Tempe Bike Count Report

2018

By Clifford Anderson, Stevie Milne, Jeff Caslake

Tempe Bicycle Action Group

Report Date: 4/7/2019

1. Abstract

In April 2018, the eigth annual city-wide bike count in Tempe was conducted as a way of understanding cycling habits and to identify routes and intersections that are problematic or dangerous. In total, 9758 bicyclists were counted by 38 volunteers from a total of 26 different locations, with 13 locations counted for all 8 years from 2011 to 2018. Overall helmet use was 17%, wrong way riding was 22% and sidewalk riding was 46%. Over the eight years of bike count data, helmet use ranged from 17 to 21%, sidewalk riding ranged from 32 to 46%, and wrong way riding ranged from 17 to 22%. Helmet use was lower while wrong way and sidewalk riding were much higher than values obtained in Pima County, AZ (Tucson area).

2. Introduction

In 1974, the Planning Department of the City of Tempe released the comprehensive Tempe Bikeway Plan, the first plan of its kind in Arizona. The Bikeway Plan aimed to "encourage use of the bicycle for everyday transportation," among other goals, as a way to decrease automobile traffic, reduce the environmental impacts of transportation, and raise the quality of living in Tempe. Now, over forty years later, Tempe has more than 175 miles of bikeways [1], was recently promoted to the gold-level League of American Bicyclists 'Bicycle Friendly Community' [2] (first inducted 1997), and has the highest percentage of residents who bike to work, at 4.2%, in the county [1]. The City of Tempe has a long-standing commitment to encouraging bicycle and pedestrian travel [1], a goal shared by Tempe Bicycle Action Group (TBAG). TBAG is a non-profit 501(c)(3) organization dedicated to advancing the bicycle as a safe, efficient, and sustainable form of transportation [3]. Despite bicycling infrastructure progress, there were 1107 pedalcyclist collisions over the 5-year period from 2010 to 2014 [4], [5].

This is the 8th annual Tempe Bike Count Report [6]. On April 10 - 12, 2018, 38 volunteers observed a total of 9757 cyclists at 26 intersections during morning (7-9 am) and evening (4-6 pm) rush hours. Besides a count, additional data was collected covering rider gender, helmet use, riding on the sidewalk, and riding on the wrong side of the street (against traffic). In addition to these data, our analysis considers vehicular traffic volume data by intersection made available by the City of Tempe [7]. The Tempe bike count method was modeled in part after a similar program by the Pima Association of Governments (PAG) [8]-[13]. Other recent reports on bicycle transportation include those from Maricopa Association of Governments [14] and a Bike Network Connectivity Study for SRP [15].

3. Results

A summary of count data and attribute data is shown in Table 1. Count and attribute data are depicted geographically in Appendix A. Historical bike count data by location is tabulated in Appendix F. A detailed tabulation of results for 2018 is given in Appendix G. Raw data is available in reference [16].

Report	Total_Count	LocCnt	Recorders	Wrongway	Sidewalk	Helmet	Female
Tempe 2018	9758	26	40	21.9%	46.2%	17.5%	25.8%
Tempe 2017	10779	44	40	20.4%	43.7%	18.2%	25.1%
Tempe 2016	12345	60	64	19.1%	40.3%	18.8%	23.4%
Tempe 2015	15429	53	81	16.6%	37.7%	21.0%	24.2%
Tempe 2014	12577	48	78	19.2%	41.8%	20.6%	24.7%
Tempe 2013	14750	54	91	17.2%	40.6%	19.0%	26.1%
Tempe 2012	6563	28	20	18.7%	45.8%	17.6%	29.8%
Tempe 2011	9407	45	58	17.5%	31.8%	17.2%	24.8%
PAG 2017	10928	95	NA	3.0%	6.0%	59.0%	26.0%
PAG 2015	12778	101	NA	3.0%	6.0%	55.0%	27.0%
PAG 2014	18426	107	NA	2.9%	4.7%	47.2%	28.9%
PAG 2013	13265	82	NA	2.9%	6.0%	50.9%	28.0%
PAG 2012	12211	86	NA	3.2%	7.0%	54.6%	24.5%
PAG 2011	15898	117	NA	2.5%	5.9%	50.3%	26.8%

Table 1 Summary of count data and attribute data [6] [8]-[13].

a. Attribute Analysis

Attributes collected were wrong-way riding, riding on the sidewalk, wearing a helmet, and gender. The calculation of overall attribute percentages was weighted according to the total count for each intersection/direction. The high incidences of cyclists riding against traffic, riding on the sidewalk and riding without a helmet are all matters of significant concern.

Overall wrong way riding was 22% which was counted for both on-street and on-sidewalk riding. This is substantially higher than that observed in the count by PAG of 3%[13]. The 20 intersections with the highest fraction of wrong-way riding are shown in Figure 1. ARS §28-812 concerns applicability of traffic laws to bicycle riders. Riding on the wrong side is dangerous, as motorists often do not anticipate or look for wrong-way traffic. While some of the intersections with high wrong-way riding lack a dedicated bike lane in the problem direction, many, such as several along University Drive in the ASU area, do have bike lanes.

Overall sidewalk riding was 46%. This is substantially higher than that observed in the count by PAG of 6%. Four intersections had greater than 90% sidewalk riding. The 20 intersections with the highest fraction of sidewalk riding are shown in Figure 2. Tempe City Code sec. 7-52 concerns riding on sidewalks or bicycle lanes. Sidewalk riding can create a hazard for pedestrians and it can create conflicts between motorists and cyclists, as motorists often do not anticipate relatively fast-moving traffic on sidewalks. This is especially true when the sidewalk traffic is moving opposite of street traffic.

Overall helmet use was 19% across the 44 intersections observed in 2018. This statistic is notably lower in the Tempe count as compared with the PAG count from 2015 (55% of riders wearing helmets). The city of Tempe does not require helmets for adults in the city, although bicycle safety groups including TBAG, Arizona State University Health & Wellness, Bike Saviours and other groups encourage usage and will assist riders in acquiring helmets.

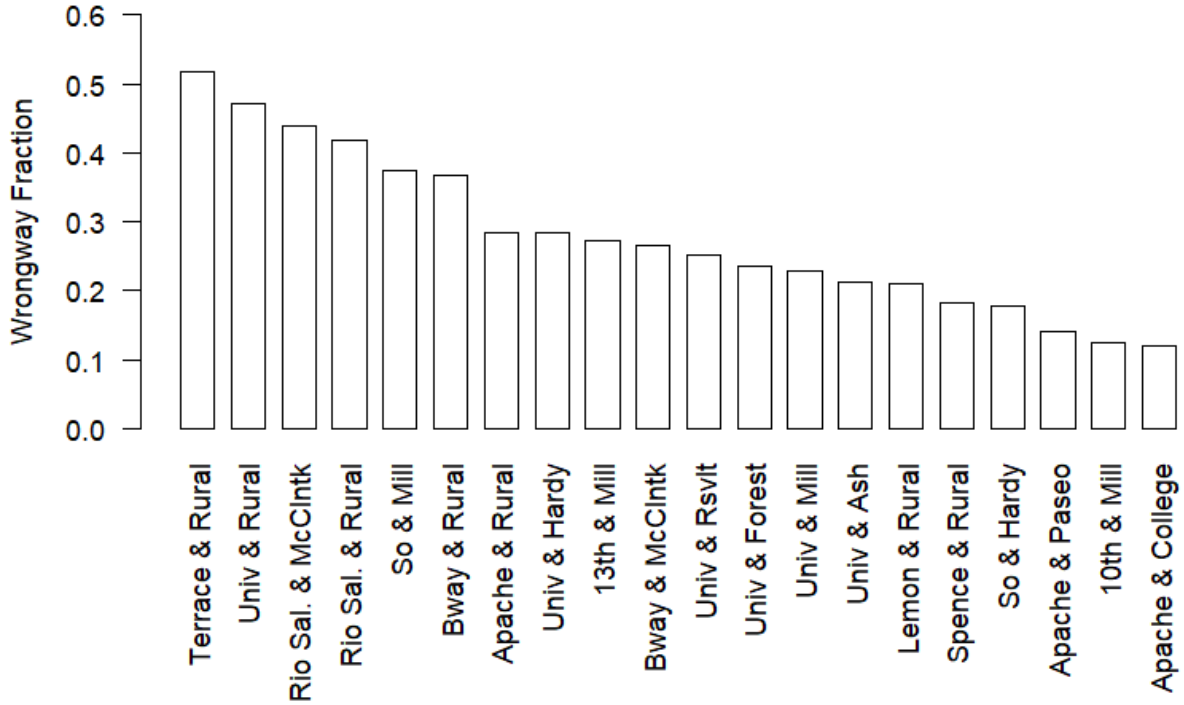


Figure 1 Top 20 locations by percentage of wrong-way riders, by intersection (directions combined)

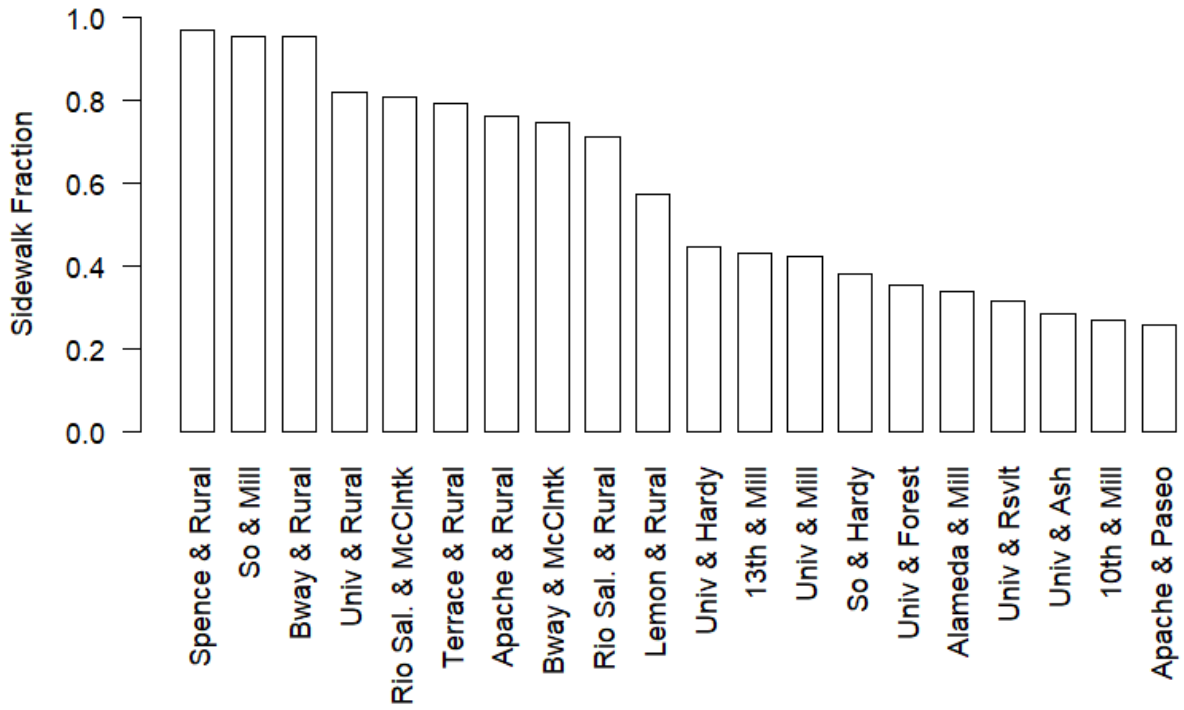


Figure 2 Top 20 locations by fraction of cyclists on sidewalk, by intersection, directions combined.

