includes all of the *MUTCD*’s voting member agencies such as the American Association of State highway and Transportation Officials (AASHTO), Institute of Traffic Engineers (ITE), American Automobile Association (AAA), etc. Prior to full approval, the HAWK must next have general approval from FHWA. FHWA would then include the HAWK in its rulemaking package for





publication in the Federal Register, which would allow for the signal to be fully official.

Because the HAWK is currently moving through its approval process, it is being included here for informational purposes. MAG is aware that certain jurisdictions in Arizona (Tempe and Tucson) and across the country are currently experimenting with this treatment.

To activate the HAWK, the pedestrian or bicyclist presses a button so the signal stops traffic along the roadway allowing pedestrian or bicyclist crossings. It allows the path to clear before motor vehicle traffic resumes. HAWK signals give motorists more positive guidance than a flashing yellow beacon while causing less delay to motorists than a signal. They are typically used in combination with other crossing treatments such as raised medians, ladder or continental style marked crosswalks, staggered crosswalks or Danish offsets, pedestrian crossing warning signs, advanced pedestrian crossing warning signs, advance stop bars, and appropriate pedestrian scale lighting. They can be located in such a way as to not interfere with roadway signal timing.

The HAWK light sequence is described below and shown in Figure 3-3:

- Sequence 1: motorists proceed through the crossing while the pedestrian is stopped with a solid hand.
- Sequence 2: motorists are warned of an imminent pedestrian/bicyclist crossing via a flashing yellow light while the pedestrian is stopped with a solid hand.
- Sequence 3: motorists are warned to stop via a solid yellow light while the pedestrian is stopped with a solid hand.
- Sequence 4: motorists are stopped via a double

### HAWK Sequence

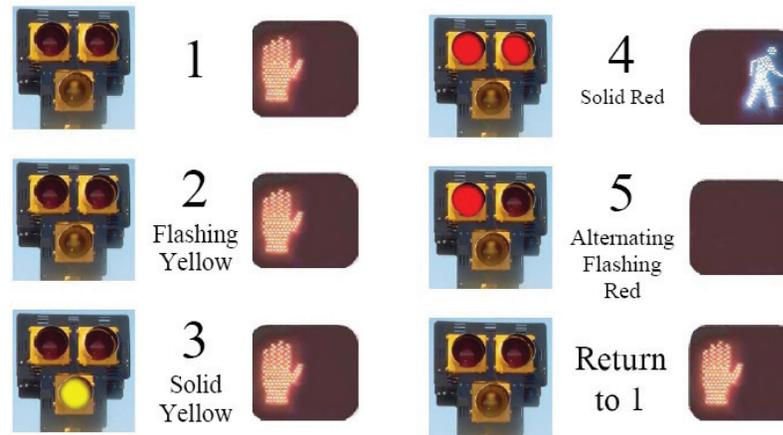


Figure 3-3 (Modified from Bird Watching Tucson Style, City of Tucson Department of Transportation)





red light and pedestrians move through crossing via a pedestrian walk signal.

- Sequence 5: motorists are stopped and warned of pedestrian walk sequence ending via a wig-wag of the two red lights while pedestrian completes crossing. The hand flashes to stop any new users from entering the crossing. Vehicles may proceed after a complete stop when pedestrians have cleared the crossing.
- Return to 1.

The best adherence to the HAWK signal would result from its consistent application at all locations, so as to better educate and create predictability for all motorists, bicyclists, and pedestrians.

### Pedestrian Crossover (PXO) Crossing

The PXO treatment (Figure 3-4) is a combination of signage markings and pedestrian activated strobe and feedback devices. Signage for the PXO includes advance warning signs (W11-2) with AHEAD supplemental plaques (W16-9p), and YIELD HERE TO PEDS signs (R1-5). Note that the YIELD

HERE TO PEDS signs are an indication of the appropriate location and do not mandate yielding behavior if no pedestrians are present. Pavement markings include yield markings and solid white lane lines (on divided multi-lane roads). The length of these lines is dependent upon the design stopping sight distance for the roadway. The pedestrian activated treatments are W11-2 signs with built in rectangular strobe flashers. Additionally, pedestrian visible strobes and a recorded message inform pedestrians of when the crossing is activated and instruct them to wait for motorists to yield. High visibility crosswalks are used with the PXO crossing treatment.



Figure 3-4. PXO Crossing





### ***Conclusion***

The use of these various mid-block crossing treatments would assist MAG jurisdictions to provide more consistent and convenient pathway crossings, and would help to create a greater degree of consistency and connectivity throughout the Region. Recognizing that the HAWK and the PXO signal are still experimental treatments, it is hoped that upon their approval by the appropriate bodies at the MUTCD and the FHWA, that local jurisdictions adopt them into their own standards. Then, once adopted, jurisdictions should strive to incorporate them into as many locations as are practical.

Again, the experimental mid-block roadway crossing treatments are provided here for information purposes only. They in no way supersede any adopted standards and are not a substitute for the application of engineering judgment.





## Chapter Four: Direction

The final Direction for this *Plan* is based upon the needs and trends identified in Chapters Two and Three and key information in relevant documents:

- *MAG Regional Bicycle Plan: 1999 Update*
- *MAG Regional Off-Street System Plan, (ROSS) 2001*
- *Maricopa County Bicycle Transportation System Plan*
- *AASHTO Guide for the Development of Bicycle Facilities, 1999*
- *Healthy Arizona 2010, Arizona Department of Health Services, 2001*
- Local jurisdictions bicycle plans



The Regional and metro area on-street and off-street bicycle system illustrated in Figures 4-1 and 4-2 incorporates routes from the above MAG Regional plans with updated information provided by local jurisdictions. In terms of mapping details of bicycle routes, this *Plan* departs from the 1999 MAG *Plan* by not providing descriptions and route numbers of each on-street segment identified in the *Plan*. This acknowledges that each jurisdiction monitors the details of its own facilities and allows this *Plan's* focus to be on tools, techniques, policies, and programs that will help foster bicycle facility and program development throughout the Region.

The Mission and Goals that follow the Regional maps are a blending and enhancement of missions and goals from all of the above documents. They address the physical improvements, policies, and programs that will foster an exemplary bicycle network.





## Regional Connectivity Context

The bicycle network in the MAG Region consists of both on-street and off-street facilities. The on-street facilities include bicycle lanes and bicycle routes. The off-street facilities, consisting of both paved paths and unpaved trails, include canal banks, washes, waterways, highway and freeway rights-of-way, railways, and utility easements. Regional and local bicycle plans have illustrated the extensive system of facilities and routes that provides opportunities to all types of users, from highly experienced riders to families and children. Planned and existing routes provide long-distance connectivity to Regional destinations such as large employment centers, as well as more localized connectivity to destinations including parks, schools, and small commercial areas.

A primary purpose of Regional and local plans is to encourage the use of bicycles for making all types of daily trips and thereby reduce single-occupancy vehicle (SOV) trips and help to improve air quality. It was assumed in the prior MAG bicycle planning documents, and still is today, that bicyclists are an integral part of the transportation community deserving of safe and attractive shared roadway space and off-street facilities.

A critical element of a successful bicycle network in the MAG Region is the ability for bicyclists to conveniently and comfortably travel along off-street facilities like canal banks, and to travel from an off-street to an on-street facility or vice versa. The design of the intersections of on-street and off-street facilities can therefore have a great impact on whether bicycling can become a functional transportation alternative.

Figures 4-1 and 4-2 illustrate the interconnectivity of on-street and off-street facilities at two different scales. Regional Bicycle Facilities (4-1) show this relationship throughout Maricopa County by focusing on the long-distance, Regional routes. Metro Area Bicycle Facilities (4-2) illustrates the finer grain of on-street and off-street facilities within the Region. Most significantly, anywhere on either map where a red line (off-street facility) intersects a blue line (on-street facility) highlights a location where special attention is needed to address transitions and crossings. This particular type of facility connectivity is a primary focus of this *Plan* and is discussed in several contexts in subsequent chapters.





Figure 4-1 Regional Bicycle Facilities (Existing and Planned)

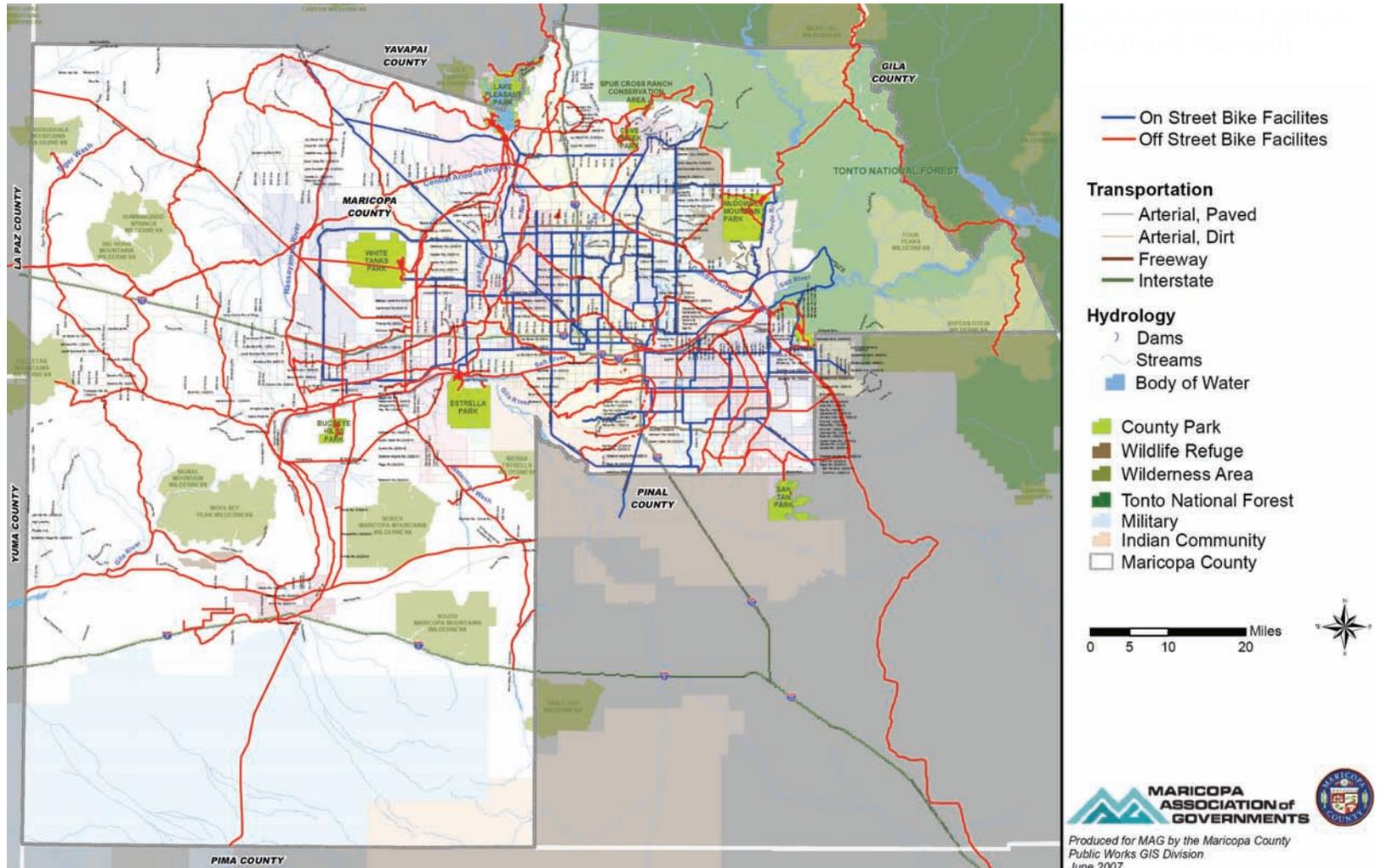
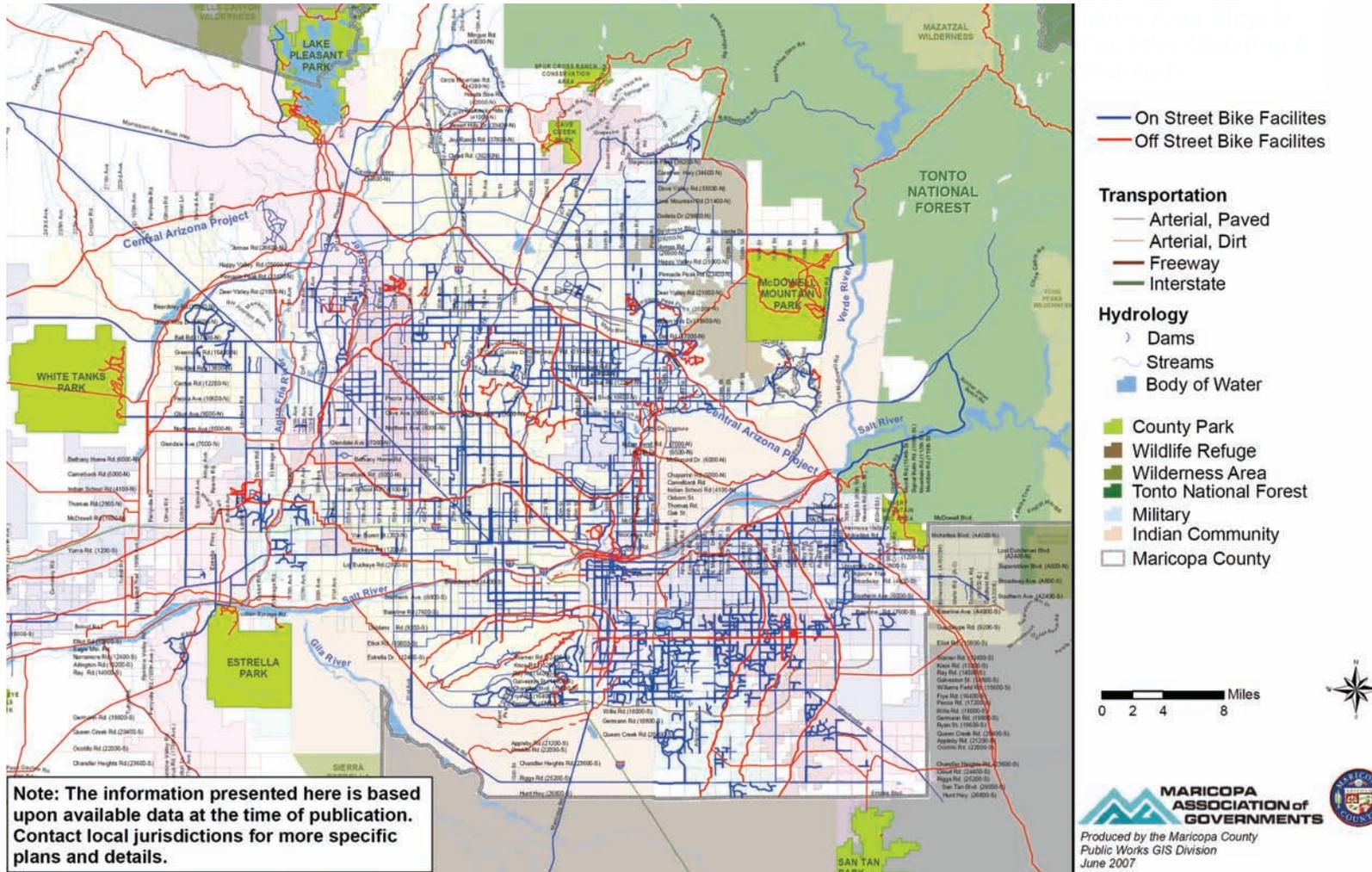




Figure 4-2 Metro Area Bicycle Facilities (Existing and Planned)





**Mission Statement**  
Provide an interconnected Regional system of bikeways that contributes to a vibrant, healthy, and livable community.

**Goals**

**Access**

Access: Provide a convenient, easily accessible, and visible bicycle transportation system comprised of connected on-street and off-street facilities within neighborhoods and jurisdictions.

Complete Streets: Design and maintain all streets to accommodate bicycles.

**Safety/Health/Education**

Safety: Develop a bicycle transportation system that increases user safety along routes and crossings by incorporating the American Association of State Highway Transportation

Officials (AASHTO) bicycle facility design standards and the principles of CPTED (Crime Prevention through Environmental Design).

Health: Increase the proportion of citizens who engage in physical activity by making bicycling facilities easily accessible from their homes and linked to desired destinations.

Enforcement: Encourage law enforcement agencies to increase levels of enforcement of traffic laws most often violated by roadway users that affect bicycle use and to improve tolerance and courtesy among all roadway users.

Education: Encourage and support new and existing bicycle safety and education programs that promote bicycle use, user group compatibility, and enforcement of traffic rules.

Promotion: Provide user-friendly maps, brochures, and websites that clarify routes and encourage bicycle riding.





Encouragement: Promote bicycling as a means of personal mobility for local and daily travel trips for all purposes, and as a form of healthy recreation and exercise.

### ***Connectivity***

Connectivity: Inter-connect a system of on-street bike lanes and off-street shared-use paths/trails to origins, destinations, and transit routes and, as a consequence, make bicycling a viable option for daily travel trips for all purposes.

### ***User-Friendliness***

User-Needs: Provide a user need-based bicycle transportation system that is safe, convenient, well-maintained, well-signed, and attractive. The system should accommodate the various skills and confidence levels of bicycle users and minimize potential conflicts with other users and vehicles.

End-of-Trip Provisions: Encourage bicycle riding by providing end-of-trip facilities that include bicycle parking, drinking water, toilets, showers, and lockers.

### ***Implementation***

Implementation Plan: Outline specific steps, timelines, policies, programs, and criteria for project selection to implement this *Plan*, thereby encouraging large-scale to spot-improvement projects.

Bicycle Friendly Policies: Institute bicycle-friendly policies in the systematic, everyday work of agencies at all levels of government.

Integrated Planning: Integrate bicycle transportation facilities into ongoing and future transportation, land use, and economic development plans created by public jurisdictions and private development.

Techniques and Tools: Develop techniques and tools that will assist MAG member agencies in implementing and prioritizing bicycle projects.

