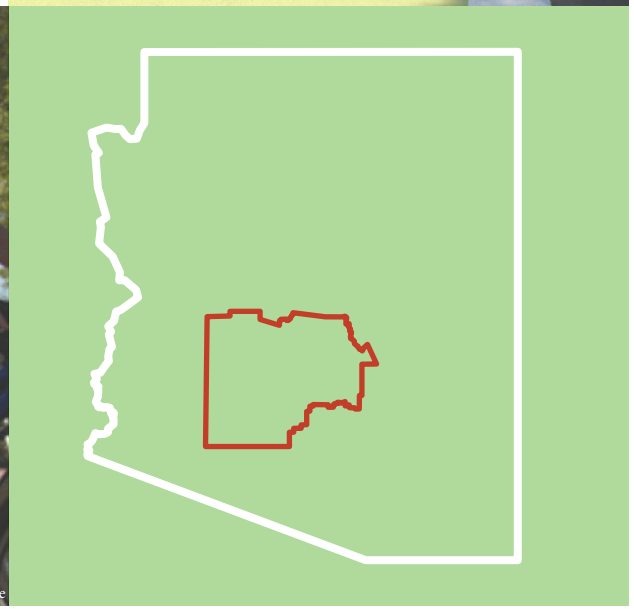
MAG Bicycles Count:

Final Report and Implementation Plan

June 2014

Coffman Studio

Graham Ware



this page is intentionally left blank

MAG Bicycles Count:

Table of Contents

Summary of Key Findings . . . 1

1.0 Background 3
- Setting . . . 4
- Purpose of the MAG Bicycles Count Project . . . 4
- Report Overview . . . 4

2.0 How We Counted Cyclists 5
- Available Count Technologies . . . 6
- Selected Count Technologies . . . 7

3.0 Where We Counted Cyclists 9
- Existing Bicycling Facilities . . . 10
- Sampling Strata . . . 13
- Population Distribution by Local Agency . . . 17

4.0 Continuous Bike Counting and Short Period Bike Counts 25
- Continuous Automated Counting . . . 26
- Short Period Manual Counting . . . 31

5.0 How We Reviewed and Cleaned the Bike Count Data 35
- Identifying Data Anomalies . . . 36
- How We Estimated Excluded Volumes . . . 39
- Developing and Applying Sidewalk Factors . . . 40

6.0 How We Estimated Daily Bicycle Volumes from Peak Period Counts 41
- Calculating Weekday and Weekend Peak Period Percentages . . . 42
- Developing and Applying a Daily Factor to the Peak Period Bicycle Counts . . . 43

7.0 Bicycle Count Summaries 45
- Bicycle Volumes by Day of Week . . . 46
- Using Temporal Patterns to Understand Bicycle Trip Purposes . . . 64
- Sidewalk Cycling . . . 67
- Comparing Cycling in Maricopa County with Other Regions . . . 67

8.0 Bicycle Counting Going Forward 69
- How MAG and Local Agencies Can Use the Bicycle Count Data . . . 70

List of References . . . 73

MARICOPA ASSOCIATION of GOVERNMENTS

CHEN RYAN

coffman studio

WILSON & COMPANY

MAG Bicycles Count:

List of Tables, Figures & Charts

List of Tables

Table 2-1: Summary of Bicycle Counting Technologies. . . . 7
Table 3-1: Bicycle Facilities per 1,000 Capita . . . 10
Table 3-2: Comparing Population and Count Station Distribution by Local Jurisdiction . . . 17
Table 4-1: Automated Count Stations by Local Jurisdiction. . . . 26
Table 4-2: Manual Count Stations by Local Jurisdiction . . . 32
Table 5-1: Locations Where Automated Count Data Was Excluded Due to Data Anomalies . . . 39
Table 5-2: Example of Original Machine Recorded Bicycle Count Data and the Median Bicycle Count Values Used to Replace Invalid Data (Site ID 73) . . . 39
Table 6-1: Summary Statistics for Peak Period Percentages Calculated from Automated Count Stations . . . 42
Table 6-2: Comparing Regional Weekday and Weekend Peak Period Percentages (San Diego and Maricopa Counties) . . . 43
Table 7-1: Average Daily Bicycle Volumes From the Automated Count Stations. . . . 47
Table 7-2: Summary of Average Daily Weekday and Weekend Bicycle Volumes for Automated Count Sites by Facility Type . . . 49
Table 7-3: Daily Estimated Weekday Bicycle Volumes at Manual Count Stations . . . 60
Table 7-4: Daily Estimated Weekend Bicycle Volumes at Manual Count Stations . . . 63
Table 7-5: Average Daily Bicycle Volumes by Day of Week at Automated Count Stations. . . . 65
Table 7-6: Comparing Maricopa County Average Daily Bicycle Volumes to Other US Regions . . . 68
Table 8-1: Annual Estimated Bicycle Data Collection Plan and Costs Going Forward . . . 70

List of Charts

Chart 3-1: Comparing Percent of Total County Population and Total Count Stations by Local Jurisdiction . . . 19
Chart 5-1: Daily East-West Bicycle Counts along Northern Road south of the Intersection of 19th Avenue and Northern Road (Count Site ID 73) . . . 36
Chart 6-1: Distribution of Weekday (4PM-6PM) Peak Period Percentages . . . 42
Chart 6-2: Distribution of Weekend (10AM-12PM) Peak Period Percentages . . . 42
Chart 7-1: Average Daily Automated Count Site Bicycle Volumes for Weekdays & Weekends along Bike Paths . . . 53
Chart 7-2: Average Daily Automated Count Site Bicycle Volumes for Weekdays & Weekends along Bike Lanes. . . . 54
Chart 7-3: Average Daily Automated Count Site Bicycle Volumes for Weekdays & Weekends along Roadways without Bicycle Facility . . . 55
Chart 7-4: Average Daily Automated Count Site Weekday Bicycle Volumes . . . 57
Chart 7-5: Average Daily Automated Count Site Weekend Bicycle Volumes . . . 58
Chart 7-6: Average Daily Automated Count Site Bicycle Volumes for Weekdays & Weekends by Facility Type. . . . 59
Chart 7-7: Average Hourly Weekday Bicycle Volumes by Facility Type . . . 64
Chart 7-8: Average Hourly Weekend Bicycle Volumes by Facility Type. . . . 64
Chart 7-9: Average Daily Bicycle Volumes by Day of Week and Facility Type . . . 66
Chart 7-10: Rates of Sidewalk Cycling by Roadway Environment . . . 67

List of Figures

Figure 3-1: Bicycle Facilities in the MAG Region 11
Figure 3-2: Sampling Strata Categories . . . 13
Figure 3-3: MAG Region Sampling Strata. . . . 15
Figure 3-4 Final MAG Bicycle Count Stations. . . . 21
Figure 4-1: Count Stations by Technology. . . . 29
Figure 4-2: Bicycle Movements Recorded at Intersections During Counts . . . 33
Figure 5-1: Automated Count Sites Excluded Due to Invalid Data . . . 37
Figure 7-1: Average Daily Weekday Bicycle Volumes for Automated and Manual Count Sites . . . 51
Figure 7-2: Average Daily Weekend Bicycle Volumes for Automated and Manual Count Sites . . . 52

MARICOPA ASSOCIATION of GOVERNMENTS

CHEN RYAN

coffman studio

WILSON & COMPANY

All Tables, Figures & Charts Prepared By Chen Ryan Associates

MAG Bicycles Count: Summary of Key Findings

The key purpose of this study was to develop a regional bicycle counting strategy, and then collect the first snapshot of bicycle counts in the region, with the anticipation of on-going counting to help build the region's understanding of cycling trends and patterns over time.

How We Counted

- 128 - Counting Sites
- 44 - Continuous Automated Sites
- 84 - Peak Period Manual Count Sites
- Developed Factors to Estimate Sidewalk Riding
- Calculated Weekday and Weekend Peak Period Percentages to Extrapolate Manual Counts to Daily Counts
- Developed Data Summaries
  - Average Daily Bicycle Volumes (Path, Lane or Route)
  - Temporal Patterns (Day of Week, Hour of Day)

Key Findings

- **Bike paths showed the highest levels of cycling activity** in the region, relative to other facilities, such as bike lanes, bike routes or roadways without bike facilities.
- **The Rio Salado Downstream Dam Bridge** in Tempe showed the highest average daily weekend bicycle count, collected via automated counters, at 859 cyclists per day on the weekend. This count site is a bike path.
- **107th Street and Thomas Road** in the City of Avondale showed the highest average daily weekday bicycle count, collected via automated counters, at 488 cyclists per day during the week. This count site is a bike lane.
- **19th Avenue and Glendale Avenue** in the City of Phoenix showed the highest average daily bicycle volume, collected via automated counters, along roadways with no facility (or bike route) with 271 average daily cyclists on the weekend and 241 average daily cyclists during the week.
- **Mill Avenue and 10th Street** in the City of Tempe showed the highest average daily weekday bicycle volumes (estimated from peak period manual counts) with an estimated 2,244 average daily cyclists during the week.
- **College Avenue and Apache Boulevard** in the City of Temple showed the highest average daily weekend bicycle volumes (estimated from peak period manual counts) with an estimated 719 cyclists during the weekend.
- All bicycle facility types experienced **higher PM peaks** compared to AM peaks **during weekdays**.
- The PM peak hour during weekdays was 5PM for all facility types. During weekdays, it was 10AM for bike paths, and 7AM for bike lanes and bike routes (or no facility).
- All bicycle facility types experienced **higher AM peak hours** compared to PM peaks **during weekends**. The PM peak hour during weekends was 4PM for bike paths and bike lanes, and 5PM for bike routes (or no facility).
- Saturdays showed the highest average daily bicycle volumes overall, with 180 average daily cyclists across all automated count sites. Friday showed the highest average daily weekday bicycle volumes across all automated count sites, with 161 average daily cyclists.
- The manual counts showed that during the AM peak hour, **between 30% and 94% of cyclists in Maricopa County are riding along the sidewalk**. The highest sidewalk cycling rates occurs along 6-lane roadways with no bike facility and with right-turn pockets.

In summary, these findings reflect the fact that Maricopa County, especially considering its population density, has noteworthy cycling levels that fall within similar "Order of Magnitude" levels of other major regions across the country.

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

this page is intentionally left blank

MAG Bicycles Count:
1.0 Background

MAG

MARICOPA ASSOCIATION of GOVERNMENTS

Setting

Planning for communities that support cycling is gaining interest across the country. Cycling is increasingly being viewed as one potential strategy to promote healthy lifestyles, reduce air pollution, and decrease dependence on the private automobile. The United States Department of Transportation Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations, signed in March, 2010 advised transportation agencies and local communities to "go beyond minimum design standards and requirements to create safe, attractive, sustainable, accessible, and convenient bicycling and walking networks." Two actions recommended by the Policy Statement include:

- "Collecting data on walking and biking trips: The best way to improve transportation networks for any mode is to collect and analyze trip data to optimize investments. Walking and bicycling trip data for many communities are lacking. This data gap can be overcome by establishing routine collection of non-motorized trip information."
- "Communities that routinely collect walking and bicycling data are able to track trends and prioritize investments to ensure the success of new facilities. These data are also valuable in linking walking and bicycling with transit."

Realizing the potential benefits and value of collecting bicycle count data, the Maricopa Association of Governments (MAG) set out to complete a regionwide bicycle count effort, as well as to establish a monitoring plan outlining future counting efforts.

Purpose of the MAG Bicycles Count Project

The MAG Bicycles Count Project is an 18-month effort focused on the development of a regional bicycle count strategy for the MAG region. The MAG Bicycles Count Project provides baseline bicycle volumes across Maricopa County for comparison against future counts and to help measure and incorporate the benefits of cycling in long range regional planning efforts. The baseline measures will help inform the impacts that future actions, such as construction of new bicycle facilities or changes in land uses, may have on cycling in Maricopa County. Additionally, measuring bicycle volumes will provide MAG and the member agencies with the information needed to compete for state and national level grant funding opportunities.

Previous working papers completed in support of the MAG Bicycles Count Project include the following topics: a best practices review of bicycle counting technologies (Working Paper #2), a data collection approach and plan (Working Paper #3), and a summary of the data collection results (Working Paper #4).

Report Overview

After this introductory chapter, **Chapter 2** describes seven basic counting technologies, including automated and manual counting methods, and describes the selected methods of peak period manual counting and continuous, automated counting used for this project.

Chapter 3 summarizes siting criteria used to define the regional network of counting stations, which will ideally serve as a framework for future bicycle counting.

Chapter 4 describes the automated and manual counting locations. A total of 128 locations were designated as counting sites, with forty-four (44) sites selected for continuous, automated bicycle counting, and eighty-four (84) sites designated as locations for weekday and weekend peak period manual bicycle counting. The automated count sites were strategically interspersed with the manual count sites, so that continuous counting in the east-west direction and in the north-south direction occurred within the general vicinity of each of the manual count sites.

Chapter 5 outlines how the team identified and treated data anomalies for the purposes of overall data summaries. Because the automated counters do not extend onto the sidewalks and therefore do not count cyclists on the sidewalk, sidewalk factors were developed from the manual counts to estimate additional cyclists not captured during the automated data collection.

Chapter 6 describes how peak period counts were extrapolated to daily counts using weekday and weekend peak period percentages obtained from the automated counts.

Chapter 7 presents bicycle count data summaries, including average daily bicycle volumes by facility type (path, lane or route), and by various temporal patterns observed by day of week and hour of day.

Finally, **Chapter 8** summarizes potential applications of the bicycle count data for enhancing our understanding of the benefits of cycling infrastructure investments, as well as to support improved health, safety and air quality assessments. Chapter 8 also outlines a plan and schedule for future data collection along with associated cost estimates for on-going counting in the region.

MAG

MAG Bicycles Count:
2.0 How We Counted Cyclists
Melody Hoffman

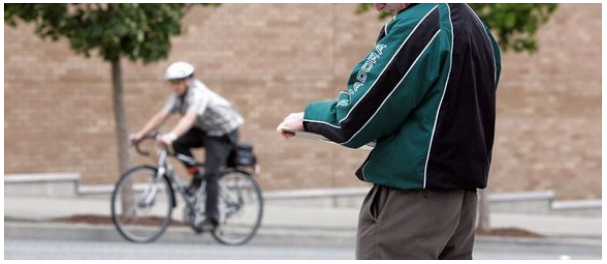
Available Count Technologies

Ryan and Lindsey (2013) recently completed an Active Living Research Brief on bicycle and pedestrian counting. This section of the report on bicycle counting technology in the U.S. borrows from that recent work, as well as from the Federal Highway's recent report Pedestrian and Bicycle Data Collection (2011). Seven basic technologies were identified over the course of this review, as described below:

- Manual
- Video
- Active Infrared
- Passive Infrared
- Computer Visioning
- Inductive Loops
- Pneumatic Tubes

Manual Counts

- Person situated in the field counts passing bicyclists
- Most Prevalent type of data collection
- Observers can easily record additional data variables (gender, helmet use, direction)
- Significant labor cost, long-term impracticality



Video Counts (Manual)

- Videotape the facility and have an observer count bicyclists from resulting video
- Ability to re-watch footage improves accuracy
- Low labor helps reduce labor costs
- Camera setup can be expensive to acquire, install, and maintain

Computer Visioning

- Video-based data collection
- Counts users through a computer model or algorithm
- Reduced labor costs and successful in crowded settings
- Currently no "off the shelf" products
- Technology remains largely non-transferable

Passive Infrared

- Detects passing bicyclist's heat signature
- Widely available and relatively low-cost
- Wide range of error rates
- Difficulty distinguishing a single user in a group

Active Infrared

- Counts bicyclists when an infrared beam is broken
- Portable, relatively low-cost
- Visual obstructions may impact counts
- Less practical along busy facilities

Inductive Loops

- Inductive loops embedded within the pavement that detect passing objects
- Distinguishes between automobiles and bicycles
- Provides a permanent bicycle count station
- Limited to counting cyclists passing directly over the loops
- Funding needed for ongoing maintenance

Pneumatic Tubes

- Rubber tubes placed across the facility and triggered by pressure from a crossing bicycle
- Distinguishes between automobiles and bicycles
- Need trained individuals to install, monitor and maintain the devices

Table 2-1: Summary of Bicycle Counting Technologies

Count Methodology	Accuracy	Cost	Other Considerations
Manual Counts	Depends on training and experience (1% - 25% subject to human error)	High (depending on duration of counts)	• Few equipment costs; • Labor intensive, requires trained observers; • Impractical for long-term counts; Comprehensive applications; • Directional counts possible.
Video (manual analysis)	High (subject to human error)	High (depending on duration of counts)	• Costs of video camera installation and operation; • Labor Intensive; • Can capture some user characteristics; • Directional counts possible.
Active Infrared (can detect speed of traveler, and therefore estimate mode)	Systematic Undercounting (5% - 15% due to clusters of people)	Low	• Portable; • Visual obstructions may affect counts; • Can provide long-term counts;
Passive Infrared (cannot detect speed of traveler, and therefore no modal information)	Systematic Undercounting (5% - 50% due to clusters of people)	Low	• Widely tested and available; • Directional counts possible.
Computer Visioning	Depends on Computer Algorithms	Medium	• Well-suited for crowded environments; • Costs of video camera installation; • Requires greater sophistication for analysis.
Inductive Loops	Varies depending on installation and maintenance of system	Depends on location of installation	• Directional counts possible if maintained; • Can provide long-term counts; • Difficult to use in shared lanes.
Pneumatic Tubes (commonly used to count cars)	High	Depends on location of installation	• Requires trained personnel; • Can provide long-term counts; • Can provide estimates of speed; • Poses problems for skaters on paths.

Sources: Ryan and Lindsey, 2013 FHWA, 2011

Selected Count Technologies

Given the budget and objectives associated with the MAG Bicycles Count Project, the project team selected the following technologies:

- Peak Period Manual Counting, and
- Continuous Automated Counting with Pneumatic Tubes.

Combining peak period manual counts with 24-hour continuous, automated counting allowed for several benefits, including:

- Broad coverage with manual counts, while maintaining the possibility of extrapolating (or growing) short counts to average daily counts using the 24-hour, continuous data; and
- Installation of temporary, continuous counters that provide rich temporal information on cycling patterns.

Wilson & Company

this page is intentionally left blank

MAG Bicycles Count:
3.0 Where We Counted Cyclists

Four key criteria were used to guide the siting of bicycle count stations across the MAG region: 1) presence of existing bicycle facility; 2) achieving a representative sample of locations in relation to population density, employment density and median household income; 3) a distribution of count sites that generally reflects the distribution of population by local jurisdiction; and 4) review and input from local agency staff. Each of these criteria is discussed below.

Existing Bicycling Facilities

Figure 3-1 displays existing bicycle facilities across the MAG region. **Table 3-1** shows miles of bike facility per 1,000 capita for 25 of 32 jurisdictions in the region with bike facilities. Four local jurisdictions (Fort McDowell Yavapai Nation, Gila River Indian Community, Salt River Pima-Maricopa Indian Community, and Town of Wickenburg) have no bicycle facilities. No data was available for three local jurisdictions (Town of Florence, City of Maricopa, and Pinal County).