Volunteer observers recorded 26% female ridership overall. Ma & Dill [17] show that inexperienced riders as well as female riders regardless of experience are more likely to use infrastructure that "gives the appearance of safety." This allows the ratio of female riders to be used as a proxy for perceived safety of infrastructure.

b. Correlation Analysis

Both wrong way riding and sidewalk riding are plotted vs. vehicular traffic volume, with each point representing a unique location and direction (N/S or E/W), in Figure 3 and Figure 4. Wrong way riding and sidewalk riding are positively correlated with vehicular traffic volume with high statistical significance, consistent with data from prior years. That is, the higher the volume of vehicular traffic in a particular direction, the higher the incidence of both riding against traffic and riding on the sidewalk. While other factors may be relevant, these correlations indicate the need to consider the possible effect of traffic volume on cyclist riding behavior.

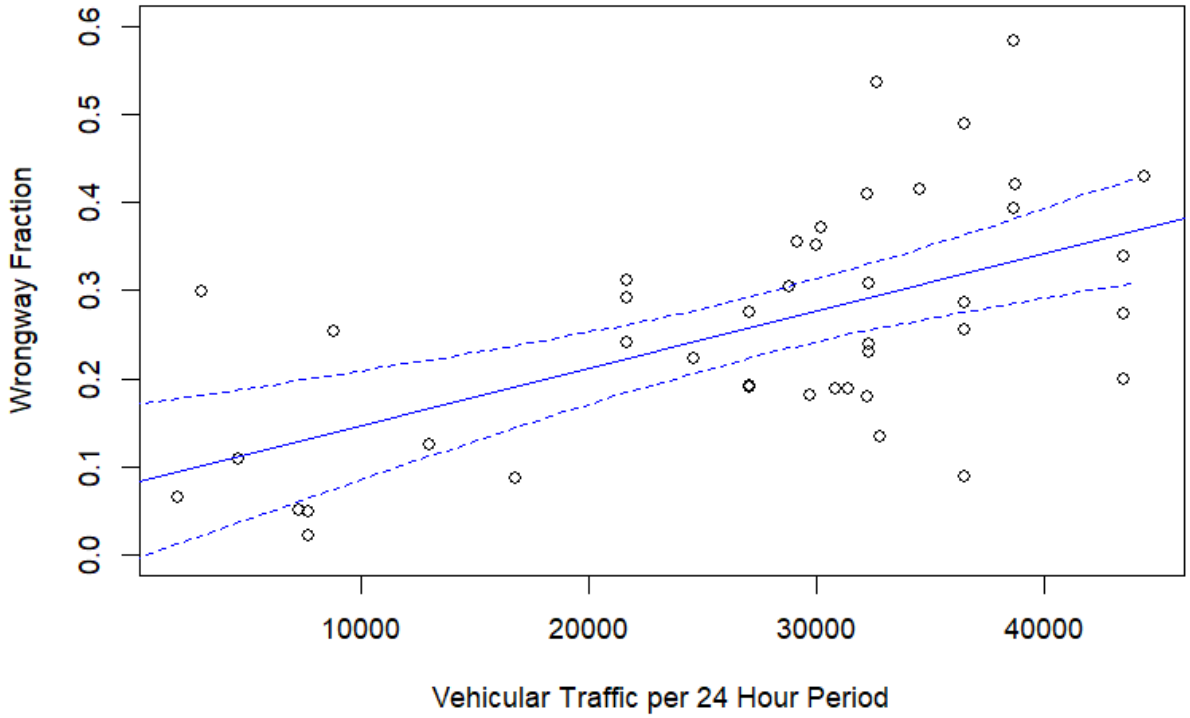


Figure 3 Scatterplot of wrong way riding % vs. vehicular traffic count (24 hour period, data through 3/29/18 and interpolated to intersections), E/W and N/S directions separated. Linear regression line and 95% confidence intervals are shown. $R^2 = 0.332$, slope p = 6.6e-5.

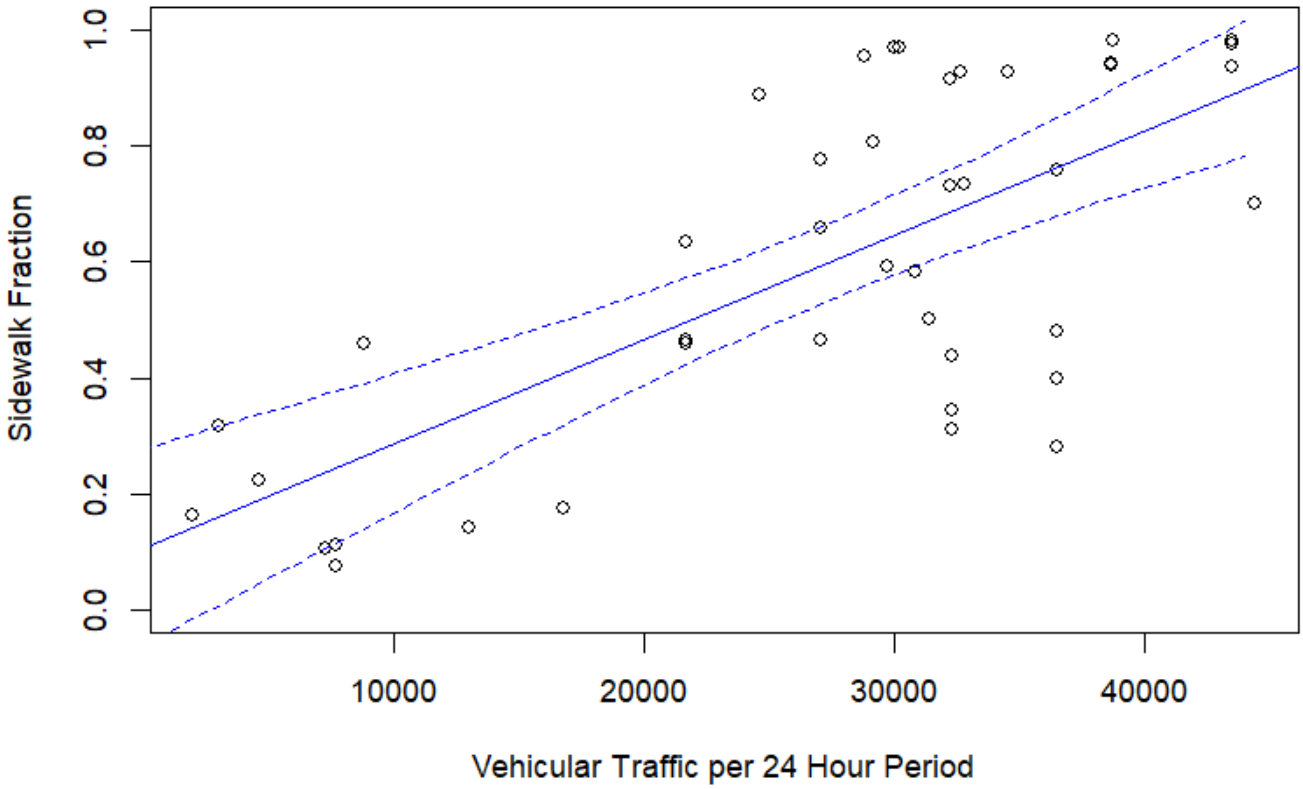


Figure 4 Scatterplot of sidewalk riding fraction vs. vehicular traffic count (24 hour period, data through 3/29/18 and interpolated to intersections), E/W and N/S directions separated. Linear regression line and 95% confidence intervals are shown. $R^2 = 0.502$, slope $p < 1.5e\text{-}7$.

With regard to collision data analysis, the reader is referred to Tempe Bike Count Report 2014 [6], section 3b, Figure 5 and Appendix B of that report.

The plot in Figure 5 shows that the highest bicycle usage areas are adjacent to the ASU campus.

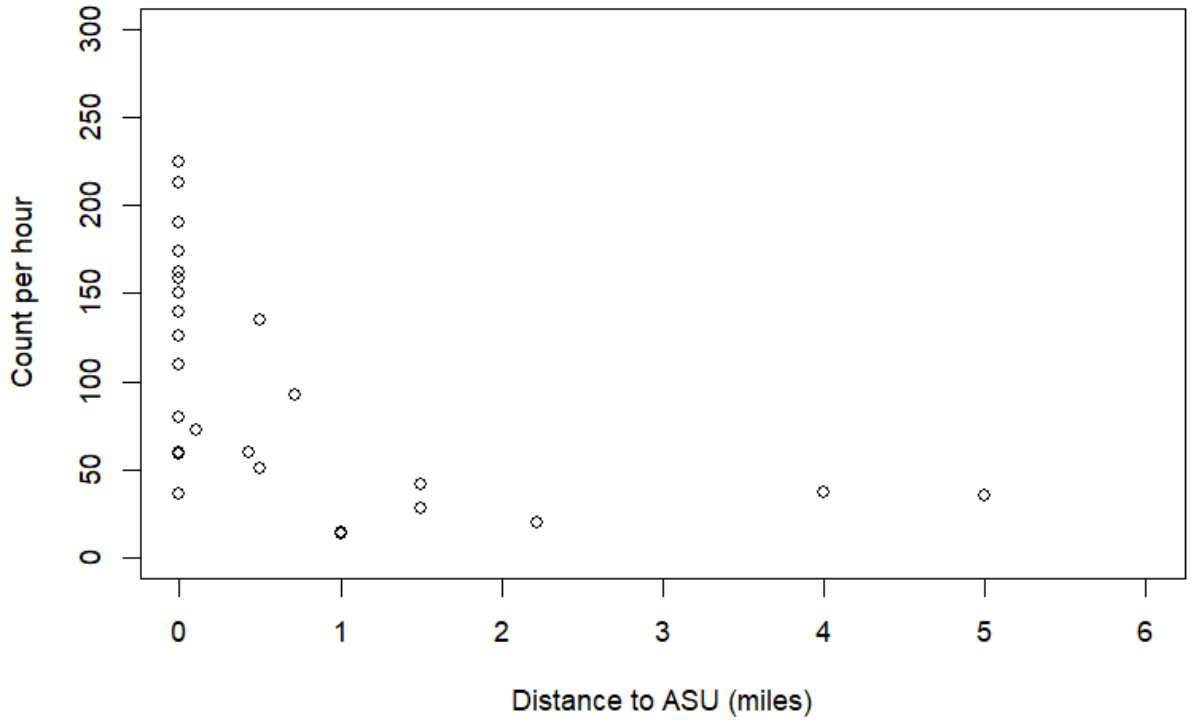


Figure 5 Relationship between cyclist count per hour and distance to ASU (miles).

c. Error Detection

Error detection methods were applied to the collected data. The detailed procedure is provided in Appendix A. Errors were detected by visual inspection and numerically as attribute count exceeding the bike count for a specific time and direction. Two recording sessions (pairs of count sheets) were thrown out due to anomalies such as substantial missing data, excessive errors detected or wrong time counted. Of the remaining data, there were 6 detected errors out of 1600 data rows (where "row" is a 15-minute time block containing count and attribute data). Of these, all were recording errors; there were no transcription errors. A recording error occurs at the time of the count; a transcription error occurs when converting handwritten marks to numbers in a database. Corrections to transcriptions are straight forward and simply involves checking the count sheets. Corrections to recording data errors can sometimes be inferred as either a bike count mark missed or a false mark applied to the attribute column. Recording corrections applied here resulted in an increase of 1 to 2 counts for the given time segment. As a result of these estimated corrections, the total bicycle count increased by 7. Based on the low percentage of errors for included sessions, the counting procedure appears to be sound. With error rate <<1%, there does not appear to be a serious problem in the data collection methodology, at least as far as the error detection method used reveals. That error detection methods were applied to detect questionable data improves confidence in the data analysis.