Maintenance & Operations: Develop guidelines for long-term local and Regional bikeway maintenance and operations programs.





External Funding: Increase bicycle facility development by exploring alternative funding and partnership opportunities with external organizations within the business and health communities among others.

Internal Funding: Increase bicycle facility development by developing alliances and integrated funding strategies between various public agencies such as transportation, flood control, parks and recreation, and health.





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## Chapter Five: Goals Illustrated

In order to fully emphasize the goals and the results that can result from achieving them, the following illustrations have been created to portray goals (such as access, connectivity, and “Complete Streets”) in a more visual way. These “Goals Illustrated” are stylized vignettes portraying bicycle facilities or other solutions that can serve as prototypes for other similar settings within the MAG Region. The treatments and solutions shown herein are comparatively economical solutions that are relatively simple to implement. They illustrate the potential results of the cost effective solutions identified in this *Plan*.

The stylized treatments and solutions shown illustrate the potential results of the cost effective solutions identified in this *Plan*.





## Complete Streets

The concept of “routine accommodation of bicycling and walking” is now being incorporated into a broader based national movement referred to as “Complete Streets.” Its multi-modal purpose is to design and operate the entire street right-of-way to enable safe access for all users. Streets built to a “Complete Streets” concept integrate the needs of pedestrians, bicyclists, neighborhoods, businesses, transit, and all types of motorists.

### TAKE NOTE OF:

- ▶ Multiple transportation modes: cars, buses, bicycles, and pedestrians
- ▶ Wide and striped bike lane
- ▶ Bicycle accommodations on buses
- ▶ Wide sidewalks
- ▶ Generous tree plantings create shade and comfort
- ▶ Supportive adjacent land uses: mixed-use developments and a variety of residential densities
- ▶ Separate unpaved trail
- ▶ Bus stop with shade, seating, bike racks, signage, and maps



A “Complete Street” properly and safely accommodates all types of users of a roadway corridor through routine design and operations.





## Canal and Open Space Corridors

The Valley already possesses many well-used shared use paths along canal banks and other corridors. The intersections of canals and roadways provide opportunities to make intermodal transportation infrastructure more visible and accommodating to all types of users from families to commuters.



Canal banks often provide both paved and unpaved riding opportunities. Amenities at key street crossings are helpful to all users.

### TAKE NOTE OF:

- ▶ Direct linkages between on-street bicycle lanes and canal bank paths and trails
- ▶ Shade, bike racks, seating, drinking fountains, route maps, and signs orient users to the overall system and make riding more comfortable and convenient
- ▶ Iconic design gives the location prominence and character
- ▶ Sidewalks and an adjacent park provide additional linkages to the canal path and trail system





## Arterial Streets

Many on-street bicycle facilities in the Region are provided on the collector (half mile) street system; however, most travel destinations are located along major arterial streets (mile streets). Particularly in newer parts of the Valley, street widths may be made to accommodate bike lanes by narrowing vehicular lane widths. Arterial street bike lanes would greatly increase the connectivity and function of the Region's bicycle network.

### TAKE NOTE OF:

- ▶ A wide, signed, and striped bicycle lane
- ▶ Adjacent bicycle destinations: restaurants, offices, retail, civic sites, and large-scale recreational areas
- ▶ "End of trip facilities" such as bicycle racks, lockers, drinking fountains, etc. at or near main building entrances



There is a range of standard travel lane widths potentially allowing for the creation of bicycle lanes by narrowing travel lanes.





## Neighborhood Collector Street System

Bike lanes on collector streets (half mile) in neighborhood settings provide the greatest opportunity to connect bicycle trip origins (residences) to typical neighborhood destinations: elementary and middle schools, neighborhood parks, neighborhood commercial centers, and nearby neighborhoods. These collector streets connect directly to the local streets where people live and from which most short travel trips originate.



Neighborhood Collector Streets provide direct linkage to typical neighborhood or short trip destinations.

### TAKE NOTE OF:

- ▶ Local street linkage to the collector street bicycle lanes
- ▶ Neighborhood commercial easily accessed from bicycle lanes and pedestrian facilities
- ▶ Wide, striped, and signed bike lanes on the collector streets
- ▶ “End of trip facilities” such as bicycle racks, lockers, drinking fountains, etc. located at or near main building entrances





## Mid-Block Crossings

Trail and path crossings of arterial streets present many problems in the MAG Region. There are, however, numerous design tools that can be used to more safely accommodate path users at these intersections.

### TAKE NOTE OF:

- ▶ Wide, striped crosswalk
- ▶ ADA ramps where the path meets the street
- ▶ Ample signage for motorists warning of the crossing
- ▶ “Shark Tooth” stop bars to keep vehicles back sufficiently from the crosswalk
- ▶ Clear visibility to the crosswalk for both the path and road user
- ▶ Path linkages to sidewalks



A variety of options exist for making mid-block crossings safer for path and trail users and thereby decrease a significant barrier to safe, comfortable, and convenient bicycle use in the MAG Region.





## Mid-Block Crossings - The "HAWK"

Path and trail users encounter significant challenges when trying to cross arterial streets at mid-block locations such as those along canal and power line corridors. One method being tested in Arizona is the "HAWK" signal, a pedestrian/bicyclist activated signal crossing. It is one type of an advanced traffic control device that stops the motorists on the roadway while path and trail users cross. It is currently in use in the Tucson area.



The "HAWK" signal is being tested in Arizona for effectiveness to bicyclists and pedestrians by stopping motorists as path and trail users cross the roadway.

### TAKE NOTE OF:

- ▶ Wide, striped crosswalk
- ▶ Pedestrian-activated "HAWK" signals that stop traffic when path/trail users are crossing
- ▶ ADA ramps where the path meets the street
- ▶ Ample signage for motorists warning of the crossing
- ▶ Stop bars to keep vehicles back sufficiently from the crosswalk
- ▶ Clear visibility to the crosswalk for both the path and road user
- ▶ Path linkages to sidewalks





## School Trips

“Safe-routes-to-school” programs throughout Arizona and the United States aim to improve walking and bicycling conditions to and from and around schools. The Arizona Department of Transportation manages a grant program that provides financial assistance to State, local, and Regional agencies, including nonprofit organizations.

### TAKE NOTE OF:

- ▶ Ample bicycle parking located along the most direct route to the school’s main entrance
- ▶ Bike lanes AND separate paths provide convenient and safe access choices
- ▶ Vehicular access is removed from bicycle and pedestrian access



Improved bicycle access to schools include a variety of features including safe and convenient bicycle parking, crossing guards, and bus traffic separated from pedestrians and bicyclists.





## Special Events

Events that draw many people to converge at one place at one time can create traffic and parking challenges. When appropriate conditions exist, however, bicycling can be a great way to travel to sporting events, festivals, concerts, or even parades. On-street and off-street bicycle facilities leading to/from and within these unique places would provide access opportunities that would help alleviate traffic and congestion.



Bicyclists can approach the site along on-street bike lanes or separate paved paths following linear parks or other open space corridors.

### TAKE NOTE OF:

- ▶ A linear park provides direct access to the event site without encountering street traffic
- ▶ Paved paths lead directly to the main entrance
- ▶ Ample bicycle parking near the facility's main entrances are more convenient than vehicular parking
- ▶ Paths are well-lit and signed
- ▶ Bike lanes AND separate paths provide access choices





## Trailheads

Well-designed and accessible trailheads can increase the attractiveness and utility of all types of bicycle facilities. Well-appointed trailheads located at the crossings of bike lanes and paved paths provide the best opportunities to help make bicycling convenient and enjoyable.

### TAKE NOTE OF:

- ▶ An on-street bike lane and an off-street paved path provide connectivity and choice
- ▶ Separate bicycle/pedestrian bridge makes canal crossings easy
- ▶ Amenities such as a drinking fountain, route maps, and shaded seating add convenience and comfort
- ▶ Car and bicycle parking located close to the paved path and bike lanes



The best trailheads provide convenient access and needed amenities to users of all ages and abilities.





## Multi-Modal Connectivity

Long distances between bicyclists' homes and desired destinations could discourage bicycle use. Direct connections between bicycle lanes and paths to bus and light rail routes would make longer distances manageable. Valley Metro buses are currently equipped with bike racks, and in the near future, light rail cars will be also. Appropriate accommodations at stops and transit stations will make bicycling an even more viable travel option.



Linked transit routes and bicycle facilities will make it possible to shorten the effective distance between destinations, thereby making bicycling a more viable travel option.

### TAKE NOTE OF:

- ▶ A bicyclist loading his bike onto a rack mounted on the bus
- ▶ Ample bicycle parking at the bus stop
- ▶ Bike lanes along the bus route
- ▶ Bus stop with shade, seating, route maps, and informational signs
- ▶ Adjacent office building supports easy connections between routes and destinations





## Site Studies and Feasible Improvements

One of the goals of this *Plan* is to create a network of bicycle facilities that links neighborhood and Regional destinations using bikeable collector and arterial streets and off-street paths. To offer solutions for the typical constraints that make interconnectivity a challenge, MAG Bicycle Task Force members selected eight locations throughout the Region that represent typical site issues and opportunities. Mid-section collector and arterial streets around these sites were studied where the provision of on-street bicycle facilities are severely constrained due to street and ROW widths, traffic volumes, and traffic speeds.

**These recommendations are applicable throughout the Valley and thus demonstrate the numerous opportunities to better accommodate active transportation and recreation.**

Because safe and comfortable bicycle travel often relies on off-street facilities as well, the representative projects include sites where canal paths intersect with collector or arterial streets.

The following section outlines the evaluations and recommended potential bicycling improvement opportunities at these representative sites. These recommendations, while for specific study areas, are applicable throughout the Valley and thus demonstrate the numerous opportunities to better accommodate active transportation and recreation. Most importantly, these recommendations illustrate how each challenge has an attainable solution. These solutions are derived directly from the policies promoted in this document.





**Situation:**

**Canal Path and Arterial Street Intersections**

**Location:**

Scottsdale - Arizona Canal at Scottsdale Road and Camelback Road

**Objective:**

To accommodate crossings by all users of the pathways on either side of the canal and minimize or eliminate mid-block crossings

**Improvement Summary:**

Bridges, sidewalk improvements, and signage

is unlikely to change, given the current intersection configuration.

Ideally, the canal pathway users would be able to cross directly through this area. If the pathway users were staying on the southern embankment pathway this might be a viable design option. However, the likelihood that users will want to change sides complicates this “direct path” approach. Additionally, pathway users are not restricted to the predominant desire lines – they travel on both the north and south sides of the Arizona Canal.

Discussion: At the intersection of Scottsdale Road and Camelback Road, the Arizona Canal crosses both roadways. Pathway users travel on the flat-graded embankments adjacent to the Arizona Canal and cross both roads at numerous locations. Currently, the preferred route or desire line for path users crossing Scottsdale and Camelback Roads is between the north side of the canal on the west side of Scottsdale Road and the south side of the canal on the east side of Scottsdale Road (Figure 6-1). Discussions with City of Scottsdale staff indicate that this existing desire line

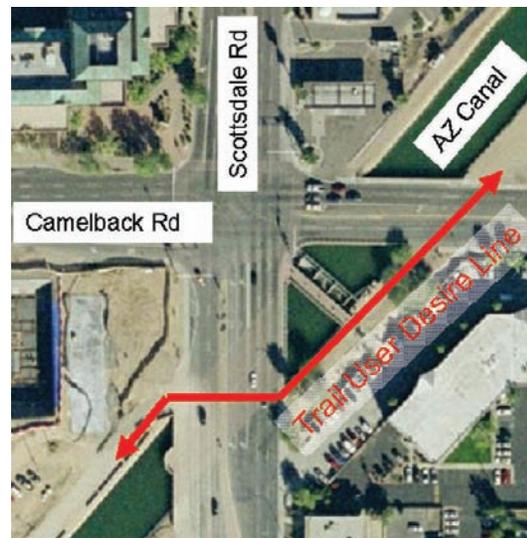


Figure 6-1. Camelback Road at Scottsdale Road (existing)





Improvements: The most practical solution is to direct the pathway users to the intersection and have them cross at the existing traffic signal. To accomplish this, two pathway/canal bridges would need to be constructed. Fortunately a bridge is planned in conjunction with the ongoing development on the west side of Scottsdale Road. An additional pathway bridge to cross the canal on the north side of Camelback Road should be considered. The northeast, southeast, and southwest sidewalk corners of the intersection should be improved to accommodate pathway users on the corners.

The northeast corner may be problematic as it appears from the property appraiser's map that much of this corner (into the roadway) is owned by the adjacent property owner. It appears, however, that the Arizona Canal right of way connects to the intersection, so with some careful alignment of this crosswalk this corner can still accommodate the pathway. The southeast corner of the crosswalk will require significant modifications to the canal weir area. The northwestern-most portion of the weir appears to be non-mechanical and may be able to be covered; this option should be explored (Figures 6-2 and 6-3).

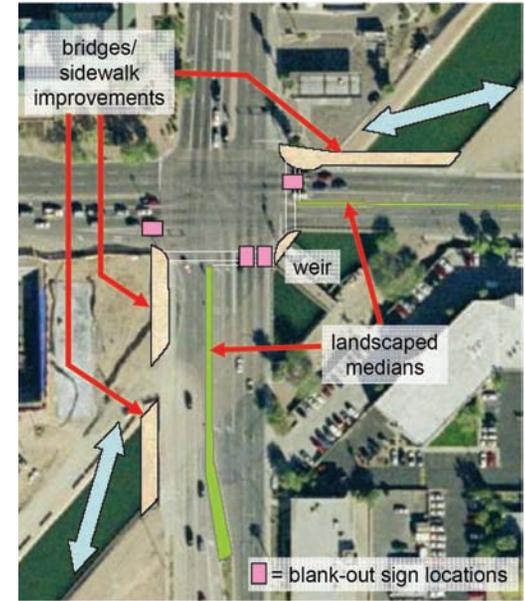


Figure 6-2. Camelback Road at Scottsdale Road (proposed)



Figure 6-3. Weir area on southeast corner of intersection





In addition to the geometric improvements, there are several potential modifications that would make the signalized intersection more convenient for path users. “No Right Turn on Red” blank-out signs for the westbound (Camelback Road) and northbound (Scottsdale Road) movements could be used to restrict right turn on red movements when pathway users press the pedestrian button. “Yield to Peds” blank-out signs could be installed for eastbound and northbound through-movements to warn of pathway users crossing during concurrent pedestrian phases (Figure 6-4).

Scottsdale Road and the south side of Camelback Road. Additionally, landscaping should be provided in the medians on the south and east approaches to the Camelback/Scottsdale intersection. These modifications, in conjunction with the bridges on the pathway approaches to the intersection, should enhance safety and increase use of the canal pathway while minimizing mid-block crossings of Camelback Road and Scottsdale Road.

Pathway users should be encouraged to use the signalized crossing as opposed to crossing mid-block. This could be achieved by eliminating the southeastern pathway’s straight connection (the desire line in Figure 6-1), and diverting users to the intersection via the sidewalks on the east side of



Figure 6-4. Potential blank-out signs





**Situation:**

**Bicycle Access on Arterial Streets at Freeway Interchanges**

**Location:**

Chandler - Chandler Boulevard at the Price Freeway

**Objective:**

To improve bike lane continuity through the intersection of Chandler Boulevard and the Price Freeway

**Improvement Summary:**

Curb, gutter, and sidewalk reconstruction to make space for bike lanes; signage

Discussion: Existing bike lanes on Chandler Boulevard are discontinued as the roadway approaches the Price Freeway (Figure 6-5). Chandler Boulevard is a six lane arterial roadway with 2006 traffic volumes of approximately 40,500 vehicles per day (vpd). Bike lanes exist on Chandler Boulevard on both approaches to the interchange with the Price Freeway. However, the bike lane striping stops several hundred feet on either side of the Price Freeway (Figure 6-6), creating a discontinuity in the bike lanes through the interchange.

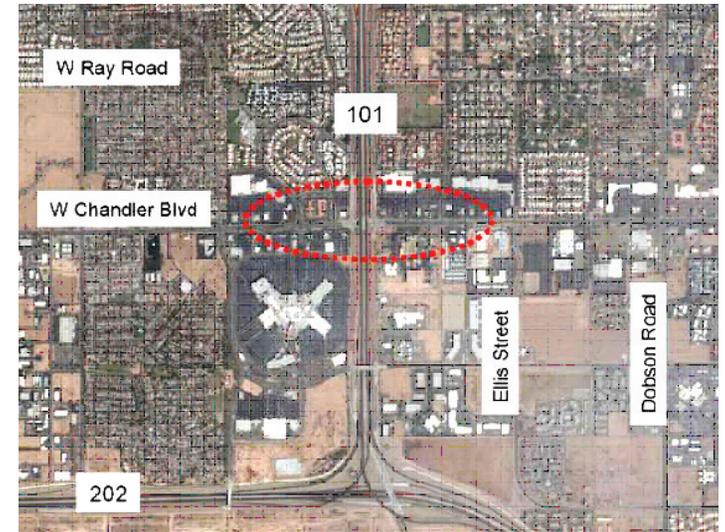


Figure 6-5. Chandler Boulevard, Price Freeway study area

Improvements: The City of Chandler is scheduled to receive CMAQ funds for a 2012 project to address this discontinuity in the Chandler Boulevard bike lane. The project will rebuild the curb, gutter, and sidewalk to provide space for bike lanes on Chandler Boulevard under the Price Freeway while maintaining the horizontal separation between pedestrians and vehicles.





This project will provide a higher level of comfort for bicyclists through the interchange and improve operating conditions for all users. It will also complete an important seven mile long east-west facility from I-10 to Hartford Street.

If the above referenced project is delayed or cannot be constructed, there are other treatments which could mitigate, to some degree, the lack of bike lanes through the interchange. SHARE THE ROAD sign assemblies (W11-1 and W16-1 signs) with bike activated flashers could be installed to alert motorists when cyclists are within the interchange area. Activated by loops within the existing bike lane on the approach to the interchange, the flashing beacons attached to these signs could be timed to flash just long enough to alert those motorists who might overtake the cyclist in the interchange area to the cyclist's presence. Quadropole loops, 20' x 2', have been found to effectively detect cyclists while not detecting motor vehicles in the adjacent lane.