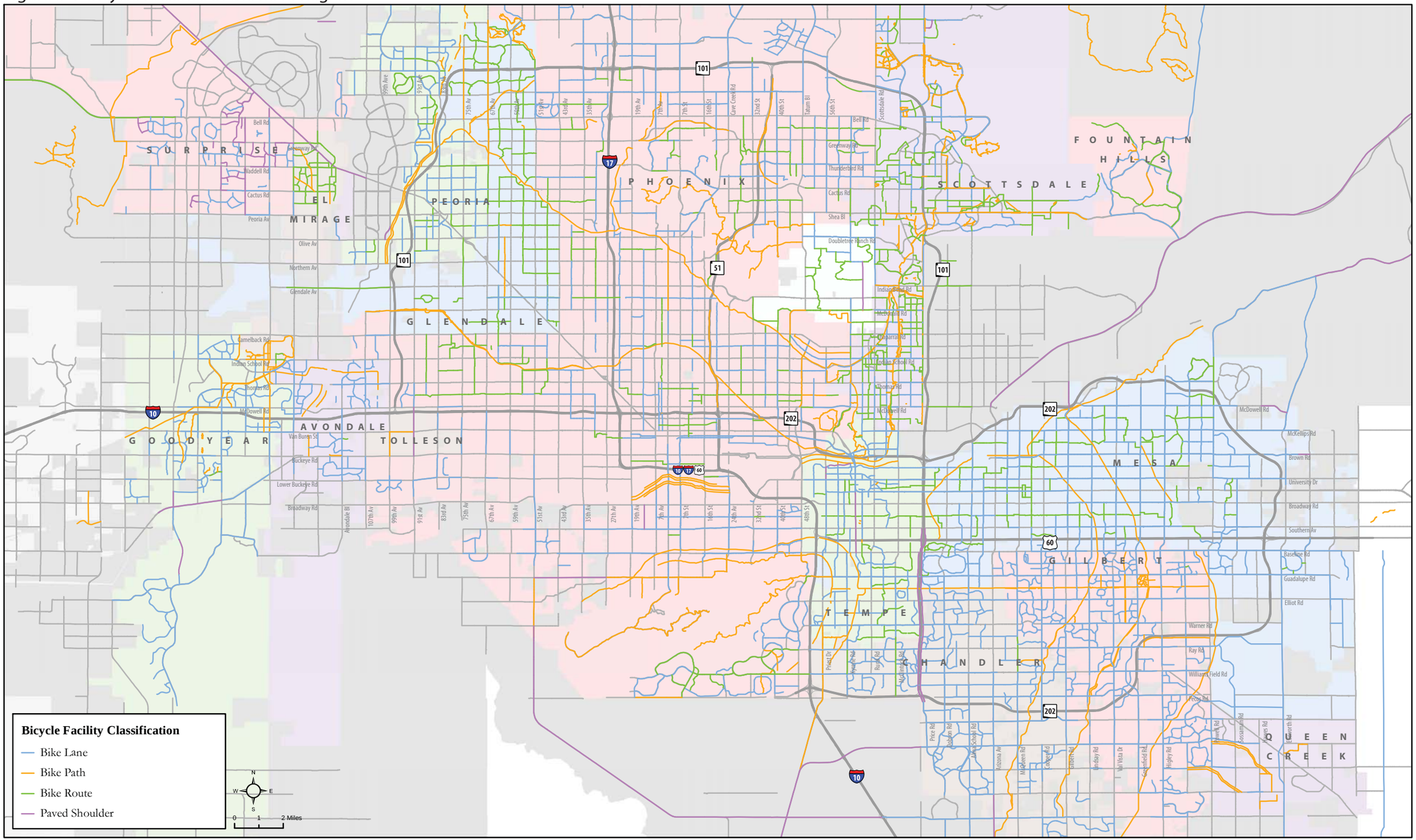
Although cyclists can legally ride along all roadways in the MAG region, as well as along sidewalks in most locations, counting in locations with existing bicycle facilities helped to narrow the more than 23,000 miles of roadways in the MAG region (where counting cyclists was possible), to just 2,287 miles of roadway with bicycle facilities.

Table 3-1: Bicycle Facilities per 1,000 Capita[1]

Jurisdiction	Miles of Bicycle Facility	2010 Population	Miles of Facility per 1,000 Capita
Carefree	0.3	3,363	0.09
Gila bend	0.2	1,922	0.10
Apache Junction	3.9	35,840	0.11
Youngtown	1.3	6,156	0.21
Guadalupe	1.3	5,523	0.24
Phoenix	699.5	1,445,632	0.48
Glendale	113.3	226,721	0.50
Buckeye	27.5	50,876	0.54
Avondale	42.7	76,238	0.56
Tolleson	4.0	6,545	0.61
Mesa	298.9	439,041	0.68
Surprise	84.0	117,517	0.71
Queen Creek	21.0	26,361	0.80
Chandler	196.2	236,123	0.83
El Mirage	26.8	31,797	0.84
Tempe	143.8	161,719	0.89
Peoria	139.3	154,065	0.90
Gilbert	236.4	208,453	1.13
Unincorporated Maricopa County	330.3	284,016	1.16
Fountain Hills	32.2	22,489	1.43
Scottsdale	327	217,385	1.50
Goodyear	108.5	65,275	1.66
Litchfield Park	9.9	5,476	1.81
Paradise Valley	30.5	12,820	2.38
Cave Creek	14.3	5,015	2.85

Note:
1. This table is sorted from lowest to highest miles of bike facility per 1,000 capita

Figure 3-1: Bicycle Facilities in the MAG Region



this page is intentionally left blank

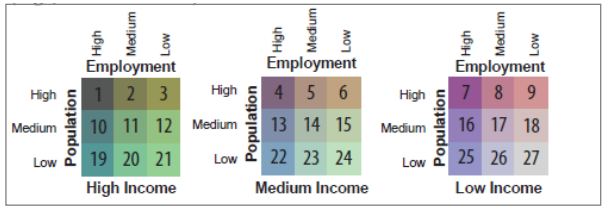
Sampling Strata

The project team used a method called "stratified sampling" to sample or select bicycle facility segments for counting. Stratified sampling entails dividing the total study population into "like" groupings (or strata) and then sampling from these strata. The strata were developed using three factors known to influence the demand for travel:

- population density,
- employment density, and
- median household income.

Ranges of values associated with population density, employment density and median household income for the MAG region were categorized into high, medium and low classes, resulting in a total of 27 sampling strata, as shown below in **Figure 3-2**.

Figure 3-2: Sampling Strata Categories



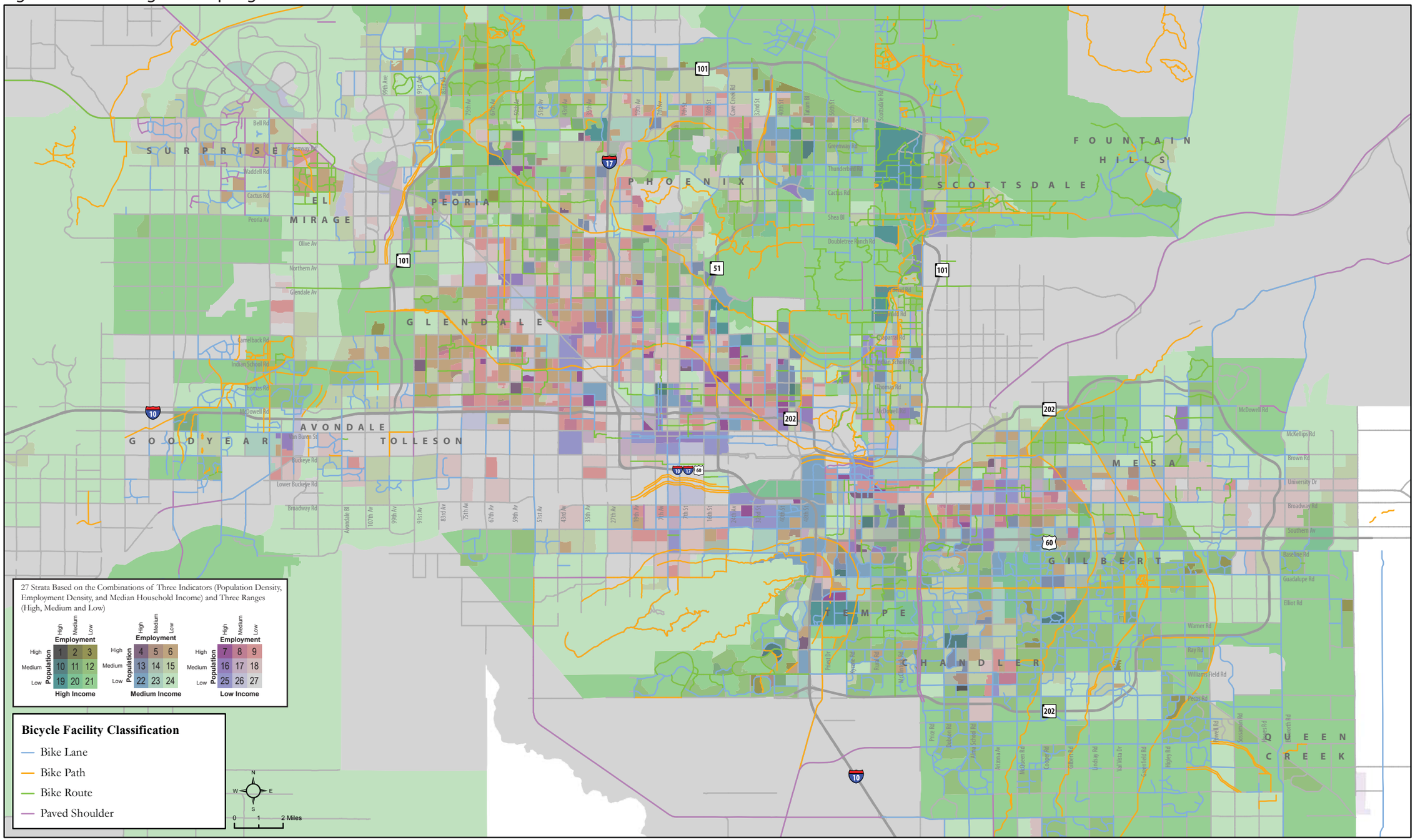
Each of the census block groups across the MAG region was assigned to a sampling stratum 1 through 27, depending on the population density, employment density and medium household income found there.

Figure 3-3 displays how census block groups across the MAG region were assigned to a sampling stratum, 1 through 27.

These criteria support the collection of bicycle count data that will allow MAG staff and member agencies to successfully estimate and forecast bicycle travel.

this page is intentionally left blank

Figure 3-3: MAG Region Sampling Strata



this page is intentionally left blank

Population Distribution by Local Agency

The project team attempted to match the percent of total bicycle count stations in each jurisdiction to its percent of total countywide population to satisfy member agency's understandable concern with the equitable distribution of planning funds from MAG. **Table 3-2** and **Chart 3-1** show how the distribution of bicycle count stations relates to the distribution of population across the 32 member agencies. MAG member agencies Gila River Indian Community, Guadalupe, Pinal County, Tolleson, and Wickenburg did not have count sites in this study.

Figure 3-4 shows the final set of 128 bicycle counting stations resulting from the selection process outlined in this chapter of the report.

Table 3-2: Comparing Population and Count Station Distribution by Local Jurisdiction

Local Jurisdiction	2010 Population	Percent of Total Population	Number of bicycle Count Stations	Percent of Total Count Stations
Apache Junction	35,840	0.84%	1	0.78%
Avondale	76,238	1.78%	3	2.34%
Buckeye	50,876	1.19%	1	0.78%
Carefree	3,363	0.08%	2	1.56%
Cave Creek	5,015	0.12%	2	1.56%
Chandler	236,123	5.52%	7	5.47%
El Mirage	31,797	0.74%	1	0.78%
Florence	25,536	0.60%	1	0.78%
Fort McDowell Yavapai Nation	971	0.02%	1	0.78%
Fountain Hills	22,489	0.53%	1	0.78%
Gila Bend	1,922	0.04%	1	0.78%
Gila River Indian Community	11,712	0.27%	0	0.00%
Gilbert	208,453	4.87%	7	5.47%
Glendale	226,721	5.30%	8	6.25%
Goodyear	65,275	1.52%	3	2.34%
Guadalupe	5,523	0.13%	0	0.00%
Litchfield Park	5,476	0.13%	1	0.78%
Maricopa	43,482	1.02%	1	0.78%
Mesa	439,041	10.26%	14	10.94%
Paradise Valley	12,820	0.30%	1	0.78%
Peoria	154,065	3.60%	5	3.91%
Phoenix	1,445,632	33.77%	41	32.03%
Pinal County	375,770	8.78%	0	0.00%
Queen Creek	26,361	0.62%	2	1.56%
Salt River Pima-Maricopa	6,289	0.15%	1	0.78%
Scottsdale	217,385	5.08%	7	5.47%
Surprise	117,517	2.75%	3	2.34%
Tempe	161,719	3.78%	8	6.25%

Table 3-2: Comparing Population and Count Station Distribution by Local Jurisdiction (Continued)

Local Jurisdiction	2010 Population	Percent of Total Population	Number of bicycle Count Stations	Percent of Total Count Stations
Tolleson	6,545	0.15%	0	0.00%
Wickenburg	6,363	0.15%	0	0.00%
Youngtown	6,156	0.14%	1	0.78%
Unincorporated Maricopa County	248,168	5.80%	4	3.13%
Total	4,280,643	100%	128	100%

Summary

In summary, the following flow chart illustrates how the four siting criteria were employed in an iterative process to select and refine bicycle count stations across the MAG region.

Bicycle Count Station Selection Process

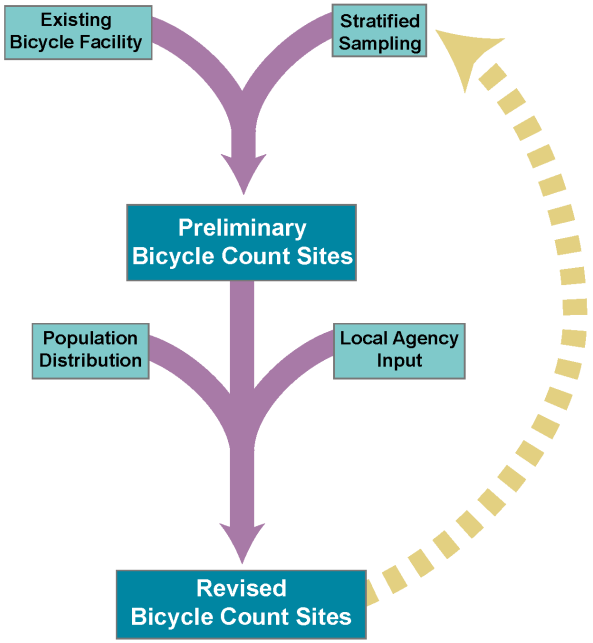
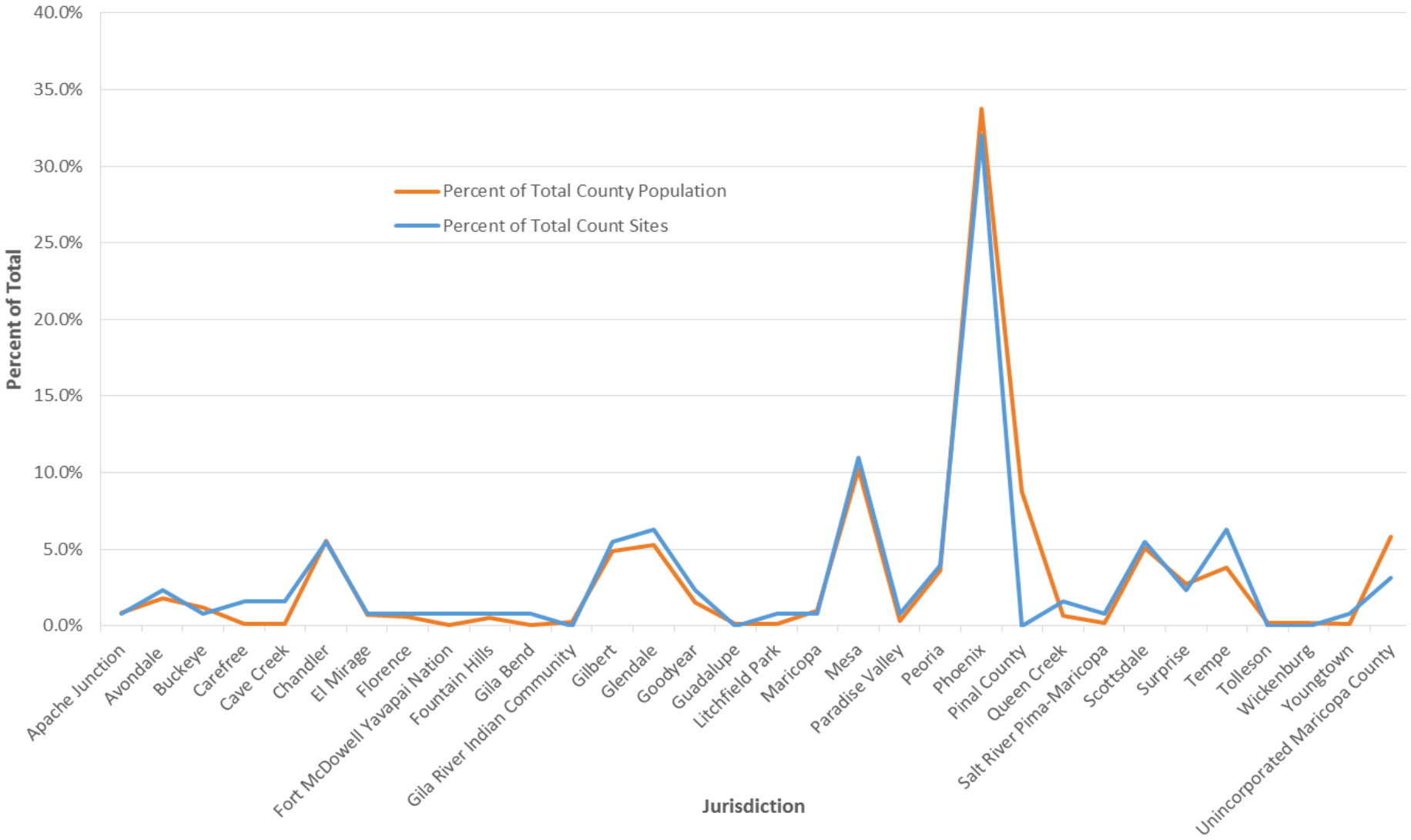
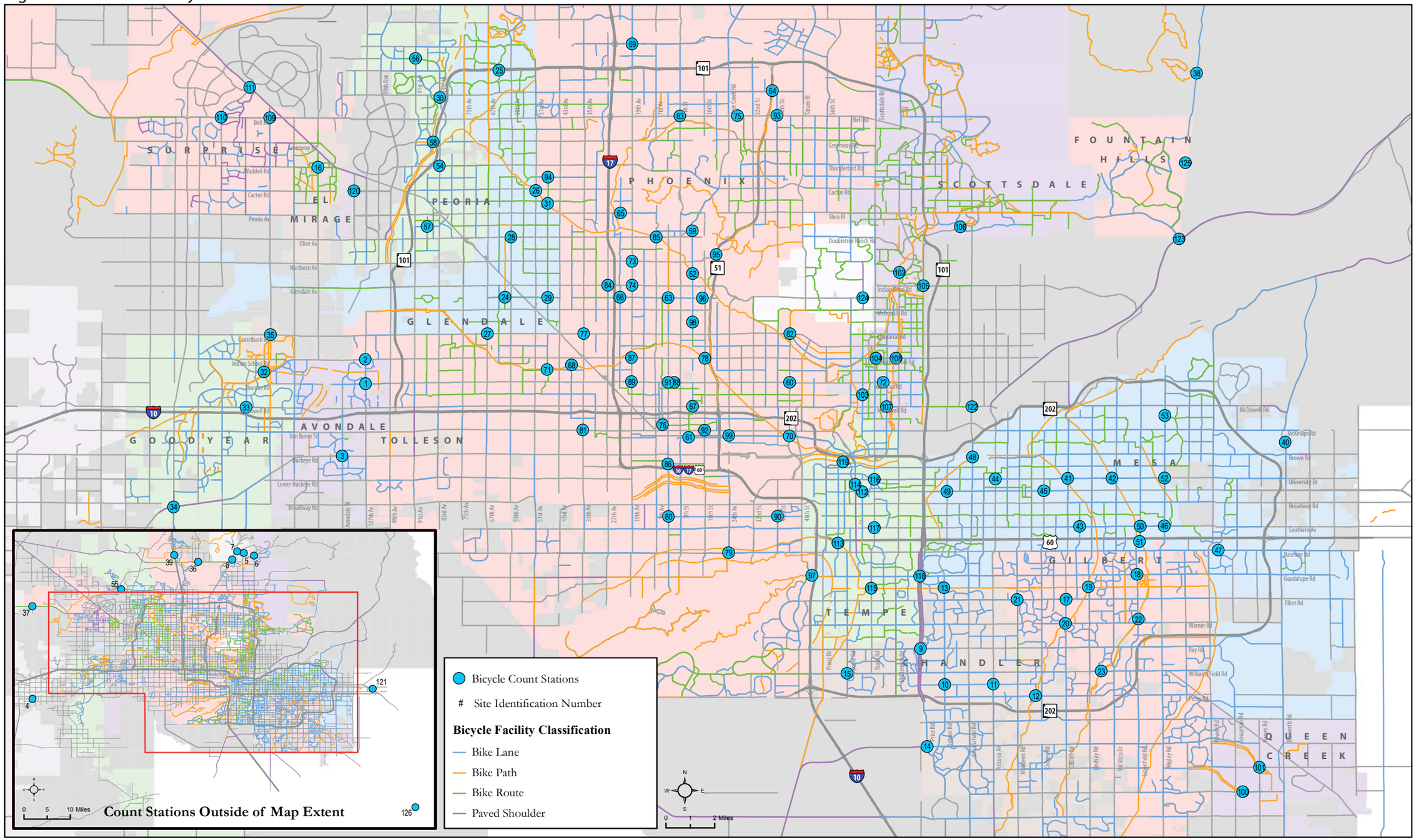


Chart 3-1: Comparing Percent of Total County Population and Total Count Stations by Local Jurisdiction



this page is intentionally left blank

Figure 3-4 Final MAG Bicycle Count Stations



this page is intentionally left blank

this page is intentionally left blank

this page is intentionally left blank

MAG Bicycles Count:
4.0 Continuous Bike Counting and
Short Period Bike Counts
Wilson & Company

Chapter 3.0 described the site selection process and the resulting 128 bicycle count locations. This chapter describes the two counting technologies selected for application in the MAG Bicycles Count Project:

- Continuous automated counting with leased pneumatic tubes, and
- Peak period manual counting.