4. Recommendations

The City of Tempe has made great strides in developing the city as a bicycle-friendly community. This bike count indicates that there is still work to do to improve bicycle safety both in terms of infrastructure improvement (bicycle lanes and paths) and education. In particular, we recommend that the city look at bike lanes on routes that are popular with cyclists. Sidewalk riding is a concern relating to car-bike collisions, especially when the bike is going the wrong way on the sidewalk. TBAG continues to work with the city on plans to improve roads, to add bike lanes, and to work on educational and enforcement campaigns.

5. References

[1] Tempe Transportation Master Plan (Jan 2015), http://www.tempe.gov/home/showdocument?id=30317.

[2] Tempe, AZ Bicycle Friendly Community. The League of American Bicyclists, Fall, 2015. http://www.bikeleague.org/sites/default/files/bfareportcards/BFC_Fall_2015_ReportCard_Tempe_AZ.pdf

[3] Tempe Bicycle Action Group (TBAG), www.biketempe.org.

[4] Tempe Traffic Collisions. Arizona Bike Law, Dec 11, 2015. http://azbikelaw.org/tempe-traffic-collisions/.

[5] ADOT traffic collision database, http://azbikelaw.org/blog/adot-traffic-collision-database/ http://azbikelaw.org/blog/arizona-crash-facts-2013/

[6] Tempe Bike Count Report, years 2011 to 2017, http://www.biketempe.org/programs/bike-count-data/ .

[7] Traffic count data from the City of Tempe, http://data-tempegov.opendata.arcgis.com/datasets/traffic-counts

[8] 2011 Regional Bicycle/Pedestrian Count Summary, http://www.pagnet.org/documents/bicycle/2011RegionalBicycleCountReport.pdf.

[9] 2012 Regional Bicycle and Pedestrian Count Summary Report, http://www.pagnet.org/documents/bicycle/2012RegionalBicycleCountReport.pdf.

[10] 2013 Regional Bicycle and Pedestrian Count Summary Report, http://www.pagnet.org/documents/bicycle/2013RegionalBicycleCountReport.pdf.

[11] 2014 Regional Bicycle and Pedestrian Count Summary Report, http://www.pagnet.org/documents/bicycle/2014RegionalBicyclePedestrianCountReport.pdf.

[12] 2015 Regional Bicycle and Pedestrian Count Summary Report, http://www.pagnet.org/documents/bicycle/2015RegionalBicyclePedestrianCountReport.pdf.

[13] 2017 Regional Bicycle and Pedestrian Count Summary Report, https://www.tucsonaz.gov/files/transportation/2017_PAG_Regional_Bicycle_and_Pedestrian_Count_Summary_Report_FINAL.pdf.

[14] MAG Bicycles Count: Final Report and Implementation Plan,http://www.azmag.gov/Portals/0/Documents/BaP_2014-08-21_FINAL-MAG-Bicycle-Count-Data-Summary-Report.pdf.

[15] Bike Network Connectivity Study for SRP Service Area, http://www.public.asu.edu/~mikekuby/BikeNetworkConnectivity/.

[16] Raw data for Tempe Bike Count: https://github.com/biketempe/DataAnalysis.

[17] Ma, L. & Dill, J. (2017). Do people's perceptions of neighborhood bikeability match "reality?". The Journal of Transport and Land Use. (10)1, 1-18. DOI: http://dx.doi.org/10.5198/jtlu.2015.796.

[18] National Centers for Environmental Information, Climate Data Online https://www.ncdc.noaa.gov/cdo-web/

Acknowledgements

Tempe Bike Count 2018 was a concerted effort by a diverse team representing a wide cross-section of the bicycle-interest community. Many thanks go out to the volunteers who contributed their time to recording data and other areas of this effort.

Bike count coordinator:

- Stevie Milne

Bike count principal investigator:

- Clifford Anderson

Other bike count contributors:

- Jeff Caslake

Count recorders:

- 38 count volunteers

REVISION HISTORY

Revision	Description	Date
1	Initial	4/7/2019

Appendix A Geographical Presentation of Statistics

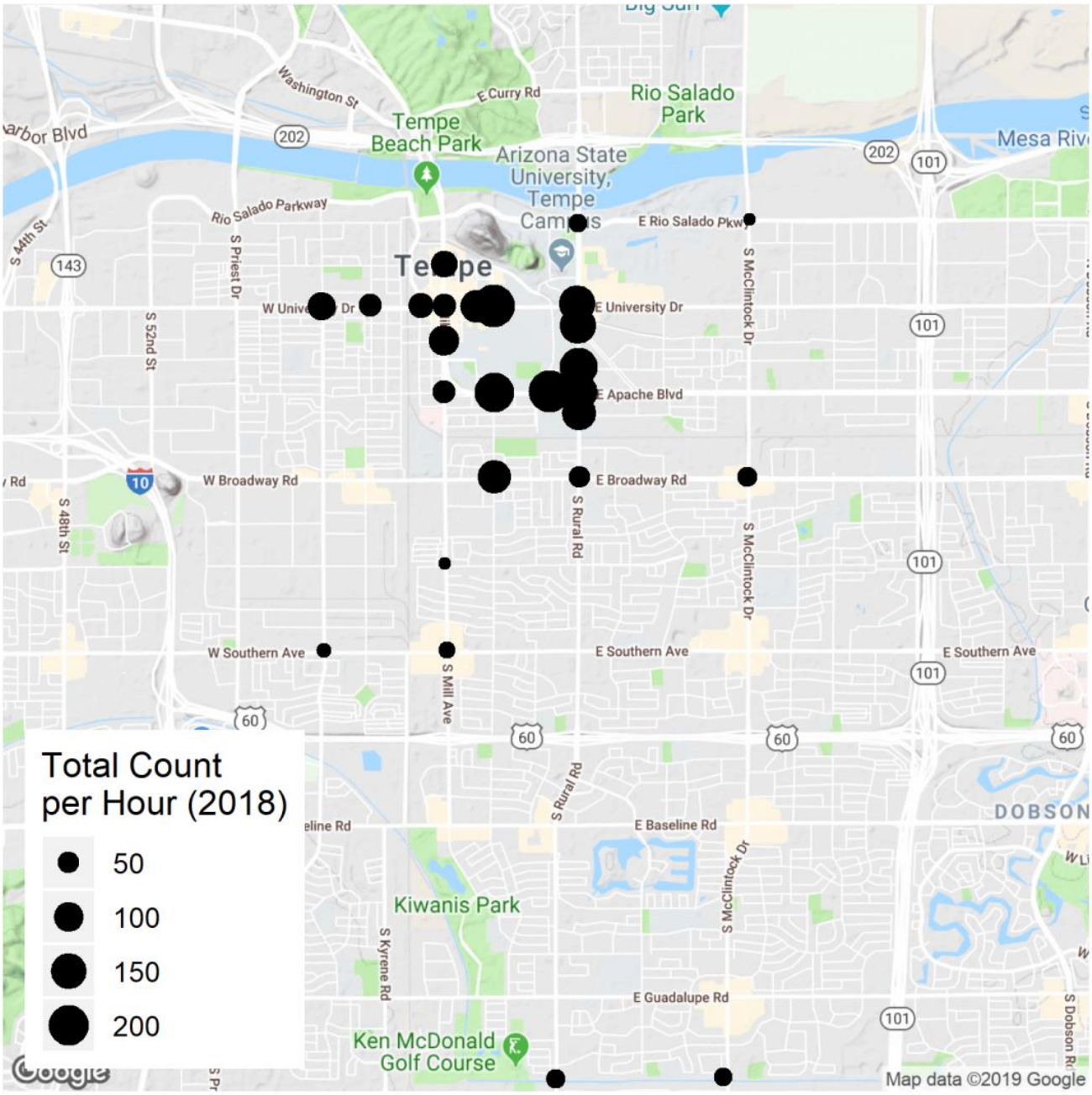


Figure A1. Total Bicycle Count per Hour

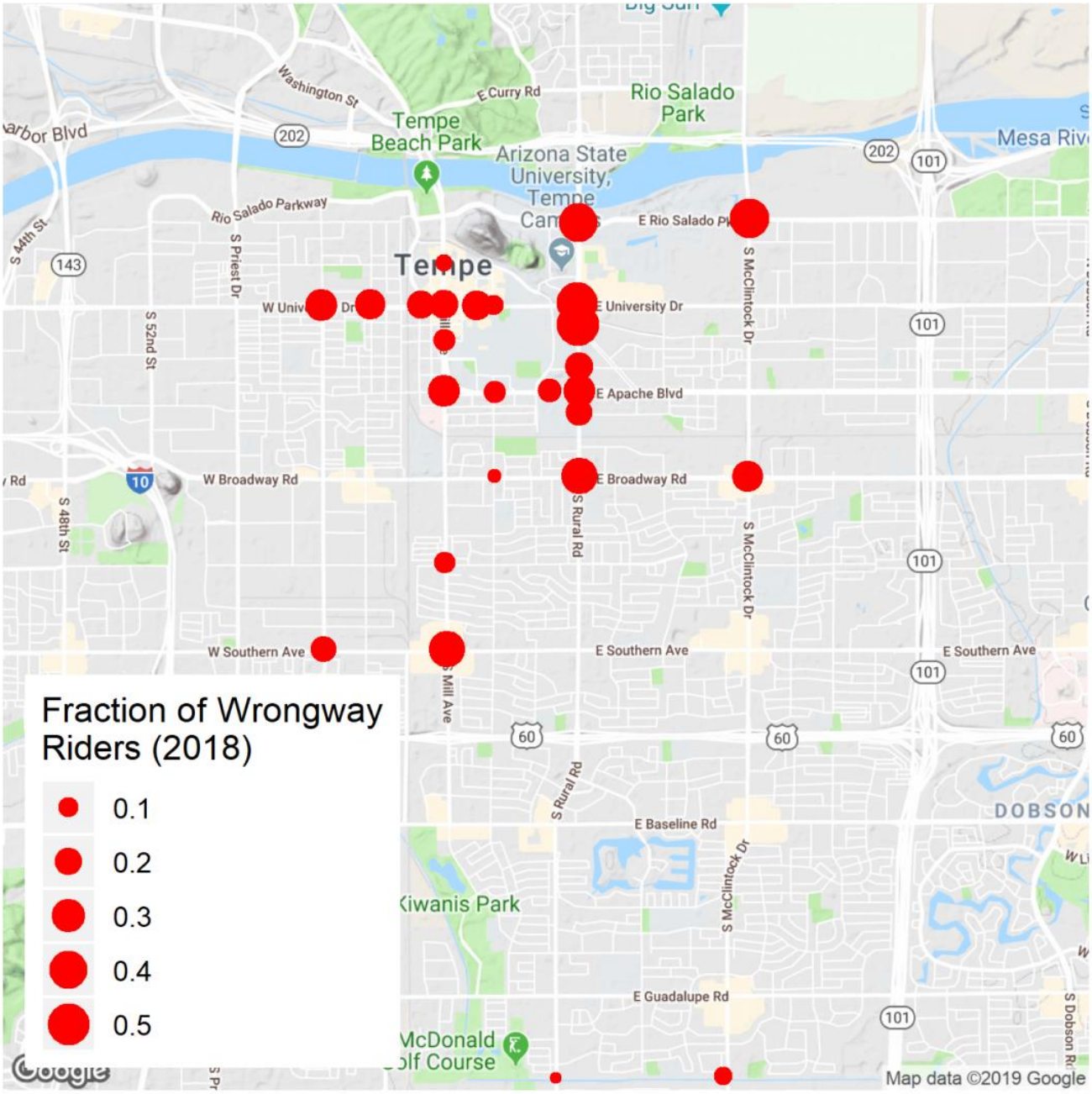


Figure A2. Fraction of Wrong Way Riders

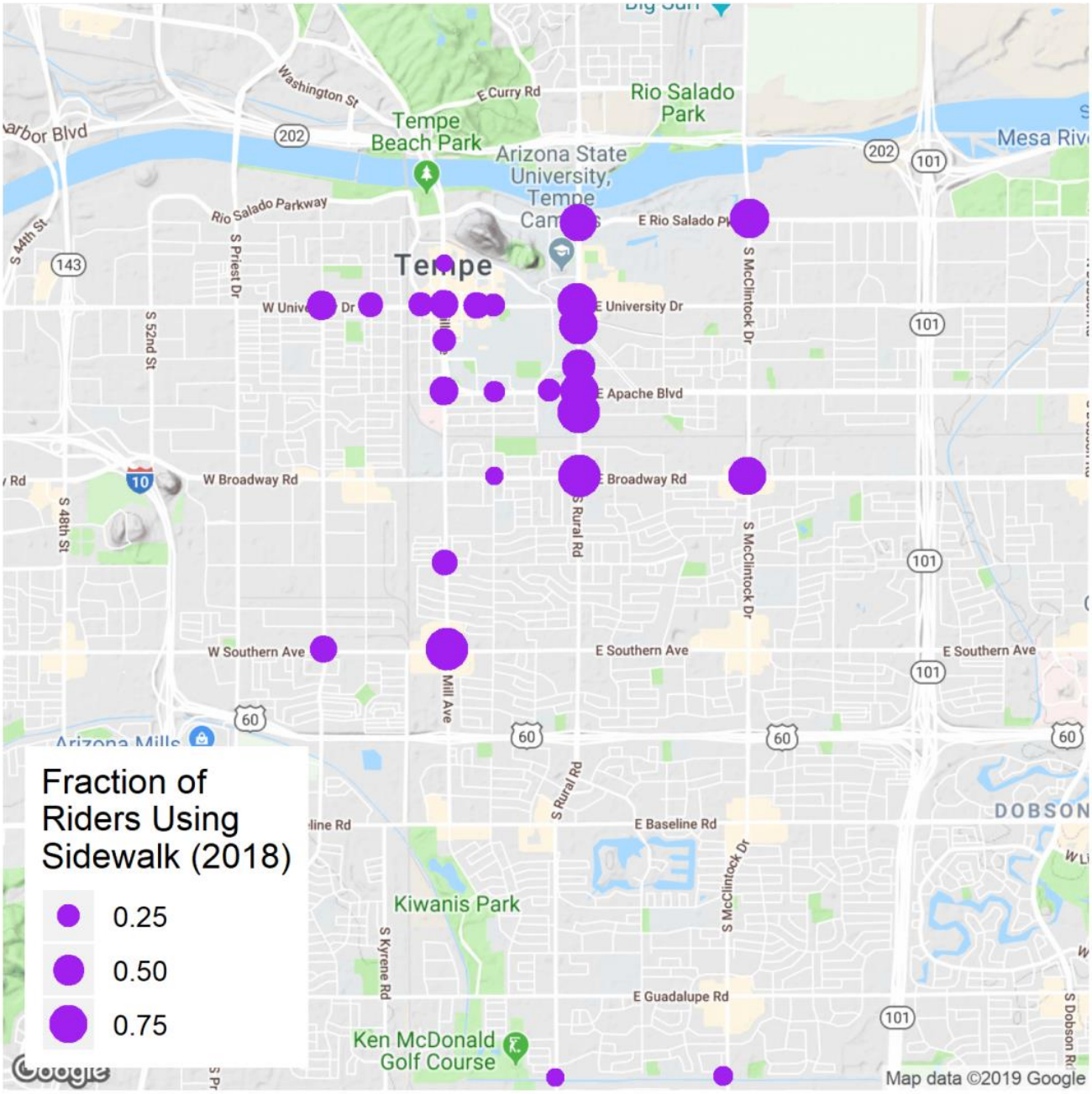


Figure A3. Fraction of Riders Using Sidewalk

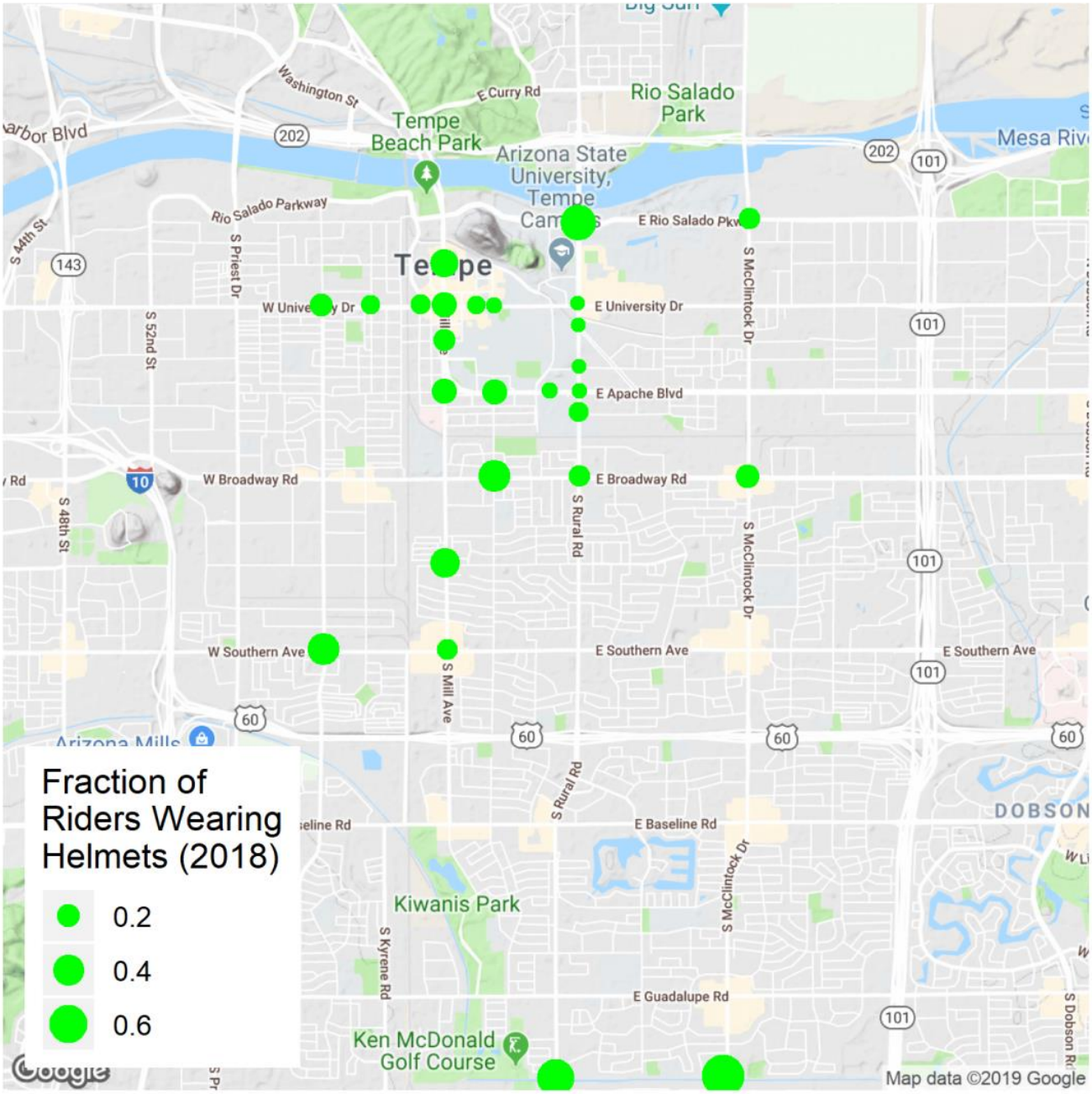


Figure A4. Fraction of Riders Wearing Helmets

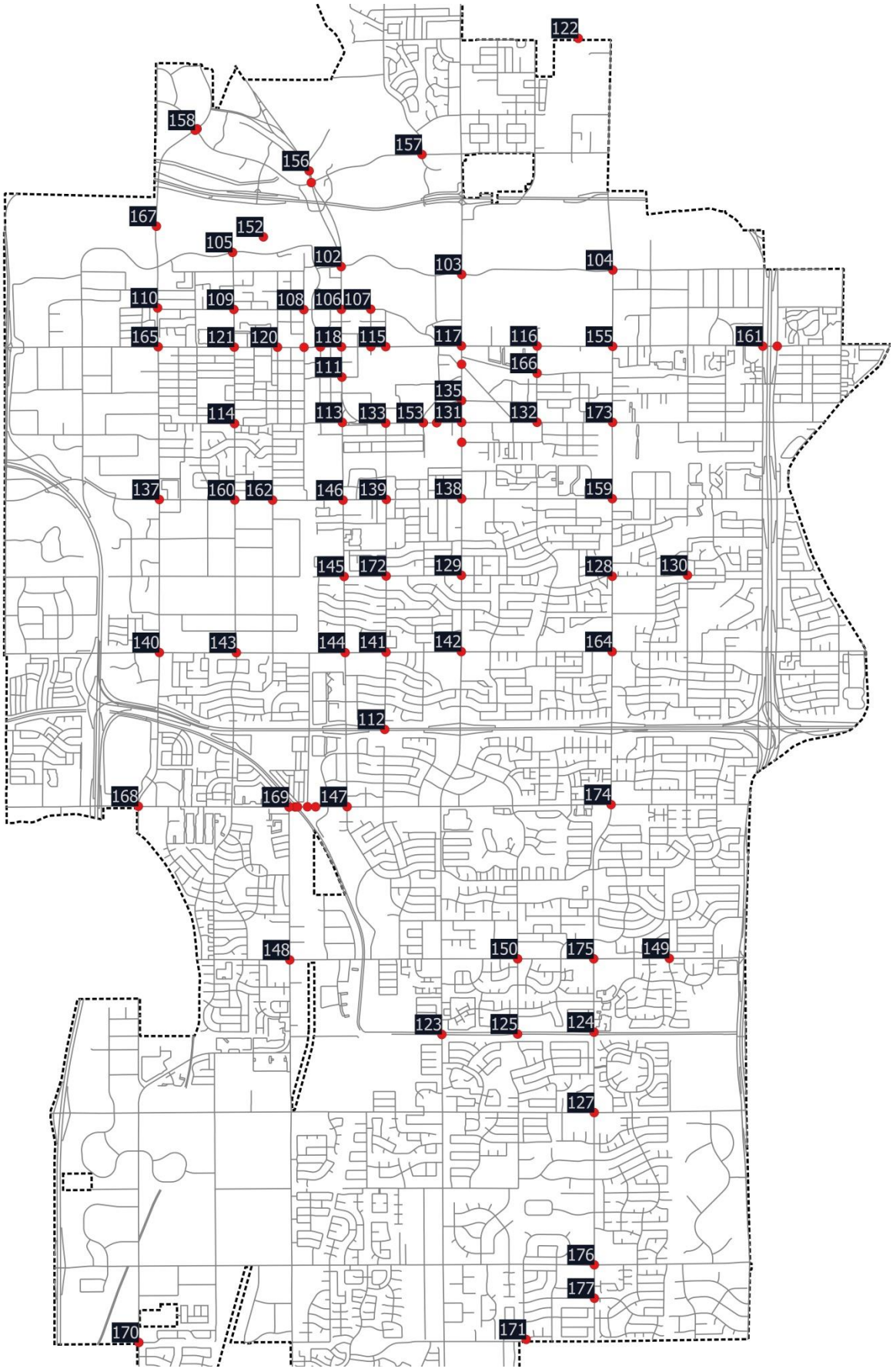


Figure A5. Location IDs (all ever counted exc. 178; some number flags omitted for clarity)

Appendix B Methodology

Locations and times for collecting data were selected based on the following characteristics (not in order of priority):

a. High anticipated bicycle count
b. Intersections
c. Recent or planned infrastructure improvements
d. High incidence of bicycle collisions
e. Establishment of cordon around (traffic in and out of) ASU
f. Coverage of a representative sample of the City of Tempe
g. Practicality of volunteer participation
h. Historical count location
i. Stakeholder recommendations (e.g., City of Tempe)

The total number of intersections in the initial plan was capped at about 50, but was limited practically by volunteer participation.

The cordon for ASU was defined as follows:

- West border: Mill Ave
- South border: Apache Blvd
- East border: Rural Rd
- North border: Rio Salado Pkwy

The time periods 7-9am and 4-6pm were chosen to be consistent with prior years and to include the morning and afternoon peak time periods while also allowing volunteers to participate with minimal interference with their normal work schedules. Tuesday, Wednesday and Thursday were selected to be consistent with prior years' counts, and are anticipated to be the highest volume days of the week and roughly equivalent to each other. Volunteers were allowed to select, at will, any one of the three days for data collection. The data collection worksheet consisted of 15 minute bins.

The set of instructions conveyed to recorders is shown in Appendix D. Training sessions were held and made available to all recorders.

Bicycle count data was collected for each of the directions (typically 4) of each intersection. For analysis, two statistics reported are a) the sum of all directions; and b) the sum of the two opposite direction counts, e.g., E/W = sum of east, west.

Total count per hour is calculated as the sum of the A.M. and P.M. sessions (4 hours total) divided 4, or if data is available only for A.M. or P.M., then the total for 2 hours is divided by 2. In the unusual event of duplicate valid counts, the counts are averaged so that total count per hour is consistent. Note that because of the difference between AM and PM count averages as shown in Figure B1, averages reported that consist of only AM or only PM are potentially skewed. This should be taken into account when comparing data between years.

