

PIMA COUNTY, ARIZONA
DEPARTMENT OF PUBLIC WORKS

BENEFIT-COST ANALYSIS
PIMA COUNTY URBAN LOOP PROJECT
TIGER II GRANT APPLICATION

August 19, 2010



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TIGER II GRANT APPLICATION

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PROJECT SUMMARY

Pima County, Arizona is implementing a continuous, off-road 55-mile bicycle and pedestrian loop pathway that encompasses four heavily utilized commuting corridors, providing a safe alternative to motor vehicle travel. The project, known as the Urban Loop, is more than one-quarter complete, and much of the remainder is already planned and through the major hurdle of environmental clearance. TIGER II grant funds are needed to supplement local, regional, and nominal federal funds so that the project can be fully realized. The TIGER II grant will help fund the completion of missing segments of the Urban Loop and bring existing segments into compliance with current AASHTO and ADA standards.

Pima County has already completed 16 miles of this urban loop at a cost of \$18.6 in local funds. Of the 39 miles that remain, Pima County is requesting TIGER II funding of \$41.1 M, matched with \$25.4 M in local funds, to complete 20 of the remaining miles. The last 19 miles to be completed will be funded by \$19.6 M in local funds and \$3.2 M in other federal funds, as shown in Exhibit 1 below, and in Map 1 on page 3. This grant request illustrates an aggregate 59% local/41% federal match, or a 38%/62% match for TIGER II project funds alone.

This benefit-cost assessment examines the project in detail, paying particular attention to project construction and maintenance costs, and the benefits attributed to enhanced bicycling by commuters and recreationalists. Based on bicycling alone, the findings demonstrate an accrued benefit that greatly exceeds costs, and illustrating the economic worthiness of the project. As a stand-alone project, the Urban Loop will produce an estimated range of benefits from \$2.66 to \$27.98 for every dollar invested. The values are slightly lower (a minimum of \$2.34) for the TIGER II projects when viewed separately. Few transportation investments exceed this rate of return.

Exhibit 1 Urban Loop: Costs and Proposed Funding Sources

Status	Miles	Local Funds	%	Federal Funds				Total Costs
				Other Federal Funds	%	TIGER II Funds	%	
Already Completed ⁽¹⁾	16	\$18,600,000	100%	\$0	0%	\$0	0%	\$18,600,000
TIGER II Grant	20	\$25,421,200	38%	\$0	0%	\$41,056,800	62%	\$66,478,000
Pima County Projects	19	\$19,580,552	86%	\$3,247,741	14%	\$0	0%	\$22,828,293
Total	55	\$63,601,752	59%	\$3,247,741	3%	\$41,056,800	38%	\$107,906,293

¹. The estimate of Local Funds is \$1.2 million per linear mile, based on Pima County cost data.

Pima County is recognized internationally for its comprehensive system of bike and pedestrian facilities and investment in the Urban Loop fulfills many of the goals and policies of the TIGER II grant program. On March 15, 2010, the U.S. Department of Transportation announced a “Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations.” It says:

“The DOT policy is to incorporate safe and convenient walking and bicycling facilities into transportation projects. Every transportation agency, including DOT, has the responsibility to improve conditions and opportunities for walking and bicycling and to integrate walking and bicycling into their transportation systems. Because of the numerous individual and community benefits that walking and bicycling provide — including health, safety, environmental, transportation, and quality of life — transportation agencies are encouraged to go beyond minimum standards to provide safe and convenient facilities for these modes.”¹

Under “Recommended Actions,” the USDOT policy states:

“The DOT encourages States, local governments, professional associations, community organizations, public transportation agencies, and other government agencies, to adopt similar policy statements on bicycle and pedestrian accommodation as an indication of their commitment to accommodating bicyclists and pedestrians as an integral element of the transportation system. In support of this commitment, transportation agencies and local communities should go beyond minimum design standards and requirements to create safe, attractive, sustainable, accessible, and convenient bicycling and walking networks.”

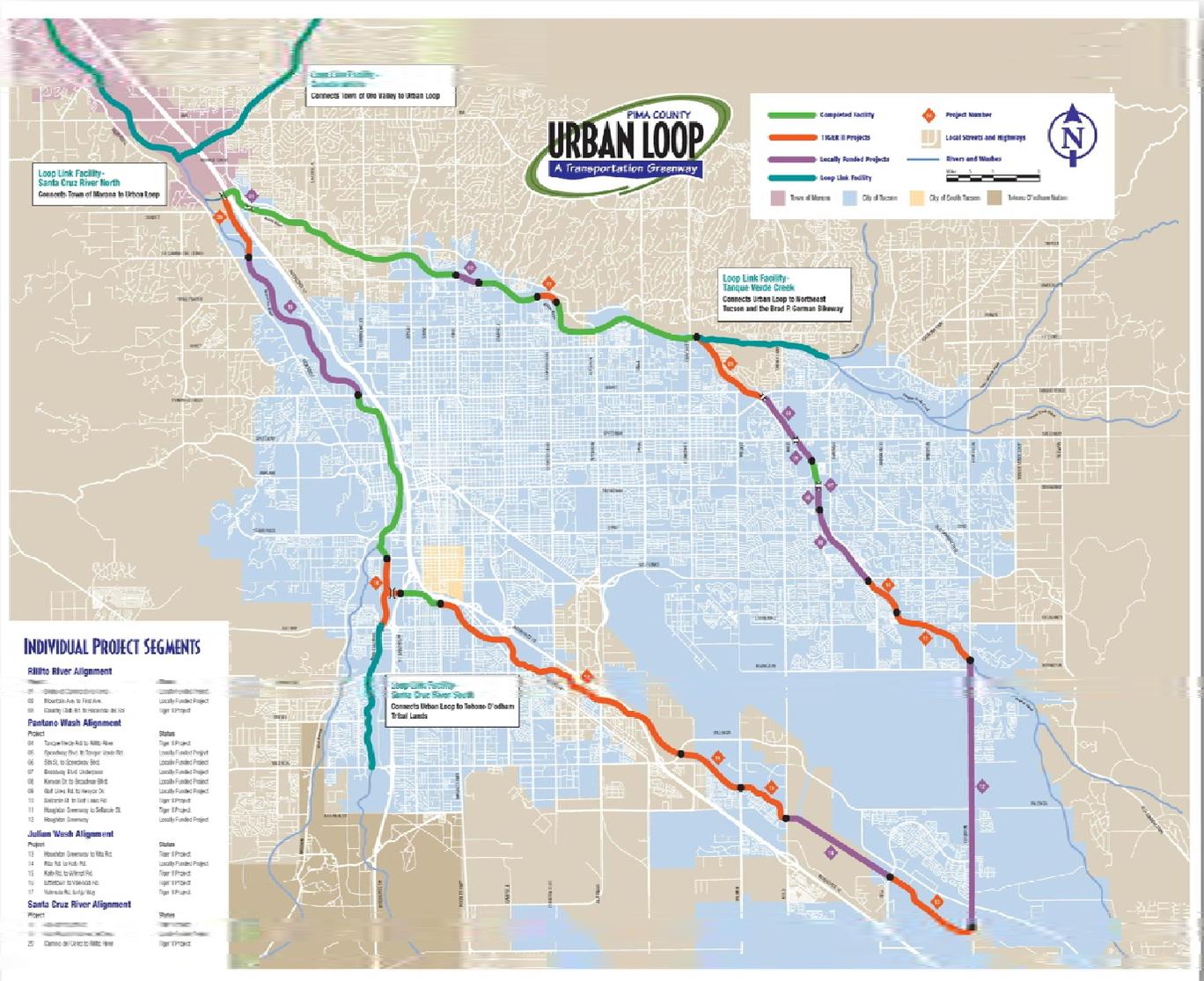
The USDOT Policy Statement concludes:

“Increased commitment to and investment in bicycle facilities and walking networks can help meet goals for cleaner, healthier air; less congested roadways; and more livable, safe, cost-efficient communities. Walking and bicycling provide low-cost mobility options that place fewer demands on local roads and highways. DOT recognizes that safe and convenient walking and bicycling facilities may look different depending on the context — appropriate facilities in a rural community may be different from a dense, urban area. However, regardless of regional, climate, and population density differences, it is important that pedestrian and bicycle facilities be integrated into transportation systems. While DOT leads the effort to provide safe and convenient accommodations for pedestrians and bicyclists, success will ultimately depend on transportation agencies across the country embracing and implementing this policy.” (Emphasis added)

Pima County, in partnership with its municipalities and Native American communities, has a long history of creating “safe, attractive, sustainable, accessible and convenient bicycling and walking networks,” reflecting a joint dedication to a livable, economically vibrant, and accessible community. For example, *Outdoor Magazine*, in its August 2010 issue, named Tucson the nation's best city for road biking., calling Tucson a "cyclist's paradise."² The League of American Bicyclists currently rates Tucson as eighth on its list of the top ten “Best Bicycling Cities in the USA.”³ *Bicycling Magazine* ranked Tucson “as the second-best place among cities its size for riding a bicycle.”⁴ Of course, Tucson is home to the El Tour de Tucson, “America’s largest perimeter bicycling event,” “with over 9,000 cyclists, 2,000 volunteers, and 27,000 spectators,” which “in its 26-year history ... has raised over \$26 million for different charitable agencies”⁵ and had in 2007 a “total economic impact (of) well over \$20 million.”⁶ Notably, “every bus in the Sun Tran fleet, the principal regional transit system, is equipped with racks for two bicycles.”⁷, and the region’s new Modern Streetcar system will accommodate cyclists at stations and on board the vehicles.