Figure 4-1 displays the proposed bicycle count stations in the MAG region, distinguishing where automated and manual counting occurred.

Continuous Automated Counting

Forty-four (44) of the 128 count locations were designated as sites for continuous, automated bicycle count data collection, with the remaining 84 sites designated as locations for peak period manual bicycle counting. The automated count sites were strategically interspersed with the manual count sites, so that continuous counting in the east-west direction and in the north-south direction occurred within the general vicinity of each of the manual count sites. This method allowed the project team to use peak hourly patterns identified through the automated counters to extrapolate or grow peak period manual counts to daily counts.

Table 4-1 displays the list of locations where continuous, automated bicycle counts were collected. Each of these locations was scheduled for approximately two weeks of 24-hour, continuous bicycle count data collection, with data being recorded and reported at 15-minute intervals.

The count sites in Table 4-1 are ordered alphabetically by local jurisdiction.

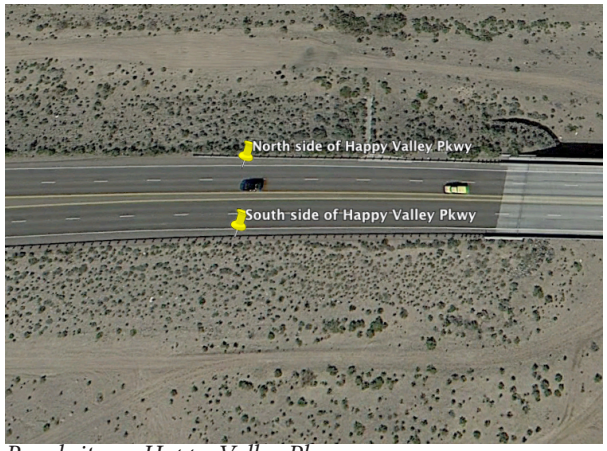
Table 4-1: Automated Count Stations by Local Jurisdiction

Count Site ID	Facility	Location	Count Direction	Intersection Leg
1	Avondale	107th Ave & Thomas Rd	NS	South
6	Carefree	Pima Rd & Cave Creek Rd	NS	North
10	Chandler	Dobson Rd & Frye Rd	NS	West
13	Chandler	Dobson Rd & Western Canal Bike Path	EW	West
9	Chandler	Price Rd & W Ray Rd	EW	North
16	El Mirage	El Mirage Rd & Thunderbird Rd	NS	West
23	Gilbert Rd.	Eastern Canal Trail & E. Williams Field Rd.	EW	North
17	Gilbert	Gilbert Rd & Elliott Rd	NS	North
18	Gilbert	Greenfield Rd & Guadalupe Rd	EW	East
26	Glendale	51st Ave & Thunderbird Paseo (Canal Path)	EW	South
24	Glendale	61st Ave & Maryland Ave	EW	East
25	Glendale	63rd Ave & Loop 101 Bike/Ped Bridge	NS	North
35	Litchfield Park	Litchfield Rd & Camelback Rd	EW	West
39	Maricopa County	Gavilan Peak Pkwy & Pioneer Rd	NS	West
43	Mesa	24th St & Southern Ave	EW	East
42	Mesa	Eastern Canal Bike Path & University Dr	EW	South
40	Mesa	Ellsworth Rd & McLellan Rd	NS	West
41	Mesa	Gilbert Rd & University Dr	EW	South
46	Mesa	Higley Rd & Southern Ave	NS	East
55	Peoria	115th Ave & Happy Valley Parkway	EW	South
54	Peoria	83rd Ave & Thunderbird Rd	NS	East
58	Peoria	New River Bike Path & Greenway Rd	NS	South
61	Phoenix	11th St & Jefferson St	EW	North
62	Phoenix	12th St & Arizona Canal Bike Path	NS	South
59	Phoenix	12th St & Hatcher Rd	EW	East
98	Phoenix	12th St & Missouri Ave	NS	South
67	Phoenix	12th St & McDowell Rd	NS	West
69	Phoenix	19th Ave & Deer Valley Rd	EW	South
74	Phoenix	19th Ave & Glendale Ave	EW	West

Table 4-1: Automated Count Stations by Local Jurisdiction (Continued)

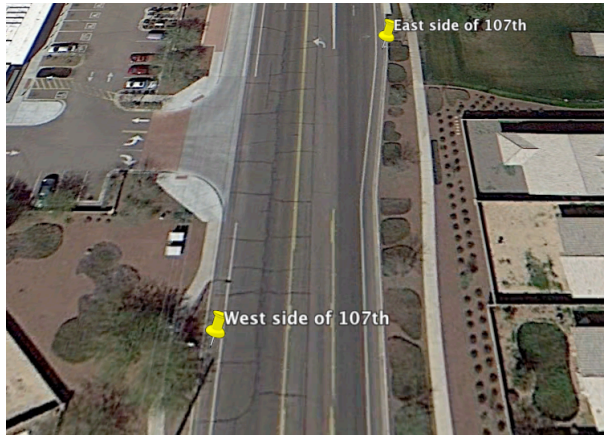
Count Site ID	Facility	Location	Count Direction	Intersection Leg
73	Phoenix	19th Ave & Northern Rd	EW	East
66	Phoenix	23rd Ave & Maryland Ave	NS	West
65	Phoenix	23rd Ave & Peoria Rd	NS	South
68	Phoenix	39th Ave & Grand Canal Bike Path	EW	South
60	Phoenix	44th St & Thomas Rd	NS	West
70	Phoenix	44th St & Washington St	EW	West
64	Phoenix	Bike Path parallel to SR-51 & Union Hills Dr	NS	North
63	Phoenix	Central Ave & Maryland Ave	EW	West
100	Queen Creek	Sonoqui Wash Path & Chandler Heights Rd	NS	West
103	Scottsdale	68th St & Oak St	NS	South
102	Scottsdale	Indian Bend Wash Path north of McCormick Pkwy	NS	North
104	Scottsdale	Scottsdale Road & Indian School Rd	EW	South
113	Tempe	Hardy Dr & Western Canal Bike Path	EW	North
119	Tempe	Rio Salado Downstream Dam Bridge	NS	East
115	Tempe	Rural Rd & Western Canal Bike Path	EW	West

The images below illustrate the variety of automated count site locations, including along bike paths, bike lanes, bike routes, and in rural locations.



Rural site on Happy Valley Pkwy

Bike path site at 63rd Ave Bike/Ped. Bridge @ the 101

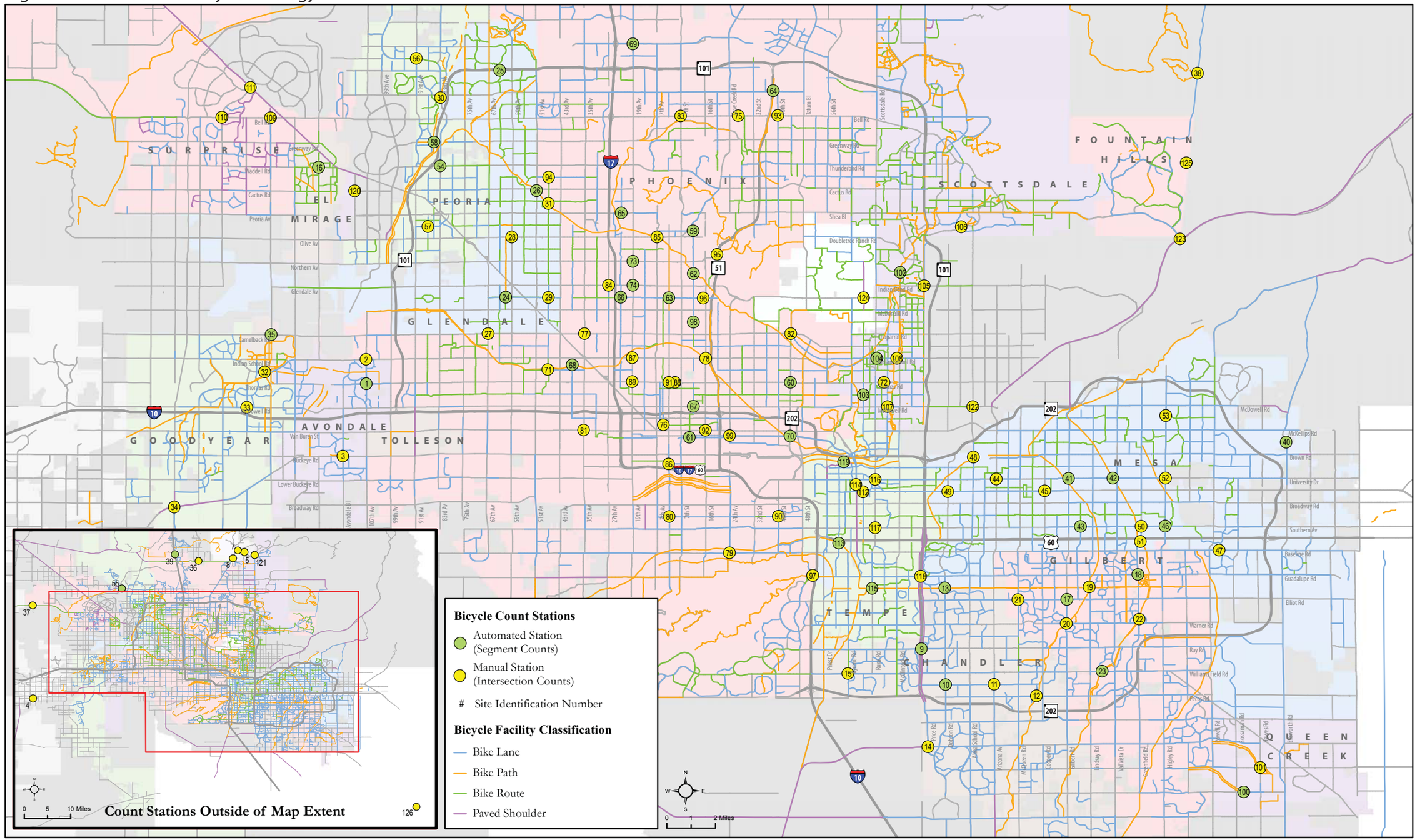


Bike lane site at 107th Ave & Thomas Rd

Bike route site at 61st Ave & Maryland Ave

this page is intentionally left blank

Figure 4-1: Count Stations by Technology



this page is intentionally left blank

Eco-Counter

Eco-Counter

Eco-Counter's Zelt Pneumatic Tubes (Zelt Tubes) were selected as the most convenient automated counting technology for this project. Key reasons for this choice include:

- Ability to distinguish automobile and cyclists when counting on-street;
- Availability of equipment leasing option and temporary installation since project funds could not be used for purchasing and installing permanent counters;
- Availability of Eco-Counter's Eco-Visio software for performing quick data summaries;
- Relatively affordable price of leasing equipment enabling a reasonable number of locations to be counted for more than one week;
- Strong level of accuracy (+/- 10%) and broad application in other jurisdictions including Portland and San Francisco.

In addition to the standard on-street pneumatic tubes, Eco-Counter supplied "mini-tubes" or "greenway tubes", designed specifically to monitor cyclists riding on bike paths. The mini-tubes are smaller, and more comfortable to ride over than the standard tubes.

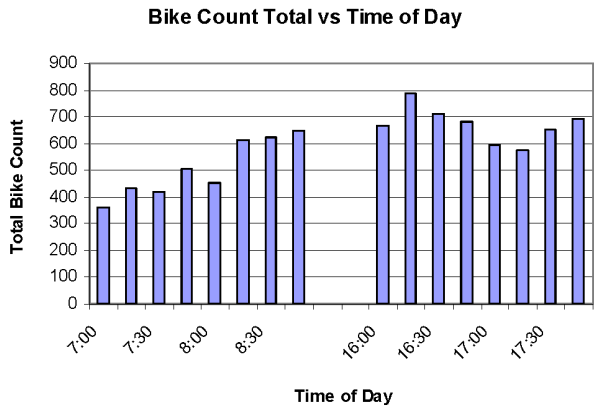
Short Period Manual Counting

Manual bicycle counting occurred at 84 of 128 count sites during a 2-hour peak period, either on a weekday from 4PM – 6PM, or on a weekend from 10AM – 12PM. The PM peak period was selected largely as a result of reviewing peak period count data from the City of Tempe, which reflected higher rates of cyclists during the 4PM – 6PM peak periods as compared with the 7AM– 9AM peak period, as shown in the graph. below. Higher PM peak period bicycle travel, relative to the AM peak period, is a common pattern found across many metropolitan regions.

Count days were established as weekdays, between Tuesday and Friday; and weekends on Saturdays. Approximately 65% of the manual count sites were collected during weekdays, and about 35% of the manual count sites were collected during the weekend.

Table 4-2 displays the locations of the 84 peak period manual count locations. Table 4-2 is sorted alphabetically by jurisdiction.

City of Tempe



Wilson & Company

Table 4-2: Manual Count Stations by Local Jurisdiction

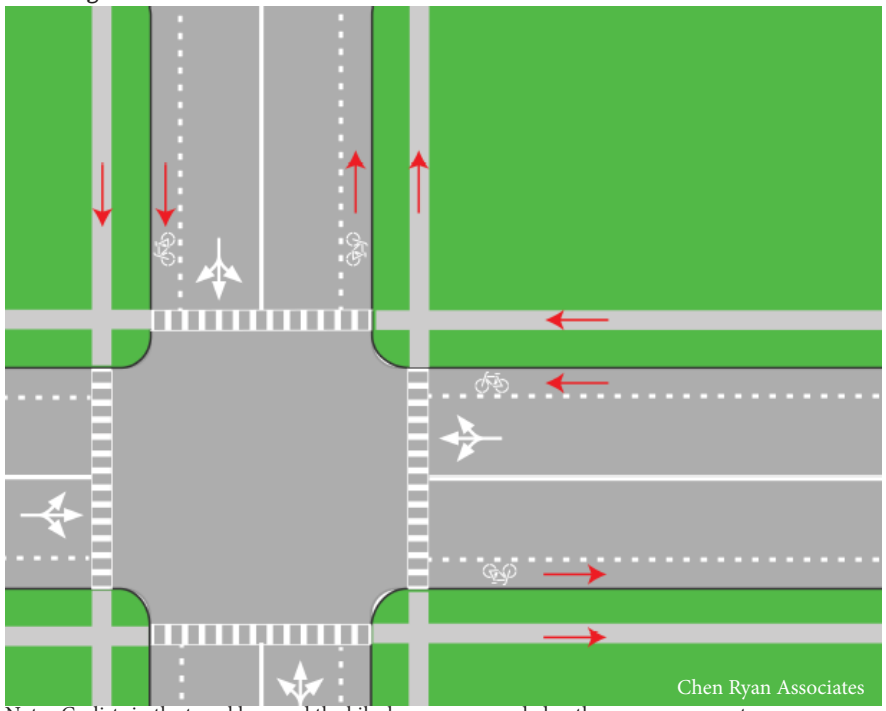
Count Site ID	Jurisdiction	Count Location
121	Apache Junction	Winchester Rd & Old West Highway
3	Avondale	Avondale Blvd & Buckeye Rd
2	Avondale	107th Ave & Indian School Rd
4	Buckeye	7th St & Monroe Avenue
5	Carefree	N Tom Darlington Dr & E Cave Creek Rd
8	Cave Creek	N Cave Creek Rd & E New River Rd
7	Cave Creek	N Schoolhouse Rd & E Cave Creek Rd
11	Chandler	Arizona Ave & Frye Rd
12	Chandler	Chandler Paseo Trail & Pecos Rd
15	Chandler	Kyrene Rd & West Chandler Blvd
14	Chandler	Price Rd & Queen Creek Rd
126	Florence	Main Street & Butte Ave
125	Fort McDowell Yavapai Nation	El Pueblo Blvd & Grande Blvd
123	Fountain Hills	Beeline Highway & Shea Blvd
127	Gila Bend	SR-85 & Martin Ave
19	Gilbert	Consolidated Canal & Western Powerline
20	Gilbert	Gilbert Rd & Warner Rd
22	Gilbert	Greenfield Rd & Eastern Canal
21	Gilbert	McQueen Rd & Elliott
31	Glendale	47th Ave & Arizona Canal Bike Path
29	Glendale	47th Ave & Maryland Ave
27	Glendale	67th Ave & Camelback Rd
30	Glendale	83rd Ave & New River Bike Path
28	Glendale	59th Ave & Olive Ave
33	Goodyear	Bullard Ave & McDowell Rd
34	Goodyear	Cotton Lane & MC 85
32	Goodyear	Litchfield Road & Indian School Road
128	Maricopa	SR-347 & Union Pacific Railroad (South of W Maricopa-Casa Grande Hwy

Count Site ID	Jurisdiction	Count Location
37	Maricopa County	243rd Ave & Sun Valley Parkway
36	Maricopa County	7th St & Carefree Highway
38	Maricopa County	McDowell Mountain Rd & McDowell Mountain Park Dr
48	Mesa	Alma School Rd & Tempe Canal Bike Path
44	Mesa	Country Club Dr & University Dr
51	Mesa	Greenfield Rd & Eastern Canal 2
50	Mesa	Greenfield Rd & Southern Ave
53	Mesa	Higley Rd & Hermosa Vista Dr
52	Mesa	Higley Rd & University Dr
49	Mesa	Dobson Rd & Main St
45	Mesa	Stapley Dr & Main St
47	Mesa	Superstition Springs Blvd & Baseline Rd
124	Paradise Valley	Mockingbird Lane & Lincoln Drive
57	Peoria	87th Ave & Mountain View Rd
56	Peoria	91st Ave & Lake Pleasant Pkwy (& adjacent path)
96	Phoenix	15th Ave & Maryland Ave
78	Phoenix	16th St & Indian School Rd
92	Phoenix	16th St & Van Buren St
87	Phoenix	19th Ave & Indian School Rd
89	Phoenix	19th Ave & Thomas Rd
79	Phoenix	24th St & Baseline Rd
99	Phoenix	24th St & Washington St
75	Phoenix	27th Ave & Bell Rd
84	Phoenix	27th Ave & Glendale Ave
77	Phoenix	35th Ave & Camelback Rd
81	Phoenix	35th Ave & Van Buren St
76	Phoenix	3rd Ave & Fillmore St
88	Phoenix	3rd Street &Thomas Rd

Table 4-2: Manual Count Stations by Local Jurisdiction (Continued)

Count Site ID	Jurisdiction	Count Location
93	Phoenix	40th St & Bell Rd
90	Phoenix	40th St & Roeser Rd
82	Phoenix	44th St & Camelback Rd
71	Phoenix	47th Ave & Osborn Rd
94	Phoenix	47th Ave & Sweetwater Ave
97	Phoenix	48th St & Guadalupe Rd (S Pointe Pkwy & Guadalupe)
72	Phoenix	75th Ave & Thomas Rd
85	Phoenix	7th Ave & Dunlap Ave
83	Phoenix	7th St & Bell Rd
86	Phoenix	Central Ave & Mohave St
80	Phoenix	Central Ave & Roeser Rd
91	Phoenix	Central Ave & Thomas Rd
95	Phoenix	Northern Ave & Bike Path south of SR-51
101	Queen Creek	Hawes Rd & Ocotillo Rd
122	Salt River Pima-Maricopa	Alma School Rd & McDowell
108	Scottsdale	Indian Bend Wash Path & Indian School Rd
107	Scottsdale	Miller Rd & McDowell Rd
105	Scottsdale	Pima Rd & Indian Bend Road
106	Scottsdale	Mountain View Rd & Via Linda
109	Surprise	Litchfield Rd & Bell Rd
110	Surprise	Reems Rd & Bell Rd
111	Surprise	Reems Rd & Grand Ave
112	Tempe	College Ave & Apache
114	Tempe	Mill Ave & 10th St
117	Tempe	Rural Rd & Southern
116	Tempe	Rural Rd & University Dr
118	Tempe	SR-101 & Guadalupe Rd
120	Youngtown	111 Ave & Youngtown Ave

Figure 4-2: Bicycle Movements Recorded at Intersections During Counts



Note: Cyclists in the travel lane and the bike lane were recorded as the same movement

A local traffic data collection firm, TRA, conducted the manual counts beginning in October 2013. TRA staff were situated at count station intersections and instructed to count screenline movements along each intersection leg, i.e. "ins" and "outs" along each intersection leg, instead of turning movements.