Figure 6-6. Existing bike lane and discontinuity on Chandler Boulevard





On each approach a loop would be provided on a section of bike lane unlikely to be driven over by motor vehicles. Two SHARE THE ROAD assemblies could be placed for each direction. A concept graphic for the west approach is shown in Figure 6-7.



Figure 6-7. Interim treatment concept for Chandler Boulevard under the Price Freeway





**Situation:**

**Collector Street Bike Lane Opportunity**

**Location:**

Tempe - Alameda Drive from I-10 to the SR 101

**Objective:**

To provide bike lane continuity along a collector street with various road widths and on-street parking conditions

**Improvement Summary:**

Bike lanes, signage, hourly parking restrictions, traffic calming

Discussion: Alameda Drive is a 4.5 mile long east-west connector route that crosses Tempe from SR 101 to I-10 (Figure 6-8). There is a break in Alameda Drive where vehicular traffic is not allowed to cross the Southern Pacific Railroad just west of Mill Avenue. Closely spaced bollards provide a vehicular barrier at the railroad crossing. The eastern section of Alameda Drive has reported weekday traffic (2005-2006) of approximately 2500 vpd. West of the railroad tracks the traffic (2005-2006) is reported at nearly 2000 vpd. Discussion and improvements are broken into separate sections.

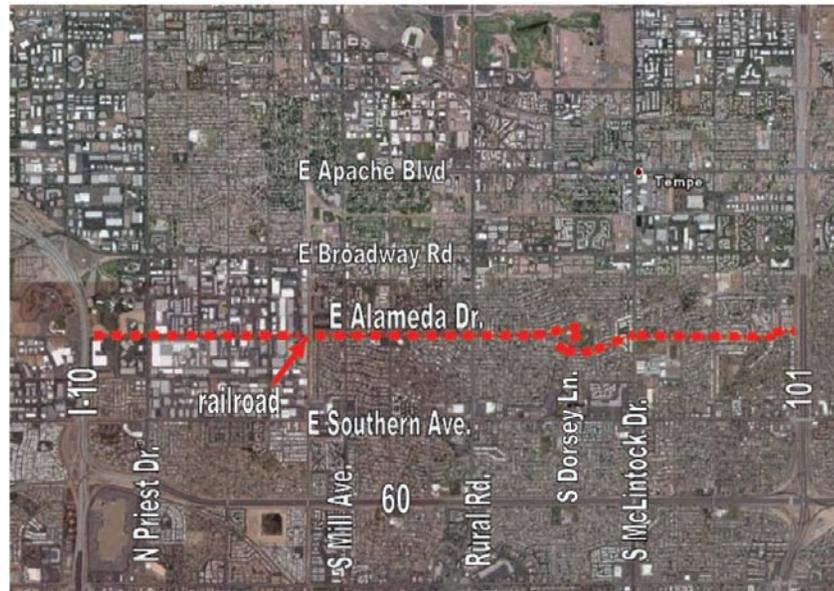


Figure 6-8. Alameda Drive Corridor





*Alameda Drive from SR 101 to South Dorsey Lane*

Discussion: This section is a two-lane, undivided roadway with on-street parking permitted on both sides of the road (Figure 6-9). Very few parked cars were observed along this section of Alameda Drive; moreover, most of the houses have off-street parking including paved driveways and carports/garages.

Improvements: The roadway space could be delineated to provide bike lanes. A possible cross section would include on-street parking on one side of the street, bike lanes, and two marked travel lanes. Additional traffic calming techniques might include contrasting pavement for the bike lanes (Figure 6-10) and curb extensions at appropriate locations. The railroad crossing could be made more amenable to bicycles with trailers by removing one of the bollards.



Figure 6-9. Existing Alameda between SR 101 and Dorsey - looking east



Figure 6-10. After - Contrasting pavement bike lanes with on-street parking removed from the north side of the street





*Alameda Drive from South Dorsey Lane to South Rural Road*

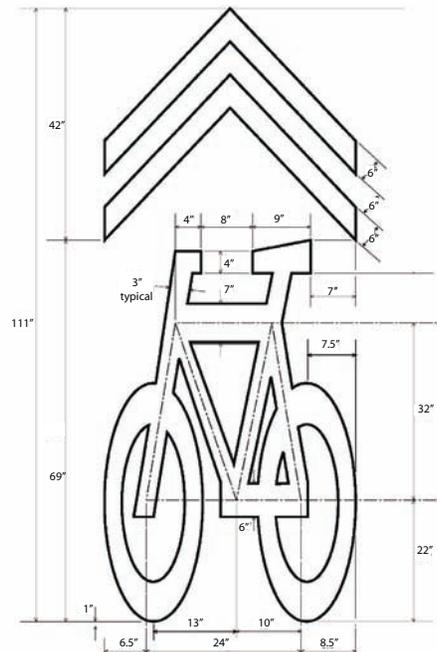
Discussion: Alameda Drive remains a two lane roadway but has a raised median. Each half of the road has approximately 20 feet of width and on-street parking is permitted.

Improvements: It may be possible to remove or limit hours of on-street parking along this 0.6 mile section of Alameda as the adjacent homes have off-street parking. A review of two sets of aerial photos revealed minimal actual on-street parking (6 cars shown on Google Earth and 3 on the County’s GIS website). If on-street parking can be restricted or time managed, bike lanes would be feasible on this section of Alameda Drive. Otherwise, shared lane symbols could be added to the roadway (Figure 6-11). This symbol has been approved by the National Committee on Uniform Traffic Control Devices.

*Alameda Drive from South Rural Road to just east of I-10*

Discussion: Alameda Drive has a three lane cross-section with on street parking.

Improvements: As with the section from SR 101 to Dorsey, the light parking use may allow for restriction of parking on one side of the street and the provision of bike lanes.



**Figure 6-11. Bike and Chevron Symbol**

*National Committee on Uniform Traffic Control Devices*





**Situation:**

**Neighborhood Path Connections  
in Developed Areas**

**Location:**

Mesa - Between Main Street and University Drive at the approximate Creston alignment

**Objective:**

North/south pathway route linking Main Street and University Drive through a dense neighborhood

**Improvement Summary:**

Overlay public access or path/trail easement on drainage easements, acquisition of public access easements, bike lane striping through parking lots

**Discussion:** No pathway currently exists in this neighborhood (Figure 6-12) of mobile home parks, an apartment complex, and a church/school, though the area is close to numerous commercial properties on nearby arterial streets, as well as the Eastern Canal, a Regional path/trail corridor. A mid-section collector-type bicycle facility is needed to provide access to these destinations.

**Improvements:** One potential solution in this area is to secure easements from property owners for the construction of a path. Approximately midway between Lindsay and Val Vista (Creston alignment), on the north side of Main Street, is a drainage outfall which is owned by Polo Club Apartments (Figure 6-13). If a public path/trail or similar easement were obtained over this drainageway, a path could follow the drainage outfall on its east bank from Main Street north to its terminus at the southern edge of the Polo Club Apartments parking lot. For the trail to continue north from here, a similar easement would need to be obtained from the Polo Club Apartments through



Figure 6-12. Study area between University Drive and Main Street





the western aisle of its parking lot to the southern boundary of the Pilgrim Evangelist Lutheran Church of Mesa. This easement could be 12 feet wide, the actual width of a path delineated on the existing asphalt by a contrasting color paint or lane markings similar to on-street bike lanes. Small sections of path would need to be constructed on the north and south end of the apartment complex site where landscaped islands currently exist. Continuing northward, the bicycle pathway would reach the school/church property, the southern half of which is a turf play field. In this location, a 16 foot public access or path/trail easement would have to be acquired along the western property boundary to accommodate a 10'-12' path. Where this corridor intersects the church/school parking lot, a dedication and treatment similar to that for the apartment complex parking lot could be made. As the path continues north through a landscaped portion of the site, another 16 foot public access or path/trail easement would be needed to bring the path to the sidewalk along University Drive.



**Figure 6-13. Potential option using easements from church and Polo Club**





The solution described above would require difficult property/easement acquisition from two landowners, the Polo Club Apartments and the Pilgrim Evangelist Lutheran Church of Mesa. Even if the easements are acquired, each owner may have concerns regarding impacts to security, privacy, and liability, highlighting the fact that attempts to create neighborhood connections amidst existing development are often very challenging. For this reason, local governments should be proactive in making every effort to secure easements from developers prior to design, permitting, or construction. Pre-construction acquisition of easements can be significantly aided by offering compelling incentives to developers. There are many concessions that can save developers money at little or no actual expense to the jurisdiction. Among the concessions that can be offered in exchange for path/trail easements are the following:

- Reductions to required yard/setbacks,
- Reduction in required parking ratio,
- Variance parking lot dimension(s),
- Greenspace (vehicle utilization area (VUA) requirement transfer,
- Internal (transfer) flexibility of required land use buffer yards,
- Floor area ratio (FAR) bonus/bump-up, and
- Trip generation (hence traffic impacts) reduction.

These compelling enticements could be effective ways to acquire pathway easements, rendering situations like the one described in this case study obsolete.





**Situation:**

**Mid-block Canal Pathway  
Crossing of a Major Arterial Street**

**Location:**

Phoenix - Arizona Canal/Sun Circle Trail at 7th Avenue

**Objective:**

To enhance bicyclist crossing opportunities at a mid-block crossing of 7th Avenue at the Arizona Canal

**Improvement Summary:**

Signalization

Discussion: The path along the Arizona Canal is a popular route for area bicyclists. One of the most difficult roadway crossings for trail users is located at 7th Avenue in Phoenix (Figure 6-14). While a path is present along both sides of the canal, City of Phoenix staff state that the northern bank is of key interest due to an underpass on the northern bank at Dunlap Avenue, approximately 800 feet east of 7th Avenue. Also, the southern bank of the canal is in relative close proximity to the intersection of 7th Avenue and Dunlap Avenue to the south, making a crossing inadvisable at the canal.

The path intersection with 7th Avenue is at-grade and is currently indicated by a marked crosswalk. 7th Avenue is a four-lane arterial roadway with a daily traffic volume of close to 10,000. This crossing requires trail users to navigate five lanes of motor vehicle traffic (the four through lanes and the beginning of the left turn lane onto Dunlap Avenue), generally operating at speeds above the posted limit of 35 miles per hour.



Figure 6-14. Arizona Canal @ 7th Avenue





Improvements: While additional passive traffic control devices including signs and markings could be applied to the current crossing, such signs may not be visible to all motorists because of the absence of a raised median in which they could be placed. For this reason and because of the distance and traffic volumes that path users encounter, a signalized crossing of some kind is recommended.

A full bicycle/pedestrian signal could be installed if it meets warrants, but a HAWK signal could also be considered to reduce the potential impacts to motor vehicle delay. As of January 2007, the HAWK signal, an experimental traffic control device, has been recommended for approval by the MUTCD, yet must still go through rulemaking procedures at the FHWA prior to full adoption. The HAWK signal is currently being tested in Tucson, as well as at two canal path/street crossings in Tempe. The bicyclist presses a button so the signal stops traffic along the arterial roadway to provide for path crossings. It allows the path to clear before motor vehicle traffic resumes. HAWK signals can give motorists more positive guidance than a flashing yellow beacon while causing less delay to motorists than a full signal. Any use of the HAWK signal would require a "Request to Experiment" to be filed with FHWA. A HAWK signal in operation is shown in Figure 6-15.



Figure 6-15. HAWK Signal in use in Tucson, AZ

*(Photo by Michael Cynecki)*





**Situation:**  
**Mid-block Canal Bike Trail**  
**Crossing of a Major Arterial Street**

**Location:**  
 Phoenix - Grand Canal at Indian School Road and N. 23rd Avenue

**Objective:**  
 To explore alternative techniques for the Grand Canal trail to cross Indian School Road

**Improvement Summary:**  
 Signalization

**Discussion:** The logistics of this crossing (Figure 6-16) are similar to those for the Arizona Canal crossing described above for 7th Avenue. In this case, the roadway being crossed by pathway users is even wider, as Indian School Road consists of seven through lanes and a two-way center turn lane. A specialized crossing treatment might be appropriate at the canal.

**Improvements:** The roadway and traffic characteristics (average daily traffic greater than 50,000) suggest consideration of a signalized crossing

of some type where the trail on the eastern side of the canal crosses Indian School Road. Because the roadway is divided, a half signal, in which only one direction of Indian School Road traffic is stopped at a time, may be a viable solution in the future if volumes allow signal warrants to be met. Also, an experimental traffic control device, such as a HAWK signal, may be appropriate.



Figure 6-16. Grand Canal @ Indian School Road





**Situation:**

**Bicycle Provisions along an Existing Major Arterial Street**

**Location:**

El Mirage - Thunderbird Road from Dysart Road to Grand Avenue

**Objective:**

To accommodate an appropriate level of bicycle facilities along Thunderbird Road in an area with numerous destinations and physical constraints

**Improvement Summary:**

Sidepath and parallel local streets

**Discussion:** Thunderbird Road (Figure 6-17) is an arterial street that provides access to the City of El Mirage's main retail area and other significant destinations (Figure 6-18). Significant residential communities have been constructed on the north and south sides of Thunderbird Road, which also provides access to El Mirage Elementary School (EMES) and is the primary route through the heart of El Mirage. Throughout this area the sidewalks are used frequently by pedestrians while Thunderbird Road carries much of the auto commuters in and out of the City. However, no bicycle facilities exist.



Figure 6-17. Thunderbird Road corridor





Thunderbird Road is a four-lane arterial with a two-way center turn lane for much of its length. The current daily traffic volume is approximately 12,500 and the roadway has a posted speed limit ranging from 25 mph to 35 mph. By the year 2026, traffic volumes are projected to be in excess of 24,000 along the eastern portion of the corridor. These conditions result in a “D” current Bicycle Level of Service, a measure of bicyclist safety/comfort. As traffic volumes increase it is expected to decline to “E.”

Concurrently, the motor vehicle level of service is operating at Level of Service “D,” and re-striping for bicycle lanes would cause further deterioration to motor vehicle delay, especially in the future condition.



Figure 6-18. Commercial destinations along the north side of Thunderbird Road





Figure 6-19. South side of Thunderbird Road



Figure 6-20. North side of Thunderbird Road

Improvements: From Dysart Road eastward to 124th Avenue (at El Mirage Elementary School), the right-of-way is wide, with sidewalks and wide landscaped areas buffering the adjoining subdivisions on the south side of Thunderbird Road (Figure 6-19). Pending the construction and development just east of Dysart Road, extensive right of way is also evident, and in some cases is even wider along the north side of the road (Figure 6-20).

This segment is ideal for the construction of a sidepath facility, provided it has community support and is designed to ensure the safety of its users at all intersections (see *AASHTO Guide for the Development of Bicycle Facilities*, p. 33). One option is to construct a sidepath on the north side of Thunderbird from Dysart Road to 126th Lane at the Rancho El Mirage development and the adjacent local park (Figure 6-21). At 126th Lane, a mid-block crossing could be constructed with appropriate crossing treatments. The sidepath could continue along the south side to provide direct access to the school property.





If additional right-of-way can be acquired from the school and if the paved staging area and fence on the southwest corner of the intersection of Thunderbird Road and El Mirage Road (Figure 6-22) can be modified, the sidepath could be continued eastward to El Mirage Road. Another option is to construct the entire sidepath facility on the south side of Thunderbird Road, which is shown as one alternative in Figure 6-23. While the right of way is sometimes not as wide, this option would eliminate the need for a crossing and would provide a continuous facility.

A noteworthy element of the western portion of the corridor is the north fork of the El Mirage Wash, which crosses underneath Thunderbird Road just east of 126th Lane. Despite the existence of signs prohibiting trespassing, several nonmotorized travelers were observed using the wash and its banks as both a north-south travel corridor and an east-west connection between neighborhoods on either side (Figure 6-24). In addition to the solutions discussed herein, the City may want to explore the possibility of path construction along or across this existing and currently utilized feature.



Figure 6-21. Rancho El Mirage entrance and adjacent park



Figure 6-22. Fence along property of El Mirage

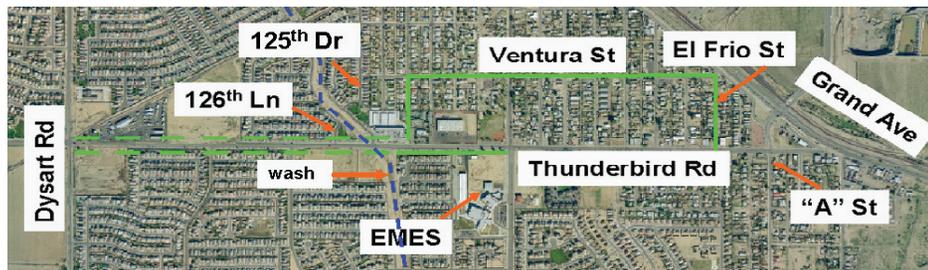


Figure 6-23. Thunderbird Road corridor route alternatives





Figure 6-24. A pedestrian walking along the El Mirage Wash despite signage



Figure 6-25. Thunderbird Road east of El Mirage



Figure 6-26. Ventura Street looking westbound

By connecting such a path with the aforementioned sidepath facility along Thunderbird Road, north-south and east-west bicycle accommodation would be achieved throughout the City in a safe and family-friendly manner.

Right-of-way is more constrained throughout the eastern half of the Thunderbird Road corridor (Figure 6-25). Fortunately a low-speed, low-volume parallel street with abundant pavement width exists. Ventura Street (Figure 6-26) parallels Thunderbird Road one block to the north from 125th Drive to El Frio Street. As seen in Figure 6-27, bicycling and walking are common in this area, especially among school children. Bicycle route signage may encourage bicyclists to bypass Thunderbird Road via El Frio Street, Ventura Street, and 125th Drive/126th Avenue. While other treatments are probably unnecessary because of the traffic volumes and speeds on the roads, speed tables and/or striped and signed bike lanes may be considered along this route.