Bicycling and walking already constitute an integral part of the civic life in Pima County, reaping many benefits, economic, personal, and health-related, in advance of completing the Urban Loop. Once completed, the Urban Loop will generate its own benefits as a stand-alone regional facility, but also will exert a synergistic impact on the existing facilities, making the whole operate more efficiently, effectively and with greater benefits. Figure 1, below, shows the Urban Loop alignment in the context of the urban area. The orange-colored segments are proposed for TIGER II funding and total about 20 miles. A larger scale version of the map is provided in the grant application.

Figure 1 Urban Loop System



PROJECT COSTS

This section identifies total construction costs and annual operations and maintenance (O & M) costs for the entire 55-mile Urban Loop Project to be completed and for the 20-mile TIGER II Grant Projects.

CONSTRUCTION COSTS

Total construction costs include right-of-way acquisition, design, construction administration, and construction. Exhibit 2 summarizes these costs for All Urban Loop Projects and for TIGER II Grant projects. The distributions of costs by type of expenditure are very similar for both categories of projects, with construction costs accounting for two-thirds of costs.

Exhibit 2 Summary of Construction Costs

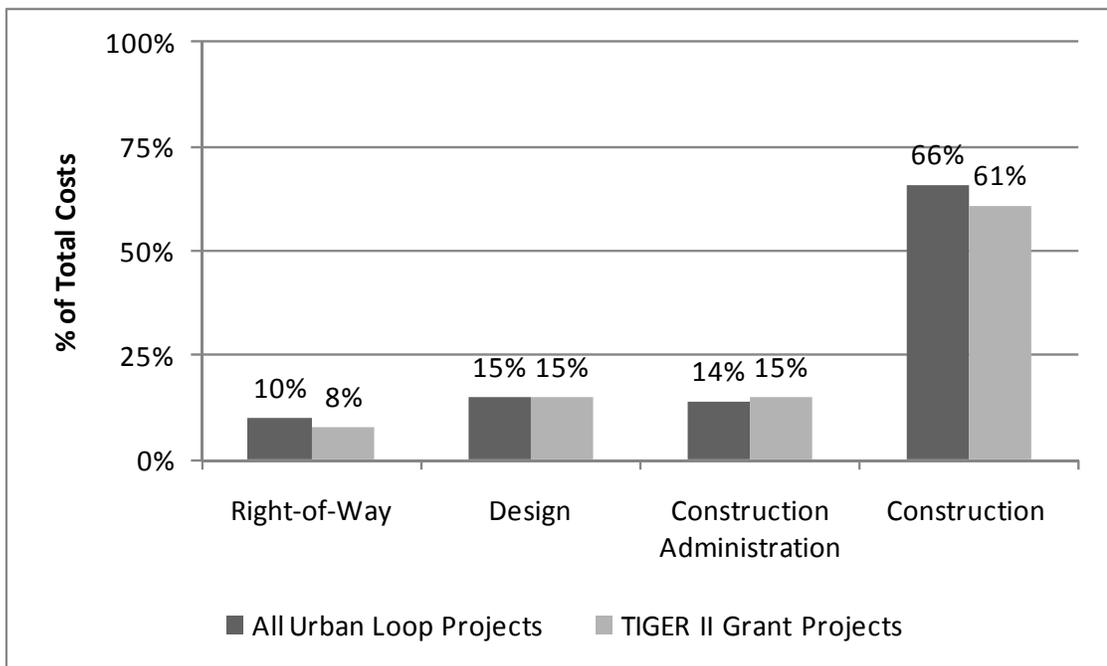


Exhibit 3 below identifies total construction costs for the entire Urban Loop to be constructed, with the TIGER II Grant projects highlighted. Exhibit 4 shows the same information, just for the TIGER II Grant projects.

Exhibit 3 Total Construction Costs for the Urban Loop Projects

Project Segment	ROW	Design	Construction Administration	Construction	Total Construction Cost
Bridge at Camino de la Tierra	\$0	\$269,100	\$296,000	\$725,760	\$1,290,860
Mountain Ave. to First Ave.	\$300,000	\$112,530	\$112,530	\$456,940	\$982,000
Country Club Rd. to Hacienda del Sol	\$0	\$132,000	\$132,000	\$536,000	\$800,000
Tanque Verde Rd. to Rillito	\$2,000,000	\$2,442,000	\$2,442,000	\$9,916,000	\$16,800,000
Speedway Blvd. to Tanque Verde Rd.	\$80,000	\$725,000	\$500,000	\$7,000,000	\$3,600,000
5th St. to Speedway Blvd.	\$320,000	\$417,600	\$123,300	\$459,533	\$1,320,433
Broadway Blvd. Underpass	\$90,000	\$119,625	\$119,625	\$485,750	\$815,000
Kenyon Dr. to Broadway Blvd.	\$300,000	\$184,800	\$184,800	\$750,400	\$1,420,000
Golf Links Rd. to Kenyon Dr.	\$1,000,050	\$329,992	\$329,992	\$1,339,967	\$3,000,000
Sellarole St. to Golf Links Rd.	\$0	\$92,070	\$92,070	\$373,860	\$558,000
Houghton Greenway to Sellarole St.	\$470,000	\$2,562,450	\$2,562,450	\$10,405,100	\$16,000,000
Houghton Greenway	\$820,000	\$359,700	\$359,700	\$1,460,600	\$3,000,000
Houghton Greenway to Rita Rd.	\$360,000	\$485,100	\$485,100	\$1,969,800	\$3,300,000
Rita Rd. to Kolb Rd.	\$450,000	\$536,250	\$536,250	\$2,177,500	\$3,700,000
Kolb Rd. to Wilmot Rd.	\$180,000	\$118,800	\$118,800	\$482,400	\$900,000
Littletown Rd. to Valencia Rd.	\$160,000	\$13,365	\$13,365	\$54,270	\$241,000
Valencia Rd. to Ajo Way	\$960,000	\$914,100	\$914,100	\$3,711,800	\$6,500,000
Ajo Way to 29th St.	\$1,000,000	\$2,409,000	\$2,409,000	\$9,782,000	\$15,600,000
Grant Rd. to Camino del Cerro	\$25,000	\$450,000	\$225,000	\$3,000,000	\$3,700,000
Camino del Cerro to Rillito River	\$300,000	\$6,435	\$6,435	\$26,130	\$339,000
Rillito repaving, widened bridges & underpasses	\$60,000	\$541,200	\$541,200	\$2,197,600	\$3,340,000
Santa Cruz repaving & widened underpasses	\$60,000	\$336,600	\$336,600	\$1,366,800	\$2,100,000
TOTAL	\$8,935,050	\$13,557,717	\$12,840,317	\$58,678,210	\$89,306,293

Exhibit 4 Total Construction Costs: TIGER II Grant Projects

Project Segment	ROW	Design	Construction Administration	Construction	Total Construction Cost
Country Club Rd. to Hacienda del Sol	\$0	\$132,000	\$132,000	\$536,000	\$800,000
Tanque Verde Rd. to Rillito	\$2,000,000	\$2,442,000	\$2,442,000	\$9,916,000	\$16,800,000
Sellarole St. to Golf Links Rd.	\$0	\$92,070	\$92,070	\$373,860	\$558,000
Houghton Greenway to Sellarole St.	\$470,000	\$2,562,450	\$2,562,450	\$10,405,100	\$16,000,000
Houghton Greenway to Rita Rd.	\$360,000	\$485,100	\$485,100	\$1,969,800	\$3,300,000
Kolb Rd. to Wilmot Rd.	\$180,000	\$118,800	\$118,800	\$482,400	\$900,000
Littletown Rd. to Valencia Rd.	\$160,000	\$13,365	\$13,365	\$54,270	\$241,000
Valencia Rd. to Ajo Way	\$960,000	\$914,100	\$914,100	\$3,711,800	\$6,500,000
Ajo Way to 29th St.	\$1,000,000	\$2,409,000	\$2,409,000	\$9,782,000	\$15,600,000
Camino del Cerro to Rillito River	\$300,000	\$6,435	\$6,435	\$26,130	\$339,000
Rillito repaving, widened bridges & underpasses	\$60,000	\$541,200	\$541,200	\$2,197,600	\$3,340,000
Santa Cruz repaving & widened underpasses	\$60,000	\$336,600	\$336,600	\$1,366,800	\$2,100,000
TOTAL	\$5,550,000	\$10,053,120	\$10,053,120	\$40,821,760	\$66,478,000

OPERATIONS AND MAINTENANCE COSTS

Annual O & M costs are calculated at \$35,000 per mile. O & M costs are estimated for year one and then for a twenty-year period in constant Year-One dollars. Exhibit 6 below summarizes these costs for All Urban Loop Projects and for TIGER II Grant Projects. For All Urban Loop Projects, Year-One O & M costs would be \$1.4 million and \$27.3 million over 20 years, in Year-One dollars. For TIGER II Grant Projects, the numbers are \$707,000 in Year-One and \$14.1 million over 20 years

Exhibit 5 Summary of Year-One and Twenty-Year-O & M Costs

	Miles	Year-One O & M Costs	20 Year O & M Costs (2010 Dollars)
All Urban Loop Projects	39.00	\$1,365,000	\$27,300,000
TIGER II Projects	20.20	\$707,000	\$14,140,000

Exhibit 6 presents the detailed information or All Urban Loop Projects and Exhibit 7 for the TIGER II Grant projects.