Figure 4-2 displays the cyclist movements that were recorded at each of the 84 intersection locations where peak period manual bicycle counts were conducted. A few important notes about the bicycle movements recorded:

- No distinction was made between cyclists in the bike lane or the travel lane; and
- Cyclists traveling the wrong-way along sidewalks, bike lanes, or travel lanes were recorded as traveling in the same direction as legal traffic flow.

this page is intentionally left blank

MAG Bicycles Count:
5.0 How We Reviewed and Cleaned the Bike Count Data

Following the completion of data collection in October and November 2013, a data cleaning process was developed and applied to the automated bicycle count data in order to ensure overall data validity and to improve the reliability of the data summaries. A three-pronged approach was used to clean the automated bicycle count data:

1. Identification of data anomalies and exclusion of irregular and unrealistic data;
2. Estimation of data values to replace invalid data; and
3. The development and application of a sidewalk cycling factor to account for cyclists riding on the sidewalk who were not detected by the automated counters.

Each of these processes is described in the sections that follow.

Identifying Data Anomalies

The project team reviewed the automated bicycle count data by day of week to identify anomalies potentially indicating unreliable or inaccurate counts. These irregularities are believed to result from two circumstances:

1. The automated counter was installed or removed on the day in question, resulting in an incomplete day of data collection; or
2. The automated counting tube was pulled up from the ground, or partially disconnected, causing the counter to either completely stop counting or begin recording vehicles.

In response to these two circumstances the project team took the following data cleaning actions:

- Excluded the first and last days of bicycle counts from each of the 2-week count periods since those days were used for installing and uninstalling equipment and the data is known to be incomplete.
- Excluded data for the days that appeared to have highly irregular machine-recorded counts and developed an estimated count to replace the missing data. The process used for estimating missing data is discussed in Section 5.2.
- Eliminated all data for seven specific sites where patterns were highly irregular and difficult to interpret over the entire count period (Site IDs 6, 9, 17, 23, 60, 70, and 103).
- Eliminated partial data associated with Site IDs 62 and 69 due to likely machine error in only one direction of travel.

Chart 5-1 displays an example of bicycle count data from Site ID 73, along Northern Road in the City of Phoenix south of the intersection of 19th Avenue and Northern Road, where four days of data were determined to be invalid and were therefore replaced with estimated bicycle counts.

Tuesday, 10/1 was excluded due to the relatively high volumes recorded along the south side of Northern Road, in both the eastbound and westbound directions of travel. Tuesday through Thursday (10/8 to 10/10) were excluded due to the low volumes along the north side of Northern Road in both the westbound and eastbound directions.

Figure 5-1 displays the 7 count stations where all data was determined to be invalid.

Table 5-1 lists the locations of the excluded automated count sites.

Chart 5-1: Daily East-West Bicycle Counts along Northern Road south of the Intersection of 19th Avenue and Northern Road (Count Site ID 73)

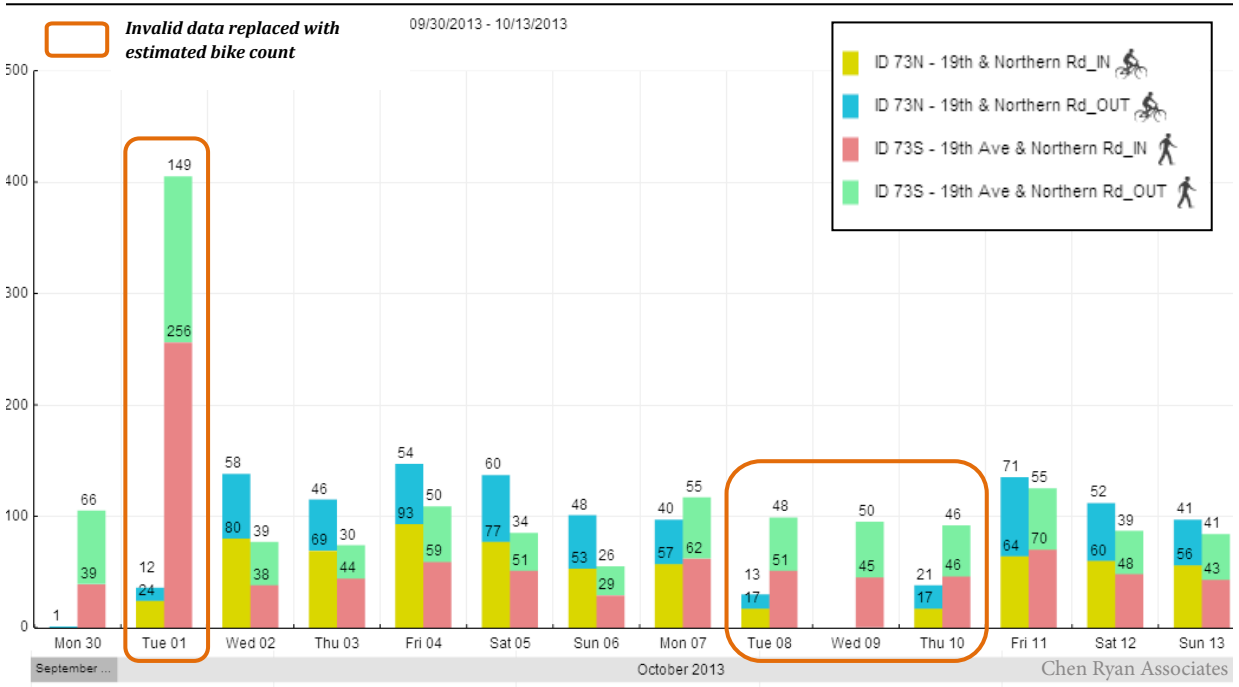
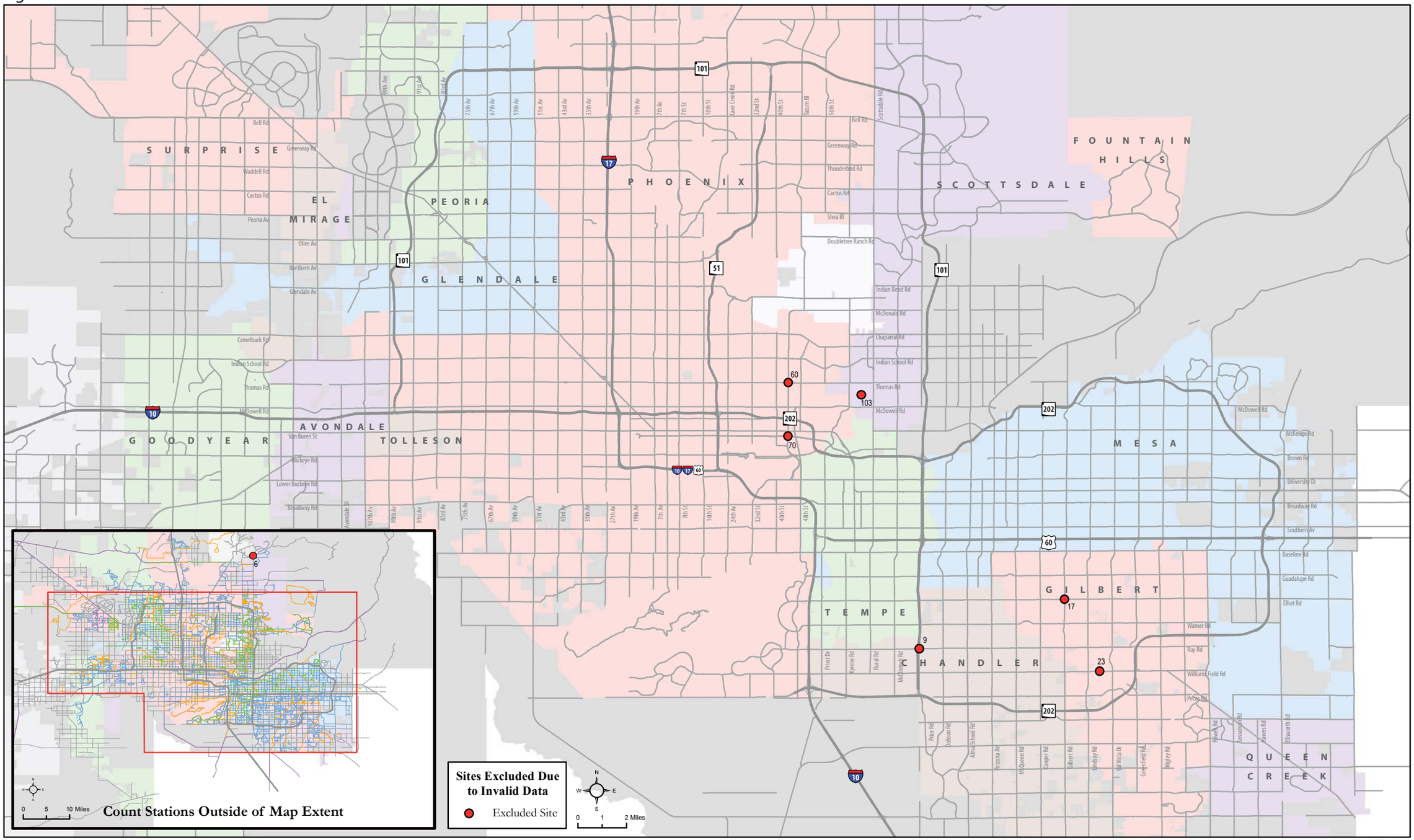


Figure 5-1: Automated Count Sites Excluded Due to Invalid Data



this page is intentionally left blank

Table 5-1: Locations Where Automated Count Data Was Excluded Due to Data Anomalies

Count Site ID	Jurisdiction	Count Location	Count Direction	Intersection Leg
6	Carefree	Pima Rd & Cave Creek Rd	NS	North
9	Chandler	Price Rd & W Ray Rd	EW	North
23	Gilbert	Eastern Canal Trail & E. Williams Field Rd	EW	North
17	Gilbert	Gilbert Rd & Elliott Rd	NS	North
60	Phoenix	44th St & Thomas Rd	NS	West
70	Phoenix	44th St & Washington St	EW	West
103	Scottsdale	68th St & Oak St	NS	South

Table 5-2: Example of Original Machine Recorded Bicycle Count Data and the Median Bicycle Count Values Used to Replace Invalid Data (Site ID 73)[1]

Date	ID 73N-IN (westbound)	ID 73N-OUT (eastbound)	ID 73S-IN (eastbound)	ID 73S-OUT (westbound)
Tue, Oct 1, 20131	24	12	256	149
Wed, Oct 2, 2013	80	58	58	39
Thu, Oct 3, 2013	69	46	46	30
Fri, Oct 4, 2013	93	54	54	50
Sat, Oct 5, 2013	77	60	60	34
Sun, Oct 6, 2013	53	48	48	26
Mon, Oct 7, 2013	57	40	40	55
Tue, Oct 8, 2013	17	13	51	48
Wed, Oct 9, 2013	0	0	45	50
Thu, Oct 10, 2013	17	21	46	46
Fri, Oct 11, 2013	64	71	70	55
Sat, Oct 12, 2013	60	52	48	39
Median Bicycle Count Value[2]	66.5	53	49.5	39

Notes:
1. Shaded rows reflect data collection days deemed invalid and replaced with the median bicycle count value, which was calculated using all valid data collection days for this count station.
2. The median bicycle count value is calculated using only data collection days that were deemed valid and not excluded, which includes Wednesday, October 2nd through Monday, October 7th; Friday, October 11th and Saturday, October 12th.

How We Estimated Excluded Volumes

The median daily bicycle volume was calculated to compensate for days when the machine count was determined to be invalid by using valid data from other days at the same location. The median volume was calculated using all valid days of counts for each respective count station. A total of 444 valid data collection days remained across the 37 count stations, after excluding the seven sites, as well as the first and last count day from each count station. In total, count estimates were developed for 67 of the 444 days, or 15% of total data collection days across the 37 count stations.

Table 5-2 shows the original bicycle count data collected along Northern Road at Site ID 73 (see **Chart 5-1**), the data collection days that were excluded indicated by shaded rows, and the median bicycle count value used to replace the excluded days of data.

Developing and Applying Sidewalk Factors

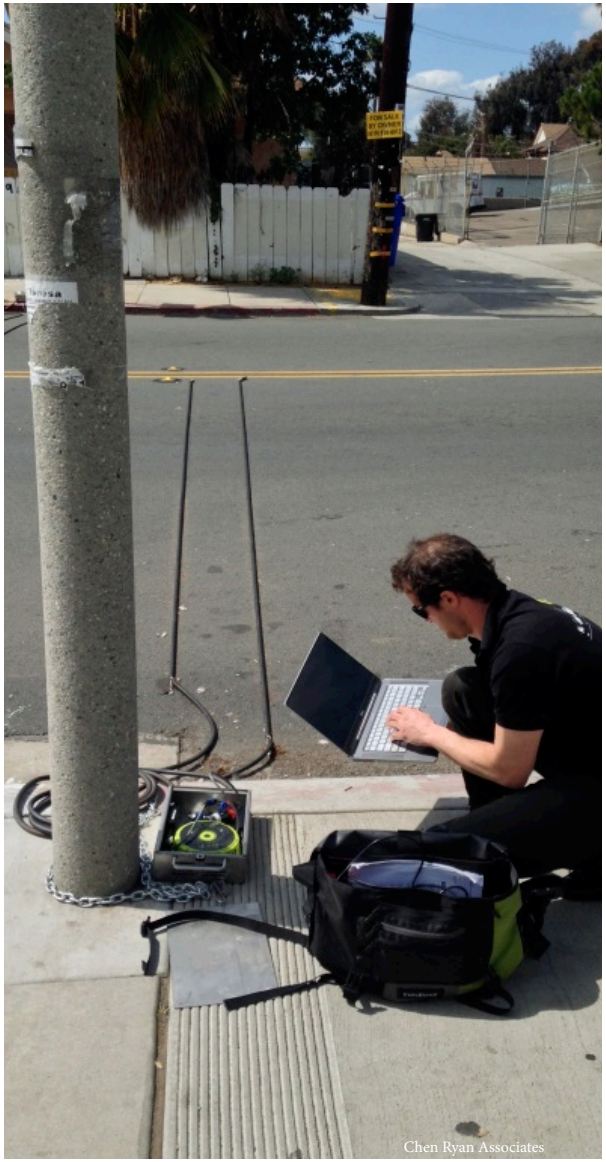
The automated counters were generally installed stretching from the curb and gutter out into the vehicle travel lane or bike lane. This installation allows for cyclists riding along bike lanes, bike routes, and travel lanes with no bicycle facility to be counted, however, the tubes typically do not extend across sidewalks. The project team therefore collected sidewalk cycling counts during the peak period manual counts to support the development of a "sidewalk cycling factor" which could then be applied to the automated bicycle count data where sidewalk cycling information was not collected.

Image 5-1 displays a typical installation of the pneumatic tubes and count logger, and illustrates how the equipment is situated along the roadway rather than the sidewalk.

Sidewalk factors were developed using the manual peak period counts by measuring the number of cyclists observed riding on the sidewalk relative to those riding in the travel lane or bike lane.

Sidewalk factors were then applied to the automated count data collected to account for the fact that the automated equipment does not capture sidewalk cycling. Sidewalk factors were not applied to automated count sites located on separated bike paths, locations without sidewalks, or to the two specific locations where the tubes were purposefully placed along the sidewalks (Site ID 73 and 74).

Image 5-1: Installation of Pneumatic Tube Bicycle Counter in the Roadway Right-Of-Way



City of Glendale

MAG Bicycles Count:
6.0 How We Estimated Daily Bicycle Volumes from Peak Period Counts

This chapter outlines the approach used to grow the 2-hour peak period manual bicycle counts into estimated daily bicycle volumes using peak period percentages established from the continuous automated count data. Weekday and weekend peak period percentages were calculated from the automated count sites, and then applied to the peak period manual count stations.

Calculating Weekday and Weekend Peak Period Percentages

The average weekday peak period percentage of total daily bicycle travel was calculated using data collected from 37 of 44 automated count sites (7 count sites were excluded due to invalid count data described in the previous Chapter). The number of cyclists detected during each weekday peak period at each site was summed then divided by the total number of cyclists recorded on those weekdays. This approach was then replicated to calculate each individual automated count site's weekend peak period percentage. These calculations resulted in 37 weekend and weekday peak period percentages.

Table 6-1 shows summary statistics for peak period percentages for the weekday and weekend peak periods associated with the 37 automated count stations.

Table 6-1: Summary Statistics for Peak Period Percentages Calculated from Automated Count Stations

Summary of Statistic	Weekday Period (4pm-6pm) Percentage of Total Daily Bicycle Travel	Weekend Period (10am-12pm) Percentage of Total Daily Bicycle Travel
Mean	16.8%	17.8%
Median	16.5%	16.1%
Minimum Value	9.6%	8.3%
Maximum Value	28.6%	33.3%

Chart 6-1: Distribution of Weekday (4PM-6PM) Peak Period Percentages

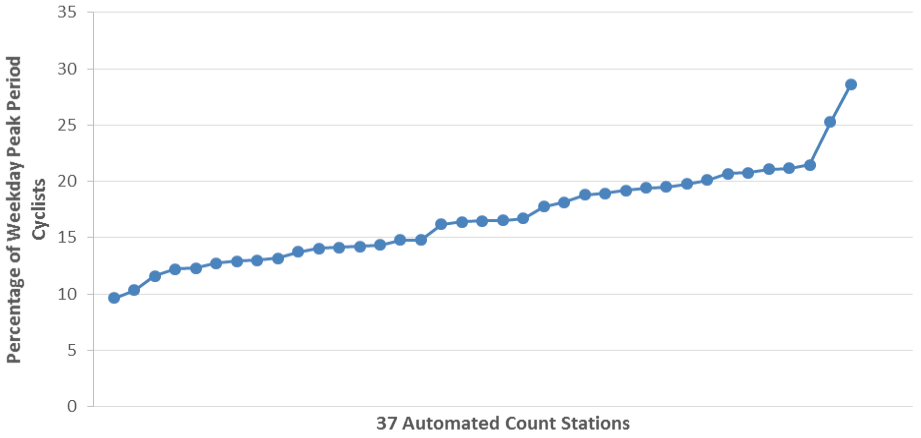
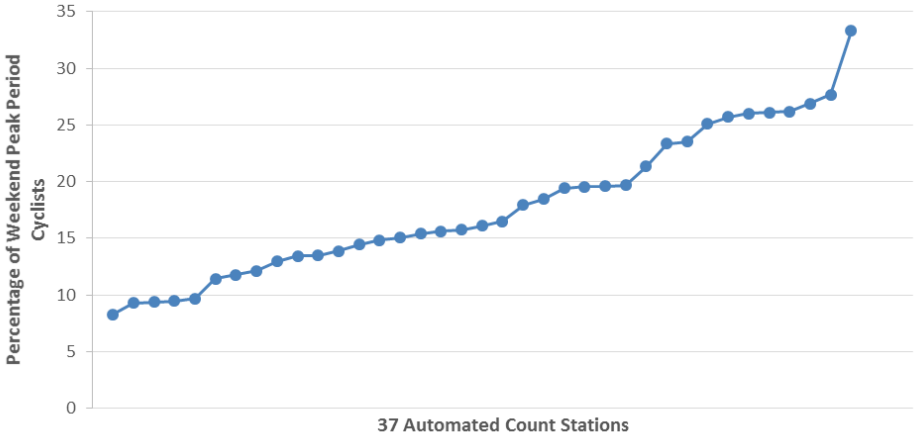


Chart 6-2: Distribution of Weekend (10AM-12PM) Peak Period Percentages



For comparison purposes, continuous automated bicycle count data collected over a six to twelve month period at 22 sites in San Diego County since February 2012 was assessed against the data from Maricopa County.

Table 6-2 shows the San Diego mean and median peak period percentages for weekdays and weekends along with those observed in Maricopa County. Interestingly, the San Diego and Maricopa County weekday peak period percentages are very similar, with the mean and median for both regions falling between 16% and 17%. The weekend mean and median show slightly greater differences between Maricopa County and San Diego County, with 21.2% in San Diego and between 16% and 17% in Maricopa County. Overall, the San Diego to Maricopa County comparison helps to validate the peak period percentages identified in Maricopa County, and builds support for using them, along with peak period manual counts, to develop average daily weekday and weekend bicycle volumes.