Error detection methods were applied to the collected data. For each cyclist observed, instructions required that one notation be recorded in the count column, with attribute data recorded in addition in each respective column as applicable. Therefore, for a given 15 minute bin, if the sum of notations for any one attribute exceeds the count column total, an error has occurred. Possible causes for errors include:

a. accidental double-counting in the attribute column
b. accidental uncounted data in the count column
c. improper procedure followed
d. data translation error from hand-written sheets to database

Time of day for the manual count was consistent with prior Tempe counts. It is intended to capture the peak morning and afternoon "rush hour" bicycle traffic, while accommodating work schedules of prospective volunteers. Average bike count per hour vs. time of day, as shown in Figure B1, peaked for the AM counts at the end of the morning shift (8:45 to 9:00 am). For the PM counts, relative peaks occurred for the 4:15-4:30 and 5:45-6:00PM segments. PM counts were higher than AM, on average. Since these are averages over all locations, it is possible that some areas exhibited peak ridership at other times. The data was likely influenced by class schedule at ASU.

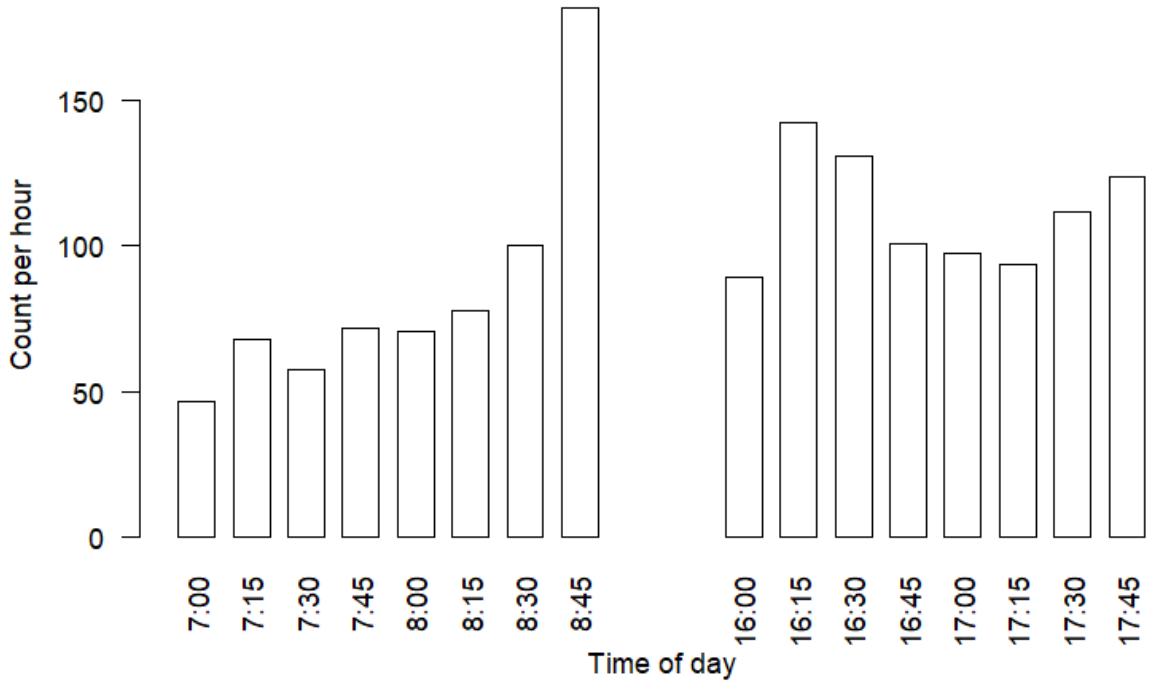
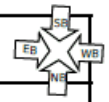


Figure B1. Average bike count per hour vs. time of day

Traffic count was obtained from City of Tempe data [7]. This data represents vehicular traffic flow over a 24-hour period in the two opposite directions (e.g., east and west, or north and south). The locations are generally not at intersections. Vehicular data has been collected over a number of years, but the locations change somewhat from year to year. The following method was used to interpret vehicular traffic data for the purpose of this study:

- The most recent data for each sampling location was used.
- For the two sides of a given intersection/direction (east/west or north/south), the larger of the two values was used. If data was available for only one side, that value was used.

Name: **Count Sheet** page #:



Date: Location ID#: Intersection of streets:

Hour _AM _PM	Approach Direction	COUNT (Check for every cyclist:)	FEMALE (Also check all that apply:)	Wearing HELMET	Wrong Way Riding	Riding on Sidewalk
:00	NB					
	SB					
	EB					
	WB					
:15	NB					
	SB					
	EB					
	WB					
:30	NB					
	SB					
	EB					
	WB					
:45	NB					
	SB					
	EB					
	WB					

Observations/ Notes:

Construction etc.

Return all completed sheets to the Spinelli's Volunteer Appreciation Party, Bicycle Cellar (200 E 5th St #105, Tempe), Boulders on Broadway's hostess desk or mail to Tempe Bicycle Action Group, PO Box 1884, Tempe, AZ 85280. Thank you for your participation! 2015 versions 1.