Exhibit 6 Year and Total 20 Year O & M Costs, All Urban Loop Projects

Project Segment	Miles	Year One O & M Costs	20 Year O & M Costs (2010 Dollars)
Bridge at Camino de la Tierra	0.25	\$8,750	\$175,000
Mountain Ave. to First Ave.	0.60	\$21,000	\$420,000
Country Club Rd. to Hacienda del Sol	0.50	\$17,500	\$350,000
Tanque Verde Rd. to Rillito	2.00	\$70,000	\$1,400,000
Speedway Blvd. to Tanque Verde Rd.	1.00	\$35,000	\$700,000
5th St. to Speedway Blvd.	0.60	\$21,000	\$420,000
Broadway Blvd. Underpass	0.25	\$8,750	\$175,000
Kenyon Dr. to Broadway Blvd.	0.80	\$28,000	\$560,000
Golf Links Rd. to Kenyon Dr.	2.00	\$70,000	\$1,400,000
Sellarole St. to Golf Links Rd.	1.00	\$35,000	\$700,000
Houghton Greenway to Sellarole St.	2.00	\$70,000	\$1,400,000
Houghton Greenway	6.00	\$210,000	\$4,200,000
Houghton Greenway to Rita Rd.	2.30	\$80,500	\$1,610,000
Rita Rd. to Kolb Rd.	3.00	\$105,000	\$2,100,000
Kolb Rd. to Wilmot Rd.	1.40	\$49,000	\$980,000
Littletown Rd. to Valencia Rd.	0.60	\$21,000	\$420,000
Valencia Rd. to Ajo Way	6.50	\$227,500	\$4,550,000
Ajo Way to 29th St.	2.20	\$77,000	\$1,540,000
Grant Rd. to Camino del Cerro	4.30	\$150,500	\$3,010,000
Camino del Cerro to Rillito River	1.70	\$59,500	\$1,190,000
Rillito repaving, widened bridges & underpasses		\$0	\$0
Santa Cruz repaving & widened underpasses		\$0	\$0
TOTAL	39.00	\$1,365,000	\$27,300,000

Exhibit 7 Year One and Total 20 Year O & M Costs, TIGER II Grant Projects

Project Segment	Miles	Annual O & M Costs	20 Year O & M Costs (2010 Dollars)
Country Club Rd. to Hacienda del Sol	0.50	\$17,500	\$350,000
Tanque Verde Rd. to Rillito	2.00	\$70,000	\$1,400,000
Sellarole St. to Golf Links Rd.	1.00	\$35,000	\$700,000
Houghton Greenway to Sellarole St.	2.00	\$70,000	\$1,400,000
Houghton Greenway to Rita Rd.	2.30	\$80,500	\$1,610,000
Kolb Rd. to Wilmot Rd.	1.40	\$49,000	\$980,000
Littletown Rd. to Valencia Rd.	0.60	\$21,000	\$420,000
Valencia Rd. to Ajo Way	6.50	\$227,500	\$4,550,000
Ajo Way to 29th St.	2.20	\$77,000	\$1,540,000
Camino del Cerro to Rillito River	1.70	\$59,500	\$1,190,000
Rillito repaving, widened bridges & underpasses		\$0	\$0
Santa Cruz repaving & widened underpasses		\$0	\$0
TOTAL	20.20	\$707,000	\$14,140,000

PROJECT COSTS, ALL URBAN LOOP AND TIGER II ONLY PROJECTS

Exhibit 8 below provides a detailed estimate of Total Estimated and 20-Year O & M Costs, for all Urban Loop Projects to be completed and then for TIGER II Grant Projects .

Exhibit 8 Total Estimated Construction and 20-Year O and M Costs

Projects	Total Construction Costs	Total 20-Year O & M Costs	Total Project Costs
All Urban Loop Projects	\$89,306,293	\$27,300,000	\$116,606,293
TIGER II Grant projects Only	\$66,478,000	\$14,140,000	\$80,618,000

Exhibit 9 and 10 below show the total project cost estimates for reach project, for all Urban Loop projects and TIGER II Grant projects only, respectively.

Exhibit 9 Total Estimated Construction and 20-Year O & M Costs

Project Segment	Total Construction Cost	20 Year O & M Costs (2010 Dollars)	Total Costs
Bridge at Camino de la Tierra	\$1,290,860	\$175,000	\$1,465,860
Mountain Ave. to First Ave.	\$982,000	\$420,000	\$1,402,000
Country Club Rd. to Hacienda del Sol	\$800,000	\$350,000	\$1,150,000
Tanque Verde Rd. to Rillito	\$16,800,000	\$1,400,000	\$18,200,000
Speedway Blvd. to Tanque Verde Rd.	\$3,600,000	\$700,000	\$4,300,000
5th St. to Speedway Blvd.	\$1,320,433	\$420,000	\$1,740,433
Broadway Blvd. Underpass	\$815,000	\$175,000	\$990,000
Kenyon Dr. to Broadway Blvd.	\$1,420,000	\$560,000	\$1,980,000
Golf Links Rd. to Kenyon Dr.	\$3,000,000	\$1,400,000	\$4,400,000
Sellarole St. to Golf Links Rd.	\$558,000	\$700,000	\$1,258,000
Houghton Greenway to Sellarole St.	\$16,000,000	\$1,400,000	\$17,400,000
Houghton Greenway	\$3,000,000	\$4,200,000	\$7,200,000
Houghton Greenway to Rita Rd.	\$3,300,000	\$1,610,000	\$4,910,000
Rita Rd. to Kolb Rd.	\$3,700,000	\$2,100,000	\$5,800,000
Kolb Rd. to Wilmot Rd.	\$900,000	\$980,000	\$1,880,000
Littletown Rd. to Valencia Rd.	\$241,000	\$420,000	\$661,000
Valencia Rd. to Ajo Way	\$6,500,000	\$4,550,000	\$11,050,000
Ajo Way to 29th St.	\$15,600,000	\$1,540,000	\$17,140,000
Grant Rd. to Camino del Cerro	\$3,700,000	\$3,010,000	\$6,710,000
Camino del Cerro to Rillito River	\$339,000	\$1,190,000	\$1,529,000
Rillito repaving, widened bridges & underpasses	\$3,340,000	\$0	\$3,340,000
Santa Cruz repaving & widened underpasses	\$2,100,000	\$0	\$2,100,000
TOTAL	\$89,306,293	\$27,300,000	\$116,606,293

Exhibit 10 Total Estimated Construction and 20-Year O & M Costs

Project Segment	Total Construction Cost	20 Year O & M Costs (2010 Dollars)	Total Costs
Country Club Rd. to Hacienda del Sol	\$800,000	\$350,000	\$1,150,000
Tanque Verde Rd. to Rillito	\$16,800,000	\$1,400,000	\$18,200,000
Sellarole St. to Golf Links Rd.	\$558,000	\$700,000	\$1,258,000
Houghton Greenway to Sellarole St.	\$16,000,000	\$1,400,000	\$17,400,000
Houghton Greenway to Rita Rd.	\$3,300,000	\$1,610,000	\$4,910,000
Kolb Rd. to Wilmot Rd.	\$900,000	\$980,000	\$1,880,000
Littletown Rd. to Valencia Rd.	\$241,000	\$420,000	\$661,000
Valencia Rd. to Ajo Way	\$6,500,000	\$4,550,000	\$11,050,000
Ajo Way to 29th St.	\$15,600,000	\$1,540,000	\$17,140,000
Camino del Cerro to Rillito River	\$339,000	\$1,190,000	\$1,529,000
Rillito repaving, widened bridges & underpasses	\$3,340,000	\$0	\$3,340,000
Santa Cruz repaving & widened underpasses	\$2,100,000	\$0	\$2,100,000
TOTAL	\$66,478,000	\$14,140,000	\$80,618,000

PROJECT BENEFIT ANALYSIS

Bicycling is popular across America among all types of people. Communities, such as Pima County, that foster that popularity by providing safe bicycle infrastructure for transportation and recreation will accrue considerable economic benefits by attracting businesses, tourism, and an active resident lifestyle. Neighborhoods become more desirable when traffic slows down and residents have more transportation choices by design. Businesses encourage shopping among local customers by making bike travel more appealing. Individuals benefit from increased levels of fitness and health that result in real cost savings and employers have healthier employees who miss fewer days of work. A modest mode shift from driving to riding has measurable impact in savings on health, road construction, congestion, and environmental remediation. This shift is possible yet unlikely without federal support of local investments in bicycle facilities to provide an appealing, safe alternative to auto travel.

