Tempe Bike Count Report

2012

Tempe Bicycle Action Group
12/04/2012

1. Abstract

In April 2012 the second 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, 6,563 bicyclists were counted from a total of 28 different locations, with 26 locations common between 2011 and 2012. Overall helmet use was 18%, wrong way riding was 19% and sidewalk riding was 46%. Helmet use and wrong way riding were comparable to Tempe 2011 data [1]. Sidewalk riding percentage was higher than last year, but this may be due to locations being, on the average, closer to ASU. Helmet use was much lower and wrong way and sidewalk riding were much higher than the values obtained for a similar count in Pima County, AZ (Tucson area) in 2011 [2].

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, almost forty years later, Tempe has more than 165 miles of dedicated bikeways, has been a League of American Bicyclists 'Bicycle Friendly Community' for fourteen years, and has one of the highest percentages of commuter cyclists in the country. Further increasing ridership is a current goal of the city, a goal shared by the Tempe Bicycle Action Group (T.B.A.G.). T.B.A.G. is a non-profit 501(c)(3) organization dedicated to advancing the bicycle as a safe, efficient, and sustainable form of transportation.

On April 3rd, 4thand 5th, 2012, 20 (2011: 58) volunteers observed cyclists at 28 (2011:45) intersections during morning (7-9 am) and evening (4-6 pm) rush hours, counting 6,563 cyclists. The count of cyclists travelling through an imaginary cordon around the ASU-Tempe campus was 353 (2011: 395) per hour in-bound in the morning and 399 (2011: 379) per hour out-bound in the afternoon. 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 includes vehicle traffic volume data by intersection made available by the City of Tempe. The Tempe bike count was modeled in part after a similar program by the Pima Association of Governments (PAG) [2].

3. Results

a. Attribute Analysis

Attributes collected were wrong-way riding, riding on the sidewalk, wearing a helmet, and gender. The high incidences of cyclists riding against traffic, riding on the sidewalk and riding without a helmet are all matters of significant concern.

At the intersection of Broadway Road and Rural Road, 40% of the 78 east/west (E/W) cyclists recorded were riding the wrong direction. The top 10 intersections in terms of wrong-way riding are shown in Figure 1. In all, there were 19 intersections at which one-fourth or more of the cyclists observed were riding the wrong direction. Riding on the wrong side is illegal as well as 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.

Sidewalk riding had even higher percentages. For Rural Road, all 5 locations monitored between Broadway Road and Rio Salado Parkway had greater than 90% sidewalk riding. The top 10 intersections in terms of wrong-way riding are shown in Figure 1 and Figure 2. While legal (if riding with traffic), 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 18%. This is substantially lower than that observed in the Pima Association of Government's (PAG; Tucson area) count of 50% [2]. Wrong way riding was 19% and sidewalk riding was 46%, both substantially higher than Tucson. Wrong-way riding was counted for both on-street and on-sidewalk riding. The calculation of overall attribute percentages was weighted according to the total count for each intersection/direction.