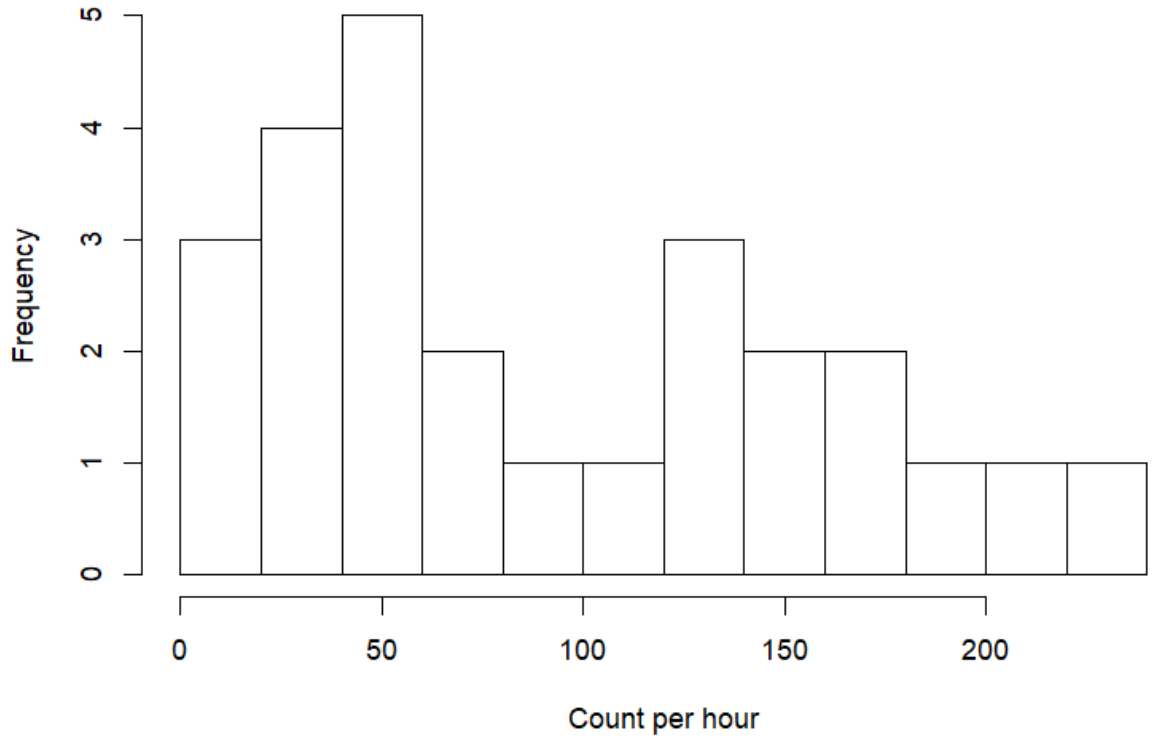
Appendix D - Bike Count Instructions

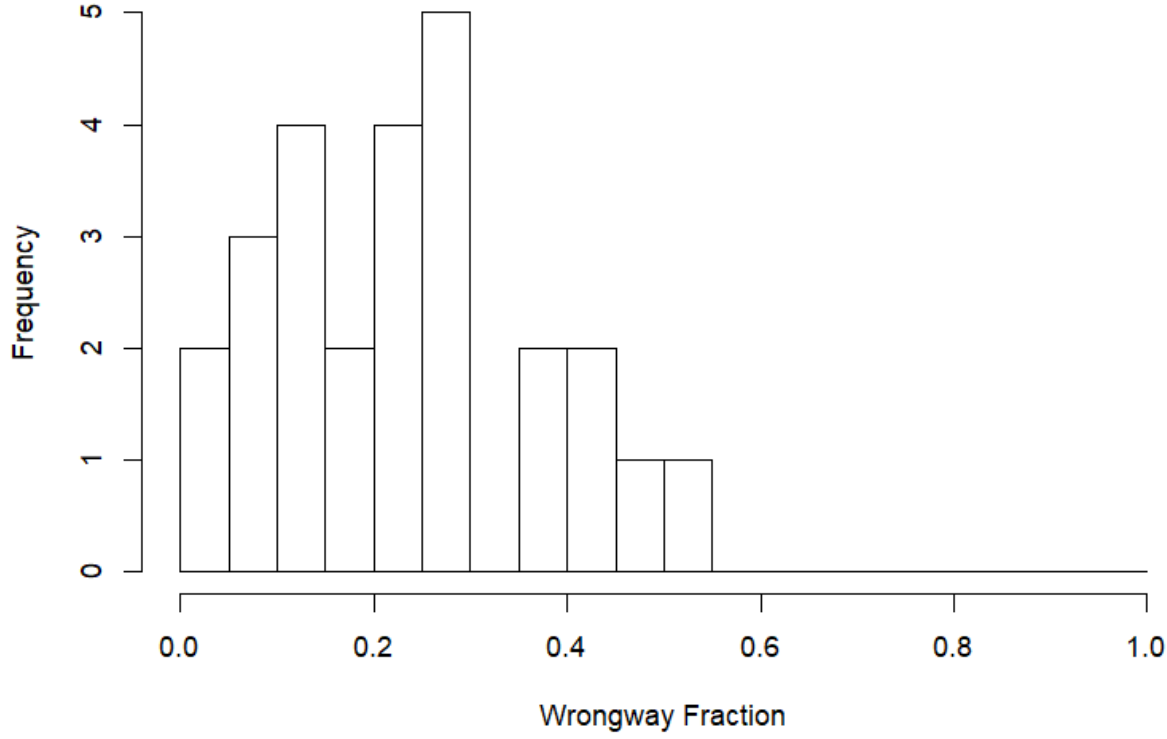
1. **Count Form Structure.**
    a. 1 hr: each form tracks 1 full hr of activity, broken into 15 minute increments.
    b. Total # of Cyclists recorded in "Count" Column. Attributes broken out in following columns.
2. **Fill In:** - Important please include the following info on each tracking sheet.
    a. Your Name (cell#)
    b. Location ID# & Location (Intersection) – this info was sent to you in your volunteer confirmation email.
    c. Hour (i.e. 4-5pm) – please record hr in far left column
    d. Total Hrs (bottom left) = total amount of time you were able to stay & count that location (i.e. 1.5 hrs or 2hrs)
    e. Page # (example: 1 of 2 – etc.)
3. **Count Shifts** (2 hr) – you will need at least 2 count sheets per shift. Busier locations may require more sheets. Extra count sheets will be available.
    - AM Rush hour: 7-9am
    - PM Rush hour: 4-6pm
4. **Priority 1**: Count (Bikes)
5. **Columns "Count"** = Total # Cyclists
    a. Approach Direction (NB, SB, EB, WB): Record the approach direction (northbound, southbound –etc.)
    b. note: turn direction is <u>not</u> recorded
    c. Intervals – the data is recorded in 15 minute intervals.
6. **Priority 2:** Record Attributes
    once you've marked the cyclists (or pedestrian) then break out the attributes a well as you can.
7. **Cyclist Attributes:** ** ***Default = Male without Helmet*** **
    a. **Approach Direction** (NB, EB, WB, SB)
    b. **Gender:** Male is assumed * Mark if cyclist Female
    c. **Helmet** (No Helmet is assumed) - Mark if the cyclist <u>is</u> wearing a Helmet
    d. **Wrong-Way Riding** - cycling against traffic
    e. **Sidewalk Riding** – does not include quick transitions at intersections or parking lots etc.
8. **Special cases**
    a. if there are multiple riders on a bike (tandem, child carrier or trailer, riding on BMX pegs, etc), each person gets counted
    b. Mopeds and e-bikes operating under peddle power are included in the count

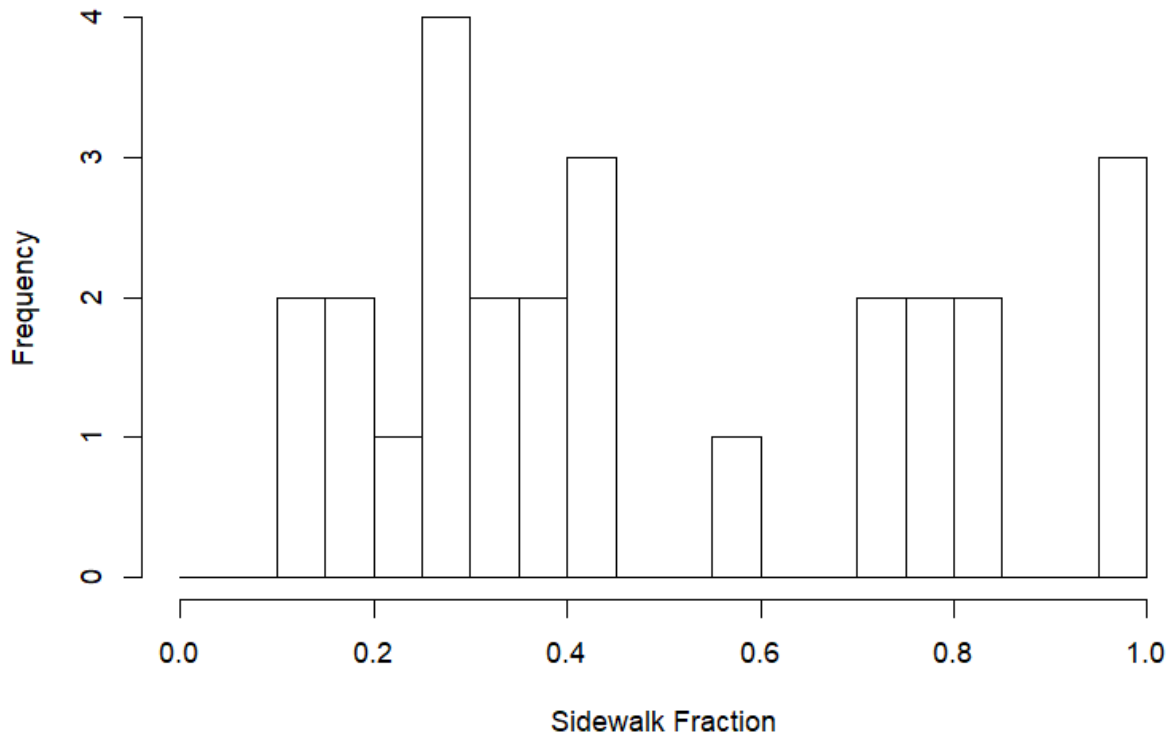
Notes:

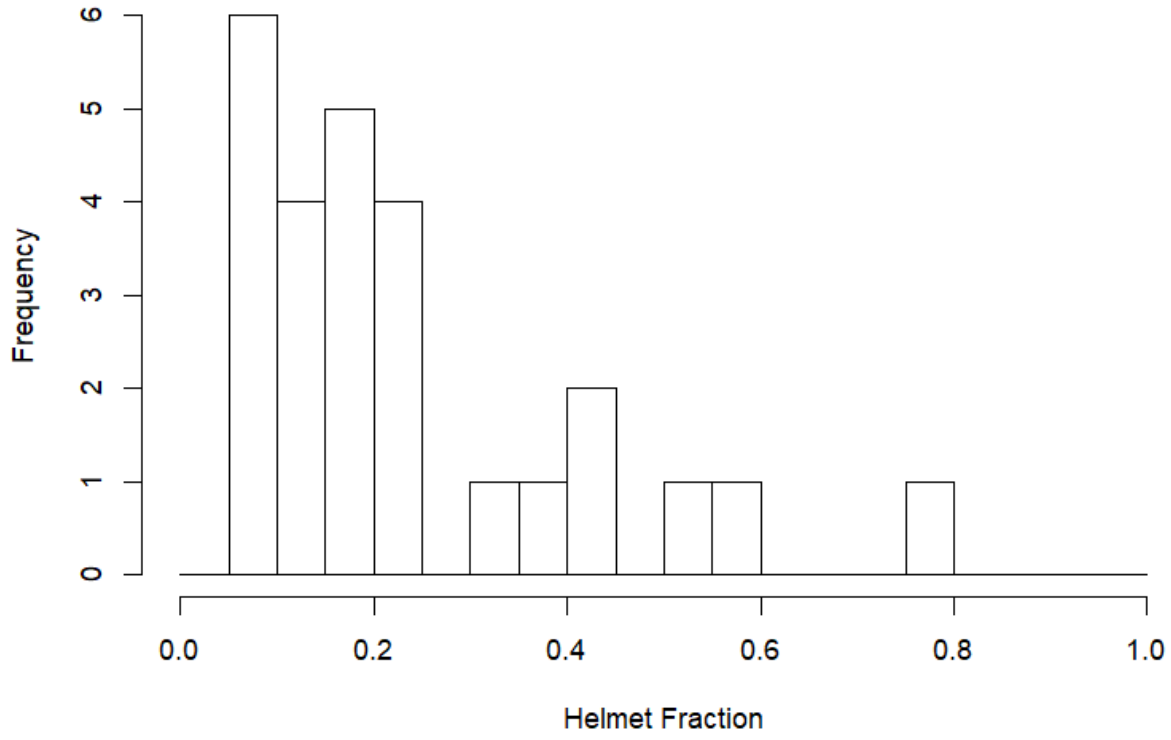
- Count sheets with pre-filled shift (location, hour, am/pm, intersection, location id) and counter's name were given to most new counters (those attending a training session), starting 2015.