Providing bicycle infrastructure clearly benefits people across income levels and geographic areas, and the Urban Loop route accommodates all income categories in the region. According to the League of American Bicyclists and our own local data, bike facilities improve cycling conditions for most riders. A 2009 study in Portland used GPS technology to collect information on bicycling behavior from 166 regular riders. It found that a “disproportionate share of the bicycling occurred on streets with bicycle lanes, separate paths, or bicycle boulevards” and concluded that “the data support the need for well-connected neighborhood streets and a network of bicycle-specific infrastructure to encourage more bicycling among adults.” A 2006 Minneapolis study shows that 83 percent of the time cyclists will choose a longer route if it includes a bike lane, and respondents were willing to add 20 minutes onto their trip in order to use an off-road bicycle facility instead of riding on roads next to parked cars.

And the NHTSA data indicate that investments in bicycling infrastructure are good for the general population. According to the National Household Transportation Survey, the distribution of urban trips to work by bike is roughly the same across all income levels, which is also true in Pima County. Additionally, for households without cars, bicycles provide a vital means of transportation. Urban households without a car will bicycle to work nearly 3.5 times more often than households with one car. Non-motorized trips are not exclusive to urban areas, 20 percent of all rural trips are one mile or less and 25 percent of those are made by walking or biking.

The anticipated benefits of the Urban Loop fall into several categories, including safety, travel cost savings, health benefits, and environmental benefits, among others. Recreational riders will switch to a safer off-road facility, as mentioned above, and so will commuters. Safe facilities (both on-road and off-road) generate new bicyclists and walkers while current bicyclists and walkers will do so more frequently. Tourists are clearly attracted to communities where it is easy to get around and where way-finding is simplified. All of these benefits are amplified by the Urban Loop, and this section quantifies the benefits associated with four categories: mobility, health, decreased auto use, and recreation.

BENEFITS ASSOCIATED WITH BIKING AND WALKING

IDENTIFICATION OF BENEFITS

In May 2010, the Pedestrian and Bicycle Information Center (funded by FHWA) issued “The National Bicycling and Walking Study: 15-Year Status Report.”⁸ In a background section, the report state:

“In 1990, bicycling and walking were described as “the forgotten modes” of transportation by the Federal Highway Administration (FHWA). ... Recognizing the decline in walking and bicycling, and the rise in fatalities, the US Department of Transportation (USDOT) adopted the first national transportation policy in 1994 to “increase use of bicycling, and encourage planners and engineers to accommodate bicycle and pedestrian needs in designing transportation facilities for urban and suburban areas, and increase pedestrian safety through public information and improved crosswalk design, signaling, school crossings, and sidewalks.”

The report notes the progress since 1994 in accomplishing the goals articulated in the 1994 policy. For example, on March 15, the U.S. Department of Transportation (USDOT) announced its “Policy Statement on Bicycle and Pedestrian Accommodation: Regulations and Regulations.” USDOT clearly articulates the multiple benefits derived from integrating bicycle and walking facilities into transportation systems.

“The DOT policy is to incorporate safe and convenient walking and bicycling facilities into transportation projects. Every transportation agency, including DOT, has the responsibility to improve conditions and opportunities for walking and bicycling and to integrate walking and bicycling into their transportation systems. Because of the numerous individual and community benefits that walking and bicycling provide — including health, safety, environmental, transportation, and quality of life — transportation agencies are encouraged to go beyond minimum standards to provide safe and convenient facilities for these modes.”⁹

Under “Recommended Actions,” the USDOT policy stated:

“The DOT encourages States, local governments, professional associations, community organizations, public transportation agencies, and other government agencies, to adopt similar policy statements on bicycle and pedestrian accommodation as an indication of their commitment to accommodating bicyclists and pedestrians as an integral element of the transportation system. In support of this commitment, transportation agencies and local communities should go beyond minimum design standards and requirements to create safe, attractive, sustainable, accessible, and convenient bicycling and walking networks.”

The USDOT Policy Statement concludes:

“Increased commitment to and investment in bicycle facilities and walking networks can help meet goals for cleaner, healthier air; less congested roadways; and more livable, safe, cost-efficient communities. Walking and bicycling provide low-cost mobility options that place fewer demands on local roads and highways. DOT recognizes that safe and convenient walking and bicycling facilities may look different depending on the context — appropriate facilities in a rural

community may be different from a dense, urban area. However, regardless of regional, climate, and population density differences, it is important that pedestrian and bicycle facilities be integrated into transportation systems. While DOT leads the effort to provide safe and convenient accommodations for pedestrians and bicyclists, success will ultimately depend on transportation agencies across the country embracing and implementing this policy.” (Emphasis added)

“The National Bicycling and Walking Study” identifies the following “Benefits of Bicycling and Walking,” what the study described as “the numerous benefits associated with these modes”:

“Health Benefits

The health benefits of regular physical activity are far-reaching: reduced risk of coronary heart disease, stroke, diabetes, and other chronic diseases; lower health care costs; and improved quality of life for people of all ages. Even small increases in light to moderate activity, such as daily bike rides or 30-minute walks, can produce measurable benefits among those who are least active.

“Transportation Benefits

Many trips are less than three miles in length, yet 72 percent of these short trips are made in vehicles. Bicyclists and walkers can often bypass congestion and gridlock traffic, and in some instances may even arrive at their destinations faster than if they had driven a car. Accommodating bicyclists and pedestrians also ensures that individuals have transportation choices aside from driving.

“Environmental/Energy Benefits

In 2007, the transportation sector accounted for nearly 30 percent of all energy consumed in the US, according to the Department of Energy. Transportation is also responsible for nearly one third of carbon dioxide emissions, and 80 percent of carbon monoxide emissions. Replacing short trips with walking or bicycling can help reduce this level of energy consumption, while also decreasing emissions from cold starts caused by short car trips.

“Economic Benefits

The cost of owning and operating a car, currently estimated at \$9,055 per year, can account for almost 18 percent of a typical household’s income. Compare that with the \$120 yearly operating cost of owning a bicycle, or essentially free travel by foot, and it is clear that walking and bicycling can provide options for those who would like to save money. Many communities are even using bicycle and walking facilities to revitalize businesses and bring new economic life to downtown areas.

“Quality of Life Benefits

Numerous intangible benefits are associated with bicycling and walking. Providing more travel options can increase a sense of independence in seniors, young people, and others who cannot or choose not to drive. Increased levels of bicycling and walking can have a great impact on an area’s sense of livability by creating safe and friendly places for people to live and work.”¹⁰

Identifying benefits derived from bicycling and walking *per se* does not address the question of whether the benefits are greater than the costs. At least two studies do claim strong positive benefits to

cost ratios. In 2004, the Minnesota Department of Transportation published a report “The Benefits of Bicycling in Minnesota,” based on work done at the Humphrey Institute of Public Affairs, University of Minnesota.¹¹ This report concluded:

“There are not a lot of bicyclists on any given day, on average about 1.5% of adults and 5% of **children. But a large fraction of the population does participate at least occasionally; probably** about half of adults will ride at least once in the course of a summer. The **benefits that result from this riding are large relative to expenditures on bicycle facilities; by conservative assumptions, total benefits are in excess of \$300 million per year.** The size of these benefits is particularly notable when one considers that they are derived from relatively limited use by most of the population. The potential benefits are much higher than this. Perhaps only 10% of adults ride more than six times a year. It is entirely realistic to suppose that much more riding could be taking place, and indeed surveys indicate that people would like to ride more than they do.” (Emphasis added)

Also in 2004, the North Carolina Department of Transportation (NCDOT) released a report “Pathways to Prosperity: The Economic Impact of Investments in Bicycle Facilities.” NCDOT commissioned the study, performed by the Institute for Transportation Research and Education at North Carolina State University, to “assess the value of their investment in bicycle facilities.¹² The study concluded there was a substantial return in economic benefits - \$60 million in annual benefits for \$6.7 million in one-time costs: an annual return of approximately nine times as much as the one-time expenditure of public funds to construct special bike facilities in the region.” The study found that “17% of visitors to the area report bicycling activity”; and “the quality of bicycling in the region had a positive impact on respondents’ vacation planning with ... 53% reporting bicycling as a strong influence in their decision to return in the future.”

CALCULATING BENEFITS FOR BICYCLING AND WALKING

Estimating benefits of alternate mode activities is exceedingly complex, and depends upon multiple assumptions. Due to the short timeframe for submitting TIGER II grant applications and relatively limited data, we based its benefit-cost analysis on three sources.

- *Benefit-Cost Analysis of Bicycle Facilities*, an on-line analysis tool based upon the research cited above, maintained by the Pedestrian and Bicycle Information Center, funded by the Federal Highway Administration and housed at the Highway Safety Research Center, University of North Carolina-Chapel Hill. This site allows one to enter certain parameters specific to a locale and bicycle improvement, and thereby generating estimates of new cyclists associated with the improvement and estimates of recreation, mobility, health and decreased auto use benefits generated by that level of demand. The Guideline study cited above describes this on-line tool as follows:

“While all the cost, demand, and benefit figures in the tool are calculated from previously available sources, the web tool is the first attempt to bring this kind of information together in an easy-to-use application. The tool can be used at many levels: a neighborhood group considering lobbying for a facility might input minimal specifications to get ballpark figures, while a professional planner could enter highly detailed information and receive substantially more accurate cost, demand, and benefit output.”