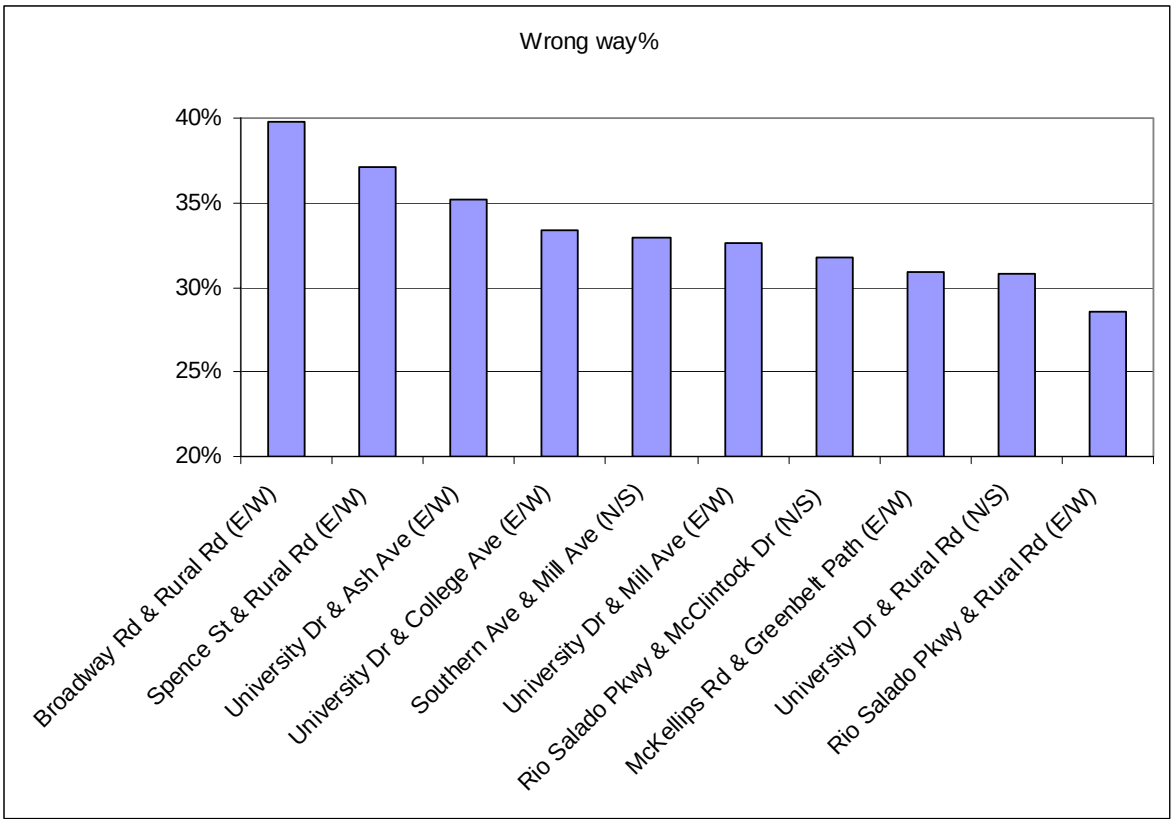

Figure 1 Top 10 locations by percentage of wrong-way riders, by intersection and direction