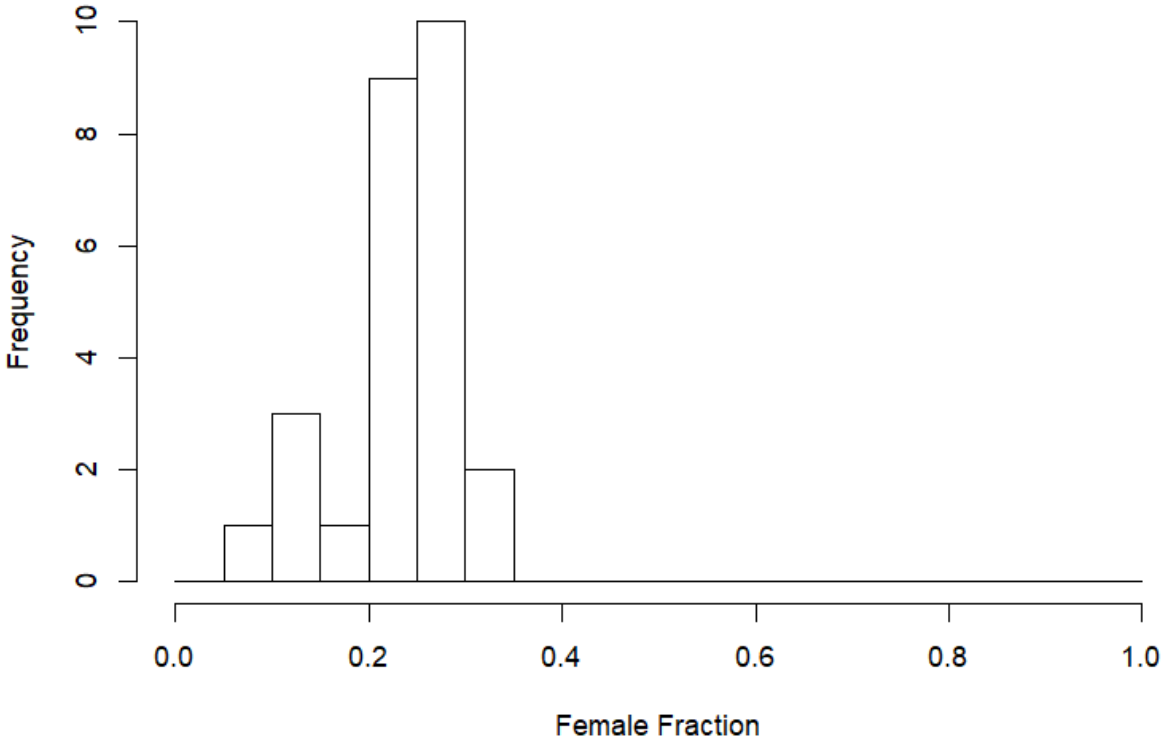
Appendix E – Additional Graphs






Frequency
0
1
2
3
4
0.0
0.2
0.4
0.6
0.8
1.0
Sidewalk Fraction


Frequency
0
1
2
3
4
5
6
0.0
0.2
0.4
0.6
0.8
1.0
Helmet Fraction


Frequency
0
2
4
6
8
10
0.0
0.2
0.4
0.6
0.8
1.0
Female Fraction

Appendix F – Historical Bike Count Data

Loc ID	LocEW	LocNS	TotPer Hr2011	TotPer Hr2012	TotPer Hr2013	TotPer Hr2014	TotPer Hr2015	TotPer Hr2016	TotPer Hr2017	TotPer Hr2018
101	Washington/Curry	Mill Ave	35	NA	45	29	48.25	23.5	NA	NA
102	Rio Salado Pkwy	Mill Ave	46.5	NA	68.25	63.625	59.5	57.75	43	NA
103	Rio Salado Pkwy	Rural Rd	48	43.5	70.25	61	57	54.25	58.5	36.5
104	Rio Salado Pkwy	McClintock Dr	38.5	19	21	30	26.25	24.75	21.25	14.25
105	Rio Salado Pkwy	Hardy Dr	8.25	NA	18.75	NA	NA	18	11.75	NA
106	5th St	Mill Ave	117.5	91	110.75	101.25	111.75	93	95.25	80
107	5th St	Forest Ave	47.5	NA	67	NA	NA	NA	NA	NA
108	5th St	Farmer Ave	NA	NA	79	78	107.25	64	NA	NA
109	5th St	Hardy Dr	NA	31.5	59.25	NA	NA	57.5	43.5	NA
110	5th St	Priest Dr	18	NA	16.5	20	20	13	NA	NA
111	10th St	Mill Ave	NA	137.75	135.5	112.5	123.75	75.5	96.75	110
112	Superstition Fwy	College Ave	32.5	27.75	38.25	28	35.75	NA	NA	NA
113	13th St	Mill Ave	49	31.5	56	52.625	58.125	33.5	52.5	58.75
114	13th St	Hardy Dr	NA	NA	50.25	40	42.5	45	39.25	NA
115	University Dr	College Ave	452	173.5	220	216.25	309.5	242.25	224.5	224.5
116	University Dr	Dorsey Ln	65.5	NA	61.75	72.75	87.875	69.25	52.5	NA
117	University Dr	Rural Rd	116	181	143	145.25	197.25	187.25	137	162.5
118	University Dr	Mill Ave	93.25	116.75	123.38	141.25	153.75	154.5	143.25	60
119	University Dr	Ash Ave	87.5	60.5	95.25	95.5	91.75	65.5	83	72
120	University Dr	Roosevelt St	45.5	50.5	54.5	53	67.5	81	69.25	59.75
121	University Dr	Hardy Dr	62	35	46.5	56.5	36	50.25	48	92.75
122	McKellips Rd	Greenbelt Path	42	40.5	42.75	44.25	46.5	39.25	NA	NA
123	Western Canal	Rural Rd	NA	44.5	61.5	40.5	40.25	32.5	NA	37
124	Western Canal	McClintock Dr	NA	NA	37.75	37.75	38	33	NA	35.5
125	Western Canal	Lakeshore Dr	86	42.5	54.5	NA	NA	NA	44.25	NA
126	Baseline Rd	Western Canal	24.5	NA	37.75	37.25	24.5	NA	NA	NA
127	Elliot Rd	McClintock Dr	9.5	NA	13.25	NA	NA	12.75	NA	NA
128	Alameda Dr	McClintock Dr	22	NA	24	17.5	31.25	26.5	22	NA
129	Alameda Dr	Rural Rd	NA	NA	59.75	63.875	50	71	45.25	NA
130	Alameda Dr	Country Club Wy	11.5	NA	20.5	NA	NA	9.5	8	NA
131	Apache Blvd	Rural Rd	NA	190.5	145.75	180	184	263.5	163.75	150.75
132	Apache Blvd	S Dorsey Ln	38	NA	64	66	65.75	NA	74.5	NA
133	Apache Blvd	College Ave	NA	233	163.75	243	220.25	218.5	238.25	190.75
134	Apache Blvd	Paseo Del Saber	121	102	181.5	NA	232.75	207.5	248.25	213.5
135	Lemon St	Rural Rd	151	NA	149.25	168.25	177.12	175.5	140.5	174.5
136	Spence St	Rural Rd	92	134.5	169.5	NA	NA	NA	157.5	139.5
137	Broadway Rd	Priest Dr	16	NA	22.5	NA	17	NA	13	NA
138	Broadway Rd	Rural Rd	NA	65.25	93	71.75	73	58	43.5	50.25

Loc ID	LocEW	LocNS	TotPer Hr2011	TotPer Hr2012	TotPer Hr2013	TotPer Hr2014	TotPer Hr2015	TotPer Hr2016	TotPer Hr2017	TotPer Hr2018
139	Broadway Rd	College Ave	104.5	NA	134.75	150	152.25	134.5	153.75	135.25
140	Southern Ave	Priest Dr	18.5	NA	26.5	NA	NA	14.75	14.75	NA
141	Southern Ave	College Ave	NA	69.5	61.5	65.75	72.25	53.75	76	NA
142	Southern Ave	Rural Rd	NA	NA	32.5	43.25	41	51.5	18.5	NA
143	Southern Ave	Hardy Dr	24.5	23	24	31	21.75	27.5	28	19.75
144	Southern Ave	Mill Ave	47.5	47.5	40.5	40	38.25	35.25	32.25	28
145	Alameda Dr	Mill Ave	29.5	23.5	21	22.25	20.25	13	18.25	13.25
146	Broadway Rd	Mill Ave	NA	36.5	36.25	27	34	33.25	NA	NA
147	Baseline Rd	Mill Ave	17	NA	27	16	20.5	NA	NA	NA
148	Guadalupe Rd	Kyrene Rd	NA	NA	27	NA	NA	NA	NA	NA
149	Guadalupe Rd	Country Club Wy	12	NA	17.75	NA	NA	NA	11.5	NA
150	Guadalupe Rd	Lakeshore Dr	23	NA	22.75	NA	NA	NA	NA	NA
151	University Dr	Forest Ave	129.5	90.25	127.5	NA	NA	NA	NA	126.25
152	Tempe Lake S.	TCA Bridge	NA	36	42.5	18	46.75	27.75	NA	NA
153	Apache Blvd	McAllister Ave	NA	NA	NA	NA	NA	NA	NA	NA
154	Terrace Rd	Rural Rd	NA	NA	194.5	NA	NA	123.5	210.5	158.5
155	University Dr	McClintock Dr	NA	NA	56	67.25	68	34	NA	NA
156	Crosscut Canal	Mill Ave	NA	NA	NA	35.5	17.75	NA	NA	NA
157	Curry Rd	College Ave	NA	NA	NA	26.75	27.25	13	NA	NA
158	Washington St	Priest Dr	NA	NA	NA	NA	33.25	30.5	NA	NA
159	Broadway Rd	McClintock Dr	NA	NA	NA	32	41.25	31.5	21.5	42
160	Broadway Rd	Hardy Dr	NA	NA	NA	23.75	19.5	29	23.5	NA
161	University Dr	Price Rd	NA	NA	NA	24.5	28.25	NA	NA	NA
162	Broadway Rd	Roosevelt St	NA	NA	NA	20	20.25	22	NA	NA
163	University Dr	Farmer Ave	NA	NA	NA	59.75	63.5	79.25	NA	NA
164	Southern Ave	McClintock Dr	NA	NA	NA	33.75	29.25	32.25	26.5	NA
165	University Dr	Priest Dr	NA	NA	NA	26.25	20.75	40.5	NA	NA
166	8th St	Dorsey Ln	NA	NA	NA	NA	56	60	NA	NA
167	Town Lake Path S	Priest Dr	NA	NA	NA	NA	17	NA	NA	NA
168	Baseline Rd	Priest Dr	NA	NA	NA	NA	NA	NA	NA	NA
169	Baseline Rd	Kyrene Rd	NA	NA	NA	NA	NA	13	NA	NA
170	Knox Rd	Priest Dr	NA	NA	NA	NA	NA	4	NA	NA
171	Knox Rd	Lakeshore Dr	NA	NA	NA	NA	NA	4.5	NA	NA
172	Alameda Dr	College Ave	NA	NA	NA	NA	NA	74.25	NA	NA
173	Apache Blvd	McClintock Dr	NA	NA	NA	NA	NA	75	72.25	NA
174	Baseline Rd	McClintock Dr	NA	NA	NA	NA	NA	14.5	18.25	NA
175	Guadalupe Rd	McClintock Dr	NA	NA	NA	NA	NA	14	14.125	NA
176	Warner Rd	McClintock Dr	NA	NA	NA	NA	NA	12	NA	NA
177	La Vieve Ln	McClintock Dr	NA	NA	NA	NA	NA	7	NA	NA
178	Curry Rd	Scottsdale Rd	NA	NA	NA	NA	NA	NA	17.75	NA