The remainder of Thunderbird Road from "A" Street east to the Grand Avenue frontage road is characterized by such low traffic volumes that bicycle-related treatments are not recommended.





Figure 6-27. Bicyclists and pedestrians in the vicinity of Ventura street north of Thunderbird Road





**Situation:**

**Bicycle Accommodation within a Congested Major Arterial Street Corridor**

**Location:**

Peoria/Glendale - Bell Road from 73rd Avenue to 91st Avenue

**Objective:**

Improve bicycle access through the Bell Road corridor as well as to the adjacent commercial establishments

**Improvement Summary:**

Restriping to create bike lanes

**Discussion:** Bell Road east and west of the Loop 101 freeway through the Cities of Peoria and Glendale (Figure 6-28) is a highly commercial, heavily traveled corridor. Currently there is no safe, comfortable, and convenient way for bicyclists to traverse the corridor or to access its numerous adjacent commercial developments (Figure 6-29).

*Bell Road between Loop 101 and 75th Avenue*

**Discussion:** The segment of Bell Road between Loop 101 and 75th Avenue is an eight-lane divided roadway with a 13.5-foot outside lane and three 12-foot inside lanes in each direction (Figure 6-30). The daily traffic volume on this segment is approximately 62,000 according to recent City of Peoria traffic data.



Figure 6-28. Bell Road corridor





Improvements: A planning-level analysis, taking into account this lane configuration and traffic volume, indicates that excess capacity currently exists. As such, a re-striping of the roadway cross-section to include eastbound and westbound bicycle lanes presents a viable and low-cost solution that will better accommodate bicyclists. Reducing each vehicular travel lane to eleven feet would decrease capacity by approximately 3%, yet would allow for the creation of a 5.5-foot paved shoulder in each direction that could be signed and striped as a bike lane. The reconfigured 11-foot travel lanes are acceptable given the traffic conditions and existing adjacent development. As a result of this potential change in cross-section, bicycling conditions would be vastly improved.



**Figure 6-29. Bicyclist on sidewalk along the south side of Bell Road**



**Figure 6-30. "Surplus pavement" on Bell Road east of Loop 101**





*Bell Road between 84th Avenue and Loop 101*

Discussion: Like the Chandler Boulevard interchange with the Price Freeway, accommodating bicyclists along Bell Road through the Loop 101 interchange area west to 84th Avenue presents another challenge. No facilities currently exist for bicyclists in this area.



Figure 6-31. Bell Road through the Loop 101 interchange

Improvements: As with the solution described earlier for Chandler Boulevard at the Price Freeway, Bell Road's concrete curbs could be reconstructed closer to the existing sidewalks, thereby creating room for bike lanes (Figure 6-31). The buffer width between the sidewalk and the roadway would be decreased, but the new bike lane would maintain separation between the sidewalk and the motor vehicle lanes. This solution allows the bike lanes to continue through to the west side of the overpass.





Figure 6-32. Bell Road west of Loop 101

*Bell Road between 84th Avenue and 91st Avenue*

Discussion: The remainder of this corridor west to 91st Avenue is a six-lane divided roadway with 36 feet of total pavement width and a 13.5-foot outside travel lane. Daily traffic volumes are in excess of 60,000 (Figure 6-32).

Improvements: By reducing each lane width to 11 feet and creating a striped three-foot bike lane, bicycle accommodation would be marginally improved. Alternatively, the nearby collector/local street network presents an option for bicyclists. Specifically, Kelton Lane (labeled in Figure 6-33 with a photo shown

in Figure 6-34) provides a more bicycle-friendly route along the south side of the commercial developments between 84th Avenue and 91st Avenue. Kelton Lane has wide (15 feet) lanes and has a posted speed of 30 mph. Kelton Lane could be re-striped with an 11-foot lane and a 4-foot bike lane. 91st Avenue from Kelton Lane north to Bell Road (Figure 6-35) is a similarly low volume roadway. While this proposed route gets bicyclists to the western edge of the study corridor, coordination with Sun City to continue the bicycle accommodation westward would be highly beneficial.





Figure 6-33. Bell Road corridor potential routes



Figure 6-34. Kelton Lane



Figure 6-35. 91st Avenue south of Bell Road





## Chapter Seven: Action

### Recommended Policies and Programs

The following policies and programs and their associated guidelines and/or approaches are intended to serve as a guide for MAG member jurisdictions as they expand their bicycle networks and generally work toward the promotion of bicycling and active transportation.

#### Policies

##### *Routine Accommodation and Complete Streets*

**RECOMMENDATION:** *Incorporate the concepts of routine accommodation and complete streets into the planning of all roadways.*

Supported Plan Goals: Complete Streets, Safety, Health, and User Needs

One of the most important ways to improve Region-wide bicycling conditions is for agencies to

develop policies that support the concepts of routine accommodation and complete streets (or ordinances that require them to be achieved by specifying design standards). Routine accommodation effectively states that bicyclists must be accommodated as new roadways are constructed or as existing roadways are resurfaced or retrofitted. Generally, accommodation can be achieved with bike lanes or wide outside lanes on arterial roadways and either paved shoulders, designated bike lanes, or wide outside lanes on collector roadways. Bicyclists are usually considered to be “accommodated” on local streets, even without exclusive facilities, because of low traffic volumes, low operating speeds, relatively few trucks, etc.

**Complete streets provide safe access for all users, including bicyclists, pedestrians, transit users, and motorists.**





Routine accommodation and roadway retrofitting both support the broader objective of complete streets. Complete streets are said to provide safe access for all users, including bicyclists, pedestrians, transit users, and motorists. While policies supporting routine bicycle accommodation and retrofitting for bicycle facilities only deal with one part of the complete streets equation, they nonetheless help overcome one of the most significant obstacles.

Training of jurisdiction roadway designers would be an important step toward achieving these ideals. Bicycle facility design courses are currently available through several outlets, including the National Highway Institute (<http://www.nhi.fhwa.dot.gov/downloads/catalog/NHICourseCatalog.pdf>) and Northwestern University (<http://nucps.northwestern.edu/division/te.asp>).

### ***Regional Connectivity Policy***

**RECOMMENDATION:** *Connect all on-street and off-street bicycle and pedestrian facilities within and between jurisdictions.*

Supported Plan Goals: Access, Complete Streets, Health, and Connectivity

Bicyclists are an integral part of the transportation infrastructure of the MAG Region, deserving of safe and attractive shared roadway space and off-street facilities. An interconnected system of on-street and off-street bicycle facilities will satisfy the needs of all bicycle riders by linking major Regional as well as local neighborhood destinations. Where local linkage can largely be implemented by individual jurisdictions, the connectivity of long-distance and/or Regional destinations usually requires the coordination of several jurisdictions. MAG jurisdictions should seek out opportunities to partner on the implementation of Regional routes, which in effect create the backbone of the entire MAG Regional Bikeway System. The MAG Regional Bicycle Task Force should continue to be the most significant avenue to pursue Regional cooperation for bicycle facility implementation.





### **Roadway Restriping Policy**

**RECOMMENDATION:** *Develop and adopt restriping policies for roadway segments where excess pavement is available.*

Supported Plan Goals: Access, Complete Streets, Safety, Health, User Needs, and Connectivity

One of the most cost effective and easily implemented solutions for improving roadway bicycle accommodation within existing curbed roadways is to identify roads with “surplus” pavement cross-sections. Restriping these roads to accommodate bicycles involves the narrowing, or removal in limited cases, of travel lanes to create space for striped paved shoulders or designated bike lanes. Because delineated lateral space is the predominant factor in creating a sense of safety and comfort for bicyclists, restriping can significantly improve a roadway’s level of accommodating bicycling without the expenses associated with adding pavement to roads or completely reconstructing them.

The type of restriping that is most generally applicable in the MAG Region is narrowing existing lanes. This opportunity usually presents itself on curbed multi-lane urban and suburban roadways where existing lanes are at least 12 feet wide. In many such cases enough width can be removed from the existing lanes to create an effective space for bicyclists without significantly affecting motor vehicle operations.

Naturally, the primary concern associated with roadway restriping is the potential effect on motor vehicle capacity and operations. As roadway lanes are narrowed, capacity is sometimes marginally reduced. In addition, roads with higher speeds and a greater volume of heavy vehicles do not operate as well with narrower lanes than low-speed, low-truck volume roads. Nonetheless, jurisdictions should promote restriping policies because the absence

**Restriping roads to accommodate bicycles involves the narrowing, or removal in limited cases, of travel lanes to create space for striped paved shoulders or designated bike lanes.**





of bike lanes on certain roads effectively eliminates bicycling as a viable mode for many cyclists, whereas the reduction in general use lane widths does not correspondingly eliminate motor vehicle travel as a viable option. There is an abundance of existing national guidance regarding appropriate lane widths for both motor vehicles and bicyclists.

### Identifying Restripe Candidates

Generally, restripe candidates are those roadways where posted speeds are less than 50 mph, no current bicycle lane or paved shoulder exists, and where a new space at least three feet wide can be created while maintaining other travel lane widths of at least eleven feet. These are minimum recommendations for use of this strategy. There are some roadway

**Generally, restripe candidates are those roadways where posted speeds are less than 50 mph, no current bicycle lane or paved shoulder exists, and where a new space at least three feet wide can be created while maintaining other travel lane widths of at least eleven feet.**

segments on which either one of these dimensions is able to be larger. These minimum recommended lane widths are based on the 2004 AASHTO *Policy on Geometric Design of Highways and Streets*. The AASHTO *Policy* states in its foreword that its intent is to recommend a “range of values for critical dimensions.” These ranges allow for flexibility, as the *Policy* describes:

*Minimum values are either given or implied by the lower value in a given range of values. The larger values within the ranges will normally be used where the social, economic, and environmental impacts are not critical.*

With regard to the width of lanes on urban arterials, the Policy states:

*Lane widths may vary from 10 to 12 feet. Lane widths of 10 feet may be used in highly restricted areas having little or no truck traffic. Lane widths of 11 feet are used quite extensively for urban arterial street designs. The 12 foot lane widths are most desirable and should be used where practical, on higher speed, free flowing, principal arterials.*





The *Policy* clarifies further,

*Under interrupted-flow operating conditions at low speeds (45 mph or less), narrower lane widths are normally adequate and have some advantages.*

When designating dimensions for the restriping of existing pavement cross-sections to include rideable shoulders, a minimum three foot wide shoulder is recommended. Where more than three feet is available, the wider space should be used, but three-foot shoulders have been shown to provide a tangible sense of comfort to cyclists. While the *AASHTO Guide for the Design of Bicycle Facilities* (1999) expresses a preference for four-foot wide shoulders, it also states, “However, where 4-foot width cannot be achieved, any additional shoulder width is better than none at all.” In order for a restriped shoulder to be signed and marked as a bike lane in a location with curb and gutter, the new space should provide a minimum of five feet between the face of the curb and the bike lane stripe, three feet of which consist of a rideable surface. On open shoulder roadways, four feet of pavement is recommended in order to designate a bike lane. An example of a restripe candidate is a

6-lane roadway with a posted speed limit of 40 mph where all lanes are currently 12 feet wide. In this case, each lane could be reduced to 11 feet, thereby creating three feet of bicycle space in each direction of travel.

### Evaluating Restripe Candidates

Once candidate roadways have been identified, the next step is to evaluate the level of accommodation provided to both motorists and bicyclists before and after the potential restriping occurs. Planning-level analysis tools for urbanized arterials are available that estimate motor vehicle level of service (LOS) based on certain readily available inputs, including the class and location of the roadway, traffic volumes, number of lanes, and signal spacing. Generally, the analysis should be performed based on forecast traffic volumes. In cases where the results of this analysis, as well as a more detailed operational analysis, indicate that the motor vehicle LOS will be operating below the jurisdiction’s designated standard, restriping should not be considered. All other segments that can be said to have “excess capacity,” should be further studied.





Restriping costs can be greatly reduced if done concurrently with routine pavement maintenance programs that require resurfacing and restriping of roadways.

### *Shared Use Path Grade Separation Policy*

**RECOMMENDATION:** *Create space for grade-separated shared use path crossings where streets intersect washes and other similar features.*

Supported Plan Goals: Access, Health, and Connectivity

Collector and arterial roadways can be a significant obstacle to shared use pathway crossings. Problems arise when paths must cross wide roadways with heavy traffic, especially at mid-block locations (as

**When path-roadway intersections are created because of roadway construction or widening, and the roadway is designed to pass over a wash, space for a path underpass can be created at the same time.**

often happens with pathways that parallel washes, canals and utility corridors).

Effective policies can be implemented to minimize the creation of these obstacles. One such policy is designed to create the opportunity for grade-separated crossings before a path comes into existence. Specifically, when path-roadway intersections are created because of roadway construction or widening, and the roadway is designed to pass over a wash, space for a path underpass can be created concurrently. This is done through the construction of an oversized culvert that can be blocked off until a pathway is put in place, at which point space for the pathway crossing is already available. Policies supporting this type of advanced provision are highly important because of the costs and difficulties that are inherent with attempting to retrofit these crossings for path access and connectivity.





### *At-Grade Mid-Block Crossing Policy*

**RECOMMENDATION:** *When grade-separation is not feasible, provide appropriate at-grade mid-block crossing treatments that will alert and enable motorists to fulfill their obligation to yield to bicyclists and pedestrians resulting in a greater sense of security, comfort, and convenience to the path user.*

Supported Plan Goals: Access, Safety, Health, and Connectivity

In many locations where paths and trails intersect a major arterial roadway, providing a grade-separated overpass or underpass is not a feasible option. In many locations, rerouting path and trail users to street intersections with or without traffic control devices is not feasible because the significant diversions to users would limit their use. Several signalized and non-signalized crossing treatments have been used in Valley cities and throughout the country that give a greater priority to path and trail users. These crossing treatments are considerably less expensive than

grade-separation and will give path and trail users a greater sense of security, comfort, and convenience.

Design treatments include raised medians, crosswalks, signage, and lighting among other things. Experimental treatments include the HAWK and the PXO. The HAWK, a pedestrian activated beacon used at otherwise unsignalized crossings, was approved by Committee at the MUTCD annual meeting in January 2007. Full approval from FHWA is on-going. See the Section on Mid-Block Crossing Treatments in Chapter 3 of this document for additional information.





### ***Connectivity at Freeways Policy***

**RECOMMENDATION:** *Accommodate bicyclists with facilities at freeway interchanges and create new connections at freeways where feasible.*

Supported Plan Goals: Health, Access, and Connectivity

The Region’s numerous freeways represent, in many locations, a significant barrier to bicycle connectivity. While arterial roads are almost always continuous through freeways that they intersect, the mid-section collector grid is generally interrupted by limited access facilities. Even when arterials continue through interchanges, bicyclist accommodations are usually not included. Because of the Regional emphasis on the importance of the arterial/collector network to bicycling and the connections that it provides, these barriers inhibit bicycling.

To alleviate this situation, either new nonmotorized collector connections (such as overpasses or underpasses) need to be created, or accommodation at existing arterial freeway crossings needs to be improved. All new freeway construction should

include appropriate bicycle/pedestrian access (grade separated crossings) as identified in Regional and local bicycle plans.

As a part of major new construction and major reconstruction, it is ADOT Intermodal Transportation Division’s Bicycle Policy to fund and construct at-grade or grade separated (including bridges) street or roadway crossings of state highway system roadways to meet cross section templates accommodating bicyclists that have been adopted as standard by the local agency. The limits of construction are determined on a project-by-project basis, are normally within the ADOT right of way, and may include appropriate transitions to existing roadways outside of ADOT right of way.

It is also ADOT Intermodal Transportation Division’s Bicycle Policy to include provisions for bicycle travel in all new major construction and major reconstruction projects on the state highway system. New bridge and roadway widening projects are normally considered as being within the scope of major construction or major reconstruction. As a minimum condition, ADOT will provide a 14 foot curb lane (exclusive of curb





and gutter) or a 4 foot paved shoulder. ADOT will consider curb lanes up to 15 feet in width (exclusive of gutter pan) and placement of a stripe at the vehicle lane edge where appropriate. This decision will be made on a project basis weighing such factors as location, vehicular traffic, grades, anticipated bicycle usage, and right of way availability. ADOT will also consider bicycle lanes -- designated by signs and pavement markings for preferential or exclusive use by bicyclists -- for inclusion when: 1) incremental costs for construction and maintenance are funded by a local agency and 2) the bicycle lane is included as a part of a bicycle facilities plan adopted by a local agency.

Furthermore, the *ADOT Statewide Bicycle and Pedestrian Plan* (2003) states that "at locations where there are residential and or commercial destinations adjacent to the interchange or adjacent roadways are open to bicycle traffic, a shared-use path connection through the interchange may be necessitated even if it connects with an on-street bicycle facility and sidewalk adjacent to the interchange so it is anticipated that future shared-use path projects are going to be an add-on to ADOT

construction projects and/or driven by local/Regional jurisdictional direction".

### ***Connectivity Along Freeways Policy***

**RECOMMENDATION:** *Accommodate bicyclists along freeway corridors.*

Supported Plan Goals: Access, Complete Streets, Safety, and Connectivity

As the *Regional Bikeway Master Plan* strives to provide both long distance and local bicycle connectivity to the entire bicycling community, a freeway system provides similar linkages. As motorists desire travel opportunities with a minimum of stops and distractions, so too do bicyclists.

The freeway system in the MAG Region is continually expanding. Many major sections have been completed in the past decade, and many more freeway corridors are in the planning and development stages now. Few, however, have integrated bicyclists into their mission and purpose. ADOT does prohibit bicyclists on the roadway and shoulder of most Valley Freeways because alternate





routes, considered comparable or better in terms of convenience and safety, are available. It is, however, ADOT Intermodal Transportation Division's Bicycle Policy to accommodate shared use paths within the ADOT right of way when the facilities are: 1) designed and located in accordance with accepted criteria for a proper and safe facility and 2) funded and properly maintained by the local agency through intergovernmental agreement. Shared use paths that parallel a roadway must include special attention to the intersection treatments to address safety considerations. It is recommended that another implementing agency take the lead on shared use path design with ADOT to provide support and cooperation.