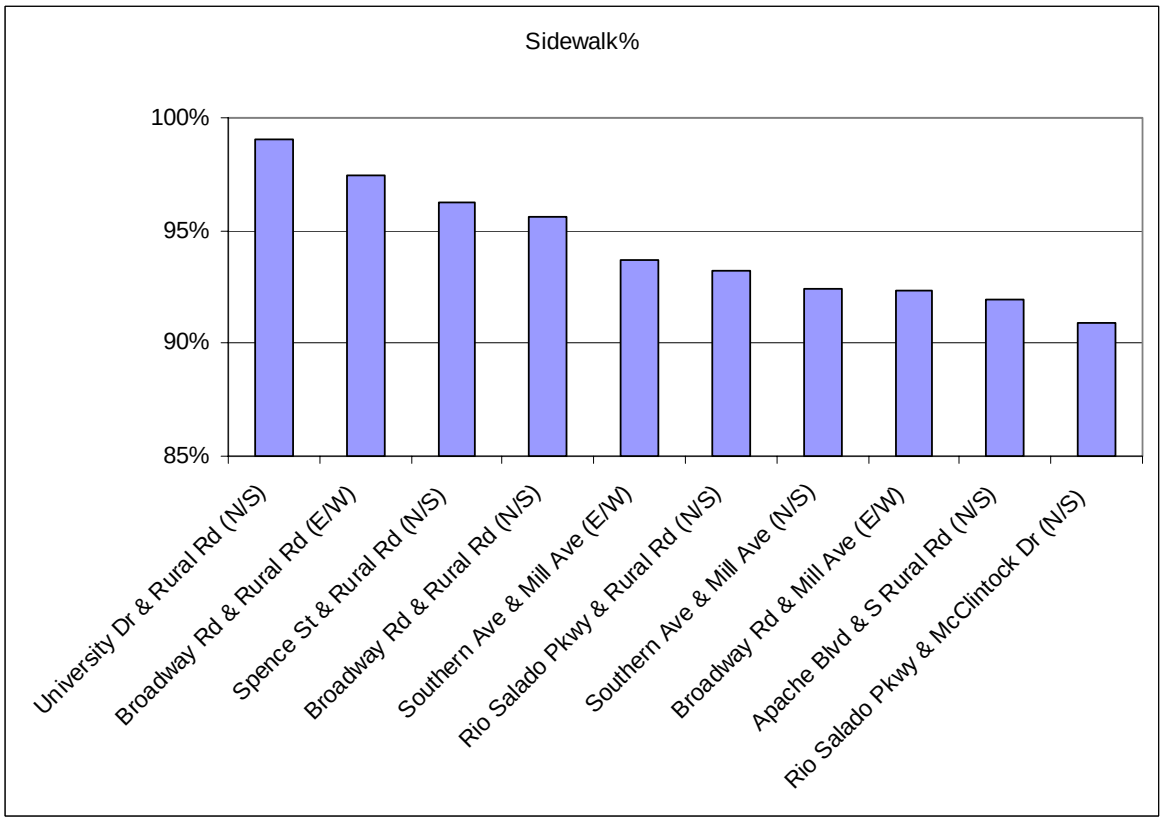

Figure 2 Top 10 locations by percentage of cyclists on sidewalk, by intersection and direction (excludes one instance where sidewalk is the only option).

When data on wrong-way and sidewalk riding are combined, the intersections of most concern are shown in Table 1:

Location or Intersection: E/W	Location or Intersection: N/S	Wrong way%	Sidewalk%	Dir
Broadway Rd	Rural Rd	39.7%	97.4%	EW
University Dr	Rural Rd	30.8%	99.1%	NS
Southern Ave	Mill Ave	32.9%	92.4%	NS
Rio Salado Pkwy	McClintock Dr	31.8%	90.9%	NS
Spence St	Rural Rd	37.1%	64.3%	EW

Table 1 Top 10 locations by percentage of wrong-way riders, by intersection and direction

A summary of count data and attribute data is shown in Table 2.

	Total Count	# locations	Wrong way%	Sidewalk%	Helmet%	Female%
Tempe 2012	6,563	28	18.7%	45.8%	17.6%	29.8%
Tempe 2011	9,407	45	17.5%	31.8%	17.2%	24.8%
PAG 2011	15,898	117	2.5%	5.9%	50.3%	26.8%

Table 2 Summary of count data and attribute data

b. Correlation Analysis

Both sidewalk riding and wrong way riding are positively correlated with vehicular traffic volume as shown in Figure 3 and Figure 4. That is, the higher the volume of vehicular traffic in a particular direction, the higher the incidence of both riding on the sidewalk and riding against traffic. These correlations indicate the need to recognize the affect of traffic volume on cyclist riding behavior.