Table 6-2: Comparing Regional Weekday and Weekend Peak Period Percentages (San Diego and Maricopa Counties)

	22 sites in San Diego County	44 Sites in Maricopa County	Difference
Weekday Mean	16.5%	16.8%	0.3%
Weekday Median	16.2%	16.5%	0.3%
Weekend Mean	21.2%	17.8%	3.4%
Weekend Median	21.2%	16.1%	5.1%

Developing and Applying a Daily Factor to the Peak Period Bicycle Counts

The peak period percentages derived from the automated count data were applied to the manual peak period count using Equations 1 and 2, for the weekday and weekend peak periods, respectively. Solving for "x" in Equations 1 and 2 for each leg of each manual count station resulted in an average daily bicycle volume (ADB), for the weekday and weekend, respectively.

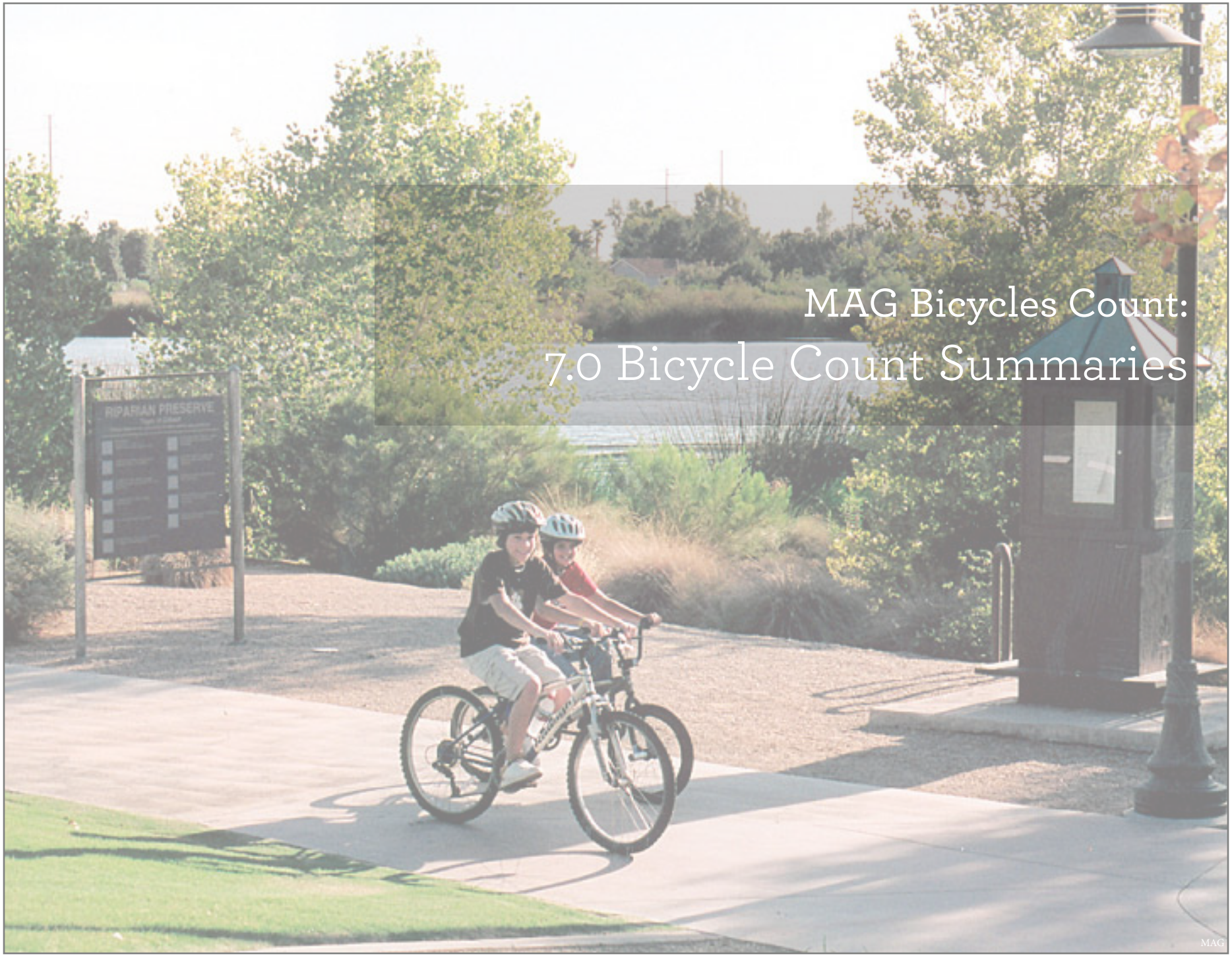
Equation 1:
$$\frac{\text{Weekday Peak Period Manual Count Volume}}{x} = \frac{16.8}{100}$$

Equation 2:
$$\frac{\text{Weekend Peak Period Manual Count Volume}}{y} = \frac{17.8}{100}$$

Where:

X = average daily weekday bicycle volume
Y = average daily weekend bicycle volume

this page is intentionally left blank



MAG Bicycles Count:
7.0 Bicycle Count Summaries

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

Bicycle Volumes by Day of Week

Automated Count Stations

Table 7-1 displays average daily weekday and weekend bicycle volumes for the automated count stations. The daily bicycle volumes are displayed for each direction of travel (east-west or north-south) and a sum of counts for both travel directions is provided. As mentioned in Chapter 5, automated count data for 7 count stations (Site IDs 6, 9, 17, 23, 60, 70, and 103) were eliminated due to irregularities in count data over the entire data collection period.

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

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

The count station with the greatest difference between average daily weekday and weekend cyclists was found at Site ID 119, where on average, 379 more cyclists were recorded on weekends than weekdays. Conversely, the count station with the smallest difference between average daily weekday and weekend cyclists was Site ID 113 along the Western Canal Bike Path, west of Hardy Drive in the City of Tempe, with an average of only two more daily weekend cyclists than weekday cyclists (89 weekend cyclists versus 87 weekday cyclists).

Table 7-2 summarizes average daily weekday and weekend bicycle volumes by facility type as collected via the automated counters. Categories of bicycle facility type include Bike Path, Bike Lane, or No Facility.

Coffman Studio

Table 7-1: Average Daily Bicycle Volumes From the Automated Count Stations

Automated Count Station ID	Count Location	Jurisdiction	Facility Type	Average Daily Bicycle Volume (Weekday)			Average Daily Bicycle Volume (Weekend)		
				NB/WB	SB/EB	Total	NB/WB	SB/EB	Total
1	107th Ave & Thomas Rd	Avondale	Bike Lane	198	290	488	170	188	358
10	Dobson Rd & Frye Rd	Chandler	Bike Lane	80	55	136	73	72	145
13	Dobson Rd & Western Canal Bike Path	Chandler	Bike Path	94	86	179	148	153	301
16	El Mirage Rd & Thunderbird Rd	El Mirage	No Facility	20	42	62	26	47	73
18	Greenfield Rd & Guadalupe Rd	Gilbert	Bike Lane	35	78	113	40	124	165
24	61st Ave & Maryland Ave	Glendale	No Facility	26	45	71	15	24	38
25	63rd Ave & Loop 101 Bike/Ped Bridge	Glendale	Bike Path	39	36	75	54	48	102
26	51st Ave & Thunderbird Paseo (Canal Path)	Glendale	Bike Path	15	15	29	18	18	36
35	Litchfield Rd & Camelback Rd	Litchfield Park	Bike Lane	12	24	36	6	13	19
39	Gavilan Peak Pkwy & Pioneer Rd	Unincorporated	Bike Lane	17	11	28	34	13	47
40	Ellsworth Rd & McLellan Rd	Mesa	Bike Lane	161	82	242	90	57	147
41	Gilbert Rd & University Dr	Mesa	Bike Lane	92	47	139	51	40	91
42	Eastern Canal Bike Path & University Dr	Mesa	Bike Lane	41	135	176	26	71	97
43	24th St & Southern Ave	Mesa	Bike Lane	268	75	342	288	43	331
46	Higley Rd & Southern Ave	Mesa	Bike Lane	71	84	155	47	77	124
54	83rd Ave & Thunderbird Rd	Peoria	Bike Lane	184	125	309	104	141	245
55	115th Ave & Happy Valley Parkway	Peoria	No Facility	56	22	78	11	16	27
58	New River Bike Path & Greenway Rd	Peoria	Bike Path	112	115	227	96	106	203
59	12th St & Hatcher Rd	Phoenix	No Facility	44	70	115	46	84	129
61	11th St & Jefferson St	Phoenix	No Facility	n/a	40	40	n/a	29	29
62	12th St & Arizona Canal Bike Path	Phoenix	Bike Path	n/a	n/a	131	n/a	n/a	251
63	Central Ave & Maryland Ave	Phoenix	Bike Lane	54	61	115	58	70	128
64	Bike Path parallel to SR-51 & Union Hills Dr	Phoenix	Bike Path	21	18	39	37	33	70
65	23rd Ave & Peoria Rd	Phoenix	Bike Lane	20	29	50	11	15	26
66	23rd Ave & Maryland Ave	Phoenix	Bike Lane	84	90	174	61	78	139
67	12th St & McDowell Rd	Average	Bike Lane	56	62	117	52	54	106
68	39th Ave & Grand Canal Bike Path	Phoenix	Bike Path	21	19	40	13	8	21
69	19th Ave & Deer Valley Rd	Phoenix	Bike Path	64	41	105	66	32	99

Table 7-1: Average Daily Bicycle Volumes From the Automated Count Stations (Continued)

Automated Count Station ID	Count Location	Jurisdiction	Facility Type	Average Daily Bicycle Volume(Weekday)			Average Daily Bicycle Volume (Weekday)		
				NB/WB	SB/EB	Total	NB/WB	SB/EB	Total
73	19th Ave & Northern Rd	Phoenix	No Facility	113	106	219	96	96	192
74	19th Ave & Glendale Ave	Phoenix	No Facility	124	147	271	110	131	241
98	12th St & Missouri Ave	Phoenix	Bike Lane	60	56	116	56	56	112
100	Sonoqui Wash Path & Chandler Heights Rd	Queen Creek	Bike Path	17	14	31	28	25	53
102	Indian Bend Wash Path north of McCormick Pkwy	Scottsdale	Bike Path	169	152	321	337	291	628
104	Scottsdale Road & Indian School Rd	Scottsdale	Bike Lane	84	62	146	105	66	170
113	Hardy Dr & Western Canal Bike Path	Tempe	Bike Path	44	43	87	43	45	89
115	Rural Rd & Western Canal Bike Path	Tempe	Bike Path	151	171	323	260	258	518
119	Rio Salado Downstream Dam Bridge	Tempe	Bike Path	223	257	480	422	437	859

Coffman Studio

Table 7-2: Summary of Average Daily Weekday and Weekend Bicycle Volumes for Automated Count Sites by Facility Type

Site ID	Count Location	Jurisdiction	Facility Type	Average Daily Weekday Volume	Average Daily Weekend Volume
13	Dobson Rd & Western Canal Bike Path	Chandler	Bike Path	179	301
25	63rd Ave & Loop 101 Bike/Ped Bridge	Glendale		75	102
26	51st Ave & Thunderbird Paseo (Canal Path)	Glendale		29	36
58	New River Bike Path & Greenway Rd	Peoria		227	203
62	12th St & Arizona Canal Bike Path	Phoenix		131	251
64	Bike Path parallel to SR-51 & Union Hills Dr	Phoenix		39	70
68	39th Ave & Grand Canal Bike Path	Phoenix		40	21
69	19th Ave & Deer Valley Rd	Phoenix		105	99
100	Sonoqui Wash Path & Chandler Heights Rd	Queen Creek		31	53
102	Indian Bend Wash Path north of McCormick Pkwy	Scottsdale		321	628
113	Hardy Dr & Western Canal Bike Path	Tempe		87	89
115	Rural Rd & Western Canal Bike Path	Tempe		323	518
119	Rio Salado Downstream Dam Bridge	Tempe		480	859
1	107th Ave & Thomas Rd	Avondale	Bike Lane	488	358
10	Dobson Rd & Frye Rd	Chandler		136	145
18	Greenfield Rd & Guadalupe Rd	Gilbert		113	165
35	Litchfield Rd & Camelback Rd	Litchfield Park		36	19
39	Gavilan Peak Pkwy & Pioneer Rd	Unincorporated		28	47
40	Ellsworth Rd & McLellan Rd	Mesa		242	147
41	Gilbert Rd & University Dr	Mesa		139	91
42	Eastern Canal Bike Path & University Dr	Mesa		176	97
43	24th St & Southern Ave	Mesa		342	331
46	Higley Rd & Southern Ave	Mesa		155	124
54	83rd Ave & Thunderbird Rd	Peoria		309	245
63	Central Ave & Maryland Ave	Phoenix		115	128
65	23rd Ave & Peoria Rd	Phoenix		50	26
66	23rd Ave & Maryland Ave	Phoenix		174	139
67	12th St & McDowell Rd	Phoenix		117	106
98	12th St & Missouri Ave	Phoenix		116	112

Table 7-2: Summary of Average Daily Weekday and Weekend Bicycle Volumes for Automated Count Sites by Facility Type (Continued)

Site ID	Count Location	Jurisdiction	Facility Type	Average Daily Weekday Volume	Average Daily Weekend Volume
104	Scottsdale Road & Indian School Rd	Scottsdale	Bike Lane	146	170
16	El Mirage Rd & Thunderbird Rd	El Mirage	No Bike Facility	62	73
24	61st Ave & Maryland Ave	Glendale		71	38
55	115th Ave & Happy Valley Parkway	Peoria		78	27
59	12th St & Hatcher Rd	Phoenix		115	129
61	11th St & Jefferson St	Phoenix		40	29
73	19th Ave & Northern Rd	Phoenix		219	192
74	19th Ave & Glendale Ave	Phoenix		271	241

Bike Path Volumes

- The lowest average daily weekday bicycle volume was 29 cyclists at Site ID 26, along the Thunderbird Paseo Canal Path, east of 51st Avenue in the City of Glendale.
- The highest average daily weekday volume was 480 cyclists at Site ID 119, along the Rio Salado Downstream Dam Bridge in the City of Tempe.
- The lowest average daily weekend volume was 21 cyclists at Site ID 68, along the Grand Canal Bike Path, east of 39th Avenue in the City of Phoenix.
- The highest average daily weekend bicycle volume was 859 cyclists at Site ID 119, along the Rio Salado Downstream Dam Bridge in the City of Tempe.

Bike Lane Volumes

- The lowest average daily weekday volume was 28 cyclists at Site ID 39, along Gavilan Peak Parkway, south of Pioneer Road in the unincorporated Maricopa County.
- The highest average daily weekday bicycle volume was 488 cyclists at Site ID 1, along 107th Avenue, south of Thomas Road in the City of Avondale.
- The lowest average daily weekend bicycle volume was 19 cyclists at Site ID 35, along Camelback Road, east of Litchfield Road in the City of Litchfield Park.
- The highest average daily weekend bicycle volume was 358 cyclists, also at Site ID 1, along 107th Avenue, south of Thomas Road in the City of Avondale.

Bicycle Volumes along Roadways without Bicycle Facility

- The lowest average daily weekday bicycle volume of 40 cyclists was at Site ID 61, along Jefferson Street, west of 11th Avenue in the City of Phoenix.
- The highest weekday volume of 271 cyclists was at Site ID 74, along Glendale Avenue, west of 19th Avenue in the City of Phoenix.
- Average daily weekend bicycle volumes were the lowest at Site ID 55, along Happy Valley Parkway, west of Agua Fria River in the City of Peoria, with 27 average daily weekend cyclists.
- The weekend maximum of 241 cyclists was at Site ID 74, along Glendale Avenue west of 19th Avenue in the City of Phoenix.

Figure 7-1 displays the average daily weekday bicycle volumes, while **Figure 7-2** displays the average daily weekend bicycle volumes for both automated and manual count sites. Volumes are displayed for each location using graduated color line segments extending approximately one-mile from the count site unless the roadway ends.

Charts 7-1 through **7-3** display average daily weekday and weekend bicycle volumes collected from the automated count stations by facility type for Bike Path, Bike Lane and No Facility sites, respectively.

Coffman Studio

Figure 7-1: Average Daily Weekday Bicycle Volumes for Automated and Manual Count Sites

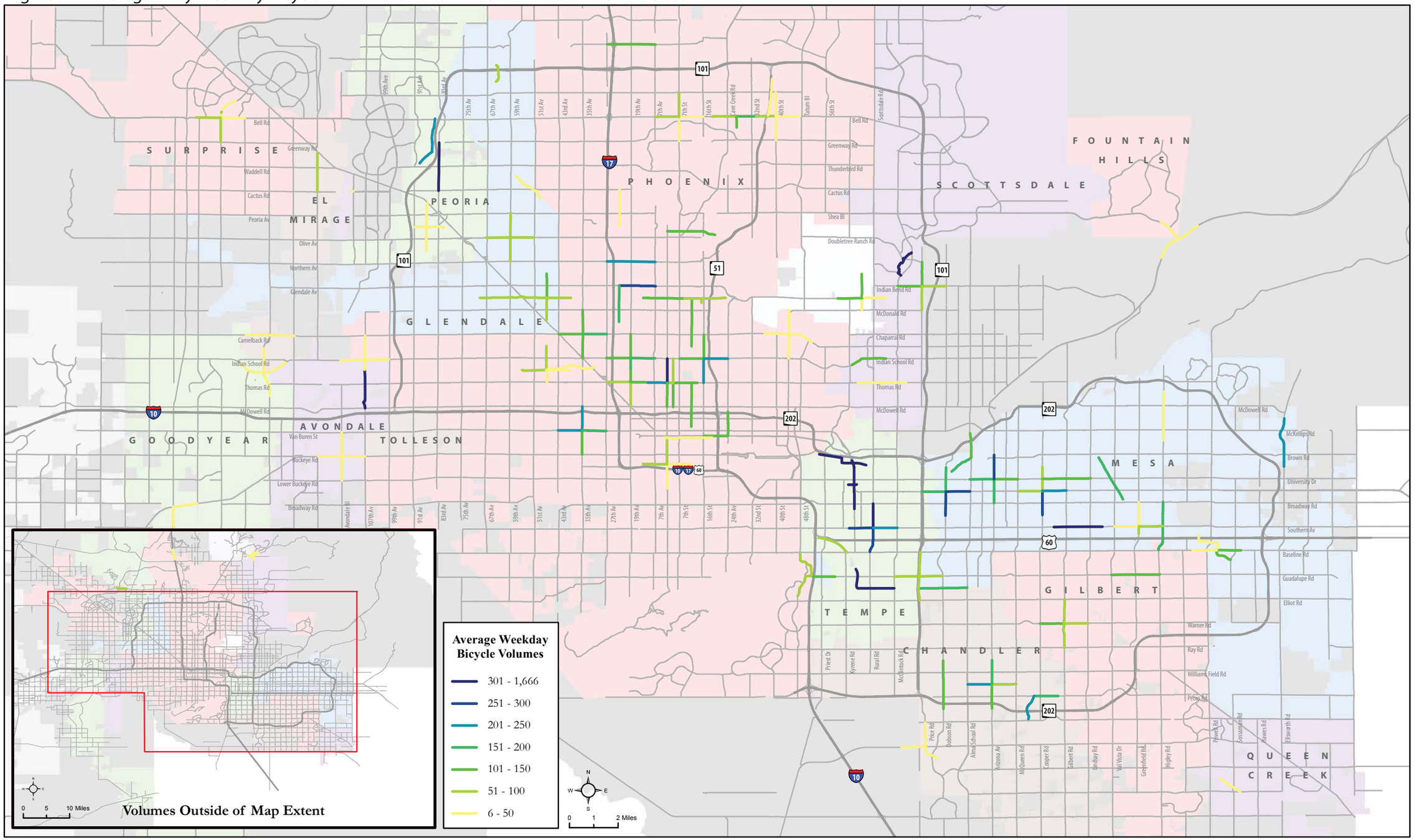


Figure 7-2: Average Daily Weekend Bicycle Volumes for Automated and Manual Count Sites