- *Guidelines for Analysis of Investments in Bicycle Facilities*, published by the National Cooperative Highway Research Program, and prepared by a consortium from the Humphrey Institute of Public Affairs (including Gary Barnes) and Department of Civil Engineering, University of Minnesota; Planners Collaborative, Inc., Boston, Massachusetts; and Highway Safety Research Center and Active Living by Design Program, University of North Carolina-Chapel Hill.

The purpose of this study was to generate guidelines for estimating the costs, forecasting the demand, and calculating the benefits of different bicycle project options. Since Pima County has already estimated the costs of the Urban Loop facility, we focused more on the study's demand-generation and benefit calculations.

Regarding forecasting of **demand** for bicycling, the study concluded:

"The findings in this report are based on the research detailing the relationship between an individual's likelihood to bike and the proximity of that individual's residence to a bike facility. The report is also based on research that indicates that the majority of bicycle riding is done by a small percentage of the population. Bicycle commuters primarily make up this subset of the population. Thus, areas with large numbers of bicycle commuters usually indicate locations where more bicycling takes place."

Regarding calculation of **benefits** associated with the use of bicycle facilities, the study concluded:

"After reviewing existing literature, canvassing available data and methods, and consulting a variety of policy officials, the team suggests that to be most useful for urban transportation planning, bicycling benefits need to be

- Measured on a municipal or regional scale,
- Central to assisting decision-makers about transportation/urban planning,
- Estimable via available existing data or other survey means,
- Converted to measures comparable to one another, and
- Described for both users and non-users (i.e., the community at large).

"There are several ways to describe the different types of benefits and to whom they apply. The suggested strategy for considering benefits of different facilities is guided by previous research. The first level distinguishes between benefits realized by the user versus the community at large. These can also be thought of as direct and indirect benefits. Within each of these user groups, one can identify specific types of benefits. The team identifies, prescribes, and demonstrates strategies to measure different types of benefits within each user group."

- *The Benefits of Bicycling in Minnesota*, a report published by the Minnesota Department of Transportation, and prepared by Gary Barnes of the Humphrey Institute of Public Affairs, University of

Minnesota. In this report, Barnes distinguishes between “facility-specific benefits” and “general benefits.”

- “Facility-related benefits” arise specifically from the improved conditions created by the specific facility. *Facility User Benefits* can be reduced accidents, reduced time and distance, or more enjoyable riding experiences. *Facility Non-User Benefits* accrue from keeping cyclists out of traffic or new transportation of recreational options. *Facility Economic Benefits* accrue from increased tourism or tourism-related sales and services related to the bicycle facility. *Facility-Demand-Related Benefits* occur when more people take to bicycling or current cyclists use facilities more often. This report stresses the complexity of demand forecasting and the provisional characteristics of available methodologies.
- “General benefits” are those that accrue because more people are riding bicycles in general, independent of the location of the new facilities. *General user benefits* include the considerable value of recreation, improved health, providing inexpensive forms of basic mobility, and lowering the costs of work and school commuting. *General societal benefits* accrue with benefits of auto substitution such as reduced congestion, pollution and infrastructure costs and from reduced health care costs. General economic benefits can accrue to increase sales and services throughout the community as a secondary impact of the bicycle related facility impacts.

We describe and utilize this benefit-cost analysis tool in Section 3.4 below.

CURRENT BIKING AND WALKING COMMUNITY IN PIMA COUNTY

DATA SOURCES – BASE CASE

We reviewed data from four sources to develop a summary profile of the biking and walking community in Pima County. This represents the base case condition without the completion of the Urban Loop

*Pima County Department of Environmental Quality: Clean Air Campaign Effectiveness Travel Behavioral Study*¹³

Pima County has operated a countywide, annual “Clean Air Campaign” (CAC) since 1988, as part of the region’s air quality State Implementation Plan requirements. For the 2007-2008 CAC, the Department of Environmental Quality contracted with FMR, Inc. to conduct a Campaign Effectiveness Travel Behavior Study (Study), “to evaluate the specific effectiveness of the 2007-2008 Clean Air Campaign, as well as analyze the overall effectiveness of the air quality media campaign after 19 campaign sessions.”

For the Study, FMR, Inc. conducted telephone interviews, of about nine minute duration, with “a random sampling of 402 men and women, 16 years of age and older, in the Pima County area ... The interviews were distributed on the basis of geographic population density in the market –with specific steps taken to ensure a proportionate number of interviews in each survey region.”

The survey asks several questions about travel mode, to work and to school.

*Pima Association of Governments Travel Reduction Program – 2007 Annual Report*¹⁴

The Travel Reduction Program (TRP) is a federally mandated programs as designated in the air quality State Implementation Plan (SIP), which the Pima Association of Governments (PAG) has operated since 1988, pursuant to Travel Reduction Ordinances (TROs) adopted by all local jurisdictions in Pima County. Pursuant to these TROs, all major employers (employers with 100 full-time equivalent employees at one work location) are required to submit and implement annual travel reduction programs.

In addition, PAG distributes annual surveys to all employees of these participating major employers, asking about commute to work modes, among other questions. The 2007-2008 Program, and survey, included 285 sites with 121,262 employees, about one-third of the regions total employees and one-fourth the workforce. The survey achieved a survey response rate of 82.6 percent.

*Pima Association of Governments 2008 Tucson Metropolitan Region Bicycle Count*¹⁵

In 2008, PAG conducted the first annual bike count for the Tucson metropolitan region. PAG will utilize data from these annual surveys for five planning purposes, including analysis of conditions and trends; network planning; crash analysis; calibrate travel demand forecasting models; and measure the effectiveness of travel demand management and safety/outreach programs.

According to PAG, “Counts were performed throughout the region by jurisdictional and regional staff, and by volunteers from the community, including members of the Tucson-Pima County Bicycle Advisory Committee (TPCBAC) and the Greater Arizona Bicycling Association (GABA).”

Counts were recorded at for a morning and afternoon peak-hours (7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m.) over three days in October at over fifty intersections, “chosen based on estimated levels of cycling activity and achieving a reasonable regional/geographic distribution.” Counts were recorded at 15-minute intervals, only by observation, without cyclist surveys. The counters recorded approach direction, gender, approximate age, helmet usage, sidewalk riding and wrong-way riding.

PAG scheduled the count in October because it is a time of high usage, because of good weather, the University of Arizona, “a major generator of bicycle-trips” is in session, and because “October has been identified as the month with the most bicycle-related crashes in the region.”

*U.S. Census: American Community Survey 2006-2008 3-Year Estimates*¹⁶

The U.S. Census Bureau conducts an annual American Community Survey (ACS), a statistical survey sent to approximately 250,000 addresses monthly (or 3 million per year). The ACS includes questions about respondents and their households, including their preferred mode of transportation to and from work. In 2005, the ACS sample size for Pima County was 8,016, with 5,640 interviews completed by telephone. For this analysis, we used the 2006-2008 3-Year Estimate for the City of Tucson as being more representative of the larger Tucson Urban Area that would most benefit from the Urban Loop, rather than relying on countywide data that includes rural populations and populations living at a far distance from the facility.

These four sources employed different methodologies and targeted different segments of the community. The ACS and TRP surveys focused only on travel mode choice to work, while the CAC survey asked about mode choice to work and school. The ACS and CAC surveys interviewed samples countywide, while the TRP survey samples a subset of the metropolitan area workforce, those working for “large employers.” These three surveys asked about both bicycling and walking, but none asked about recreational riding and walking.

The PAG Bicycle Count did not include a travel survey, so was not able to distinguish trip purpose (to work or school, or recreation), time and distance, or other facts. The Bike Count, however, recorded real time bicycling, by location, direction, time, gender and age. The Bike Count, obviously, did not include observations on walking.

PROFILES OF BICYCLISTS AND WALKERS BASED ON THIS DATA

The PAG Ride Count resulted in the following information:

- 8,316 bicyclists counted
- 75% were male
- 90% + between ages of 18 and 65
- 52% counted in PM; 48% in A.M.
- 3,613 counted in the U of A area
- 3,025 counted in the urban core
- 1,176 counted downtown
- Only 46% wore helmets
- Only 9% were riding on sidewalks

This bicycle count data can be combined with age data from the ACS data for Tucson and with enrollment and employee counts from the University of Arizona to provide provisional estimates of a mode choice for bicycling. Exhibit 11 below shows some provisional estimates. The ACS counted 426,251 people in Tucson who were 15 years of age or older; applying a bicycle count of 8,316 to this population produces a mode share of 1.95% for the total population between 15 and 64 years of age, the mode share is 2.29%.

Using the same age categories for males only, who accounted for 75% of the riders counted (6,237) results in mode shares of 2.98% and 3.4%. For the University of Arizona with a total student body and staff of 51,793 and 3,613 riders counted in the area, the calculation shows a mode share of 6.98%.