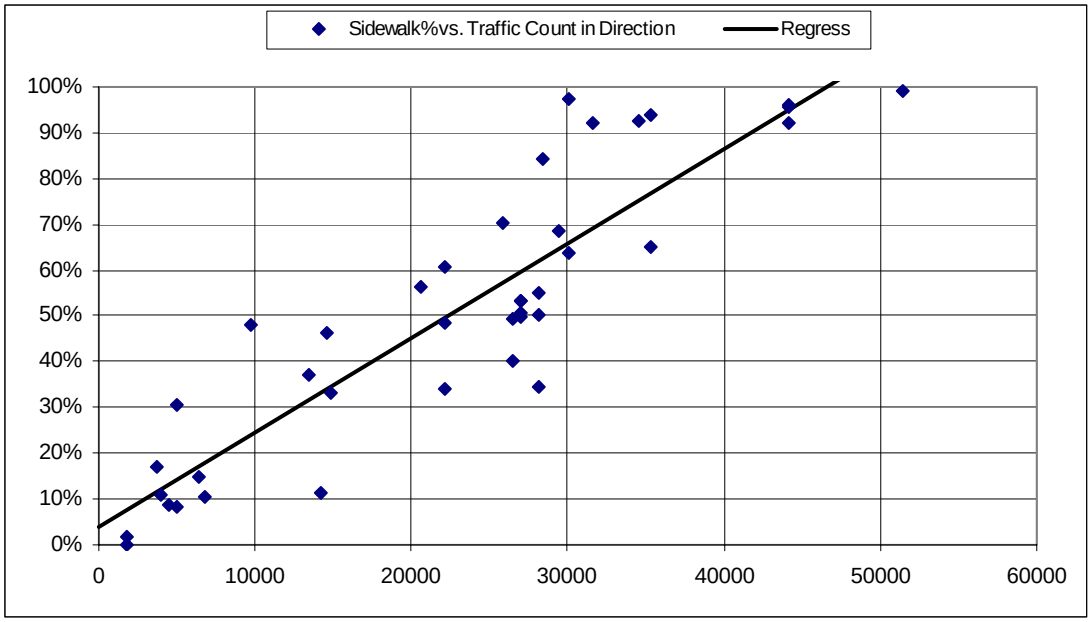

Figure 3 Correlation between sidewalk riding and vehicular traffic count, by direction. $R^2 = 0.81$; $P = 4 \times 10^{-15}$.

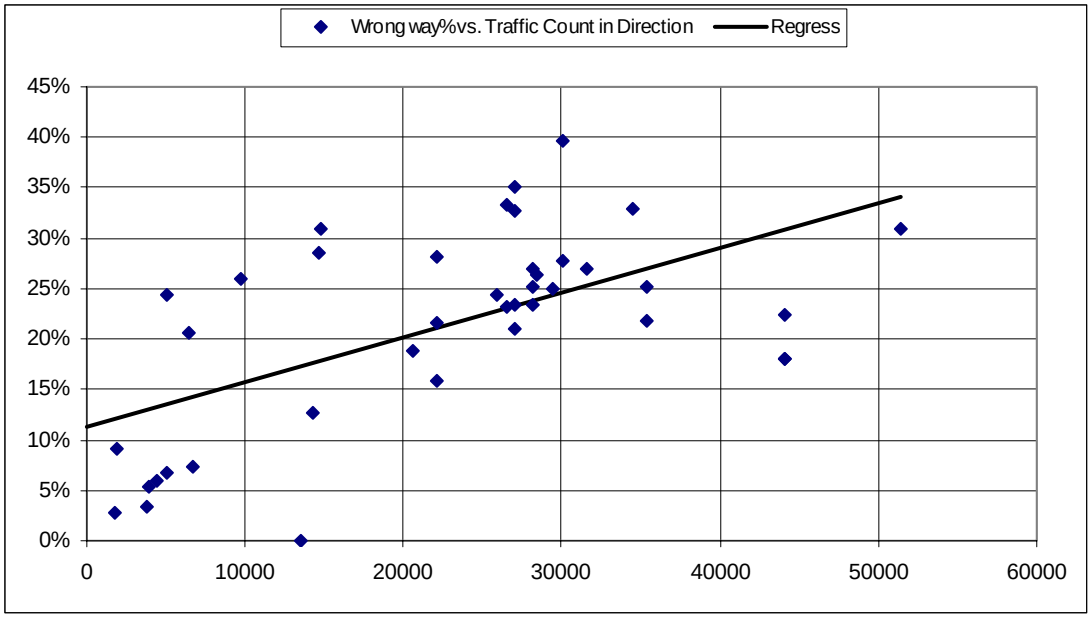

Figure 4 Correlation between wrong way riding and vehicular traffic count, by direction. R^2 = 0.35; P = 6 x 10^{-6}.