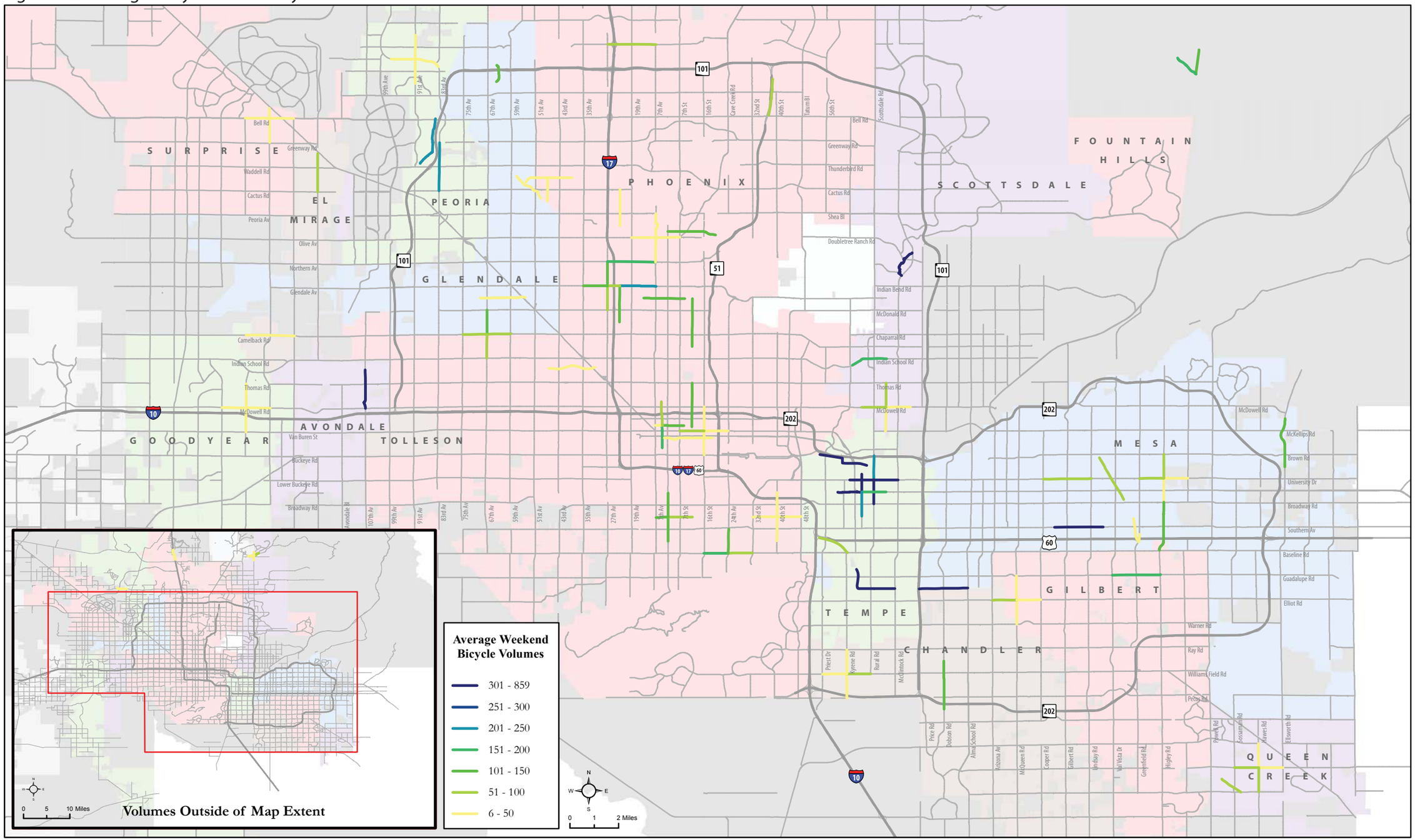


Chart 7-1: Average Daily Automated Count Site Bicycle Volumes for Weekdays & Weekends along Bike Paths

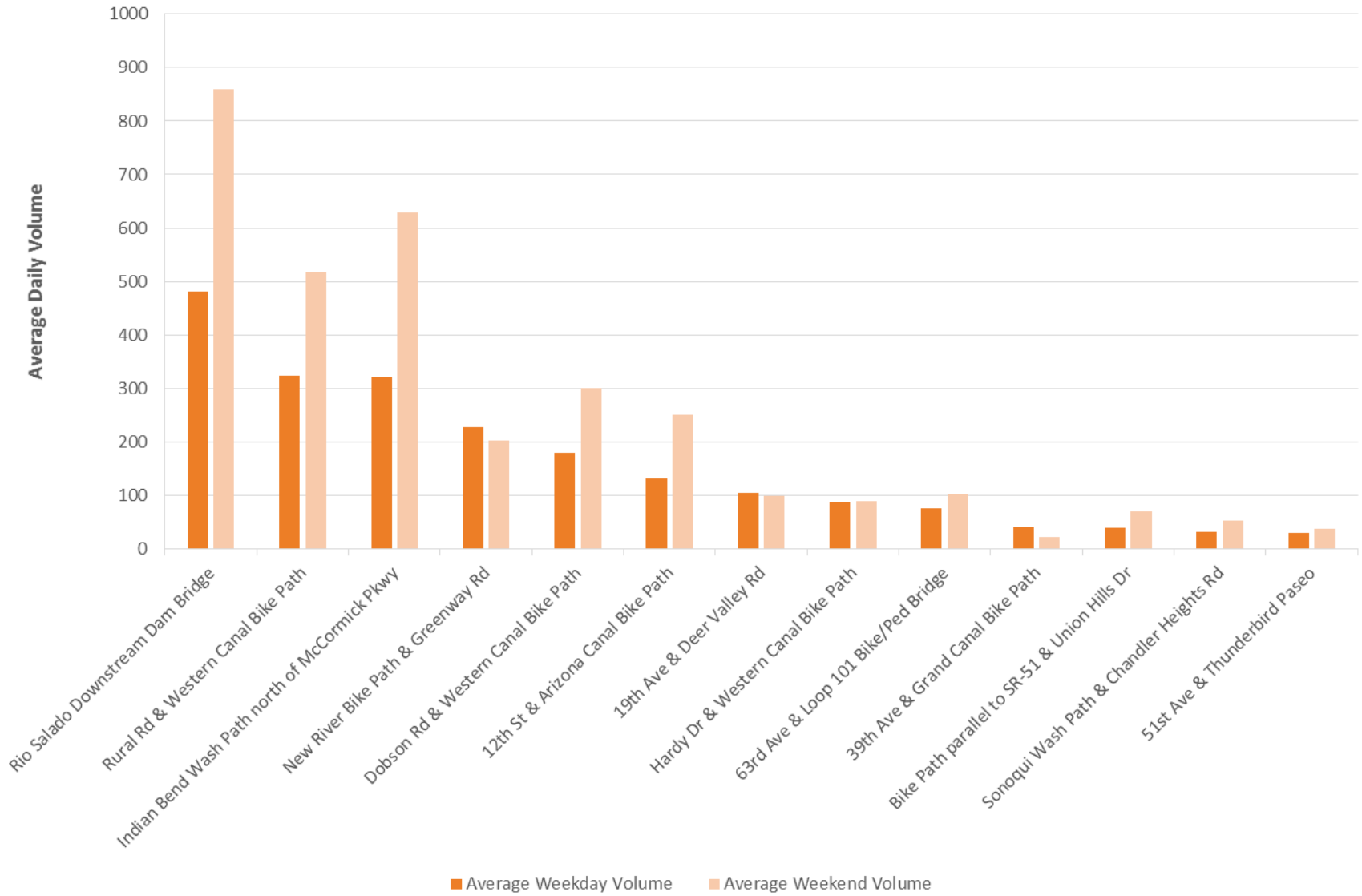


Chart 7-2: Average Daily Automated Count Site Bicycle Volumes for Weekdays & Weekends along Bike Lanes

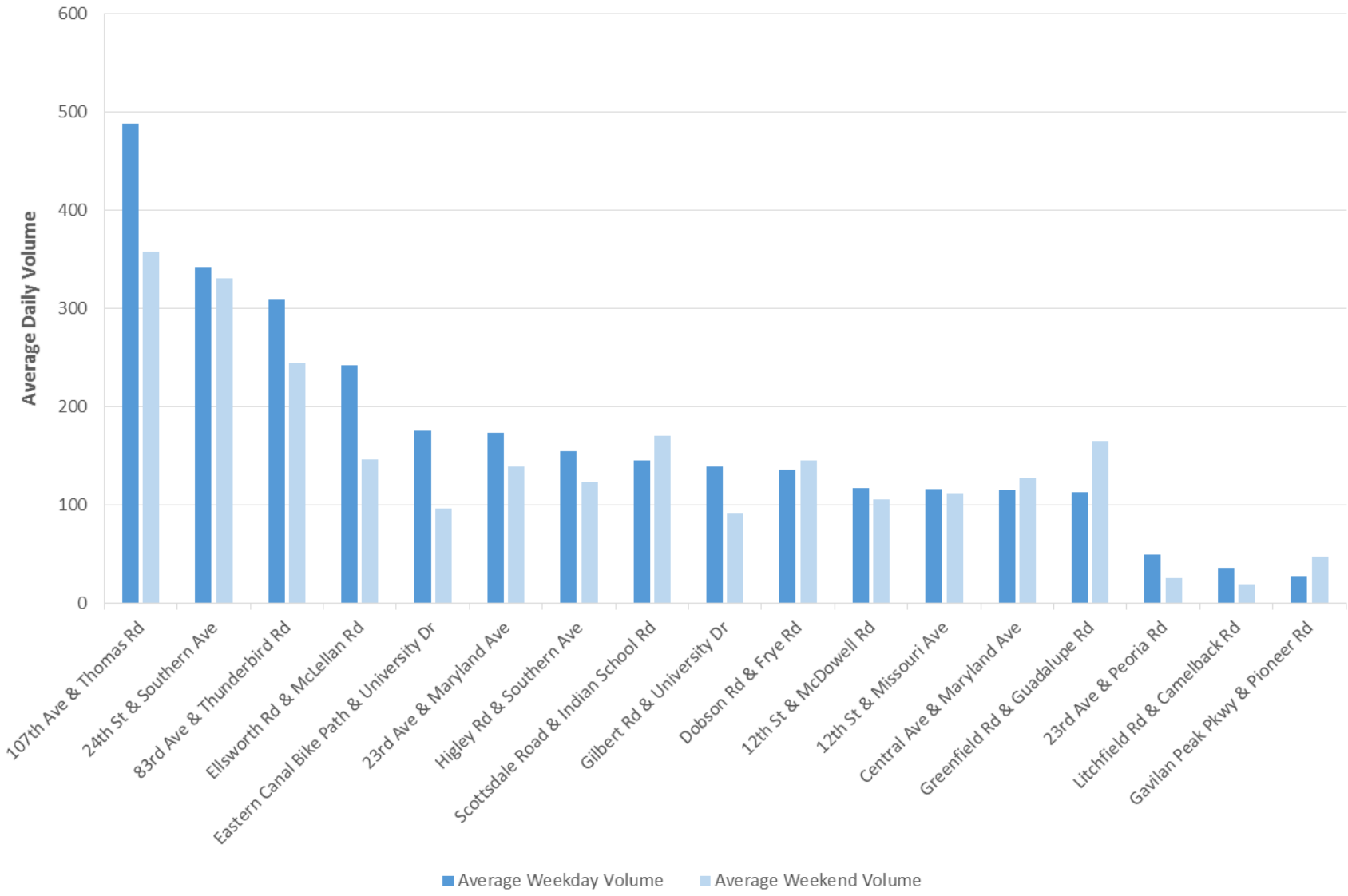
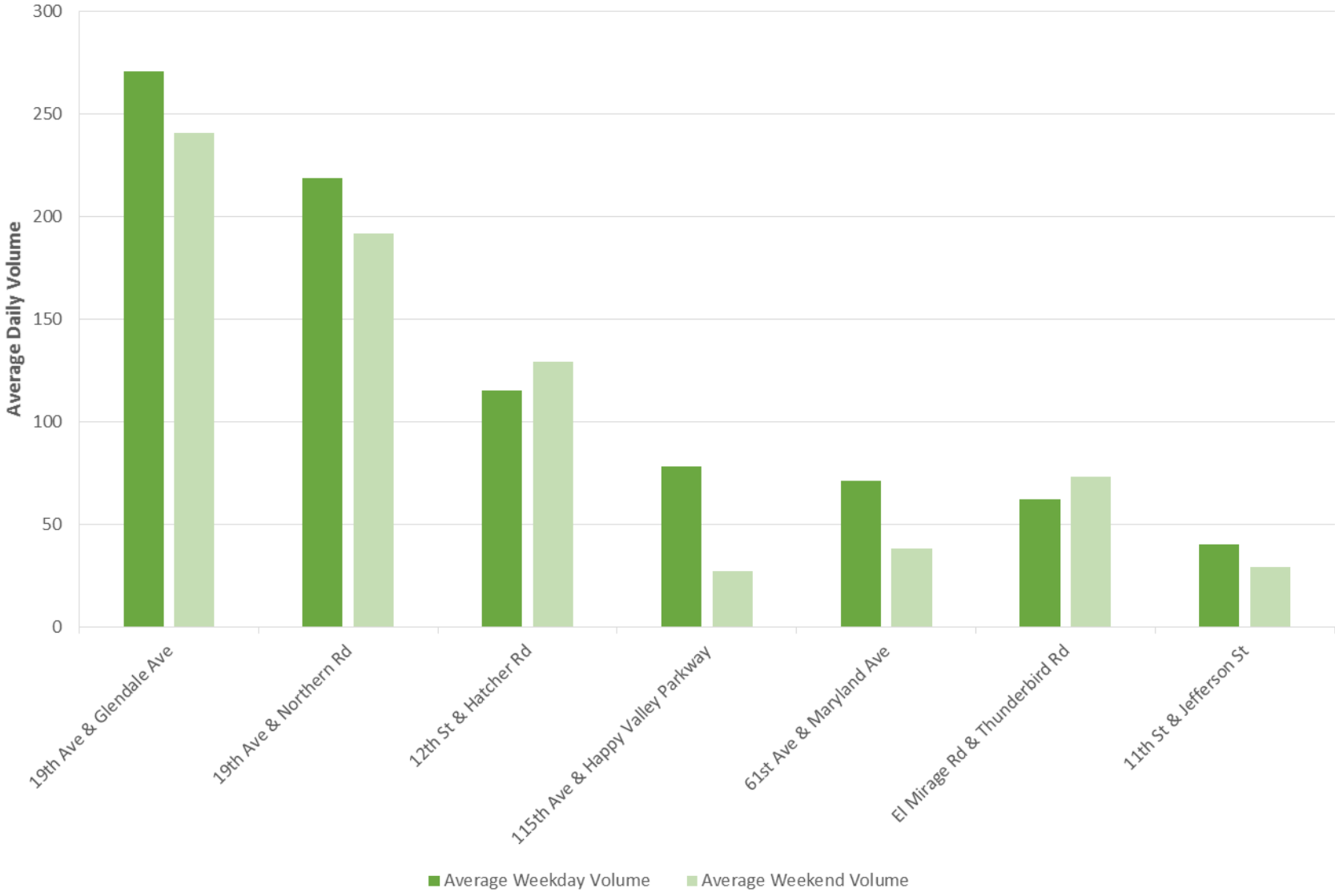


Chart 7-3: Average Daily Automated Count Site Bicycle Volumes for Weekdays & Weekends along Roadways without Bicycle Facility



As shown in **Chart 7-1**, in about eight of twelve total sites where counts were collected along bike paths, average daily weekend bicycle volumes were higher than average daily weekday bicycle volumes. Conversely, twelve of seventeen locations where automated counts were collected along bike lanes showed higher weekday versus weekend average daily bicycle volumes. For count stations with no facility locations, five of seven sites showed higher weekday versus weekend average daily bicycle volumes.

These findings reflect the fact that bike paths are used more frequently overall. The findings may also indicate that utilitarian bicycle trips are more constrained in terms of destination and route choice; therefore bike lanes and roadways without facilities have higher rates of cycling on weekdays, when the destination and route choice is less flexible, compared to weekends.

Chart 7-4 displays the average daily weekday bicycle volumes for all automated count sites by facility type, sorted from highest volume to lowest volume, while **Chart 7-5** displays the average daily weekend bicycle volumes by facility type, also sorted from highest to lowest volume.

Chart 7-6 provides a side-by-side comparison of average daily bicycle volumes for weekdays and weekends by facility type. Bike path volumes tend to be higher overall, followed by bicycle volumes on bike lanes, followed by roadways with no facility.