Exhibit 11 Percent Bicycling by Population Categories

Population Categories	Population	Ridership Count	% Bicyclists
Total Population 15 and older	426,215	8,316	1.95%
Total Population between 15 and 64	362,903	8,316	2.29%
Males 15 and older	209,047	6,237	2.98%
Males between 15 and 64	183,408	6,237	3.40%
University of Arizona	51,793	3,613	6.98%

Exhibit 12 below shows differences in mode share estimates, based on methodological and sampling differences. The Clean Air Campaign data shows much higher mode shares, but this is probably due to their sampling including work and school commutes. The other two data sources reflect only work commute mode choices, with the TRP sample covering only one-quarter of the workforce (those employed by large employers) and the ACS data based on sampling to represent the entire workforce.

Exhibit 12 Estimates of Mode Share for Walking and Bicycling, from Three Data Sources

Data Source	Bicycling	Walking
Clean Air Campaign	8.0%	14.0%
Travel Reduction Program	1.7%	1.6%
American Community Survey	1.8%	3.8%

In the Travel Reduction Program and American Community Surveys data, walking occurs more frequently than bicycling.

The following data is based entirely on the American Community Survey data for Tucson. Exhibit 13 below summarizes mode shares for bicycling and walking in Tucson from the American Community Survey. Walking enjoys a significantly larger mode share than bicycling – 3.8% compared to 1.8%. Both modes capture a 5.7% mode share.

Exhibit 13 ACS Data on Mode Share for Bicycling and Walking, Tucson

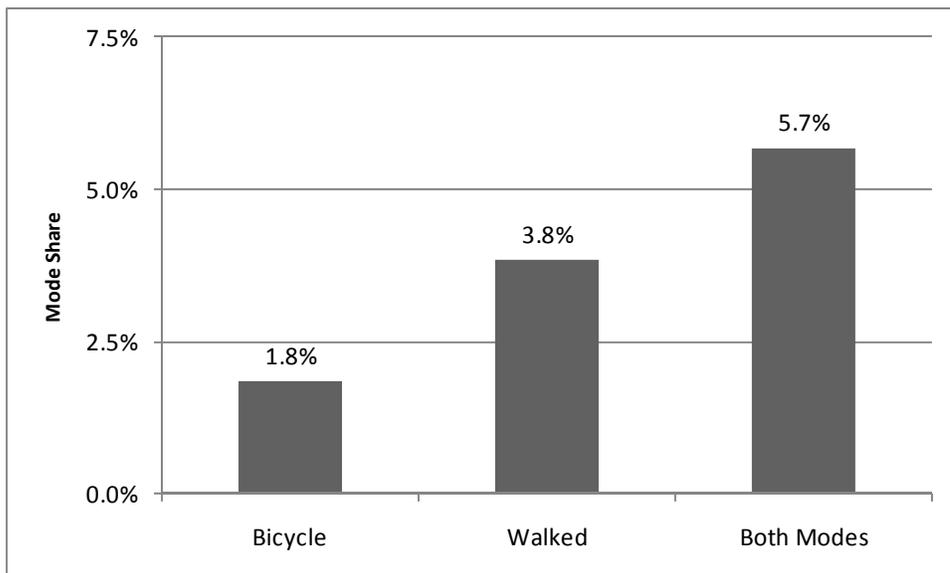
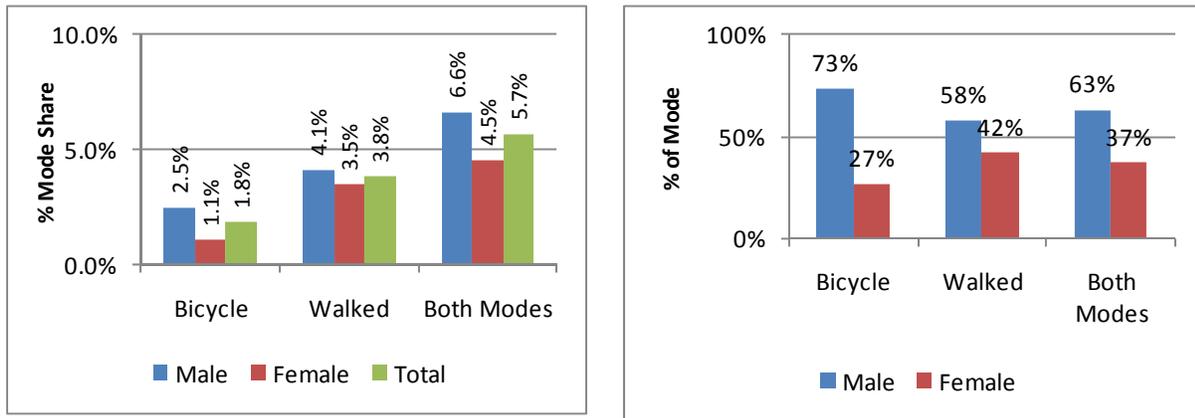


Exhibit 14 below presents data on bicycling and walking, based on gender. This data is consistent with the PAG Bike Count observation that three-quarters of riders were male. When it comes to walking, however, the disparity between males and females is much less pronounced.

Exhibit 14 ACS Data on Bicycling and Walking by Gender



Exhibits 15 through 17 below present select information on the profiles of bicyclists and walkers in Tucson from the American Community Survey. For these calculations, the Census Bureau combined bicyclists with users of other modes, such as commuters riding motor cycles or taking taxicabs, so the information on bicycling might be distorted. The data presents a profile of bicyclists and walkers who spend less travel time to work; are younger; and have lower annual earnings.

Exhibit 15 Median Travel Time by Mode

Mode	Median Travel Time
Drove alone	20 to 24 minutes
Carpooled	20 to 24 minutes
Public transportation	35 to 44 minutes
Walked	10 to 14 minutes
Bicycle, or other means	15 to 19 minutes
All Modes	20 to 24 minutes

Exhibit 16 Median Age by Mode

Mode	Median Age
Drove alone	38.8
Carpooled	32.8
Public transportation	35.3
Walked	30.3
Bicycle, or other means	32.3
Worked at home	45.6
All Modes	37.9

Exhibit 17 Median Earnings by Mode

Mode	Median Earnings
Drove alone	\$28,517
Carpooled	\$20,309
Public transportation	\$12,817
Walked	\$13,365
Bicycle, or other means	\$19,432
Worked at home	\$16,024
All Modes	\$25,452

DESCRIPTION OF EXPECTED BENEFITS OF THE URBAN LOOP

Consistent with the FHWA polices and studies cited, the overall Urban Loop Project and the TIGER II Projects will generate multiple benefits, both as stand-alone projects and, equally, or perhaps even more importantly by the synergistic effects that will be exercised by the multiple connections the completed loop will create. Particular benefits the projects will create include, but are not limited, to the following categories.

Population and Employment

The average population density in Pima County is 2,500 persons per square mile, a density matched or exceeded along the alignment of the Urban Loop. Pima County believes a radius around a new facility of three miles for bicyclists and perhaps 1-mile for walkers is the zone of attraction for new users and expanded use by current users of facilities. Proximity, density, and mode splits are three predictors of demand for new facilities. Exhibit 18 below shows the estimated population and

employment within 1, 2 and 3 miles radii of the Urban Loop. Note that four major employment areas are within the “attraction zone” of the Urban Loop: the Central Business District, University of Arizona, Science and Technology Park, and Davis-Monthan Air Force Base.

Exhibit 18 Population and Employment within a 1, 2 and 3 Miles of the Urban Loop

Socio-economic Attribute	Spatial Relationship to Urban Loop		
	<u>1 mile</u>	<u>2 miles</u>	<u>3 miles</u>
Population Base	275,000	440,000	594,000
Employment Base	99,000	154,000	181,500

Source: CLA Estimates based on DES, PAG, and other data.

Connectivity with Current Bicycle and Pedestrian Facilities

Figure 2 on the next page shows an overlay the Urban Loop on the existing regional bicycle and trail systems in eastern Pima County. The Urban Loop is shown in green, and the system is shown in red lines. The map demonstrate the multiple access points the Urban Loop will create, with access from existing facilities to the Urban Loop and from the Urban Loop to existing facilities. This connectivity will enhance safety by providing a more extensive off-road facility to new and current users. The connectivity will provide expanded opportunities for new and current recreational riders and hikers to make longer trips. The multiple existing parks and trailheads adjacent to or near the Urban Loop provide opportunities multiple social events and enhanced sociability.