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

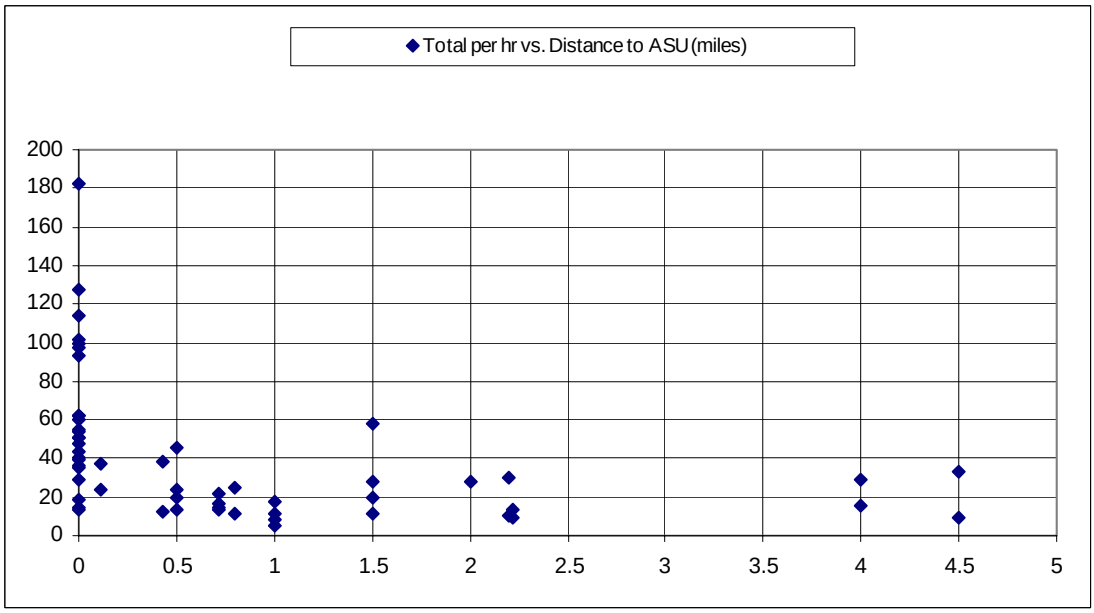

Figure 5 Relationship between cyclist count per hour and distance to ASU (miles), by direction.

c. Spatial Analysis

Maps of some of the data for each intersection can be found in Appendix A. Some clear patterns can be observed, especially concerning total bike activities and certain dangerous behaviors (low helmet use and sidewalk and wrong-way riding) on University, Rural and East of ASU campus. Many of the worst intersections for sidewalk riding are along the major arterials, and for wrong-way riding, along University road, especially along ASU campus. At several locations, sidewalk riding is the only option: the Western Canal, the TCA bridge, the Greenbelt path, and northbound at College & University.

d. Error Detection

Error detection methods were applied to the collected data. The detailed procedure is provided in Appendix B. Seven count locations had errors in attribute data indicated by the attribute count exceeding the bike count for a specific time and direction. There were 13 errors detected out of 1240 data points, with the majority due to transcribing. Based on this low percentage of errors, the counting procedure appears to be sound. As a result of corrections, the total bicycle count increased by 20.

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 accidents, especially when the bike is going the wrong way on the sidewalk. T.B.A.G. [4] would like to work with the city on plans to improve these roads, to add bike lanes, and to work on educational and enforcement campaigns in these areas.

Detected errors were reduced substantially relative to last year's count. This improvement is likely due to the following corrections made in the overall count process:

1) Training
2) Count sheet (simplification, e.g., removal of lower-priority metrics)

The use of cross-checking reduced the effect of errors even further. While the detection of errors may indicate problems in the data collection methodology, it does not imply the results are less accurate than comparable count data analysis results in other cities. The fact that error detection methods were applied to detect questionable data improves the final data analysis accuracy.

5. References

[1] Tempe Bike Count 2012, http://www.biketempe.org/wp-content/uploads/2011/12/Tempe-Bike-Count-2011-Final-Report1.pdf
[2] 2011 Regional Bicycle/Pedestrian Count Summary, http://www.pagnet.org/Programs/TransportationPlanning/TravelDemandManagement/BicycleandPedestrianEvaluationPrograms/tabid/1034/Default.aspx
[3] Traffic count data from the City of Tempe, www.tempe.gov/traffic
[4] Tempe Bicycle Action Group (T.B.A.G.), www.biketempe.org

Acknowledgements

Tempe Bike Count 2012 was a concerted effort by a diverse team representing a wide cross-section of the bicycle-interest community. Many thanks go out to the 22 volunteers who contributed their time to recording data and other areas of this effort.