The two most common “end-of-trip” provisions cited in nationally prominent opinion surveys as influencing the choice to bicycle for transportation are bicycle parking and the workplace provision of locker/showers.

The freeway system in Phoenix provides improved mobility to every motorist in the Region. Those same corridors can help to alleviate traffic congestion and improve air quality by fully integrating the bicycle mode as well.

### ***End-of-Trip Bicycle Facilities Policy***

**RECOMMENDATION:** *Require end-of-trip bicycle facilities (e.g., parking, lockers, and showers) at all new commercial developments or implement developer incentives to conduct such facilities.*

Supported Plan Goals: Health, Encouragement, User Needs, and End-of-Trip Provisions

A quarter century of nationwide research, opinion and behavioral surveys, and the Region's very own experience underscore the importance of bicycle mode encouragement in the form of “end-of-trip” provisions. The two most common “end-of-trip” provisions cited in nationally prominent opinion surveys as influencing the choice to bicycle for transportation are bicycle parking and the workplace provision of lockers/showers. Observation of codes throughout





the Valley, Arizona, and many metropolitan areas in the United States confirms that bicycle parking being required along with land development is increasingly prevalent (see Article IX, Section 9.103 of Scottsdale's Basic Zoning Ordinance section in the City's Zoning Code and Chapter 4, Section 4-603 of the City of Tempe's Zoning Code for Valley examples). However, workplace bicycle lockers and change and/or shower facilities are generally not being constructed. It appears that the current incentives are insufficient. Thus there are two options: increase (or change) the incentives or mandate the facilities. Several approaches to the first option are outlined below. The continued investment in bicycle transportation infrastructure by MAG jurisdictions can be significantly leveraged by offering compelling incentives to developers. There are a number of incentives that can be offered to the (private) sector developing and managing land use. Many of these incentives can be offered at little or no actual expense to the jurisdictions. There are two phases during which they can be effective: upon initial land development or during tenant build-out and/or maintenance.

Among the compelling incentives for the construction of bicycle locker/changing/shower facilities that can be effective at initial land development are:

- Trip generation (hence traffic impacts) reduction during traffic impact assessments (e.g., up to five percent of total trip generation, depending on land use)
- Floor Area Ratio (FAR) bonus/bump-up (e.g., up to five percent for office development)
- Reductions to required yard/setbacks (e.g., up to 20 percent for facilities with capacity of serving up to five percent of employees)
- Greenspace (for vehicle utilization area (VUA)) requirement reduction, (e.g., up to twenty times the building square footage dedicated to the bicycle facility)

Incentives for conditions subsequent to initial development (e.g., tenant build-outs and building maintenance) include ad valorem tax exclusion of at least two times the square footage of the building dedicated to the locker/changing/shower facility. This exclusion could be increased if the tenant businesses participated in additional transportation demand management programs.





## Programs

### *Regional Bicycle Use Promotional Events*

**RECOMMENDATION:** *Develop and promote bicycle events to increase awareness of bicycling as a viable mode of transportation.*

Supported Plan Goals: Health, Education, Promotion, and Encouragement

Creating bicycle promotional events is an effective way to get communities involved in bicycling and active transportation. Fortunately for local Valley jurisdictions, an ideal venue for such events has already been created by a Regional agency: Valley Metro's "Valley Bike Month." Thousands of employees ride their bicycles to work one or more days each week instead of driving, combining their commute with daily exercise. Additionally, Valley residents

Each year Valley Bike Month (formerly Valley Bike Week) celebrates the bicycle as a way to replace automobile trips for the work commute and other short trips.

and visitors bicycle for health and recreation. A variety of events are held as part of the celebration including bicycle rodeos, races, tours, swap meets, and designated Bike to Work and/or School days. The opportunity exists for MAG member jurisdictions to piggyback the Regional festivities, as numerous cities in the Region already do. The addition of more and more related events will support numerous *Plan* goals and reinforce the importance of bicycling in the public consciousness.

### *Interactive Website Bicycle/Action Transportation Map*

**RECOMMENDATION:** *Create a Regional interactive bike route mapping website.*

Supported Plan Goals: Health, Education, Promotion, Encouragement, and User Needs

To increase bicycle ridership and active transportation, it is important to enable residents and visitors to better access and use bicycle-friendly transportation routes anywhere in the Valley. One of





the best ways to empower interested parties is through new computer-based technologies, specifically an interactive bicycle transportation mapping website. The primary objective of the website would be to enable the user to discover the best route, given the identified planned trip origin and destination, from either (or a combination of both) shortest distance or bicycling-friendliness perspectives. Similar sites are currently operated in the Portland, Oregon region, the San Francisco Bay area, New York City, and Southern California.

Using a website interface, similar to that of MapQuest™, the website visitor could either type in the physical addresses of their trip origin and destination, pick the points on a map (with attendant pan and zoom capabilities), or type in the closest intersection of major streets.

The travel route options could be selected by the website visitor by selecting an interactive “trade-off” scale bar (similar in appearance and function to a home sound system’s balance “slider” between base

and treble extremes). The route preference options would range from “shortest distance” to “most comfortable bicycling” in terms of minimal interaction with motor vehicle traffic. A linked window “port” to the “trade-off” slider, showing the selected range among bicycling conditions “A” through “F,” would enable the website visitor to select his or her minimum tolerance for on-street bicycling.

The website visitor could then select “display route” and the route, according to the user’s prescribed parameters, would be displayed on the screen in a color coded sequence of links from the trip origin to destination. The color codes could include bicycling conditions “A” (best) through “F” (least comfortable) in typically a green through purple color array

**The primary objective of the website would be to enable the user to discover the best route, given the identified planned trip origin and destination, from either (or a combination of both) shortest distance or bicycling-friendliness perspectives.**





with a concomitant narrowing of line width for visualization. Roadway sections with shoulders and/or bike lanes could have additional line elements (and widths) as would off-street multi-use paths (line type would denote paved versus unpaved) for the website visitors' information.

If the selected route is suitable, the website visitor would print a selected map window for PDF creation and immediate printing (or emailing).



If the website visitor would like to explore alternative routing options, he or she could select that option. Immediately the network surrounding their trip origin and destination would be displayed in the color coded "A" through "F" bicycling conditions range. The website visitor could then visually decide

if they want to increase or decrease the shortest distance/bicycling conditions "slider" to display another route option.

#### Other Map Attributes

Other attributes of the map would include the locations of public schools, parks, and off-street bicycling pathways. To further the goal of active transportation, map icons of trailheads, park entrances, and unpaved canals would have hot-linked photos of the facilities.

Additional potential website attributes include health and fitness information including calories burned (as a function of various displayed travel speeds and rider weight) and consequential health benefits on an annualized basis for various frequencies of bicycling.

Personal economic and Regional air quality benefits information would also be available.





Other Website Hotlinks

- Transit Route & Schedule Information (including bike on bus)
- Public Parks and Recreation information
- Calendar of Events
- Scheduled bike club rides and (running) road and triathlon events
- Safe Routes to School; Bicycle Safety & Maintenance Tips
- Bicycle Maintenance Information
- Resources links to Bike & Walking Clubs
- City departments to report maintenance issues

Needed Inventory & Route Evaluation

In order to provide the website users with safe and reliable route selection information, it would be necessary to have an annual update of roadway cross-sectional (and bike facility) and traffic information downloaded into a statistically-reliable bicycling conditions (spreadsheet programmed) evaluation, such as Bicycle Level of Service.

***Web-Based Citizen Participation***

***Recommendation:*** *Gather citizen input on bicycle related planning, programs, and projects through a web-based interactive questionnaire.*

Supported Plan Goals: Education, Promotion, Encouragement, User-Needs, Techniques and Tools

Any defensible public planning or development project should be based upon opinions and priorities given by the public. A public planning process is now routinely incorporated into most if not all public projects. At any time there are several planning processes taking place in any jurisdiction, and most citizens have limited time to provide valuable

**To further the goal of active transportation, map icons of trailheads, park entrances and unpaved canals would have hot-linked photos of the facilities.**





comments, much less be fully engaged in the process. Consequently, traditional means of gathering public input often result in unsatisfactory levels of meaningful comments.

Understanding this dilemma, MAG and the Maricopa County Department of Transportation partnered with Valley Metro to develop and administer a web based questionnaire that would help direct the MAG *Regional Bikeway Master Plan* and the *County Bicycle Transportation System Plan*. In approximately six weeks, over 2000 individuals responded to email invitations to take the Bicycle Use Questionnaire. These responses greatly outnumbered the total number of citizens attending all public hearings and meetings on the two projects. Though the responses

were not “statistically valid” as the respondents were not randomly chosen, they did represent the opinions of citizens who were already engaged in walking, bicycling and transit related issues. These respondents would likely be the same individuals who would be motivated to attend public meetings if time permitted. The questionnaire allows people to provide valuable information at their convenience.

Valley Metro had the capabilities to adapt an already prepared questionnaire into their web based system. Much software exists to simplify the questionnaire process and many jurisdictions have similar capabilities as Valley Metro. They and their citizens would benefit from the use of more web based questionnaires.





## Action Plan

The following table (Table 7-1) provides a summary of the *Plan's* goals as outlined in Chapter 4 while assigning MAG's role and a general timeline. MAG's role is either to lead or support the goal. When leading, MAG staff and/or the MAG Regional Bicycle Task Force will lead the course of action designed to achieve that goal. When supporting, MAG staff and/or the MAG Regional Bicycle Task Force will support the course of action being lead by MAG member agencies. The timeframe is divided between short, mid, and long term and those goals which are ongoing in nature, deserving of constant monitoring and actions.





Table 7-1. Action Plan

MAG Role*	Goal (Task or Program)	Short-Term (1-2 years)	Mid-Term (3-4 years)	Long-Term (5 years or longer)	Ongoing
<b>Access</b>					
<b>Lead</b>	1. Provide a convenient, easily accessible, and visible bicycle transportation system comprised of connected on-street and off-street facilities within neighborhoods and jurisdictions.				<b>X</b>
<b>Support</b>	2. Design and maintain all streets to accommodate bicycles.				<b>X</b>
<b>Safety / Health / Education</b>					
<b>Lead</b>	3. Develop a bicycle transportation system that increases user safety along routes and crossings by incorporating the AASHTO bicycle facility design standards and the principles of CPTED (Crime Prevention Through Environmental Design).				<b>X</b>
<b>Lead</b>	4. Increase the proportion of citizens who engage in physical activity by making bicycling facilities easily accessible from their homes and linked to desired destinations.				<b>X</b>
<b>Support</b>	5. Encourage law enforcement agencies to increase levels of enforcement of traffic laws most often violated by roadway users that affect bicycle use and to improve tolerance and courtesy among all roadway users.				<b>X</b>
<b>Support</b>	6. Encourage and support new and existing bicycle safety and education programs that promote bicycle use, user group compatibility, and enforcement of traffic rules.				<b>X</b>





Table 7-1. Action Plan (Continued)

MAG Role*	Goal (Task or Program)	Short-Term (1-2 years)	Mid-Term (3-4 years)	Long-Term (5 years or longer)	Ongoing
Lead	7. Provide user-friendly maps, brochures, and websites that clarify routes and encourage bicycle riding.	X			
Lead	8. Promote bicycling as a means of personal mobility for local and daily travel trips for all purposes, and as a form of healthy recreation and exercise.				X
<b>Connectivity</b>					
Lead	9. Inter-connect a system of on-street bike lanes, and off-street shared-use paths/trails, to origins, destinations, and transit routes, and as a consequence make bicycling a viable option for daily travel trips for all purposes.				X
<b>User-Friendliness</b>					
Lead	10. Provide a user need-based bicycle transportation system that is safe, convenient, well-maintained, well-signed, and attractive. The system should accommodate the various skills and confidence levels of bicycle users, and minimize potential conflicts with other users and vehicles.				X
Support	11. Encourage bicycle riding by providing end-of-trip facilities that include bicycle parking, drinking water, toilets, showers, and lockers.	X			





Table 7-1. Action Plan (Continued)

MAG Role*	Goal (Task or Program)	Short-Term (1-2 years)	Mid-Term (3-4 years)	Long-Term (5 years or longer)	Ongoing
<b>Implementation</b>					
Lead	12. Outline specific steps, timelines, policies, programs, and criteria for project selection to implement this <i>Plan</i> thereby encouraging large-scale to spot-improvement projects.	X			
Support	13. Institute bicycle-friendly policies in the systematic, everyday work of agencies at all levels of government.				X
Support	14. Integrate bicycle transportation facilities into ongoing and future transportation, land use, and economic development plans created by public jurisdictions and private development.		X		
Lead	15. Develop techniques and tools that will assist MAG member agencies in implementing and prioritizing bicycle projects.	X			
Lead	16. Develop guidelines for long-term local and Regional bikeway maintenance and operations programs.			X	
Support	17. Increase bicycle facility development by exploring alternative funding and partnership opportunities with external organizations within the business and health communities among others.		X		
Support	18. Increase bicycle facility development by developing alliances and integrated funding strategies between various public agencies such as transportation, flood control, parks and recreation, and health.		X		

\*Lead: A specific course of action implemented by MAG staff or by the MAG Regional Bicycle Task Force.

Support: A specific course of action implemented by MAG member agencies and which can be supported by MAG staff and/or the MAG Regional Bicycle Task Force.





## Chapter Eight: Funding

### Project Evaluation

The MAG Bicycle Task Force has used a variety of procedures for establishing the priority for funding Transportation Improvement Program bicycle projects, as well as for MAG's Bicycle and Pedestrian Improvement Grant Program. The purpose of the evaluation system is to ensure that proposed projects reflect the *MAG Regional Bikeway Master Plan* mission, goals, and actions. A new project evaluation form has been developed as part of this *Plan* that closely corresponds to the defined mission and goals. This project evaluation will assist the MAG Bicycle Task Force to assess future projects. It may also be helpful to other jurisdictions as they develop and evaluate their own potential bicycle projects.

The developed Project Evaluation Form is shown in Table 8-1. The "Attributes" are based upon the *Plan's* goals and prior evaluation attributes. Each attribute has a stated purpose. The "Variable" factor identifies the degree to which a particular project accomplishes the overall purpose and goals of the *MAG Regional Bikeway Master Plan*. A point range is given from zero if the project would do little or nothing to accomplish the purpose to three points if the project does numerous things to accomplish the purpose. For instance, for a project to receive three full points for Safety/Security: "to make bicycle facilities as safe and secure as possible," a project should





improve an “existing” safety/security issue. Improving an existing safety/security issue is considered more important and thus deserving of more points than a project that would prevent a “potential” issue. Likewise, for the attribute of Multi-Modal Linkage, projects that provide direct access to transit routes would receive more points than projects miles from transit. For Destination, projects that improve access to several destinations would receive more points than projects that improve access to no destinations.

The “Weight” factor represents priorities given to each attribute by the MAG Bicycle Task Force. The “Variable” is multiplied by the “Weight” to determine the overall “Score” for that “Attribute” in the far right column. The “Scores” for each attribute are then added to determine the “Total Points” for the project. “Total Points” for each project are compared with one another to determine the projects’ rankings.

Significantly, for any project to be considered for funding review and evaluation by the MAG Bicycle Task Force, they must first meet existing national bicycle facility guidelines.