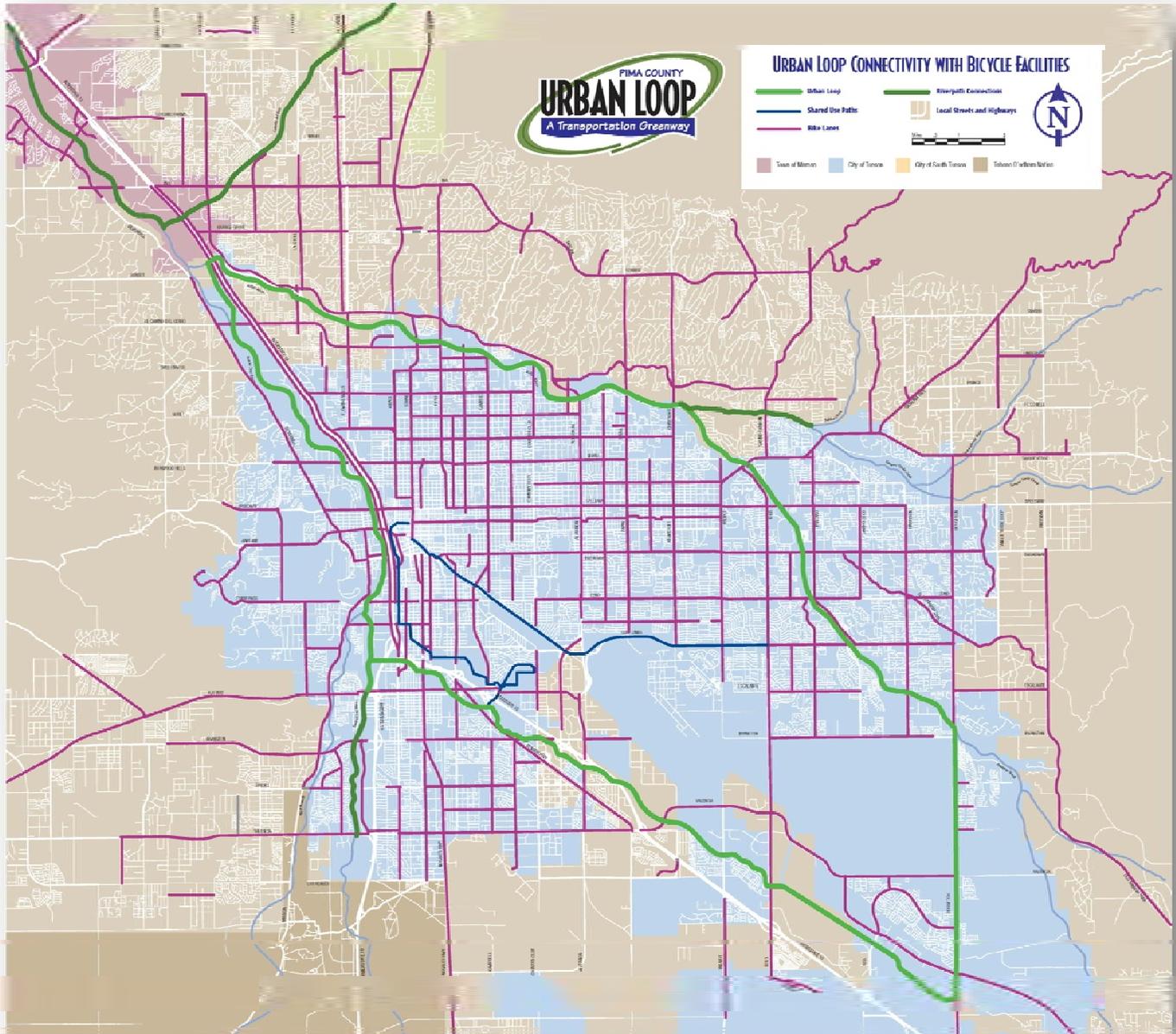
Public Transportation Facilities

The region’s public transit system, Sun Tran, has 11 routes that intersect the Urban Loop, providing mode transfer opportunities for pedestrians and bicyclists. The Modern Streetcar connects with and has an effective “interchange” with the Santa Cruz River element of the Urban Loop at the Cushing Street Bridge. The Modern Streetcar will connect the Urban Loop to the downtown and the University of Arizona, two primary bicycle locations. This connectivity with public transit permits riders and walkers to make longer, multi-mode trips with seamless interconnections.

Major Transportation Corridors

The Urban Loop intersects numerous east-west corridors (River Road, Grant Road, Speedway Boulevard, Broadway Boulevard, and 22nd Street) and north-south corridors (Stone Avenue, First Avenue, Mountain Avenue, Campbell Avenue, Swan Road, Craycroft Road, and Kolb Road) all of which have or will have bicycle lanes.

Figure 2 Urban Loop Relative to the Bike System Map



Commercial Activity Centers

The Urban Loop is adjacent to or near major commercial activity centers, including shopping centers, tour attractions, and performance venues. In fact, there are about 13,000 hotel and motel rooms in Pima County and more than 60% of them are within the Urban Loop’s three-mile demand area.

BENEFIT COST QUANTIFICATION

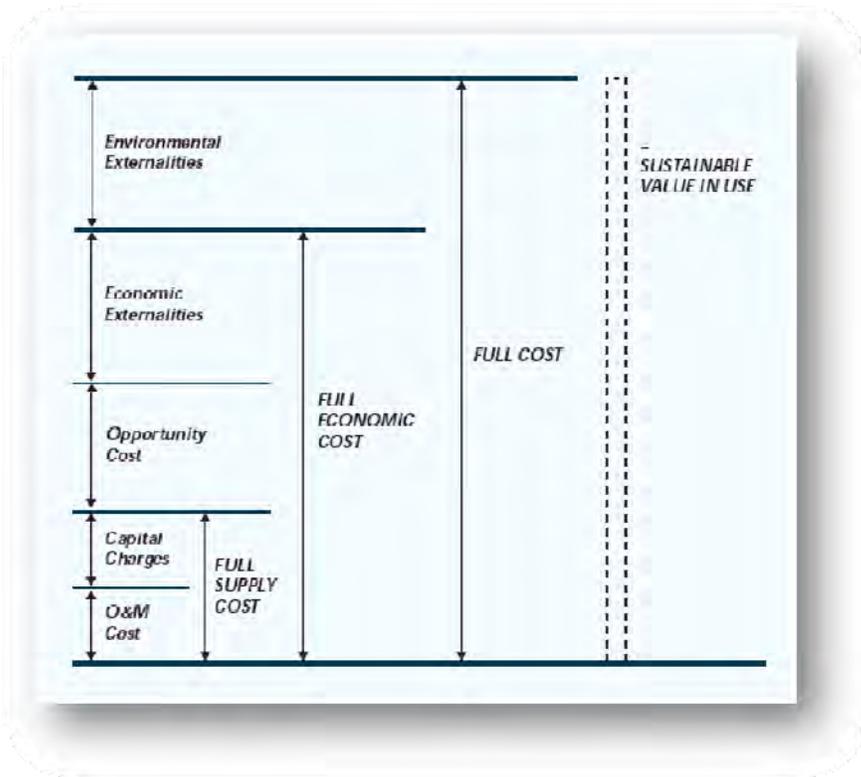
The US Department of Transportation (USDOT) published in the Federal Register of June 1, 2010 a “notice of funding availability” under the TIGER II Discretionary Grant program. In this notice, USDOT

states that “applicants for TIGER II Discretionary Grants are generally required to identify, quantify, and compare expected benefits and costs,” using the label “benefit-cost analysis” (BCA) to describe this requirement placed on applicants. BCA is one of many analytic tools available to help decision makers by “monetizing” benefits and costs. The BCA is positive when benefits have a greater value than costs, and negative when costs are larger than the benefits. The Federal Register states, “If it is clear to DOT that the total benefits of a project are not reasonably likely to outweigh the project’s costs, DOT will not award a TIGER II Discretionary Grant to the project.”

Benefit-cost analysis primarily aids decision makers’ choice between desirable projects under conditions of financial scarcity. Since scarcity is the norm, BCA analyzes choices between different projects. In the case of TIGER II applications, applicants are asked to conduct a BCA to evaluate and justify a project which they have already selected, and not to compare the value of the preselected project against an array of competing projects. USDOT intends to use the BCA analyses as one of their evaluation criteria, but it is important to recognize the limited scope of what USDOT expects of the applicants.

Figure 3 Economic Analysis Context Diagram

Pima County is requesting \$41 million in TIGER II Discretionary Grant funds for twelve projects. Pima County identified and quantified all capital costs (right-of-way, design, construction administration, and construction) and Year One O & M costs. Economists use the concept of “full cost” of a product, as depicted in the chart on the right. The concept of “full cost” embraces the concept of O & M costs, capital costs, opportunity costs, economic externalities, and environmental externalities. The schema combines O & M costs and capital costs under the term “full supply cost,” or what we consider “direct project costs.” The Federal Register focused on quantifying direct project costs, and did not expect applicants to identify and quantify opportunity costs or externality costs.



Identifying and Quantifying Benefits

Identifying and quantifying benefits has always been the bigger challenge in BCA analysis. The Federal Register lists as methodologies for quantifying benefits “surveys, travel demand forecasts, market forecasts, statistical analyses, and so on...” The Federal Register notice also acknowledges the

inescapable problem that many important benefits defy, or at least strenuously resist, quantification, especially in monetary terms. Therefore, the Federal Register indicates denial of further consideration “in the event of an unreasonable absence of data analysis, or poor applicant effort to put forth a robust quantification of benefits and costs.”