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Appendix A Maps

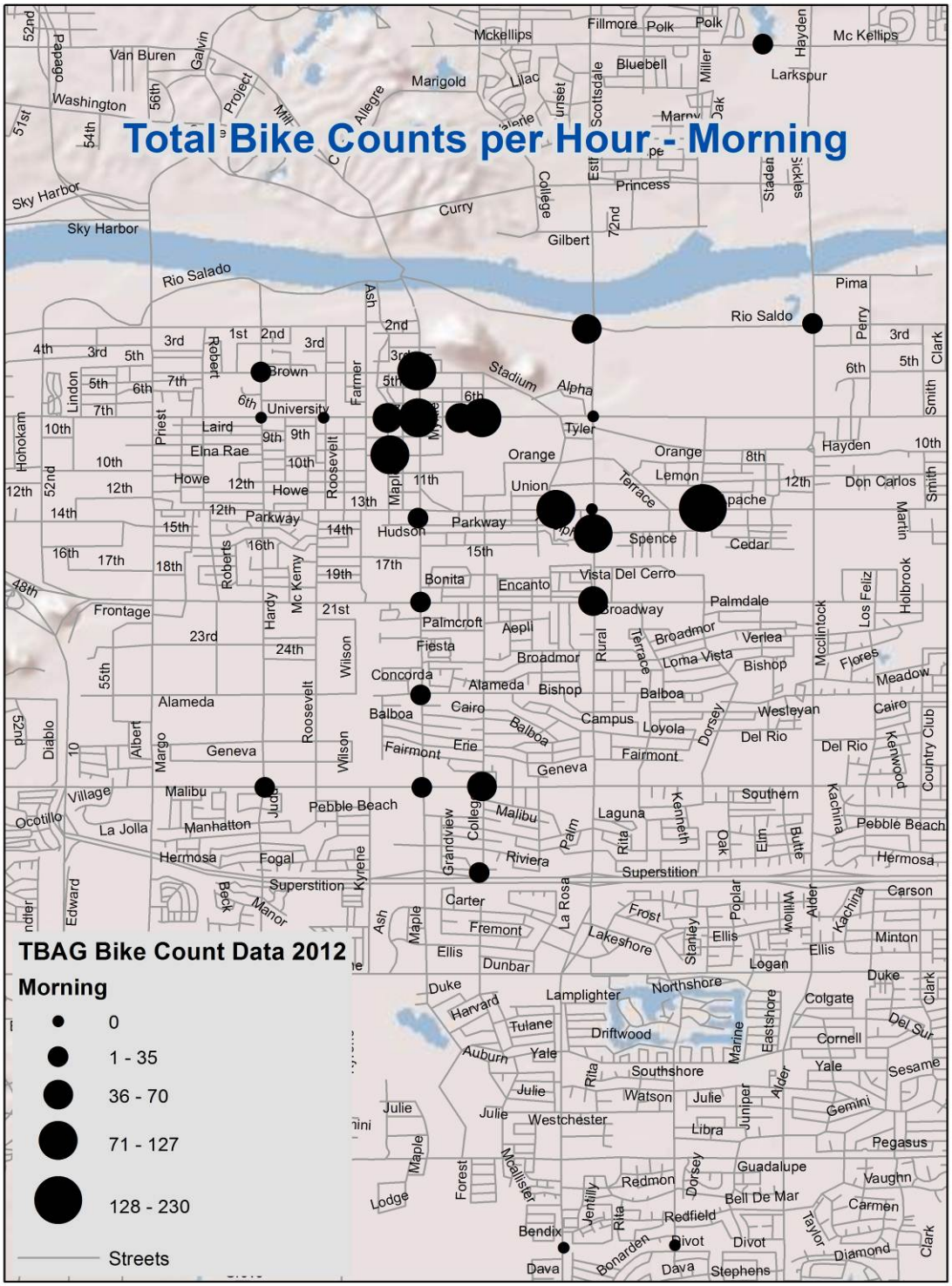