Table 8-1. Project Evaluation Form

Attribute	Variable	Variable (0-3)	Weight	Score = Variable x Weight
<b>Safety/Security</b> Purpose: to make facilities as safe and secure as possible.	• Project prevents a potential safety/security issue.	1	3	
	• Project improves upon an existing safety/security concern.	2		
	• Project improves upon an existing safety issue and provides more than one personal security feature such as improved lighting, emergency phones, bicycle storage lockers, etc.	3		





Table 8-1. Project Evaluation Form (Continued)

Attribute	Variable	Variable (0-3)	Weight	Score = Variable x Weight
<p><b><i>Bicycle-Friendly Policies</i></b>                      Purpose: to encourage the adoption of policies and programs that ease and encourage the development and use of bicycle facilities in all facets of programming, planning, and development.</p>	<p><u>Policies:</u></p> <ul style="list-style-type: none"> <li>• The local jurisdiction has a bicycle plan that has been adopted by the appropriate governing body.</li> <li>• Within any new development proposal, bike lanes are required on all arterial streets (corresponding street cross sections with bicycle facilities identified and provision of bicycle facilities in the Land Development Code).</li> <li>• Within any retrofit of existing arterial streets, bike lanes are required.</li> <li>• Within any new development proposal, bike lanes are required on all collector streets.</li> <li>• Within any retrofit of existing collector streets, bike lanes are included where feasible.</li> <li>• Within new and/or retrofit of existing developments, shared-use paths/trails are required.</li> <li>• Bicycle parking and other end of trip amenities are required of all new and retrofit developments.</li> <li>• Bicycle programs are in place such as safety programs, bike rodeos, promotional events, etc.</li> <li>• Jurisdiction wide or local area bicycle maps and brochures are developed for public use.                             <ul style="list-style-type: none"> <li>- <b><i>None</i></b> of the above policies are in place.</li> <li>- <b><i>One to two</i></b> of the above policies are in place.</li> <li>- <b><i>Three to five</i></b> of the above policies are in place.</li> <li>- <b><i>Six or more</i></b> of the above or other bicycle friendly policies are in place.</li> </ul> </li> </ul>	<p>0 1 2 3</p>	<p>3</p>	





Table 8-1. Project Evaluation Form (Continued)

Attribute	Variable	Variable (0-3)	Weight	Score = Variable x Weight
<b>Continuity / Connectivity</b> Purpose: to increase miles of usable and continuous bicycle facilities.	<ul style="list-style-type: none"> <li>Project contributes to <b>less than one additional mile</b> of continuous on-street or off-street bicycle facilities (combined new and existing facilities).</li> </ul>	1	2	
	<ul style="list-style-type: none"> <li>Project contributes <b>between one and 2.5</b> additional miles of continuous on-street or off-street bicycle facilities.</li> </ul>	2		
	<ul style="list-style-type: none"> <li>Project contributes <b>over 2.5</b> additional miles of continuous on-street or off-street bicycle facilities and/or connects the bikeways of adjacent cities, towns, or County land.</li> </ul>	3		
<b>Destination</b> Purpose: to improve short trip bicycling opportunities.	<ul style="list-style-type: none"> <li>The project improves access to <b>zero</b> destinations.</li> </ul>	0	2	
	<ul style="list-style-type: none"> <li>The project improves access to <b>one</b> destination.</li> </ul>	1		
	<ul style="list-style-type: none"> <li>The project improves access to <b>two to four</b> destinations.</li> </ul>	2		
	<ul style="list-style-type: none"> <li>The project improves access to <b>five or more</b> destinations.</li> </ul> <p>NOTE: Short trip destinations include among others: senior centers, community centers, libraries, parks, shopping areas, employment areas, medical campus, etc. Each of the above represents ONE destination site.</p>	3		
<b>School Linkage</b> Purpose: to improve bicycling conditions around schools.	<ul style="list-style-type: none"> <li>Project is <b>greater than two miles</b> from a school.</li> </ul>	1	2	
	<ul style="list-style-type: none"> <li>Project is <b>one to two miles</b> from a school.</li> </ul>	2		
	<ul style="list-style-type: none"> <li>Project is <b>less than one mile</b> from a school.</li> </ul> <p>NOTE: any school type from elementary to university</p>	3		





Table 8-1. Project Evaluation Form (Continued)

Attribute	Variable	Variable (0-3)	Weight	Score = Variable x Weight
<b>Convenience/ Comfort</b> Purpose: to improve or provide factors that make bicycling more convenient and comfortable thereby increasing all user types including children, families, the elderly, etc.	<ul style="list-style-type: none"> <li>Project incorporates <b>up to two</b> convenience or comfort improving factors.</li> </ul>	1	1	
	<ul style="list-style-type: none"> <li>Project incorporates <b>three to four</b> convenience or comfort improving factors.</li> </ul>	2		
	<ul style="list-style-type: none"> <li>Project incorporates <b>more than four</b> convenience or comfort improving factors.</li> </ul>	3		
	NOTE: Factors include bike racks, signage, rest areas, drinking water, etc.			
<b>Multi-Modal Linkage</b> Purpose: to improve linkages between alternative transportation modes.	<ul style="list-style-type: none"> <li>The project is <b>greater than two miles</b> from bus or light rail transit routes, stops, or stations.</li> </ul>	0	1	
	<ul style="list-style-type: none"> <li>The project is <b>greater than one mile</b> from bus or light rail transit routes, stops, or stations.</li> </ul>	1		
	<ul style="list-style-type: none"> <li>The project is <b>less than one mile</b> from bus or light rail transit routes, stops, or stations.</li> </ul>	2		
	<ul style="list-style-type: none"> <li>The project provides improved <b>direct access</b> to bus or light rail transit routes, stops, or stations.</li> </ul>	3		
<b>Prior Identification</b> Purpose: to respect prior planning efforts and citizen involvement.	<ul style="list-style-type: none"> <li>The project has <b>not been identified</b> in either <b>local or Regional plans</b>.</li> </ul>	0	1	
	<ul style="list-style-type: none"> <li>The project has been identified in <b>local plans</b>.</li> </ul>	1		
	<ul style="list-style-type: none"> <li>The project has been identified in <b>Regional plans</b>.</li> </ul>	2		
	<ul style="list-style-type: none"> <li>The project has been identified in <b>both local and Regional plans</b>.</li> </ul>	3		
<b>TOTAL POINTS</b>				





## Potential Funding Sources

There are numerous sources which can be used to provide monetary assistance for bicycle facilities and programs. Many of these sources are available on the Federal level, as dictated in the recently passed transportation legislation. Most of these programs are administered by the Arizona Department of Transportation. Additionally, there are other State, Regional, and local funding sources which can be used to help achieve the goals and objectives of this *Plan*. Finally, a myriad of private funding sources exist which can be used by local governments to implement bicycle-related programs.



The various funding sources are described below, categorized as Federal, State, Regional, local, and private:

### ***Federal***

Bicycle transportation facility projects are broadly eligible for funding from almost all the major Federal-aid highway, transit, safety, and other programs. Bicycle projects must be “principally for transportation, rather than recreation, purposes” and must be designed and located pursuant to the transportation plans required of States and Metropolitan Planning Organizations.

Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFTEA-LU, Public Law 109-203) was signed into law August 10, 2005. SAFTEA-LU authorizes the Federal surface transportation programs for highways, highway safety, and transit for the 5-year period 2005-2009. It replaces TEA-21, its legislative predecessor.





Federal-aid Highway Program

National Highway System funds may be used to construct bicycle transportation facilities and pedestrian walkways on land adjacent to any highway on the National Highway System, including Interstate highways.

Surface Transportation Program (STP) funds may be used for either the construction of bicycle transportation facilities and pedestrian walkways, or non-construction projects (such as maps, brochures, and public service announcements) related to safe bicycle use and walking.

Ten (10) percent of each State’s annual STP funds are set aside for Transportation Enhancements (TE). The law provides a specific list of activities that are eligible TE projects and this includes “provision of facilities for pedestrians and bicycles, provision of safety and educational activities for pedestrians and bicyclists,” and the “preservation of abandoned railway corridors (including the conversion and use thereof for pedestrian and bicycle trails).”

Another ten (10) percent of each State’s STP funds are set aside for the Hazard Elimination and Railway-Highway Crossing programs, which address bicycle and pedestrian safety issues. Each state is required to implement a Hazard Elimination Program to identify and correct locations which may constitute a danger to motorists, bicyclists, and pedestrians. Funds may be used for activities including a survey of hazardous locations and for projects on any publicly owned bicycle or pedestrian pathway or trail, or any safety-related traffic calming measure. Improvements to railway-highway crossings “shall take into account bicycle safety.”





Under the Congestion Mitigation and Air Quality (CMAQ) program, funding is available for projects that contribute to air quality improvements and reduce congestion. Bicycle and pedestrian infrastructure projects comprise one of the eligibility categories for this program. Eligible agencies must be located within air quality non-attainment areas (areas that fail to meet the National Ambient Air Quality Standards).

Recreational Trails Program (Section 1109) funds may be used for all kinds of trail projects. Of the funds apportioned to a state, 30 percent must be used for motorized trail uses, 30 percent for non-motorized trail uses, and 40 percent for diverse trail uses (any combination). Examples of trail uses include hiking, bicycling, in-line skating, equestrian use, cross-country skiing, snowmobiling, off-road motorcycling, all-terrain vehicle riding, four-wheel driving, or using other off-road motorized vehicles.

The Transportation, Community, and System Preservation (TCSP) Pilot Program is a comprehensive initiative of research and grants to investigate the relationships between transportation and community

and system preservation and private sector-based initiatives. States, local governments, and Metropolitan Planning Organizations are eligible for discretionary grants to plan and implement strategies that improve the efficiency of the transportation system; reduce environmental impacts of transportation; reduce the need for costly future public infrastructure investments; ensure efficient access to jobs, services, and centers of trade; and examine private sector development patterns and investments that support these goals. Section 1117 of SAFTEA-LU, Public Law 109-203 authorized the TCSP Program through FY 2009. A total of \$270 million is authorized for this program in FY's 2005-2009.

Federal Lands Highway Program (FLHP) funds may be used to construct roads and trails within (or, in some cases, providing access to) federal lands. FLHP funds total about \$800 million per year. Recreation interests often benefit from FLHP funds.

Job Access and Reverse Commute Grants are available to support projects, including bicycle-related services, designed to transport welfare





recipients and eligible low-income individuals to and from employment.

High Priority Projects and Designated Transportation Enhancement Activities identified by SAFETEA-LU include numerous bicycle, pedestrian, trails, and traffic calming projects in communities throughout the country.

#### Federal Transit Program

Title 49 USC allows the Urbanized Area Formula Grants, Capital Investment Grants and Loans, and Formula Program for Other than Urbanized Area transit funds to be used for improving bicycle and pedestrian access to transit facilities and vehicles. Eligible activities include investments in “pedestrian and bicycle access to a mass transportation facility” that establishes or enhances coordination between mass transportation and other transportation.

The Suburban Mobility Initiatives Program was established in response to a need to develop solutions to suburban mobility challenges. The objective of the program is to provide assistance to suburban public

agencies in their efforts to reduce dependence on the single occupant vehicle.

The Regional Mobility Program provides technical assistance, develops planning methods and conducts outreach, research, demonstration, and project evaluations that assist local communities in improving Regional transportation mobility.

#### Highway Safety Programs

Pedestrian and bicyclist safety remain priority areas for State and Community Highway Safety Grants funded by the federal Section 402 formula grant program. A State is eligible for these grants by submitting a Performance Plan (establishing goals and performance measures for improving highway safety) and a Highway Safety Plan (describing activities to achieve those goals).

Research, development, demonstrations, and training to improve highway safety (including bicycle and pedestrian safety) are carried out under the Highway Safety Research and Development (Section 403) Program.





### Federal/State Matching Requirements

Matching requirements for Federal-aid projects are based on sliding scale rates in Public Land states, including Arizona. Under the current program, Transportation Enhancement activities and Hazard Elimination projects are 94.3 percent federally funded in Arizona, which is higher than the general national guideline of 80 percent. A 5.7% match from the project's sponsoring agency is required. For Transportation Enhancements projects outside of State right-of-way, and Hazard Elimination projects, the maximum amount of federal funding available is \$500,000 per project. For individual State projects, the amount of federal funding available is \$1,000,000. Proposed projects that share right-of-way with both the state highway system and another jurisdiction are required to be located on a minimum of 75 percent of ADOT right-of-way to be considered a State Enhancement Project and eligible for this amount of federal funding. The State and/or local funds used to match Federal-aid highway projects may include in-kind contributions (such as donations). Funds from other Federal programs may also be used to match Transportation Enhancement, Scenic Byways, and

Recreational Trails program funds. A Federal agency project sponsor may provide matching funds to Recreational Trails funds provided the Federal share does not exceed 95 percent.

### Safe Routes to School Program

The Safe Routes to Schools Program, which is included in the Federal Reauthorization bill – Safe, Accountable, Flexible, Efficient Transportation Equity Act for the 21st Century – A Legacy for Users (SAFETEA-LU), is designed to enable and encourage children to walk and bicycle to school, and to “facilitate the planning, development, and implementation of projects and activities that will improve safety and reduce traffic, fuel consumption, and air pollution in the vicinity of schools.” Safe Routes to school projects include on-street bicycle facilities, off-street bicycle facilities, and secure bicycle parking facilities.

The funds are apportioned to each state based on their relative share of enrollment in primary and middle schools. Not less than 10% or more than 30% of the funds are for non-infrastructure related activities to encourage walking and bicycling to school. Not





less than 70% or more than 90% are for infrastructure related projects that will substantially improve the ability to safely walk and bicycle to school.

Other Federal Sources

**Land and Water Conservation Fund (LWCF) Grants, National Park Service Land and Water Conservation Fund (LWCF) Grants** This federal funding source was established in 1965 to provide “close-to-home” parks and recreation opportunities to residents throughout the United States. Money for the fund comes from the sale or lease of nonrenewable resources, primarily federal offshore oil and gas leases, and surplus federal land sales. LWCF grants can be used by communities to build a variety of parks and recreation facilities, including trails and greenways. LWCF funds are distributed by the National Park Service to the states annually. Communities must match LWCF grants with 50 percent of the local project costs through in-kind services or cash. All projects funded by LWCF grants must be used exclusively for recreation purposes, in perpetuity. Projects must be in accordance with each State’s Comprehensive Outdoor Recreation Plan.

**Community Development Block Grants (CDBG) US Department of Housing and Urban Development (HUD)**

CDBG provides eligible metropolitan cities and urban counties (called “entitlement communities”) with annual direct grants that they can use to revitalize neighborhoods, expand affordable housing and economic opportunities, and/or improve community facilities and services, principally to benefit low- and moderate-income persons. Eligible activities include building public facilities and improvements, such as streets, sidewalks, sewers, water systems, community and senior citizen centers, and recreational facilities. Several communities have used HUD funds to develop greenways, including the Boscobel Heights “Safe Walk” Greenway in Nashville, Tennessee.

**Healthy People 2010 Community Implementation Grants Program**

Federal Department of Health and Human Services The Federal Department of Health and Human Services plans to award hundreds of “micro-grants” to community organizations for activities that support the goals of Healthy People 2010, the Nation’s public health agenda for the next decade. Worth up to \$2,010 each, the micro-grants represent a new,





low-cost approach to foster effective prevention efforts at the community level. Each grant will support efforts by local groups to promote health education, quality care, access to care, and other projects that support the far-reaching national health goals of Healthy People 2010.

**National Trails Fund American Hiking Society** The American Hiking Society's National Trails Fund is the only privately funded national grants program dedicated solely to hiking trails. National Trails Fund grants have been used for land acquisition, constituency building campaigns and traditional trail work projects. Since the late 1990s, the American Hiking Society has granted nearly \$200,000 to 42 different organizations across the U.S.

### ***State of Arizona***

(Note: The following information is taken directly from the adopted (2003) *ADOT Statewide Bicycle Pedestrian Plan*)

State revenues include the State sales tax, Highway User Revenue Funds, Local Transportation Assistance Funds, Arizona State Parks Heritage Funds, and Arizona Game and Fish Department Funds. Additional funding was considered as part of the State of Arizona Vision 21 process, which was a recent multi-year study to determine multimodal transportation needs and potential funding sources to meet those needs. Following is a brief summary of each source.

#### State Sales Tax

The State sales tax revenues, as with local jurisdiction sales tax revenues, are generally budgeted to high priority programs and needs which generally have not included bicycle and pedestrian improvements; however, these revenues are available for bicycle and pedestrian facilities and programs.

#### Highway User Revenue Fund (HURF)

The HURF, made up of State gas tax revenues, the vehicle license tax, and other miscellaneous fees and services, is a revenue source constitutionally restricted to roadway purposes, which includes all improvements contained within the roadway right-of-way. Arizona





jurisdictions have utilized HURF to provide landscaping and to construct bicycle lanes, paved shoulders, sidewalk facilities, and shared-use pathways that are within the right-of-way. The State Highway Fund receives 50.5 percent of annual HURF monies, while cities and counties receive the remainder.

### Local Transportation Assistance Fund (LTAF)

Recent legislation has changed the eligibility of LTAF funds, which are generated by the Arizona Lottery. LTAF must now be used for transit purposes in all jurisdictions. These funds may be available for construction of sidewalks, bike racks, and other facilities that directly relate to transit use.

### Arizona State Parks Heritage Funds

Monies are appropriated statewide from this fund to a variety of State Parks projects including trail development. Trail funds are a 50-50 match to locally provided money. When trails are a part of other projects, such as an interpretive center, park development, trailheads, etc., they may be eligible for other Heritage Fund categories. The specific trails

fund category of the Arizona Heritage Fund is only available to trails currently listed or nominated to the Arizona State Trails System.

### Arizona Game and Fish Department Heritage Funds

The Game and Fish Department provides 100 percent funding grants for projects including habitat creation, interpretive displays, signage, improved access areas for wildlife, and other improvements. The grants do not require agency matches, and are awarded annually through a nomination and approval process similar to that of the Arizona State Parks Heritage Funds.

### Growing Smarter Planning Grant Program

The Arizona Department of Commerce offers the Growing Smarter Planning Grant to help small and rural municipalities or counties in developing comprehensive plans that meet State Growing Smarter requirements. Revised comprehensive plan provisions entail greater attention towards multimodal transportation and recreational areas.





### *Regional*

#### Maricopa Association of Governments (MAG) Regional Funds

Maricopa Association of Governments (MAG) has maintained an active role in promoting the establishment of improved travel opportunities for bicyclists and pedestrians for many years. In 2003, MAG produced the Regional Transportation Plan (RTP) – a performance based plan which guides the development of a comprehensive, multi-modal and coordinated transportation system through 2028. The RTP covers all major modes of transportation from a Regional perspective, including freeways/highways, streets, public mass transit, airports, bicycles, pedestrians, goods movement, and special needs transportation. The RTP is updated annually through a cooperative effort among government, business, and public interest groups and includes a community outreach and public involvement program.

The MAG Regional Bicycle Task Force, which was responsible for assisting in the development of the original MAG Bicycle Plan in 1992, has maintained an

active role in promoting improved travel opportunities for bicyclists. The MAG Regional Bicycle Task Force continues to provide key input into bicycle planning and decision making activities. MAG is also a leader in promoting improvement in the Valley's streetside environments to better accommodate pedestrian travel. Past pedestrian planning efforts conducted by MAG and its member agencies have led to a variety of pedestrian-oriented policies, programs, and roadway improvements. In 1994, MAG formed the Pedestrian Working Group to promote increased awareness of walking as an alternative mode of travel and to improve facilities for people who walk.

The bicycle and pedestrian element of the RTP should be viewed as an illustrative plan rather than a fully funded plan component. The cost to reconstruct existing roadways to accommodate the above RTP plan is beyond the reasonable available revenues at this time. The bicycle element can serve as a guide to coordinate street and bicycle investments within cities and between jurisdictions. In addition, the MAG Regional Transportation Plan and MAG Transportation Improvement Program (TIP) include





a strong commitment to implement bicycle facility improvements. It should be noted that many street projects in the TIP that add new through-lane capacity include improvements to accommodate bicycle use. The funding for bicycle improvements is not possible to separate out from the total cost of the street improvement.

The RTP has identified a share of the Regional funding available for bicycle and pedestrian projects. This funding consists primarily of Congestion Mitigation and Air Quality (CMAQ) funds.