We identified all of the benefits typically associated with pedestrian and bicycle facilities, in particular the benefits enumerated in the USDOT “Policy Statement on Bicycle and Pedestrian Accommodation, Regulations and Recommendations,” published on March 15, 2010. The benefits generated by the Urban Loop will be many and substantial. To facilitate this analysis, we identified several analytical options and chose to use the on-line “Benefit-Cost Analysis of Bicycle Facilities”. This is available at <http://www.bicyclinginfo.org/bikecost/>. The main web site for “bicyclinginfo.org” states that, “This site is funded by the U.S. Department of Transportation Federal Highway Administration and maintained by the Pedestrian and Bicycle Information Center within the University of North Carolina Highway Safety Research Center.”

The web page states that the analysis also is sponsored by the National Cooperative Highway Research Program, the Minnesota Department of Transportation, and the Midwest Regional University Transportation Center. The tool is based on extensive research from the University of Minnesota, North Carolina University, and the Planners Collaborative, as mentioned in Section 3.1.B, above. The web site is maintained by the Highway Safety Research Center at the University of North Carolina.

The analytic tool can provide estimates of cost, demand, and benefits. Since cost estimates of for the Urban Loop are already ready, we used the site first to generate estimates of demand, which the tool calculates based on population density within 400 meters, 800 meters, and 1,600 meters. If the facility and a measure of bicycling mode share for the area. The tool asks about the type of facility, where it is located, and its length. The analysis tool provides a drop-down table allowing us to tailor the analysis to the Tucson urban area.

We used the countywide average residential density of 2,500 residents per square mile for each of the three distances from the Urban Loop. The analytic tool assumes a mode share of 1.43% of bicycling in Tucson, with an option to input a different share if desired. Because of the range of data on mode share reported above, we chose to use the 1.43% estimate. We described the project as an “off-road bicycle trail,” as being located in a city (as opposed to suburb or small town/rural area), and input 55 miles (in meters it is 88,514 meters). The results of this analysis are shown on the next page. Based on these inputs, the analytic tool generated estimates of “total new cyclists,” ranging from a low of 3,331 to a high of 42,399. The analytic tool generates estimates of benefits from recreation, mobility, health, and decreased auto use. Our calculations are based on the entire project. These values are reduced in the next section to account for TIGER II-funded projects only.

Exhibit 19 Summary of Benefits of the Full Urban Loop Project

Benefit	Low Estimate	Mid Estimate	High Estimate
Recreation	\$8,915,247	\$100,304,470	\$151,513,830
Mobility	\$3,197,067	\$3,197,067	\$3,197,067
Health	\$426,405	\$3,631,288	\$5,427,123
Decreased Auto Use	\$2,986,644	\$2,986,644	\$2,986,644
Total	\$15,525,363	\$110,119,469	\$163,124,664

Note: Values indicated are for entire 55 mile project. For TIGER II projects only, factor by 0.364.

SUMMARY OF BENEFIT COST ANALYSIS

The analysis of costs and benefits is summarized for the TIGER II projects only by taking into consideration their respective values. The TIGER II project elements of the overall URBAN Loop project are projected to cost about \$41 million for construction and \$707,000 per year in maintenance. These costs are in constant 2010 dollars, as identified previously in Exhibits 1 and 5.

Benefits are identified in Exhibit 19 for four categories, and in ranges of low, medium and high. These estimates are for the entire 55-mile project. Since the TIGER II projects represent about 20 miles, the benefits are factored by 20/55, or 0.364 to account for only the TIGER II projects. Finally, the benefits are calculated for year 2010, yet the population base (beneficiaries and users) is expanding at about 1.25% per year in the demand area. These factors are all taken into consideration in Exhibit 20 on the following page. The net result is a benefit stream that is an estimated 2.34 times the costs for the twenty year period.

The very favorable benefit analysis should be considered a conservative or low estimate for the following reasons:

- We used the low range of benefits for the entire analysis period.
- Some benefits could not been included because they are not readily quantifiable: economic activity associated with tourism, safety, increased property values, and air pollution for example.
- The regional growth rate has slowed due to the economic downturn, and historic growth rates are higher than used in the calculations.
- The calculated benefits for the entire project are proportionately higher than the costs for the entire project, making the assessment of the entire 55-mile loop even more economically attractive than the 20-mile TIGER II section.

In summary, we find that the Urban Loop project is a sound transportation investment that represents good stewardship of public funds with an array of benefits to taxpayers and facility users.

Exhibit 20 Summary of Benefits and Costs

		TIGER II Projects, Estimated Benefits (Low Range, \$2010)				TIGER II Project Costs (All \$2010)	
Calendar Year	Project Year	Decreased Auto Use	Health	Mobility	Recreation	Capital	O&M
2011	1	\$ 1,087,138	\$ 155,211	\$ 1,163,732	\$ 3,245,150	\$ 41,056,800	N/A
2012	2	\$ 1,100,728	\$ 157,152	\$ 1,178,279	\$ 3,285,714		\$ 707,000
2013	3	\$ 1,114,487	\$ 159,116	\$ 1,193,008	\$ 3,326,786		\$ 707,000
2014	4	\$ 1,128,418	\$ 161,105	\$ 1,207,920	\$ 3,368,371		\$ 707,000
2015	5	\$ 1,142,523	\$ 163,119	\$ 1,223,019	\$ 3,410,475		\$ 707,000
2016	6	\$ 1,156,805	\$ 165,158	\$ 1,238,307	\$ 3,453,106		\$ 707,000
2017	7	\$ 1,171,265	\$ 167,222	\$ 1,253,786	\$ 3,496,270		\$ 707,000
2018	8	\$ 1,185,905	\$ 169,312	\$ 1,269,458	\$ 3,539,973		\$ 707,000
2019	9	\$ 1,200,729	\$ 171,429	\$ 1,285,326	\$ 3,584,223		\$ 707,000
2020	10	\$ 1,215,738	\$ 173,572	\$ 1,301,393	\$ 3,629,026		\$ 707,000
2021	11	\$ 1,230,935	\$ 175,741	\$ 1,317,660	\$ 3,674,389		\$ 707,000
2022	12	\$ 1,246,322	\$ 177,938	\$ 1,334,131	\$ 3,720,318		\$ 707,000
2023	13	\$ 1,261,901	\$ 180,162	\$ 1,350,808	\$ 3,766,822		\$ 707,000
2024	14	\$ 1,277,675	\$ 182,414	\$ 1,367,693	\$ 3,813,908		\$ 707,000
2025	15	\$ 1,293,646	\$ 184,695	\$ 1,384,789	\$ 3,861,582		\$ 707,000
2026	16	\$ 1,309,816	\$ 187,003	\$ 1,402,099	\$ 3,909,851		\$ 707,000
2027	17	\$ 1,326,189	\$ 189,341	\$ 1,419,625	\$ 3,958,724		\$ 707,000
2028	18	\$ 1,342,766	\$ 191,708	\$ 1,437,370	\$ 4,008,209		\$ 707,000
2029	19	\$ 1,359,551	\$ 194,104	\$ 1,455,337	\$ 4,058,311		\$ 707,000
2030	20	\$ 1,376,545	\$ 196,530	\$ 1,473,529	\$ 4,109,040		\$ 707,000
	Total	\$24,529,081	\$ 3,502,032	\$ 26,257,269	\$ 73,220,248	\$ 41,056,800	\$13,433,000
Grand Total Benefits:		\$127,508,629					
Grand Total Costs:		\$54,489,800					
Benefits/Costs:		2.34					

End Notes

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- ¹ “<http://www.dot.gov/affairs/2010/bicycle-ped.html>”
- ² Doug Kreutz, *Arizona Daily Star*, “Magazine extols bike paths, climate, array of area terrain,” August 3, 2010
- ³ The League of American Bicyclists. at: <http://www.bicyclefriendlycommunity.org>
- ⁴ “http://en.wikipedia.org/wiki/El_Tour_de_Tucson”
- ⁵ “<http://www.permiterbicycling.com/!ETT/EETQandA.html>”
- ⁶ “http://www.bikeleague.org/news/newsletter/e-news_022007.html”
- ⁷ “http://www.suntran.com/how_bike.php”
- ⁸ “http://www.walkinginfo.org/15_year_report/”
- ⁹ “<http://www.dot.gov/affairs/2010/bicycle-ped.html>”
- ¹⁰ Further information on the benefits of walking and bicycling can be found at <http://www.walkinginfo.org/why> and <http://www.bicyclinginfo.org/why>”
- ¹¹ <http://www.lrrb.org/pdf/200450.pdf>
- ¹² http://www.ncdot.gov/_templates/download/external.html?pdf=http%3A//www.ncdot.gov/bikeped/download/bikeped_research_EIAoverview.pdf
- ¹³ http://www.deq.pima.gov/air/pdf/2007-8_CACFull.pdf
- ¹⁴ “[http://www.pagnet.org/documents/TRP/Annual Reports/AnnualReport2007-2008.pdf](http://www.pagnet.org/documents/TRP/Annual%20Reports/AnnualReport2007-2008.pdf)”
- ¹⁵ “<http://www.pagnet.org/documents/bicycle/2008TucsonMetropolitanRegionBicycleCount.pdf>”
- ¹⁶ “http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=ACS&_submenuid=datasets_2&_lang=en&_ts=”