Figure A1 Total counts per hour – morning period

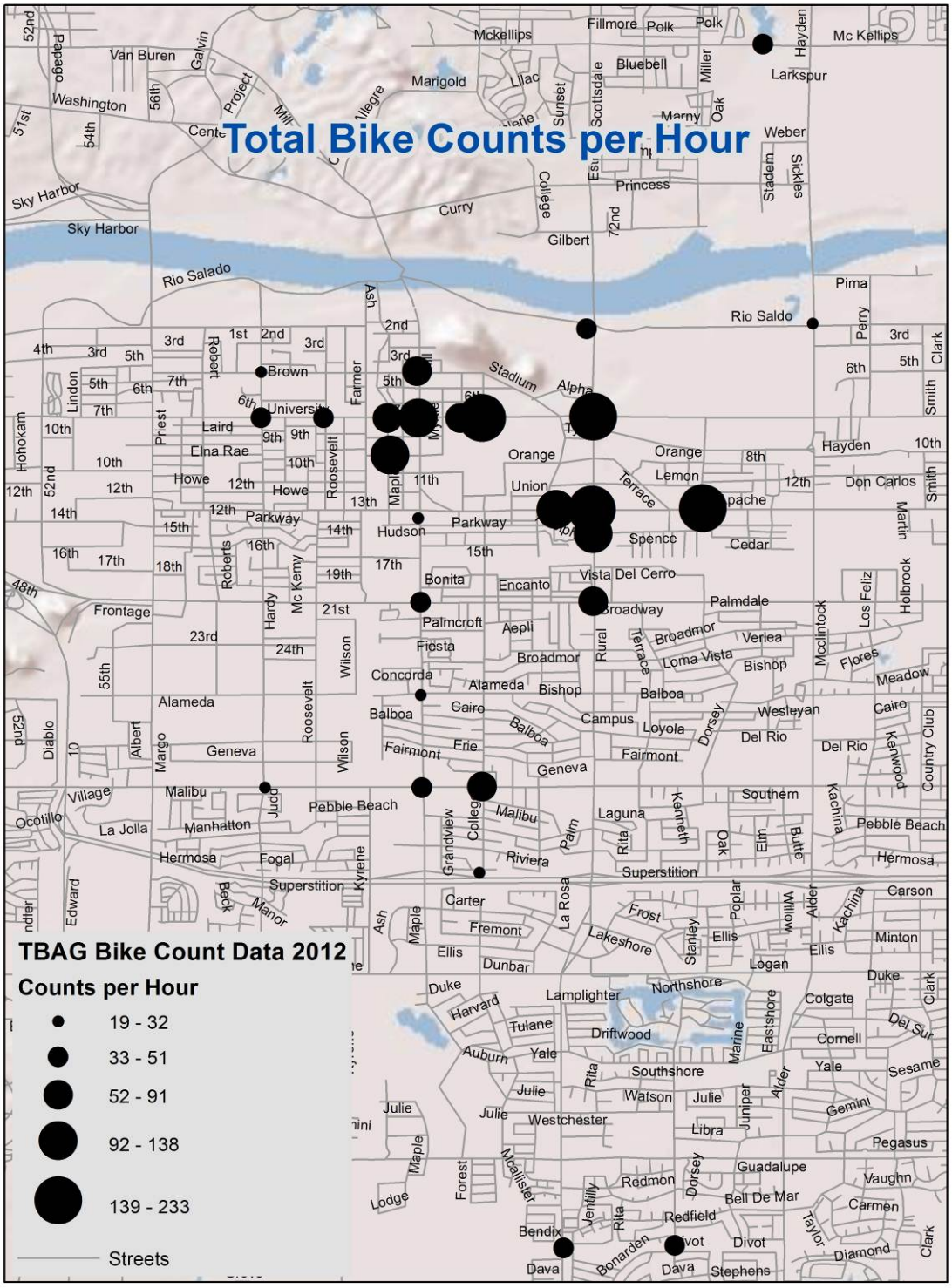


Figure A2- Total counts