### ***Local***

(Note: The following information is taken directly from the adopted (2003) *ADOT Statewide Bicycle Pedestrian Plan*)

#### General Funds

One of the primary local revenue sources of cities, towns, and counties available for use in pedestrian- and bicycle-related improvements are general

funds resulting from sales taxes, property taxes, and other miscellaneous taxes and fees. There are generally few restrictions on the use of these funds for numerous government services. Design and construction of bikeways and walkways using this funding source usually receives limited support from local governments unless their constituents lobby effectively for such use.

In some cases a component of local general funds can be dedicated to transportation improvements, including pedestrian amenities and bikeways. Some cities have voted to collect a percentage of city sales tax specifically for transportation.

Counties, too, can choose to collect sales taxes specifically for transportation. The Arizona Department of Revenue collects an additional 0.5 percent transportation excise tax on sales in Pinal and Gila counties. This money may be used for the construction, reconstruction, and repair for a number of public facilities, including streets, sidewalks,





crosswalks, bridges, tunnels, steps, and recreational areas. In FY 2002, Gila County raised \$2.6 million, and Pinal County generated \$6.7 million for transportation projects.

#### Development Impact Fees

New developments, both residential and commercial, place a strain on existing public facilities, such as parks and streets. Development impact fees are paid by developers to help cover the additional costs resulting from new construction, and these funds may be used for the provision of paved shoulders, bike lanes, and sidewalks built as part of the required roadway cross section. In some circumstances, shared-use paths have been constructed by jurisdictions using impact fees if they serve transportation needs generated by the new development.

#### Parks and Recreation Funds

Local parks and recreation funds are generally derived from property and sales taxes and some fee revenues. Bathrooms, pocket parks, lighting, landscaping, and pathways are sometimes funded through parks

and recreation departments. Maintenance costs for shared-use paths are often incurred by these departments.

#### Flood Control District Funds

Flood Control District funds can be used to construct shared-use pathways as well as flood control structures, railing, bridges, bank protection, and other devices that can facilitate pathway development. This source has limited availability but should be considered as pathway projects are developed that can be combined with flood control improvements. For instance, flood control maintenance roadways can be designed and constructed to accommodate maintenance vehicles while allowing use by bicyclists and pedestrians as well. New flood control district facilities can be designed to accommodate bicycle and pedestrian use, such as provision of new railing that can meet bike-pedestrian safety guidelines. Pathway undercrossings of major roadways and sidewalks on bridges can be “piggybacked” when any major bridge structure work is conducted or when new bridges are built.





### Revenue and General Obligation Bonds

Bonds are usually considered a financing mechanism rather than revenue source, and debt service obligations should receive consideration before this mechanism is pursued. In this discussion revenue and General Obligation (G.O.) bonds are considered as a funding source because when bond packages are presented for voter approval they are often tied to specific facility or program improvements. For instance, a G.O. bond package can be forwarded to voters for citywide sidewalk and lighting improvements or for specific sidewalk, pathway, bicycle lane, or other enhancements that are clearly defined in the legal language of the bond.

In this respect, bonds should be considered a revenue source because identified pedestrian and bicycle projects will be constructed according to truth-in-bonding requirements versus competing with numerous other local demands on general funds. Revenue bonds, such as those repaid through State Highway User Revenue Funds, also can be considered a revenue source because specific projects will be

“locked in” and constrained (provided revenue projections and cost estimates bear out as projects are developed).

### Tribal Casino Revenues

Casino revenues can and are being used for pedestrian and bicycle facilities, plans, and safety programs.

### ***Private***

#### AmeriCorps’ National Civilian Community Corps (NCCC)

One project that NCCC members work on is the building or improving of trails. AmeriCorps’ NCCC members created or improved more than 200 miles of hiking trails in 25 states nationwide. Teams cleared trees and brush, leveled trails to comply with Federal guidelines on handicapped access, implemented erosion control techniques, and created and updated signs. These trails are located in rural, urban, and national parks from California to Maine, and are used by tens of thousands of Americans each year.





#### Bikes Belong Coalition

Bikes Belong Coalition seeks to assist local organizations, agencies, and citizens in developing bicycle facilities projects that will be funded by TEA-21. Bikes Belong Coalition will accept applications for grants of up to \$10,000 each, and will consider successor grants for continuing projects. Funding decisions are made on a rolling basis.

<http://bikesbelong.org/site/page.cfm?PageID=21>  
(grant applications due quarterly)

#### American Greenways Awards Program

##### The Conservation Fund

The American Greenways Awards program is a program started by the Conservation Fund. The Fund works with private companies such as DuPont and Kodak to provide funding for greenway development.

<http://www.conservationfund.org/?article=2372>  
(grant applications due from March 1 to June 1 annually)

#### Fish America Foundation

Fish America Foundation provides funding to public and private organizations for projects that enhance or conserve water and fisheries resources, including community efforts. In the last 18 years, the Foundation has provided 620 grants totaling more than \$4.9 million to improve the fisheries resource in all 50 states and Canada. To apply for a grant, one sends a completed application, a letter of support from a state resource agency, and evidence of the organization's nonprofit status. The grant award is approximately \$10,000. This grant can include greenways that enhance or conserve water resources.

<http://www.fishamerica.org/faf/grants/index.html>  
(grant proposals due July 31 annually)

#### Oracle Corporation Giving Program

Oracle provides grants to medical research, endangered animal protection, environmental protection and K-12 math, science and technology education. Past recipients have included trail groups.





### National Tree Trust (NTT)

NTT has grants available for tree seedlings through the Community Tree Planting program. This is a great way to beautify the community, replant a neglected area, or simply a good excuse to get out in the fresh air. Seedlings are available for delivery January through April, and the main requirements for the grant are as follows:

- Trees must be planted on public land.
- Project must utilize volunteers for planting and/or maintaining seedlings.
- Matching funds are required, which may include volunteer hours, donated items and non-federal moneys.
- Two years of annual reporting are required for each grant.

Visit the website at [www.nationaltreetrust.org](http://www.nationaltreetrust.org) for more information about the Community Tree Planting program and to download an application. Seedlings are allocated on a first come, first served basis. This is a two-part application process. Applications will not be

considered if any forms are incomplete or submitted after their deadlines. This grant can include trail-side tree planting programs.

### The Global ReLeaf Program

The Global ReLeaf Forest Program is American Forests' education and action program that helps individuals, organizations, agencies, and corporations improve the local and global environment by planting and caring for trees. The program provides funding for planting tree seedlings on public lands. Emphasis is placed on diversifying species, regenerating the optimal ecosystem for the site and implementing the best forest management practices. This grant is for planting tree seedlings on public lands.

Global ReLeaf Program: [http://www.americanforests.org/global\\_releaf/grants/](http://www.americanforests.org/global_releaf/grants/) (proposals due January 15 and July 1 annually)





#### The Robert Wood Johnson Foundation

The Robert Wood Johnson Foundation seeks to improve the health and health care of all Americans. One of the primary goals of the Foundation is to “promote healthy communities and lifestyles.” Specifically, the Foundation has an “Active Living by Design” grant program that promotes the principles of active living, including non-motorized transportation. Multiple communities nationwide have received grants related to promotion of trails and other non-motorized facilities. The Robert Wood Johnson Foundation is online at [www.rwjf.org](http://www.rwjf.org).

#### Salt River Project

In an example of an ongoing private partnership in the MAG Region, the Salt River Project, a local utility company, is providing directional and interpretive trail signage. According to the Pedestrian and Bicycle Information Center, other corporate sponsors of the Arizona Trail are the Hughes Missile Systems, BHP Cooper and Pace American, Inc.







MAG Regional Bikeway Master Plan:

Appendix





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# MAG/MCDOT BICYCLE USE QUESTIONNAIRE

**Regional Bikeway Master Plan Survey**

## Bicycle Use Questionnaire

We encourage all interested members of your household to complete a separate questionnaire.

We appreciate your time

1. What is your zip code?

2. How do you classify yourself, in terms of your interest in bicycling? [Check ALL that apply]

(A) Bicycle rider     (B) Bicycle advocate  
 (C) Bicycle planner     (D) Not a bicycle rider [Skip to Question #6]

3) From the following list, please RANK ALL the places you ride a bicycle in Maricopa County. In the space to the left, check all the places you ride in Maricopa County. Then, in the space to the right, RANK your choices with 1 being the place you ride most, 2 for the second place you ride most, etc.

(A) On-street bicycle lanes with lanemarkings

(B) Major streets without bicycle lanes

(C) Neighborhood streets

(D) Off-street shared use paths [canals, washes, rivers, utility corridors, etc.]

(E) Other

4. From the following list, please RANK ALL the REASONS you ride a bike in Maricopa County. In the box to the left, check all the reasons you ride in Maricopa County. Then rank your choices in the boxes to the right of the item, with 1 being the most important reason you ride, 2 for the second most important reason you ride, etc.

(A) Ride to work

(B) Ride to school

(C) Run errands

(D) Recreation

(E) Health

(F) Other

5. Please indicate HOW IMPORTANT the following facilities/items are to your household.

	Extremely	Very	Somewhat	Not Very	Not at All
(A) On-street bicycle lanes with lane markings	<input type="radio"/>				
(B) Signed bike routes on streets without lane markings	<input type="radio"/>				
(C) Paved shared use paths along canals and non-street corridors	<input type="radio"/>				
(D) Unpaved shared use paths along canals and non-street corridors	<input type="radio"/>				
(E) Bike route maps	<input type="radio"/>				
(F) Bicycle parking at major destinations	<input type="radio"/>				
(G) Overpasses/underpasses at street, wash, river, canal, crossings, etc.	<input type="radio"/>				
(H) Special crossing features (other than over- or underpass) where a shared use path encounters a street	<input type="radio"/>				
(I) Pedestrian activated light in order to cross a street to continue on a canal shared use path	<input type="radio"/>				
(J) Local bicycle information on Internet	<input type="radio"/>				
(K) Safe bicycling routes to schools	<input type="radio"/>				

6. If bicycling facilities were improved, would you be more likely to ride a bicycle in Maricopa County?

Yes  
 No. Skip to Voluntary Information

7. If the following conditions or facilities were improved, would you be likely to ride a bicycle more often in Maricopa County?

	Definitely	Possibly	Probably Not
(A) More marked bicycle lanes (with signs and striping)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
(B) More marked bicycle routes (with signs)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
(C) More bicycle parking at destinations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
(D) More off-street bicycle paths (i.e. along canals)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
(E) More crossings to connect the canal paths and other off-street paths	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
(F) Better pavement or shoulder condition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
(G) More underpasses and overpasses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
(H) Bicycle facilities/routes closer to my home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>





- (I) More roadway intersections with signals
- (J) Other

7B. If you chose (J) Other on the question above, please specify:

8. Various jurisdictions within Maricopa County are planning projects that will improve opportunities for bicycle riding throughout the region. This will include improvements on facility types including bicycle lanes/routes, shared use paved and unpaved paths, and crossings at washes, canals, and major streets. Creating new facilities and/or maintaining or enhancing existing facilities are being considered.

From your personal knowledge, please identify, at least, the **THREE MOST NEEDED** specific project improvements along these types of facilities. Then, indicate your preferred order of priority by typing the number "1" for your highest priority, then 2, 3, etc. for your next highest priorities. [If you are not familiar enough with specific bicycle facilities routes and locations, skip to [Voluntary Information](#)]  
In your description, please use major cross-street references like "the north side of Camelback Road & west side of 44th Street".

Project Improvement and Priority:

**Thank you for your time.**

Your responses will remain completely confidential. They will greatly help plan and implement new and improved bicycle facilities throughout Maricopa County.

Voluntary Information

Please complete if you would like to be on MAG or MCDOT Bicycle mailing lists:

Please provide your complete mailing address: Name, Street, City, and zip and your e-mail address if you have one.

Submit Survey





## QUESTIONNAIRE OPEN-ENDED QUESTION SUMMARY

### Most needed specific improvements – Categorical Groupings

### Total Responses Per Priority Listing

	Total	#1	#2	#3	#4	#5
1. Missing Link ( #1-0 , #2-0 ,#3-1 , #4-0 ,#5-0 - other)	1828	619	588	401	151	70
a. On Arterial Road Bike Lane	1405	474	491	304	89	47
b. On Secondary Road Bike Lane	19	6	7	2	3	1
c. Off- Road Bike Facility	325	119	73	65	48	20
d. Park and Ride	12	4	3	5	0	0
e. Bike Parking/Facilities (water, shade, etc.)	66	15	14	24	11	2
2. Barrier ( #1-18, #2-2,#3-8 , #4-4 ,#5-3 - other)	267	143	27	54	26	17
a. Freeway	79	43	9	12	11	4
b. Canal	114	60	11	29	8	6
c. River	15	9	0	3	1	2
d. Wash	15	11	2	1	0	1
e. Railroad	9	2	3	1	2	1
3. Non-Standard ( #1-0 , #2-0 ,#3-0 , #4-1 ,#5-0 - other)	522	214	76	105	85	41
a. Bike Lane too narrow or not continuous	411	187	30	91	71	32
b. Lighting	24	12	8	2	1	1
c. Signage/Signals	78	12	37	10	12	7
d. More Bike Capacity on Bus Bike Racks	8	3	1	2	1	1
4. Missing or Inadequate Crossing						
No Solution ( #1-2 , #2-0 ,#3-16 , #4-10 ,#5-7)	394	169	102	78	30	15
a. At Grade Solution	116	47	40	26	3	0
b. Grade Separated Intersection Solution	243	120	62	36	17	8
5. Signals	73	27	5	26	15	0
6. Maintenance	231	78	65	43	27	18
7. Safety Concern	82	54	23	4	0	1
8. More Bike Lanes Needed - no specific locations	208	117	88	0	1	2
9. More Off-Road Bike Paths Needed - no specific locations	96	48	45	0	1	2
10. Design/Planning Suggestions – changes to bike lane specifications	70	23	13	20	7	7
11. Enforcement	57	19	11	10	10	7
12. Education/Promotions/Incentives	103	22	28	28	28	17
<b>TOTAL – number higher- multiple comments</b>	<b>3952</b>	<b>1533</b>	<b>1071</b>	<b>769</b>	<b>382</b>	<b>197</b>
<b>TOTAL – number listed on survey print-out</b>	<b>3390</b>	<b>1235</b>	<b>965</b>	<b>715</b>	<b>307</b>	<b>168</b>





## TRAVEL DEMAND

Travel demand refers to how much people would travel under various circumstances. A number of geographic, demographic, and transportation system factors can affect nonmotorized travel demand. A number of methodologies and models have been developed to help planners predict how specific changes in these factors can affect walking and bicycling activity (Schwartz, et al, 1999; Dill and Carr, 2003; Schneider, Patten and Toole, 2005; Petritsch, 2005).

When walking and bicycling increase, a portion of this additional travel often substitutes for motor vehicle travel, which can help achieve transportation planning objectives such as congestion reduction, road and parking facility cost savings, energy conservation, and pollution emission reductions. According to some estimates, 5-10% of automobile trips can reasonably be shifted to nonmotorized transportation in a typical urban area (Mackett, 2000). A given increase in walking and bicycling can provide a proportionately larger reduction in motor vehicle travel since a relatively short nonmotorized trip often substitutes for a longer car trip. For example, a shopper might choose between walking to a small local store and driving a longer distance to shop at a supermarket. In addition, bicycling and walking improvements can also help support shifts from driving to public transit.

Since walking and bicycling trips are relatively short and slow compared with motorized travel, nonmotorized travel represents a relatively small portion of total travel distance (which is how transportation professionals tend to measure travel) but a relatively large portion of travel time (which is how users tend to perceive travel-mode-utility). For example, an average walking trip of 0.7 miles and 16 minutes represents only about 1.7% of average daily travel distance but about 25% of average daily travel time. As a result, a small improvement in walking and bicycling travel convenience, speed, and comfort can significantly affect the relative utility of these modes.

### Current Walking and Bicycling Activity

Conventional travel surveys provide some information on the amount of bicycling and walking in an area, but generally undercount nonmotorized travel because survey respondents tend to overlook short trips, travel by children, recreational travel, and walking and bicycling links of transit and automobile trips. For example, a bike-bus-walk trip is often classified simply as a bus trip, and an automobile-walk trip is often coded simply as an automobile trip, even if the bicycling and walking occur on public facilities and represent a significant portion of travel time (Litman, 2003).





The 2001 National Household Travel Survey (NHTS) made a special effort to obtain walking and bicycling travel data, and as a result found significantly higher levels of nonmotorized travel than indicated by typical surveys (Weinstein and Schimek, 2005). That survey found that about 0.8% of all trips are by bicycle, 8.7% of trips are just by walking, and another 1.7% of trips involve both walking and public transit, indicating that more than 11% of all trips involve nonmotorized travel, as summarized in Table 1. This makes nonmotorized modes the second most common travel mode, after automobile.

This table indicates the portion of total trips made by bicycling and walking according to three national travel surveys. However, such surveys tend to undercount nonmotorized travel so the actual portion of trips by these modes is probably somewhat

higher. (\* Estimated based on 86% of transit trips involve a walking link, as in 2001.)

**Walking Activity**

Using NHTS data, Weinstein and Schimek (2005) found that Americans average 3.8 walking trips per week or 0.54 trips per day. About 15% of respondents report walking on a particular day and about 65% of respondents reported walking during the previous week. The median walk trip took 10 minutes and was about ¼ mile in length, much less than the mean walking trip (i.e., a minority of walking trips are much longer than average). The table below summarizes their walking trip data. This indicates that about a quarter of walking trips are for recreation and exercise (including dog walking), and these non-utility trips tend to be longer than average in distance and duration.