Coffman Studio

Chart 7-4: Average Daily Automated Count Site Weekday Bicycle Volumes

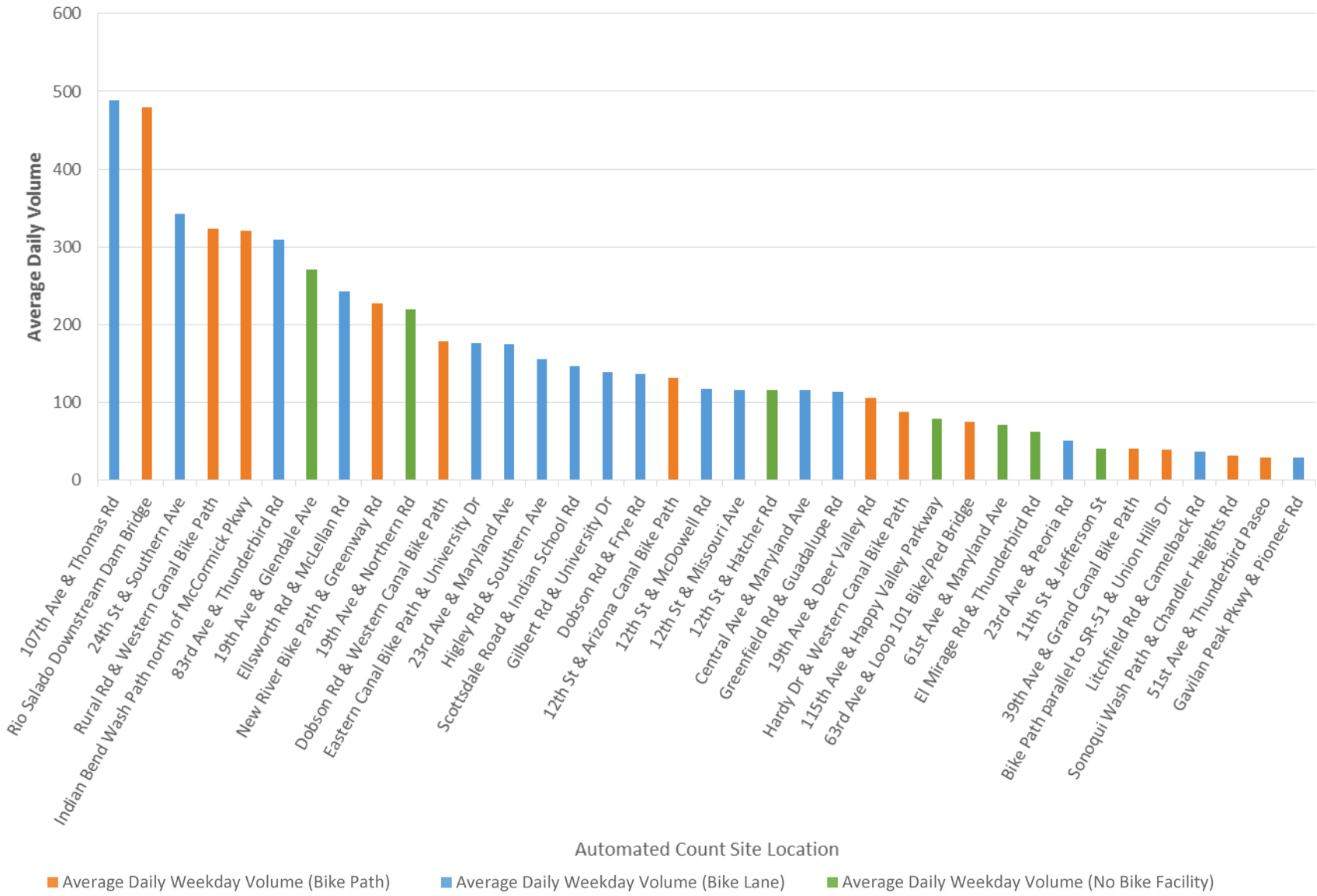


Chart 7-5: Average Daily Automated Count Site Weekend Bicycle Volumes

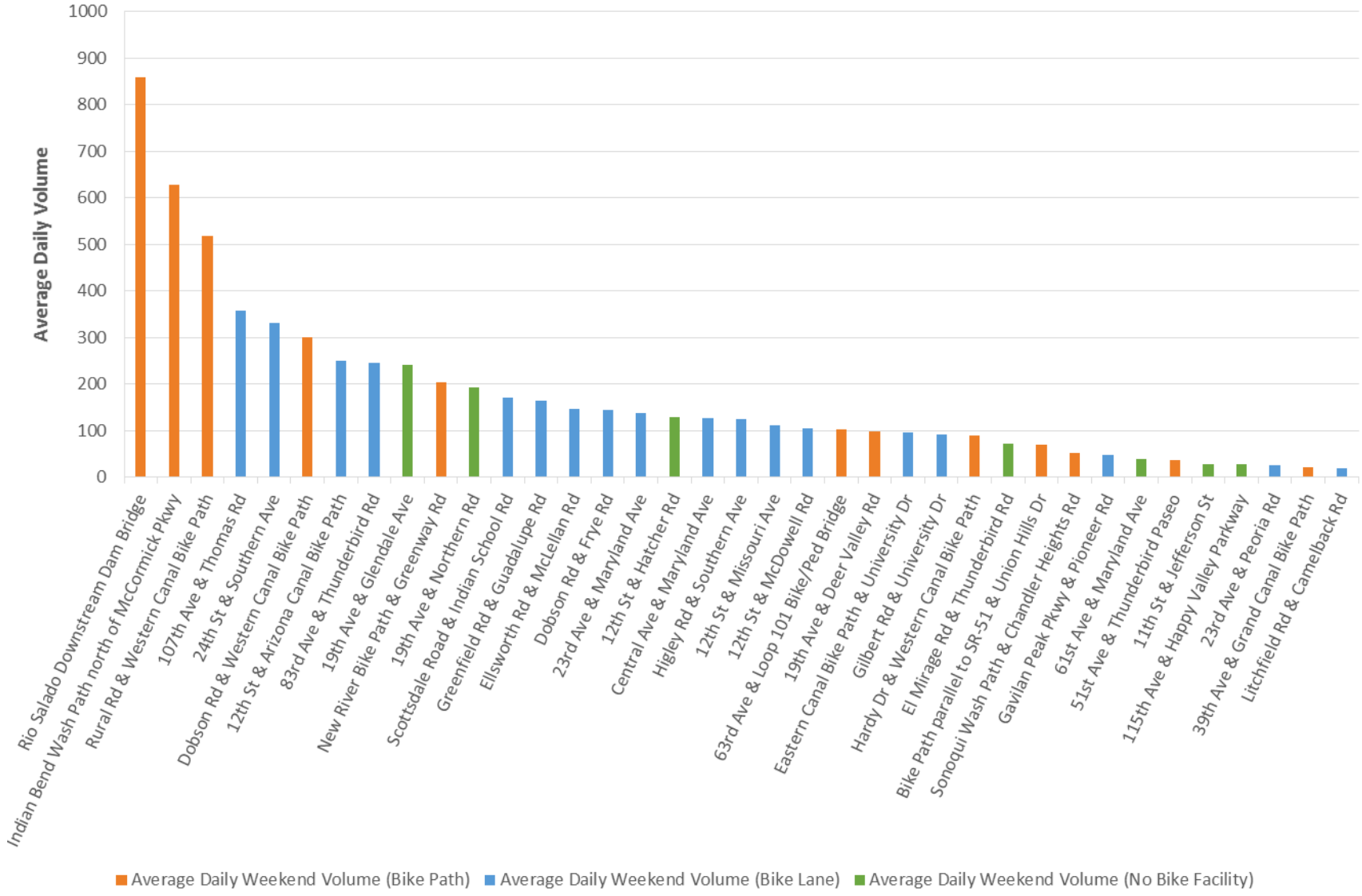


Chart 7-6: Average Daily Automated Count Site Bicycle Volumes for Weekdays & Weekends by Facility Type

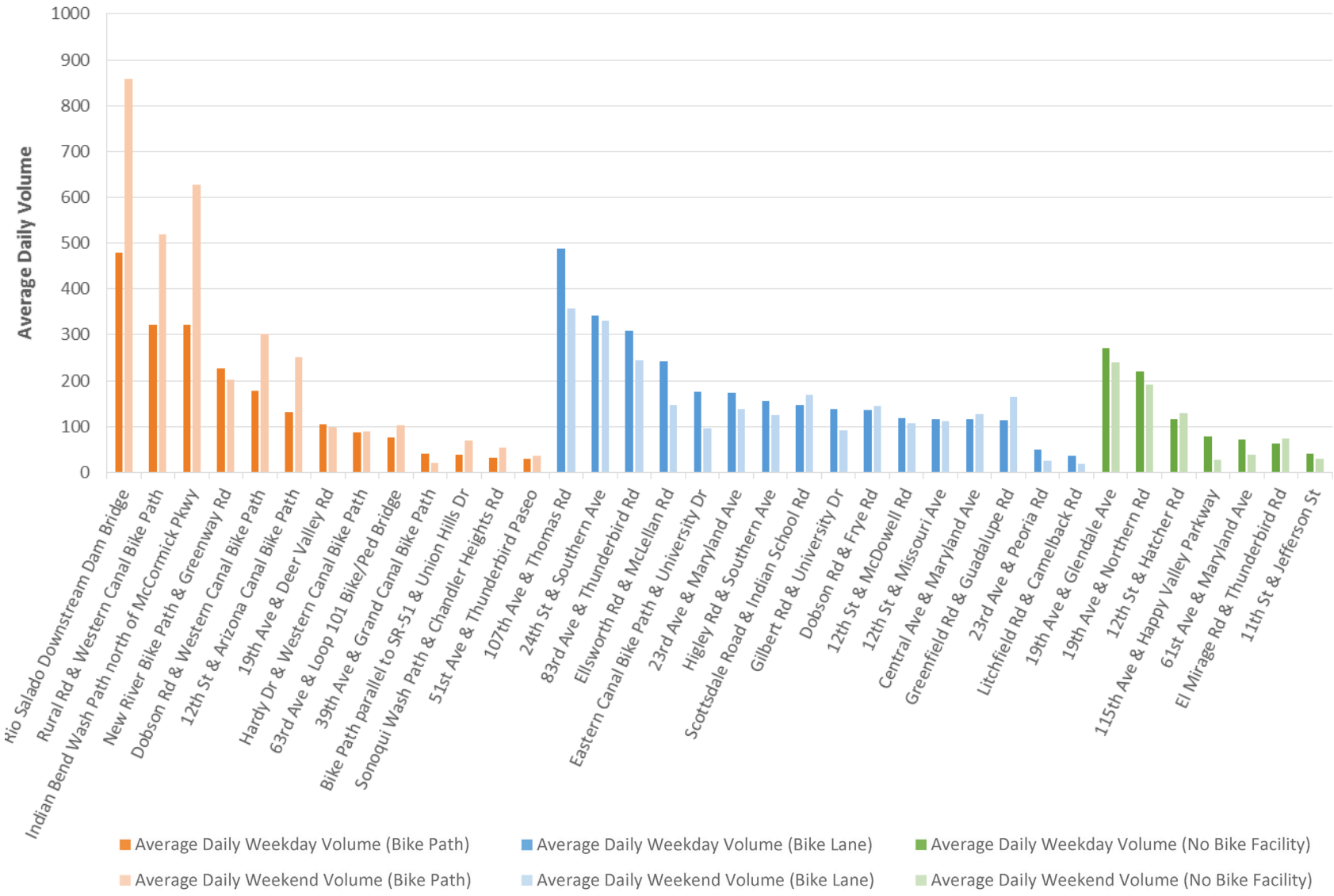


Table 7-3 displays estimated daily weekday bicycle volumes at manual count stations. As described in Chapter 4, manual bicycle counting occurred at 84 of 128 count sites during a 2-hour peak period, either on a weekday from 4PM – 6PM, or on a weekend from 10AM – 12PM. These peak period counts were expanded into daily estimates using the daily factors developed from the automated count data, as described in Section 6.2.

Table 7-4 displays estimated daily bicycle volumes at manual count stations for weekends. The estimated daily weekday volumes range from a minimum of 6 cyclists, observed at Site ID 34 (at the Cotton Lane & MC 85 intersection in the City of Goodyear), to a maximum of 2,244 cyclists at Site ID 114 (at the Mill Avenue and 10th Street intersection in the City of Tempe).

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

Table 7-3: Daily Estimated Weekday Bicycle Volumes at Manual Count Stations

Manual Count Station ID	Count Location	North Leg of Intersection	South Leg of Intersection	East Leg of Intersection	West Leg of Intersection	Total Daily Estimated Bicycle Volume at the Intersection[1]
2	107th Ave & Indian School Rd	36	30	24	18	54
3	Avondale Blvd & Buckeye Rd	42	18	12	36	54
5	N Tom Darlington Dr & E Cave Creek Rd	6	24	18	18	33
8	N Cave Creek Rd & E New River Rd	18	24	0	6	24
11	Arizona Ave & Frye Rd	173	113	95	250	316
12	Chandler Paseo Trail & Pecos Rd	0	232	167	0	200
14	Price Rd & Queen Creek Rd	30	12	0	18	30
20	Gilbert Rd & Warner Rd	90	96	66	125	189
22	Greenfield Rd & Eastern Canal	30	72	202	102	203
28	59th Ave & Olive Ave	78	84	78	90	165
29	47th Ave & Maryland Ave	119	78	54	96	174
30	83rd Ave & New River Bike Path	190	78	54	96	174
31	47th Ave & Arizona Canal Bike Path	18	185	328	387	459
32	Litchfield Road & Indian School Road	24	24	30	30	54
34	Cotton Lane & MC 85	0	6	6	0	6
36	7th St & Carefree Highway	6	12	6	0	12
37	243rd Ave & Sun Valley Parkway	6	84	89	0	90
44	Country Club Dr & University Dr	286	184	148	178	398
45	Stapley Dr & Main St	96	274	214	90	337
48	Alma School Rd & Tempe Canal Bike Path	143	0	0	155	149

Table 7-3: Daily Estimated Weekday Bicycle Volumes at Manual Count Stations (Continued)

Manual Count Station ID	Count Location	North Leg of Intersection	South Leg of Intersection	East Leg of Intersection	West Leg of Intersection	Total Daily Estimated Bicycle Volume at the Intersection[1]
49	Dobson Rd & Main St	166	256	274	190	443
50	Greenfield Rd & Southern Ave	36	84	96	48	132
53	Higley Rd & Hermosa Vista Dr	36	6	0	30	36
57	87th Ave & Mountain View Rd	18	18	6	24	33
71	47th Ave & Osborn Rd	90	42	36	72	120
72	75th Ave & Thomas Rd	60	36	6	30	66
75	27th Ave & Bell Rd	0	148	172	60	190
77	35th Ave & Camelback Rd	125	119	160	131	268
78	16th St & Indian School Rd	107	214	220	137	339
81	35th Ave & Van Buren St	250	143	160	238	396
82	44th St & Camelback Rd	36	36	24	42	69
83	7th St & Bell Rd	84	30	42	72	114
86	Central Ave & Mohave St	78	36	12	54	90
87	19th Ave & Indian School Rd	108	155	178	107	274
88	3rd Street &Thomas Rd	90	119	131	78	209
89	19th Ave & Thomas Rd	119	72	108	84	192
91	Central Ave & Thomas Rd	316	142	184	238	440
93	40th St & Bell Rd	42	48	48	54	96
95	Northern Ave & Bike Path south of SR-51	0	0	71	48	60
96	15th Ave & Maryland Ave	84	54	54	95	144
97	48th St & Guadalupe Rd	54	90	107	0	126
99	24th St & Washington St	143	0	0	131	137
105	Pima Rd & Indian Bend Road	131	66	72	137	203
106	Mountain View Rd & Via Linda	24	18	20	196	223
108	Indian Bend Wash Path & Indian School Rd	226	345	0	0	286
110	Reems Rd & Bell Rd	36	89	36	90	126
111	Reems Rd & Grand Ave	24	18	18	12	36
114	Mill Ave & 10th St	608	1,666	1,500	714	2,244
117	Rural Rd & Southern	310	285	250	274	560

Table 7-3: Daily Estimated Weekday Bicycle Volumes at Manual Count Stations (Continued)

Manual Count Station ID	Count Location	North Leg of Intersection	South Leg of Intersection	East Leg of Intersection	West Leg of Intersection	Total Daily Estimated Bicycle Volume at the Intersection[1]
118	SR-101 & Guadalupe Rd	54	54	66	54	114
120	111 Ave & Youngtown Ave	0	0	18	12	15
123	Beeline Highway & Shea Blvd	12	0	6	6	12
124	Mockingbird Lane & Lincoln Drive	149	6	12	149	158
126	Main Street & Butte Ave	18	0	0	12	15
127	SR-85 & Martin Ave	0	6	6	0	6

1. Total Daily Estimated Bicycle Volume at the Intersection was calculated by adding all volumes along the intersection legs and dividing by 2

Coffman Studio

Table 7-4: Daily Estimated Weekend Bicycle Volumes at Manual Count Stations

Manual Count Station ID	Count Location	North Leg of Intersection	South Leg of Intersection	East leg of Intersection	West Leg of Intersection	Total Daily Estimated Bicycle Volume at the Intersection[1]
4	7th St & Monroe Avenue	23	39	22	6	45
7	N Schoolhouse Rd & E Cave Creek Rd	0	12	151	141	152
15	Kyrene Rd & West Chandler Blvd	28	39	51	50	84
19	Consolidated Canal & Western Powerline	62	96	326	415	450
21	McQueen Rd & Elliott	50	33	39	56	89
27	67th Ave & Camelback Rd	101	73	90	61	163
33	Bullard Ave & McDowell Rd	39	11	11	39	50
38	McDowell Mountain Rd & McDowell Mountain Park Dr	129	0	23	151	152
47	Superstition Springs Blvd & Baseline Rd	22	113	112	22	135
51	Greenfield Rd & Eastern Canal 2	22	0	0	45	34
52	Higley Rd & University Dr	62	17	39	84	101
56	91st Ave & Lake Pleasant Pkwy	12	23	17	6	29
76	3rd Ave & Fillmore St	73	158	129	17	189
79	24th St & Baseline Rd	124	118	61	157	230
80	Central Ave & Roeser Rd	130	101	73	101	203
84	27th Ave & Glendale Ave	101	79	67	101	174
85	7th Ave & Dunlap Ave	34	28	12	17	46
90	40th St & Roeser Rd	12	6	6	12	18
92	16th St & Van Buren St	34	40	45	56	88
94	47th Ave & Sweetwater Ave	0	34	34	22	45
101	Hawes Rd & Ocotillo Rd	45	56	23	56	90
107	Miller Rd & McDowell Rd	73	17	17	62	85
109	Litchfield Rd & Bell Rd	17	23	23	17	40
112	College Ave & Apache	438	247	185	567	719
116	Rural Rd & University Dr	248	416	421	304	695
121	Winchester Rd & Old West Highway	6	39	56	34	68
125	El Pueblo Blvd & Grande Blvd	23	34	0	11	34
128	SR-347 & Union Pacific Railroad (South of W Maricopa-Casa Grande Hwy)	28	0	0	28	28

1. Total Daily Estimated Bicycle Volume at the Intersection was calculated by adding all volumes along the intersection legs and dividing by 2

Using Temporal Patterns to Understand Bicycle Trip Purposes

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

Hour of Day Bicycle Travel

Chart 7-7 displays the average hourly weekday bicycle volumes by facility type for Bike Path, Bike Lane and No Facility as collected at automated count stations. Both morning and evening peaks are visible for each facility type. The two peaks are more prominent at count stations along Bike Paths and Bike Lanes as compared to roadways without bicycle facilities. However, peaking is still noticeable at stations along roadways without bicycle facilities. Across each of the three facility types the highest average hourly weekday bicycle volume occurred between 5PM and 6PM, with 18 cyclists per hour.

Chart 7-8 displays the average hourly weekend bicycle volumes by facility type. A 10AM peak is visible for both Bike Paths and Bike Lanes, while roadways without bicycle facility experienced an 11AM weekend peak. An additional weekend peak also appears to occur along each of the three facility types around 4PM or 5PM.

Chart 7-7: Average Hourly Weekday Bicycle Volumes by Facility Type

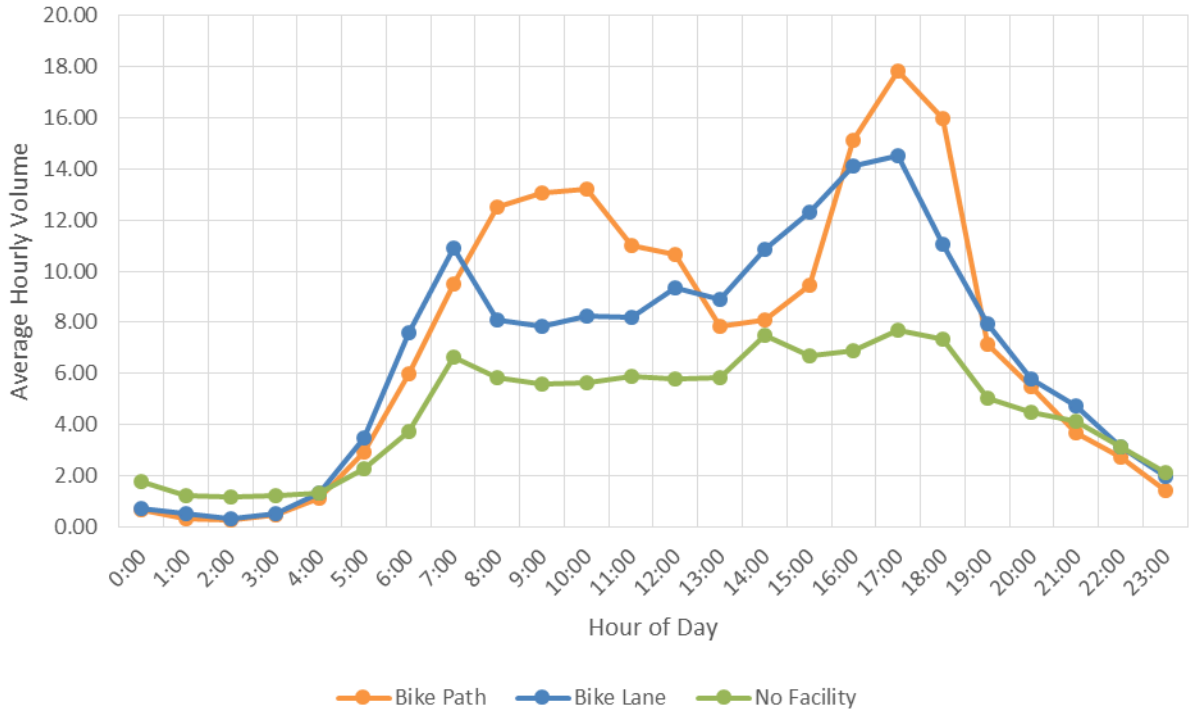
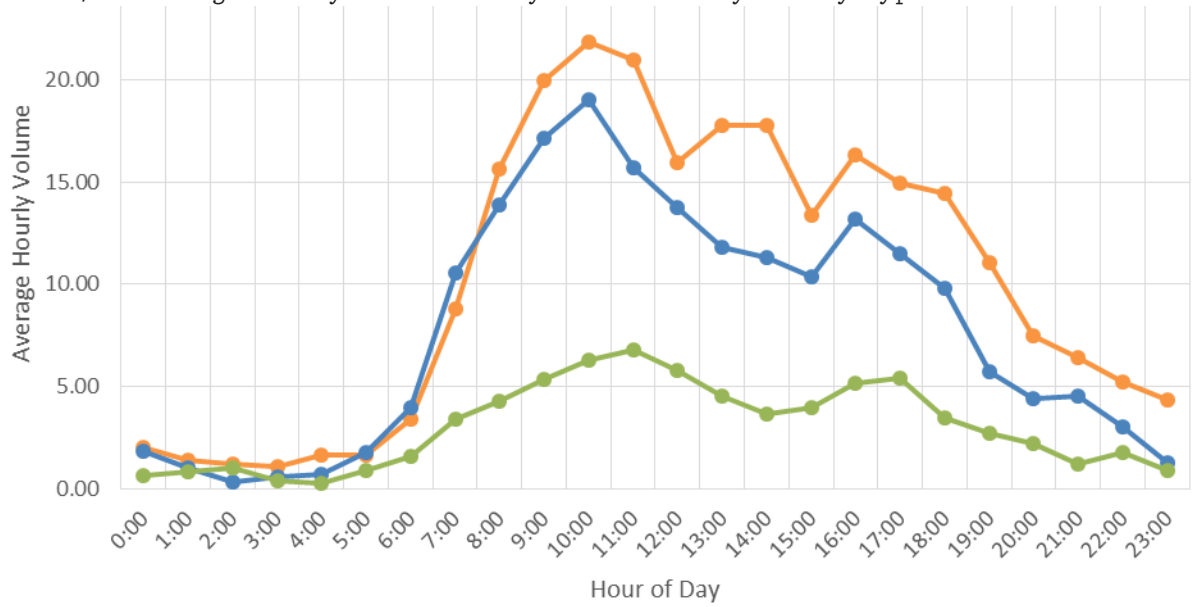


Chart 7-8: Average Hourly Weekend Bicycle Volumes by Facility Type



Day of Week Bicycle Travel

Table 7-5 presents daily bicycle volumes for each day of the week for the automated count stations. The average daily bicycle volume by day of week ranged from a low of 155 on Wednesday to a high of 180 on Saturday.