Appendix G Data Summary

TotPerHr = bike count per hour ; Vehicular traffic count = 24 hour period, most recent data 3/29/2018, interpolated to intersections, N/S or E/W combined; DistASU = distance in miles from intersection to ASU boundary; Lane Dir: 1=bike lane or path; 0=no bike lane

North-South Direction

LocID	LocEW	LocNS	TotPerHr	AMPerHr	PMPerHr	Helmet	Wrongway	Sidewalk	Female	TrafficNS	DistASU	Lane Dir	Dir
103	Rio Salado Pkwy	Rural Rd	34.25	28	40.5	53.3%	43.1%	70.1%	27.7%	44461	0	0	NS
104	Rio Salado Pkwy	McClintock Dr	10.25	12	8.5	9.8%	53.7%	92.7%	12.2%	32685	1	0	NS
106	5th St	Mill Ave	34.5	32.5	36.5	31.2%	8.7%	17.4%	18.8%	16813	0	1	NS
111	10th St	Mill Ave	34	29	39	23.2%	27.6%	65.8%	21.0%	27094	0	0	NS
113	13th St	Mill Ave	14.5	10	19	34.5%	19.0%	77.6%	20.7%	27094	0	0	NS
115	University Dr	College Ave	106.5	67	146	9.4%	10.8%	22.3%	26.5%	4611	0	1	NS
117	University Dr	Rural Rd	42.75	28.5	57	11.7%	42.1%	98.2%	19.3%	38744	0	0	NS
118	University Dr	Mill Ave	24.75	25.5	24	34.3%	19.2%	46.5%	25.3%	27094	0	1	NS
119	University Dr	Ash Ave	17.5	17	18	14.3%	12.9%	20.0%	22.9%	NA	0.11	1	NS
120	University Dr	Roosevelt St	16.25	17.5	15	6.2%	30.8%	23.1%	15.4%	NA	0.43	1	NS
121	University Dr	Hardy Dr	41.5	26.5	56.5	23.5%	25.3%	45.8%	25.9%	8840	0.72	1	NS
123	Western Canal	Rural Rd	7.5	6.5	8.5	33.3%	13.3%	73.3%	20.0%	32806	4	0	NS
124	Western Canal	McClintock Dr	7.75	13	2.5	54.8%	35.5%	80.6%	16.1%	29155	5	1	NS
131	Apache Blvd	Rural Rd	64	67	61	10.9%	27.3%	93.8%	21.5%	43512	0	0	NS
133	Apache Blvd	College Ave	138.5	147	130	28.7%	4.9%	11.0%	32.7%	7707	0	1	NS
134	Apache Blvd	Paseo Del Saber	98.5	62	135	7.6%	2.3%	2.3%	31.0%	NA	0	1	NS
135	Lemon St	Rural Rd	61	55.5	66.5	7.4%	39.3%	94.3%	29.1%	38694	0	0	NS
136	Spence St	Rural Rd	102.75	94	111.5	15.3%	20.0%	97.8%	20.0%	43512	0	0	NS
138	Broadway Rd	Rural Rd	29.5	29.5	NA	21.2%	33.9%	98.3%	23.7%	43512	0.5	0	NS
139	Broadway Rd	College Ave	118.5	104	133	46.2%	2.1%	7.4%	25.5%	7707	0.5	1	NS
143	Southern Ave	Hardy Dr	14	16	12	55.4%	12.5%	14.3%	14.3%	13042	2.22	1	NS
144	Southern Ave	Mill Ave	10.25	8.5	12	19.5%	41.5%	92.7%	19.5%	34540	1.5	0	NS
145	Alameda Dr	Mill Ave	5.5	6	5	13.6%	18.2%	59.1%	9.1%	29767	1	0	NS
151	University Dr	Forest Ave	65.25	46.5	84	14.9%	18.8%	23.8%	31.0%	NA	0	0	NS
154	Terrace Rd	Rural Rd	78	81.5	74.5	5.9%	58.5%	93.9%	27.7%	38694	0	0	NS
159	Broadway Rd	McClintock Dr	24	NA	24	25.0%	18.8%	58.3%	8.3%	30881	1.5	1	NS

East-West Direction

LocID	LocEW	LocNS	TotPerHr	AMPerHr	PMPerHr	Helmet	Wrongway	Sidewalk	Female	TrafficEW	DistASU	Lane Dir	Dir
103	Rio Salado Pkwy	Rural Rd	2.25	4	0.5	22.2%	22.2%	88.9%	22.2%	24622	0	1	EW
104	Rio Salado Pkwy	McClintock Dr	4	4	4	37.5%	18.8%	50.0%	12.5%	31439	1	1	EW
106	5th St	Mill Ave	45.5	43	48	32.4%	4.9%	10.4%	32.4%	7277	0	1	EW
111	10th St	Mill Ave	76	64	88	15.3%	5.8%	9.4%	38.5%	NA	0	1	EW
113	13th St	Mill Ave	44.25	38	50.5	20.9%	29.9%	31.6%	25.4%	3036	0	1	EW
115	University Dr	College Ave	118	126	110	7.6%	8.9%	28.2%	23.9%	36499	0	1	EW
117	University Dr	Rural Rd	119.75	81.5	158	4.8%	49.1%	76.0%	25.9%	36499	0	1	EW
118	University Dr	Mill Ave	35.25	37.5	33	16.3%	25.5%	39.7%	19.1%	36499	0	1	EW
119	University Dr	Ash Ave	54.5	39.5	69.5	13.8%	23.9%	31.2%	28.4%	32345	0.11	1	EW
120	University Dr	Roosevelt St	43.5	36.5	50.5	16.1%	23.0%	34.5%	32.8%	32345	0.43	1	EW
121	University Dr	Hardy Dr	51.25	22	80.5	15.6%	30.7%	43.9%	21.5%	32345	0.72	1	EW
123	Western Canal	Rural Rd	29.5	35	24	62.7%	0.0%	0.0%	21.2%	NA	4	1	EW
124	Western Canal	McClintock Dr	27.75	38	17.5	82.9%	0.0%	0.0%	27.0%	NA	5	1	EW
131	Apache Blvd	Rural Rd	86.75	72	101.5	6.1%	29.1%	63.4%	27.4%	21727	0	1	EW
133	Apache Blvd	College Ave	52.25	49	55.5	13.9%	31.1%	46.4%	37.3%	21727	0	1	EW
134	Apache Blvd	Paseo Del Saber	115	109	121	9.3%	24.1%	45.9%	27.0%	21727	0	1	EW
135	Lemon St	Rural Rd	113.5	87	140	6.8%	11.2%	37.7%	23.6%	NA	0	1	EW
136	Spence St	Rural Rd	36.75	19.5	54	9.5%	13.6%	95.2%	20.4%	NA	0	1	EW
138	Broadway Rd	Rural Rd	20.75	20.75	NA	12.0%	41.0%	91.6%	28.9%	32224	0.5	0	EW
139	Broadway Rd	College Ave	16.75	20.5	13	13.4%	17.9%	73.1%	29.9%	32224	0.5	1	EW
143	Southern Ave	Hardy Dr	5.75	3.5	8	8.7%	30.4%	95.7%	8.7%	28817	2.22	0	EW
144	Southern Ave	Mill Ave	17.75	11.5	24	14.1%	35.2%	97.2%	12.7%	30005	1.5	0	EW
145	Alameda Dr	Mill Ave	7.75	7	8.5	51.6%	6.5%	16.1%	9.7%	1994	1	1	EW
151	University Dr	Forest Ave	61	57.5	64.5	8.6%	28.7%	48.0%	25.4%	36499	0	1	EW
154	Terrace Rd	Rural Rd	80.5	47	114	7.1%	45.2%	65.2%	21.7%	NA	0	1	EW
159	Broadway Rd	McClintock Dr	18	NA	18	16.7%	36.1%	94.4%	13.9%	30221	1.5	0	EW

Appendix H Climate Data, TEMPE ASU AZ US [18]

Date	PRCP	TMAX	TMIN	Station Name
3/29/2011	0	86	48	TEMPE ASU, AZ US
3/30/2011	0	87	49	TEMPE ASU, AZ US
3/31/2011	0	92	53	TEMPE ASU, AZ US
4/3/2012	0	79	41	TEMPE ASU, AZ US
4/4/2012	0	85	44	TEMPE ASU, AZ US
4/5/2012	0	88	51	TEMPE ASU, AZ US
3/26/2013	0	88	54	TEMPE ASU, AZ US
3/27/2013	0	85	50	TEMPE ASU, AZ US
3/28/2013	0	86	51	TEMPE ASU, AZ US
3/25/2014	0	88	48	TEMPE ASU, AZ US
3/26/2014	0	81	49	TEMPE ASU, AZ US
3/27/2014	0	76	46	TEMPE ASU, AZ US
3/24/2015	0	86	48	TEMPE ASU, AZ US
3/25/2015	0	87	51	TEMPE ASU, AZ US
3/26/2015	0	89	54	TEMPE ASU, AZ US
3/29/2016	0	77	54	TEMPE ASU, AZ US
3/30/2016	0	69	47	TEMPE ASU, AZ US
3/31/2016	0	74	41	TEMPE ASU, AZ US
3/28/2017	0	79	57	PHOENIX AIRPORT, AZ US
3/29/2017	0	84	47	TEMPE ASU, AZ US
3/30/2017	0	89	45	TEMPE ASU, AZ US
4/10/2018	0	97	77	TEMPE ASU, AZ US
4/11/2018	0	98	76	TEMPE ASU, AZ US
4/12/2018	0	87	66	PHOENIX AIRPORT, AZ US

Note: Station substitution (Phoenix Airport) due to missing data
Average difference for these dates, PHX - ASU: TMAX=0; TMIN=8.2