**Table 1: Walking and Bicycling Trips (FHWA, 2004; Weinstein and Schimek, 2005)**

	Walking Trips		Walk & Transit		Bicycling Trips		Combined Trips	
	Billion	Percent	Billion	Percent	Billion	Percent	Billion	Percent
1990 NPTS	18.0	7.2%	4.7*	1.5%	1.7	0.7%	24.4	9.4%
1995 NPTS	20.3	5.3%	5.7*	1.5%	3.3	0.9%	29.3	7.7%
2001 NHTS	35.3	8.7%	6.9	1.7	3.3	0.8%	45.7	11.2%





**Table 2: NHTS Walking Trip Attributes (Weinstein and Schimek, 2005)**

Purpose	Frequency	Mean Distance	Median Distance	Mean Duration
	Percent	Mile	Mile	Minutes
Personal business/shopping/errands	48%	0.44	0.22	11.9
Recreation/exercise	20%	1.16	0.56	25.3
To transit	16%	N/A	N/A	19.6
To or from school	7%	0.62	0.33	13.3
To or from work	4%	0.78	0.25	14.1
Walk dog	3%	0.71	0.25	19.0
Other	2%	0.57	0.22	14.8
Totals	100%	0.68	0.25	16.4

*This table summarizes the results of NHTS walking trip data. N/A = not available.*

In the MAG Region, comparable surveys show a correlation with the national statistics. For example, the Maricopa Regional Household Travel Survey was conducted by Nu-Stats for MAG from February through December 2001. Table 3 lists the percentage of walk trips, the mean duration, and the minimum and maximum percentages by geographic area.

**Table 3: Maricopa Travel Survey – Walking Trip Attributes (MAG, 2002)**

Purpose	Frequency (percent)	Mean Duration (minutes)	Minimum and Maximum
Home-based work	1.9%	22.01	0% - Apache Junction 3.5% - Gilbert
Home-based shopping	3.7%	16.08	0% - Northwest 7.6% - East Central Phoenix
Home-based other	10.6%	13.36	5.4% - Sun City/Sun City West 15.9% - West Central Phoenix
Non-home-based	6.8%	10.92	3.1% - Sun City/Sun City West and Southwest 12.2% - Gilbert
All trips	7.4%	13.32	1.9% - Sun City/Sun City West 21.4% - Southwest





**Bicycling Activity**

Using available travel surveys, researchers Barnes and Krizek (2005b) estimated that adult bicycling trips nationally average 7 to 10 miles in length and 40 minutes in duration, and that roughly 1% of adults in the United States ride a bicycle on a particular day, 5.3% in a week, 16% in a month, and 40% in a year. Over large geographic areas such as metropolitan areas or states, the portion of adults who bicycle on a particular day ranges between about 0.3% and 2.5%. Over smaller areas such as specific parts of metropolitan areas, the range could go as high as 15%. They conclude that total adult bicycling can be estimated in a particular area as 0.3% plus 1.5 times the commute share. They find that a relatively large portion of bicycling is performed by a relatively small number of cyclists. The 5% most active cyclists generate about half the riding days, the other 95% generate the other half. Because so many of the trips are generated by such a small number of people, a relatively small part of the population can have a big impact on the total amount of bicycling in an area. If 4% of the public were in the “frequent” category, rather than the 2% that probably are now, that could conceivably lead to a 40% increase in the total amount of biking.

Table 4 shows levels of nonmotorized commuting in Phoenix and other large U.S. cities. Phoenix currently has lower rates of walking commuting and higher rates of cycle commuting than the national average.

**Table 4: Nonmotorized Commuting In Large U.S. Cities (2000 Census; Dill & Carr, 2003)**

City	Walked Percent	Biked Percent	Total Bike & Walk Percent
Philadelphia, Pa.	10.4	0.63	11.03
San Francisco, Ca.	8.8	1.8	10.6
New York, N.Y.	9.3	0.42	9.72
Chicago, Ill.	5.6	0.51	6.11
Tucson, Ariz.	3.4	2.22	5.62
Mesa, Ariz.	2.1	1.64	3.74
Los Angeles, Calif.	2.9	0.63	3.53
Houston, Tex.	2.6	0.35	2.95
San Diego, Calif.	2.3	0.48	2.78
<b>Phoenix, Ariz.</b>	<b>1.9</b>	<b>0.87</b>	<b>2.77</b>
Indianapolis, Ind.	2.5	0.18	2.68
Dallas, Tex.	2.2	0.2	2.4
Detroit, Mich.	2.3	0.1	2.4
Columbus, Ohio	2	0.22	2.22
San Jose, Calif.	1.7	0.42	2.12
Jacksonville, Fla.	1.5	0.4	1.9
<b>Total for U.S.</b>	<b>2.7</b>	<b>0.5</b>	<b>3.2</b>

Note: A limited survey conducted for the 2003 *ADOT Statewide Bicycle/Pedestrian Plan* indicates that bicycle use for recreation and/or exercise (most frequent) and commuting are the most frequent reasons for bicycle use in Arizona (ADOT 2003).





Survey statistics from a MAG-sponsored travel survey are comparable to the above. Table 5 lists the percentage of bicycling trips, the mean duration, and the minimum and maximum percentages by geographic area. These data are from the Maricopa Regional Household Travel Survey.

The 2002 National Survey of Pedestrians and Bicyclists Attitudes and Behaviors (USDOT, 2002), which involved phone interviews with more than 9,600 adults age 16 and older throughout the U.S., found the following:

- Nearly 80% of adult Americans take at least one walk of five minutes or longer during the summer months, while fewer than 30% ride a bike, according to a major new survey released today by the U.S. Department of Transportation.
- Bicycling is most common among younger residents. Nearly 40% aged 16 to 24 ride a bicycle during the summer, 26% aged 45 to 54 cycle, but only about 9% of those age 65 and older report they cycle.
- Walking declines slightly as people age. Eighty-two percent of those aged 16 to 24 take walks, 80% aged 45 to 54 walk, and 65% aged 65 and older report taking walks.

**Table 5: Maricopa Travel Survey – Bicycling Trip Attributes (MAG, 2002)**

Purpose	Frequency (percent)	Mean Duration (minutes)	Min / Max
Home-based work	1.3%	28.72	0% - four areas 5.1% - Tempe/Guadalupe
Home-based shopping	0.9%	14.53	0 – five areas 4.3% - Sun City/Sun City West
Home-based other	1.4%	17.00	0.5% - North Phoenix 3.4% - Tempe/Guadalupe
Non-home-based	0.5%	18.70	0% - four areas 1.5% - Tempe/Guadalupe
All trips	1.1%	19.56	0.3% - East Central Phoenix 3.3% - Tempe/Guadalupe





- Only half of all adults are satisfied with their communities' designs for bicycling safety, whereas three out of four adults are satisfied with their communities' designs for pedestrian safety.
- Survey respondents were also asked to recommend changes to their communities for either bicycling or walking. Most persons suggested changes in bicycle and pedestrian facilities. For those recommending changes, 73% wanted new bicycle facilities, such as trails, bicycle lanes and traffic signals, and 74% wanted pedestrian facilities including sidewalks, lighting, and crosswalks.

Note: The 2003 ADOT survey mentioned in the note to Table 4 above reveals that concerns regarding "no facilities to ride on" ranked among the highest ranked reasons why people do not ride more often (ADOT 2003).

- People who do not take walks cite these reasons: disability or other health problems (25%); unfavorable weather (22%); and too busy or no opportunity (19%). Those who do not bike cite lack of access to a bicycle (26%); too busy or no opportunity (17%); disability or other health problems (10%).
- Males are more likely to take a bike ride during the summer than are females. However, both groups are about equally likely to take walks during the summer.

This and other surveys indicate significant latent demand for active transportation, that is, many people would like to bicycle and walk more than they currently do, if they had suitable conditions and resources (Komanoff and Roelofs, 1993; Pucher, Komanoff, and Schimek, 1999). A survey of Americans' attitudes toward walking found (STPP, 2003):

- More than half of respondents (55%) say they would like to walk more often either for exercise or utilitarian trips.
- The type of walking Americans would like to do more of is walking for exercise or fun, followed by walking to a specific destination. Majorities associate walking with exercise, relaxation, and fun.
- Excessive distance to common destinations (stores, schools, etc.) is the largest constraint to utilitarian walking.
- Large majorities of Americans support policies to ensure the safety of walkers and to make their communities more walkable. The most popular policies to improve pedestrian safety include tougher enforcement of the speed limit and designing streets with more sidewalks and safe crossings.
- Majorities favor making it easier for children to walk to school, improving public transportation, and increasing federal spending on pedestrian safety.
- When offered various options for improving transportation in their community, 35% choose improved public transportation,





31% choose developing communities where people do not have to drive long distances to work or shop, and only 25% choose building new roads.

Several researchers and practitioners have developed methods to assess the comparative latent demand for nonmotorized travel at either the TAZ or corridor level. One such popular method, the Latent Demand Method, is a relatively easy-to-use technique for estimating potential demand for bicycle travel. Landis (1996) describes the model and examples of its application. It is similar to conventional four-step models, but uses a number of simplifying assumptions to reduce data requirements. It estimates the probability of bicycle (or pedestrian) travel on individual roadway (or even off-street) corridor segments based on area demographics and the proximity, frequency, and magnitude of adjacent trip generators. These trip attractors/generators (employment, shopping, parks, and schools) are geocoded and stratified according to proximity. Nonmotorized trips are predicted using the latent demand (i.e., gravity model equation), which has different bicycle or pedestrian trip probabilities versus distance for each trip purpose. The resulting database and GIS map allows planners to anticipate the relative bicycle use among transportation corridors within a metropolitan area for construction prioritization. An analysis described above was

conducted for the MAG's *Pedestrian Plan 2000*, and a similar analysis for bicycling and walking is currently being performed in Scottsdale.

The Latent Demand Method was applied to approximately 1000 miles of major roadways in the MAG Region. The study corridor areas were analyzed and ranked Regionally according to their latent travel demand, or potential pedestrian activity. The Latent Demand modeling results were stratified into groups approximately representing the four general classifications of pedestrian (activity intensity) areas outlined in the 1995 MAG *Pedestrian Area Policies and Design Guidelines*. The stratification schedule of the Latent Demand Scores into the four general pedestrian (activity) area types is:

- Latent Demand 100% to 80% = Highest potential for pedestrian activity. Represents the "District" area type from the 1995 MAG *Pedestrian Area Policies and Design Guidelines* which are "...areas of high intensity with a wide variety of land uses with a Regional appeal..."
- Latent Demand 79% to 60% = Second highest potential for pedestrian activity. Represents the "Campus" area type from the 1995 MAG *Pedestrian Area Policies and Design Guidelines* which are "...high intensity areas with a single or limited mix of land uses..."





- Latent Demand 59% to 30% = Third highest potential for pedestrian activity. Represents the “Community” area type from the 1995 MAG *Pedestrian Area Policies and Design Guidelines* which are “...areas of low to medium intensity...”
- Latent Demand 29% to 0% = Fourth highest potential for pedestrian activity. Represents the “Neighborhood” area type from the 1995 MAG *Pedestrian Area Policies and Design Guidelines* which are “...areas of low intensity with a limited mix of land uses...”

This classification then permits the establishment of appropriate roadside walking environment performance guidelines in the Region.

The continued rapid growth of the MAG Region indicates a growing latent demand for bicycling and walking. Consider the following:

- The population of the MAG Region is projected to double in 30 years, from 3,128,000 on July 1, 2000 to 6,320,000 on July 1, 2030. The average growth per year is 106,000 (MAG, 2005a).
- In 2003, 54,000 residential permits were issued in the MAG Region (MAG, 2005a).

- The number of jobs in the MAG Region is projected to more than double in 30 years, from 1,570,000 in 2000 to 3,412,000 in 2030 (MAG, 2005a).

These numbers can give a rough idea of how much growth in bicycling and walking may occur in the next 30 years. More detailed estimates for individual travel corridor levels require development and application of calibrated logit (or mode choice) models. Currently, calibrated models sensitive to the specific provision of bicycle or pedestrian facilities are not available. However, a current study, initiated and funded by the Florida DOT, seeks to predict bicycling and walking trips at the corridor level. Comprehensive models are being developed for mode shift (from motorized to nonmotorized trips that result when bicycling and walking facilities are built), induced utilitarian travel (bicycling and walking trips that would not have been made had bicycling and walking facilities not been built), and induced recreational travel. These models are planned to be available in 2007.





### Factors That Affect Active Travel

Both urban form and demographics are factors that affect walking and bicycling activity; they are discussed in more detail below.

### Urban Form

A number of studies have attempted to model the effects of geographic factors on nonmotorized travel (W.L. Schwartz, et al, 1999; Barnes and Krizek, 2005a). Walking tends to increase with land use density, mix, and connectivity. Described differently, walking tends to serve relatively short trips, and so represents a greater share of total trips in compact communities where destinations are closer together. Using travel survey data from Portland, Oregon, Lawton (2001) found that land use density, mix, and road network connectivity significantly affect residents' mode split and nonmotorized travel. Those living in the most urbanized areas drive significantly less, and walk significantly more than residents of more automobile-oriented, suburban neighborhoods, as indicated in Figure 1.

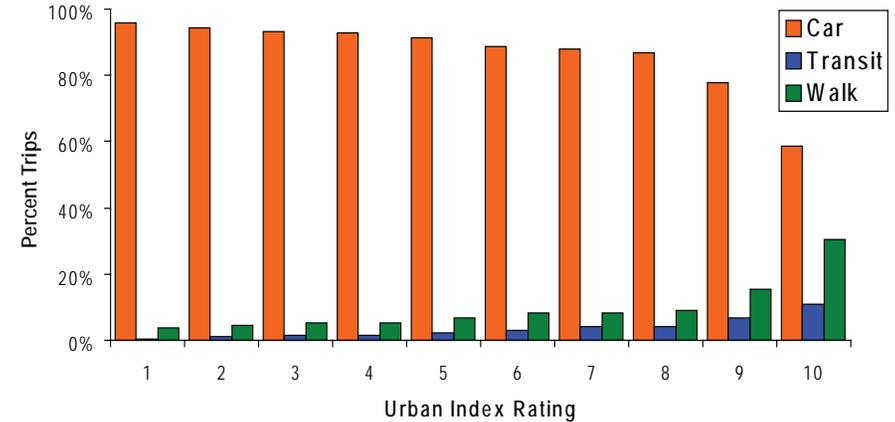


Figure 1: Urbanization Impact On Mode Split (Lawton, 2001)

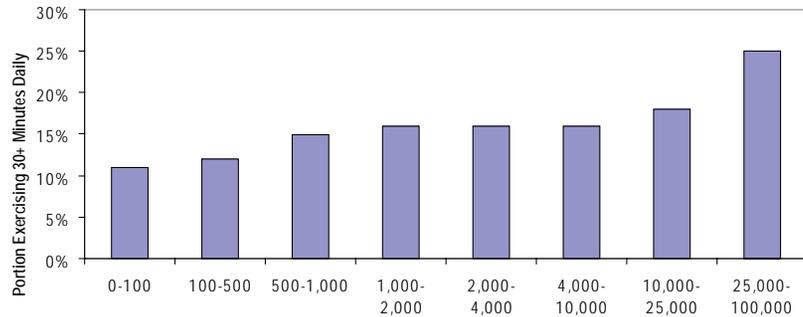
*As an area becomes more urbanized the portion of trips made by transit and walking increases, and driving declines.*

Similarly, Khattak and Rodriguez (2003) found that residents of more walkable, multi-modal neighborhoods tend to achieve most of the minimum amount of physical activity required for health (20 minutes a day most days of each week). Unpublished analysis by transport modeler William Gehling found that the portion of residents who walk and bicycle at least 30 minutes a day increases with land use density, from 11% in low density areas





(less than 1 resident per acre) up to 25% in high density (more than 40 residents per acre) areas.



**Figure 2: Portion of Population Walking & Bicycling 30+ Minutes Daily (Unpublished Analysis of 2001 NHTS by William Gehling)**

*As and use density increases the portion of the population that achieves sufficient physical activity through walking and bicycling increases. Based on 2001 NHTS data.*

Frank, et al (2006) developed a walkability index that reflects the quality of walking conditions, taking into account residential density, street connectivity, land use mix, and retail floor area ratio (the ratio of retail building floor area divided by retail land area). They found that in King County, Washington a 5% increase

in their walkability index is associated with a 32.1% increase in time spent in active transportation (walking and bicycling), a 0.23 point reduction in body mass index, a 6.5% reduction in VMT, and similar reductions in air pollution emissions.

Cao, Handy and Mokhtarian (2005) used a travel survey performed in Austin, Texas to evaluate the effects of land use patterns on strolling (walking for pleasure or exercise) and utilitarian walking trips. They found that the pedestrian environment at the origin (home) has the greatest impact on strolling trips, while the pedestrian environment at the destination appears to be at least as important for utilitarian trips. They found that people are more likely to stroll or walk to a store when fewer vehicles travel residential and commercial streets. They found that strolling accounts for the majority of walking trips, and tends to be undercounted.

Certain types of destinations tend to attract bicycling, including schools, college/university campuses, employment centers, recreation centers, and parks.

Topography and climate can affect walking and bicycling, but not as much as might be expected. For example, the northwestern





cities of Seattle, Portland, and Missoula report significantly higher levels of bicycle transportation than many “Sunbelt” cities that are flat and have mild climates. Community attitudes seem to have a major impact on bicycling activity. Bicycling tends to be much more common in communities that have developed a supportive culture than in otherwise comparable communities that lack this level of support. It may take several years for a community to fully achieve its full nonmotorized travel potential. First year impacts are frequently modest, but tend to increase as individuals become more accustomed to nonmotorized travel and as additional support facilities (pedestrian and bicycle network, bicycle parking, etc.) develop.

### Demographics

Bicycle commuting tends to be more common among younger males, lower income employees, and higher-income college educated employees.

Households with no automobiles report more utility walk trips than those that do have a motor vehicle (Weinstein and Paul Schimek, 2005). People living in households without cars reported slightly higher average numbers of utility walk trips and a slightly longer

average distance per trip. However, the biggest difference was the number of people reporting any utility walk trips: 12% for those with access to a car and 46% for those without.

Minorities (Blacks or Latinos) tend to walk more for utilitarian purposes and less for exercise than Whites. However, they were more likely to report exercise trips. As before, these differences in the number of people reporting the trips tended to be larger than the differences in trip distance and duration. Owning a household dog appears to increase walking trips, although it is possible that, at least in some cases, the causation goes the other way, and households that enjoy walking tend to own dogs, perhaps for company and security.