Chart 7-9 summarizes the automated count volumes by day of week by facility type to better understand trends in travel patterns along Bike Paths, Bike Lanes and roadways without bicycle facility. As shown, the highest activity day of the week for Bike Paths is Sunday, with over 274 average daily cyclists. The highest activity day of the week along Bike Lanes is Thursday, with 179 average daily cyclists (followed closely by Fridays at 178 average daily cyclists). For roadways without facilities, Fridays show the highest average daily cyclists, with 126 cyclists.

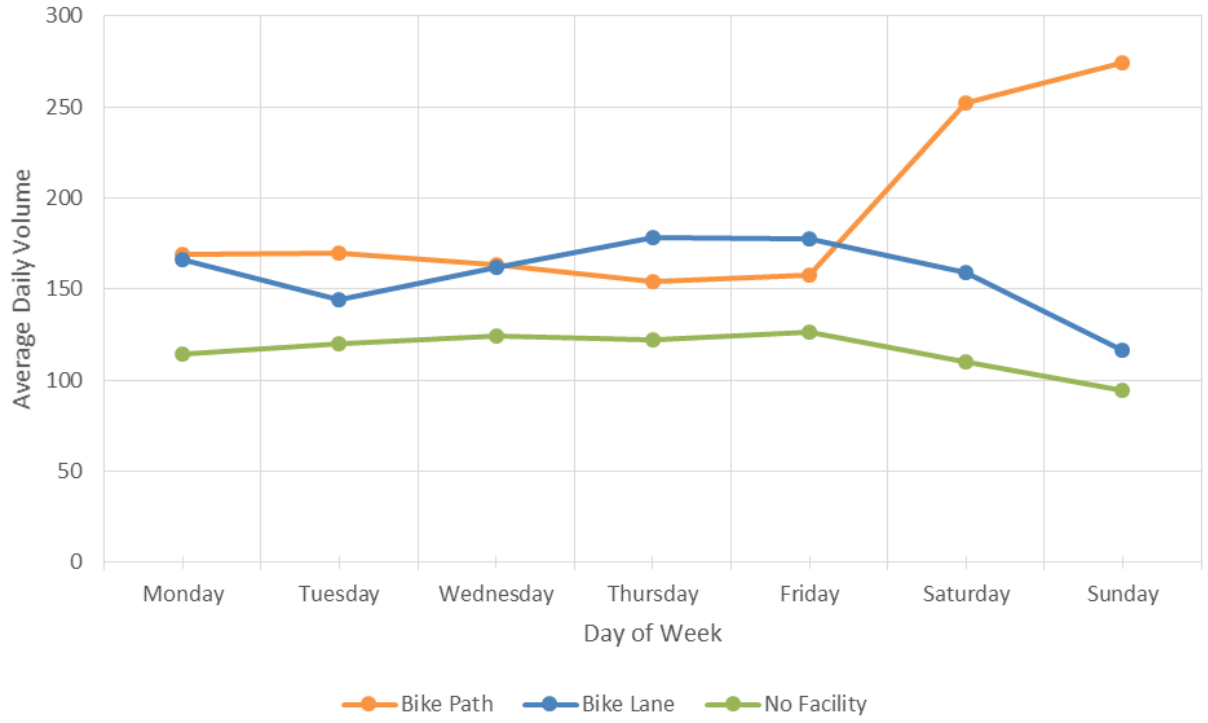
Table 7-5: Average Daily Bicycle Volumes by Day of Week at Automated Count Stations

Site ID	Count Location	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
59	12th St & Hatcher Rd	72	123	119	125	113	141	107
39	Gavilan Peak Pkwy & Pioneer Rd	29	39	19	28	24	49	43
62	12th St & Arizona Canal Bike Path	117	91	119	119	141	234	251
63	Central Ave & Maryland Ave	108	136	110	98	117	117	148
64	Bike Path parallel to SR-51 & Union Hills Dr	36	44	28	37	50	79	54
65	23rd Ave & Peoria Rd	42	55	51	44	52	32	15
66	23rd Ave & Maryland Ave	169	185	191	182	139	141	134
69	19th Ave & Deer Valley Rd	225	69	90	92	110	98	100
73	19th Ave & Northern Rd	214	208	212	199	258	211	156
74	19th Ave & Glendale Ave	236	264	264	285	287	242	239
98	12th St & Missouri Ave	73	124	119	121	120	130	74
10	Dobson Rd & Frye Rd	157	79	115	178	158	146	143
61	11th St & Jefferson St	37	41	39	34	46	29	30
67	12th St & McDowell Rd	112	95	122	138	117	123	73
102	Indian Bend Wash Path north of McCormick Pkwy	331	329	301	318	332	615	655
104	Scottsdale Road & Indian School Rd	143	66	127	200	192	174	164
113	Hardy Dr & Western Canal Bike Path	72	103	98	67	84	94	79
119	Rio Salado Downstream Dam Bridge	505	522	486	425	476	855	867
13	Dobson Rd & Western Canal Bike Path	187	202	154	186	172	265	375
18	Greenfield Rd & Guadalupe Rd	159	87	105	112	124	142	209
40	Ellsworth Rd & McLellan Rd	159	254	295	231	229	192	58
41	Gilbert Rd & University Dr	114	123	159	167	117	110	54
42	Eastern Canal Bike Path & University Dr	141	183	186	176	179	105	81
43	24th St & Southern Ave	376	255	365	391	341	357	277
46	Higley Rd & Southern Ave	144	170	162	137	155	150	73

Table 7-5: Average Daily Bicycle Volumes by Day of Week at Automated Count Stations (Continued)

Site ID	Count Location	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
100	Sonoqui Wash Path & Chandler Heights Rd	54	30	27	24	32	54	52
115	Rural Rd & Western Canal Bike Path	283	340	355	313	304	491	573
1	107th Ave & Thomas Rd	482	329	325	535	767	511	206
16	El Mirage Rd & Thunderbird Rd	73	44	86	66	48	72	74
24	61st Ave & Maryland Ave	87	75	71	60	69	43	34
25	63rd Ave & Loop 101 Bike/Ped Bridge	92	80	85	81	48	104	99
26	51st Ave & Thunderbird Paseo (Canal Path)	40	15	40	25	16	35	38
35	Litchfield Rd & Camelback Rd	40	31	33	50	30	25	13
54	83rd Ave & Thunderbird Rd	317	321	346	334	230	261	230
55	115th Ave & Happy Valley Parkway	81	86	77	87	62	32	22
58	New River Bike Path & Greenway Rd	278	234	231	209	209	185	220
68	39th Ave & Grand Canal Bike Path	38	48	39	43	30	18	25
	Average	157	148	155	160	161	180	163

Chart 7-9: Average Daily Bicycle Volumes by Day of Week and Facility Type



Based on the analyses throughout this section, there appears to be consistent use of all three facility types, Bike Path, Bike Lanes, and roadways with no facility, for both Commuting and Recreational trips. Each facility type displayed noticeable peaks during weekday mornings and evenings, potentially due to bicycle commuters going to and from work or school.

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

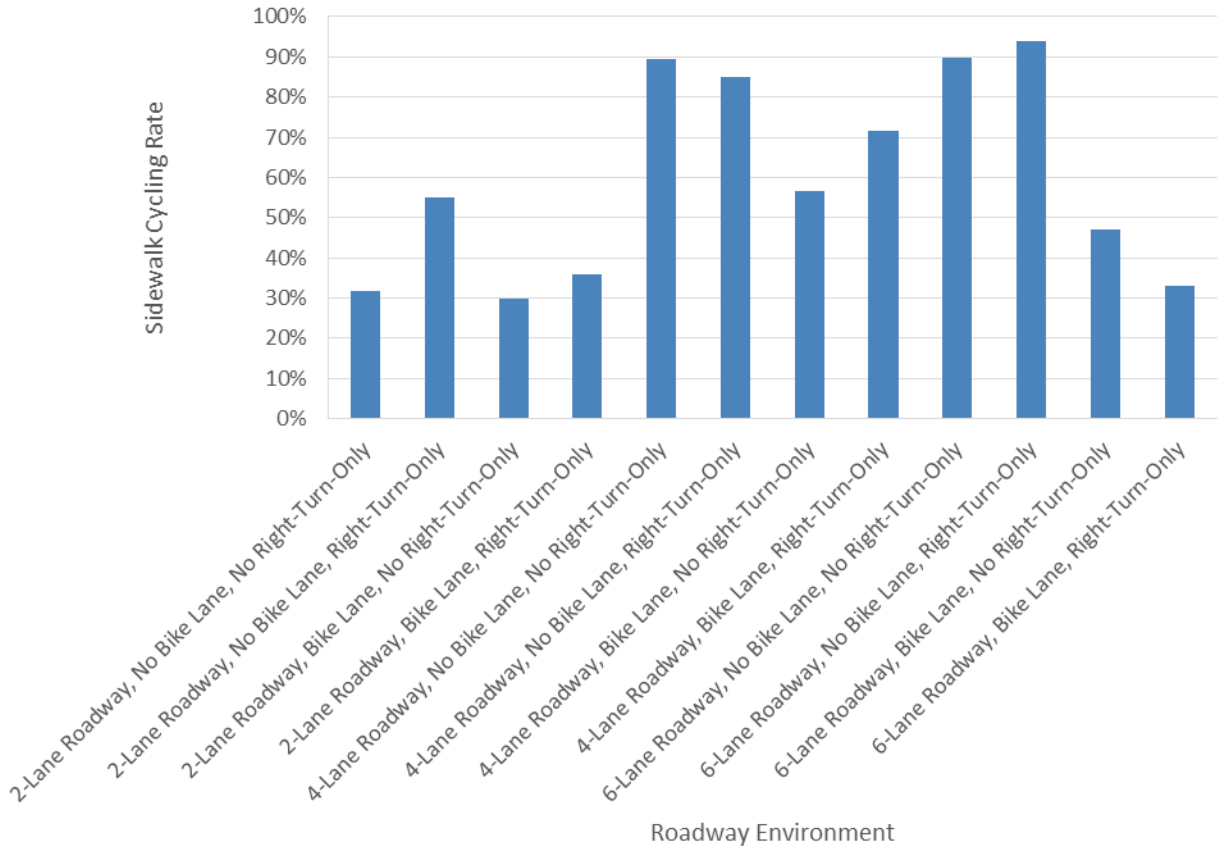
Sidewalk Cycling

Sidewalk cycling rates are a potential indicator of cyclist comfort or perception of cycling safety along a roadway. As described in Chapter 5, sidewalk cycling rates were developed to compensate for cyclists riding on the sidewalk and likely not counted by the automated counters. The number of cyclists riding on the sidewalk or roadway was recorded during the manual count phase and enabled the project team to assign rates of sidewalk cycling by different roadway environments.

Chart 7-10 displays the rates of sidewalk cycling associated with twelve roadway types distinguishing intersection approaches by number of lanes, presence of a bike lane, and presence of a right-turn-only lane. The roadway environment showing the highest rate of sidewalk cycling (94.0%) was found along a 6-lane roadway without bike lanes and with a right-turn-only lane. Conversely, the lowest sidewalk cycling rate (29.7%) was found along a 2-lane roadway, with bike lanes and no right-turn-only lane.

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

Chart 7-10: Rates of Sidewalk Cycling by Roadway Environment



Comparing Cycling in Maricopa County with Other Regions

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

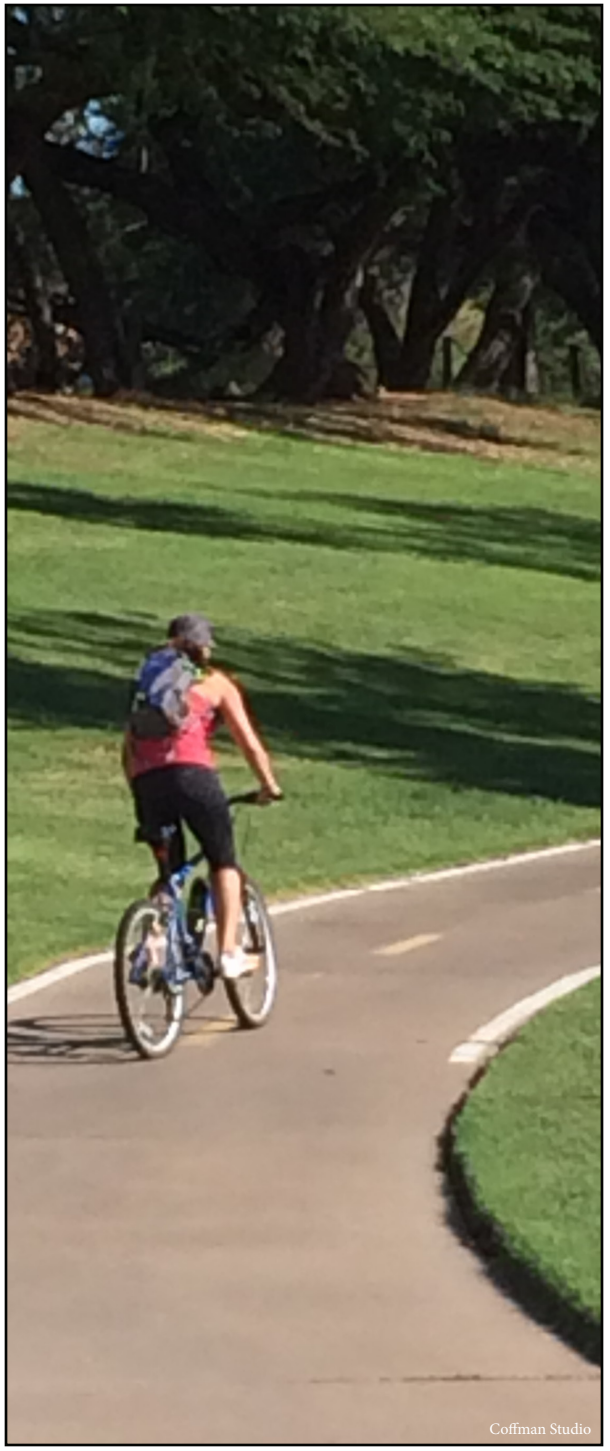
Table 7-6 displays population density information and cycling level summaries for the five cities/counties. Total population, land area, population density, the three count sites with the highest average daily cycling volumes cited in various cycling count reports, and the three count sites with the lowest cycling volumes reported.

As shown, San Francisco has the highest population density at 25.7 persons per squares mile, and Maricopa County has the lowest population density, at 0.65 persons per square mile. Minneapolis reports the site with the highest average daily bicycle volume (7,370 cyclists), followed by Portland (4,105 cyclists), followed by Maricopa County (2,244 cyclists), then followed by San Francisco and San Diego at 1,365 cyclists and 754 cyclists, respectively.

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

Table 7-6: Comparing Maricopa County Average Daily Bicycle Volumes to Other US Regions

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


Coffman Studio

MAG Bicycles Count:
8.0 Bicycle Counting Going Forward

MAG

A key purpose of the MAG Bicycles Count Project is to establish the foundation for an on-going bicycle counting program. The components of a planned on-going bicycle counting program are outlined in the following sections, along with potential applications for this data over time.

Data Collection Plan

The Bicycles Count Project established a thorough and well-vetted bicycle data collection program for the Maricopa County region. It is recommended that MAG continue tracking cycling trends over time to support improved understandings of the benefits of cycling infrastructure and programmatic investments, to develop cycling safety risk models that can guide and prioritize future investments, and to improve the region's overall understanding of the health and air quality benefits of cycling.

Future bicycle counting should attempt to follow the current program established through this project, including the data collection sites, and the manual and automated technologies employed. **Table 8-1** outlines the key components of an on-going data collection plan for cycling in Maricopa County at an annual cost of about $40,500/year. MAG is also budgeting for the one-time purchase of 13 automated pneumatic tube bike counters at a cost of about $40,000.

Another consideration is to structure some level of public access to the bicycle count data in simple excel or GIS formats on MAG's website. This will facilitate usage of the data by local agencies, planners and advocates in the region.

Table 8-1: Annual Estimated Bicycle Data Collection Plan and Costs Going Forward

Number of Sites	84 Manual Peak Period Counts	
	44 Automated Continuous	
Count Locations	Manual Counts (see Table 4-2)	
	Automated Counts (see table 4-2)	
Schedule	October/Novemember Bi- Annual	
	March/April Bi-Annual	
Estimated Costs	Manual Counts(84 Sites)	$15,000/year
	Intallation of Automated Counters (44 sites)	$20,000/year
	Automated Data Transmission	$5,500/year
	Total Estimated Annual Costs	$40,500/year

How MAG and Local Agencies Can Use the Bicycle Count Data

There are several important potential applications for the bicycle count data collected through this project and an on-going monitoring program. This section outlines five potential applications for bicycle count data that will support and enhance the region's understanding of cycling travel patterns and associated regional benefits.

Cycling Trends Over Time

Implementing a regional cycling monitoring program where systematic bicycle counts are collected every year will inform a number of important aspects of travel behavior, including:

- How many cyclists are out in the region,
- Is the number of cyclists growing or shrinking over time,
- How do cycling levels vary by facility type,
- How does cycling varying by time or day, day of week, and season, and
- What percent of cyclists are riding on the sidewalk.

This rich data can support the production of an annual "State of Cycling in Maricopa County" report that serves to inform policy makers, planners, advocates, and community members about how much and where cycling is occurring in the region.

Linking Cycling Trends to Investments

Once MAG and local agency staff are tracking cycling trends by time and location, there is an opportunity to link specific investments to changes in cycling patterns in a manner that improves our understanding of how community members respond to new or enhanced cycling facilities and programs. This kind of before-after assessment is critical to supporting long range planning and directing investments toward active travel.

Cycling Safety Assessment

A more comprehensive understanding of cycling demand allows for a more rigorous safety assessment of bicycle-vehicle crash risk. MAG will be able to develop a bicycle-vehicle crash risk model that accounts for cyclist exposure, such as crashes per million bicycle miles of travel, utilizing the network-wide estimates of cycling demand that can be generated from data collected by an on-going monitoring program.

Cycling-Related Emissions Reductions

The annual cycling counts can be combined with other primary data collection at count stations, such as intercepting cyclists to inquire about details of their cycling behavior. Understanding bicycle trip lengths by age, income and gender, and average rates of bicycle trips replacing automobile trips can allow for calculations of auto trip travel time reductions associated with cycling, which can in turn support an estimate of automobile-related emissions reduction.

Cycling-Related Health Benefits

Intercepting cyclists at count stations to inquire about bicycle trip lengths can support an estimation of daily and annual minutes of physical activity associated with cycling. Understanding physical activity gained through cycling will allow for estimations of the health benefits related to cycling.

this page is intentionally left blank

List of References

Bike Walk Twin Cities. 2012 Count Report. 2013.

City of Boulder Transportation Division. 2009 Downtown Boulder Bicycle Count. 2009.

City of Boulder Transportation Division. City of Boulder Transportation Metrics. 2008.

Federal Highway Administration. Pedestrian and Bicycle Data Collection Final Report. 2011. Prepared by AMEC E&I, Inc. and Sprinkle Consulting, Inc. HPPI-30.

Federal Highway Administration. 2012. Report to the U.S. Congress on the Outcomes of the Nonmotorized Transportation Pilot Program. SAFETEA-LU Section 1807. With the U.S. Department of Transportation's Volpe National Transportation Systems Center. Washington D.C.

Minneapolis Public Works Department. 2012 Minneapolis Bicyclist & Pedestrian Count Report. February, 2013.

National Bicycle and Pedestrian Documentation Project. "Fact Sheet and Status Report." Institute of Transportation Engineers and Alta Planning + Design. 2009.

New York City Department of Transportation. Cycling in the City: An Update on NYC Cycling Counts. 2013.

Norback, K., Piatkowski, D., Janson, N. N., Marshall, W. E., Krizek, K. J., Main, D. S, "Using Inductive Loops to Count Bicycles in Mixed Traffic," Journal of Transportation, v1,1. 2011.

Portland Bureau of Transportation. 2011 Bicycle Counts Report. February, 2012.

Ryan, S. and Lindsey, G. "Counting Bicycles and Pedestrians to Inform transportation Planning." Active Living Research Brief, Robert Wood Johnson Foundation. February, 2013.