per hour combined AM and PM

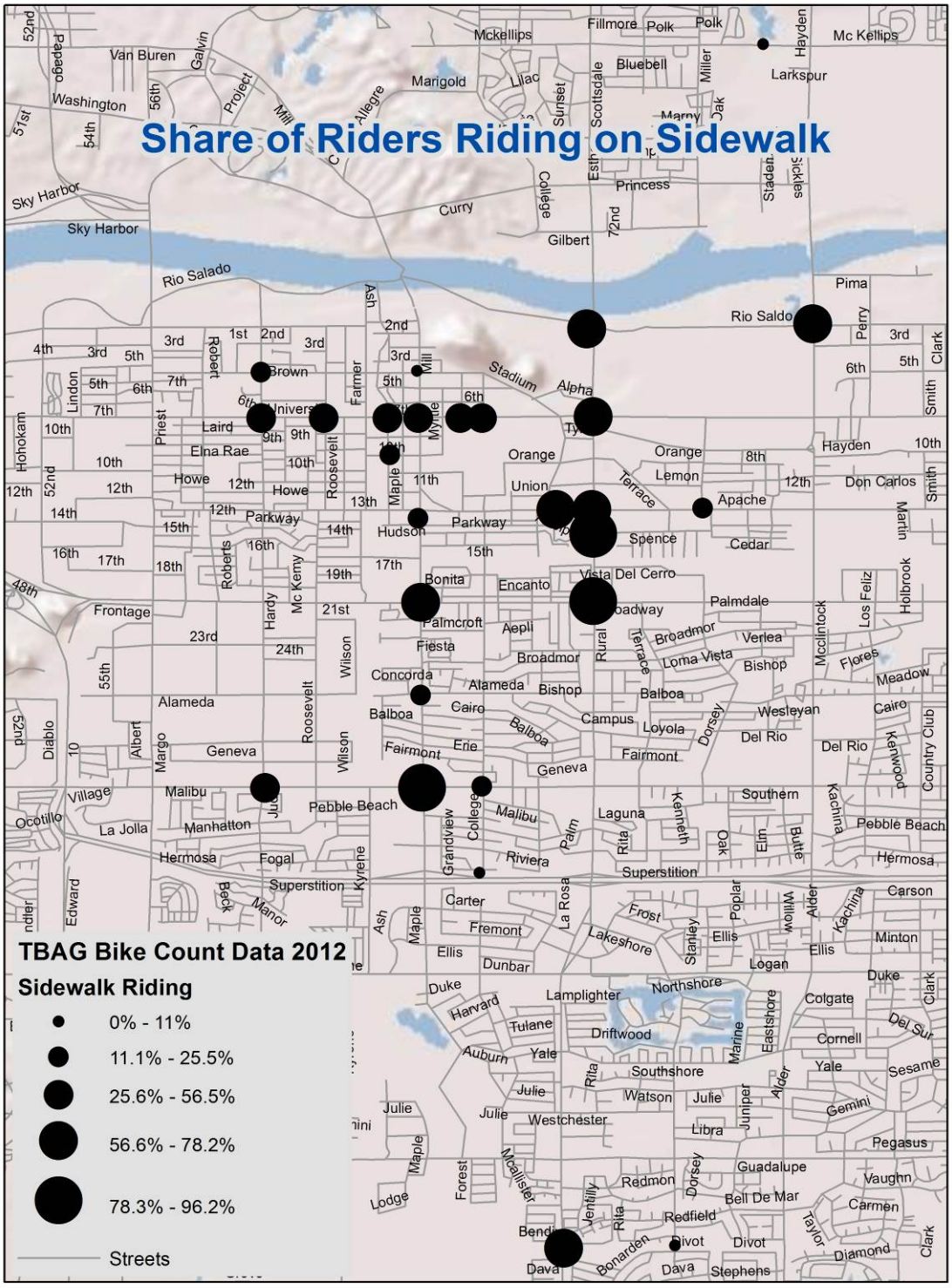


Figure A3 Share of riders riding on sidewalk

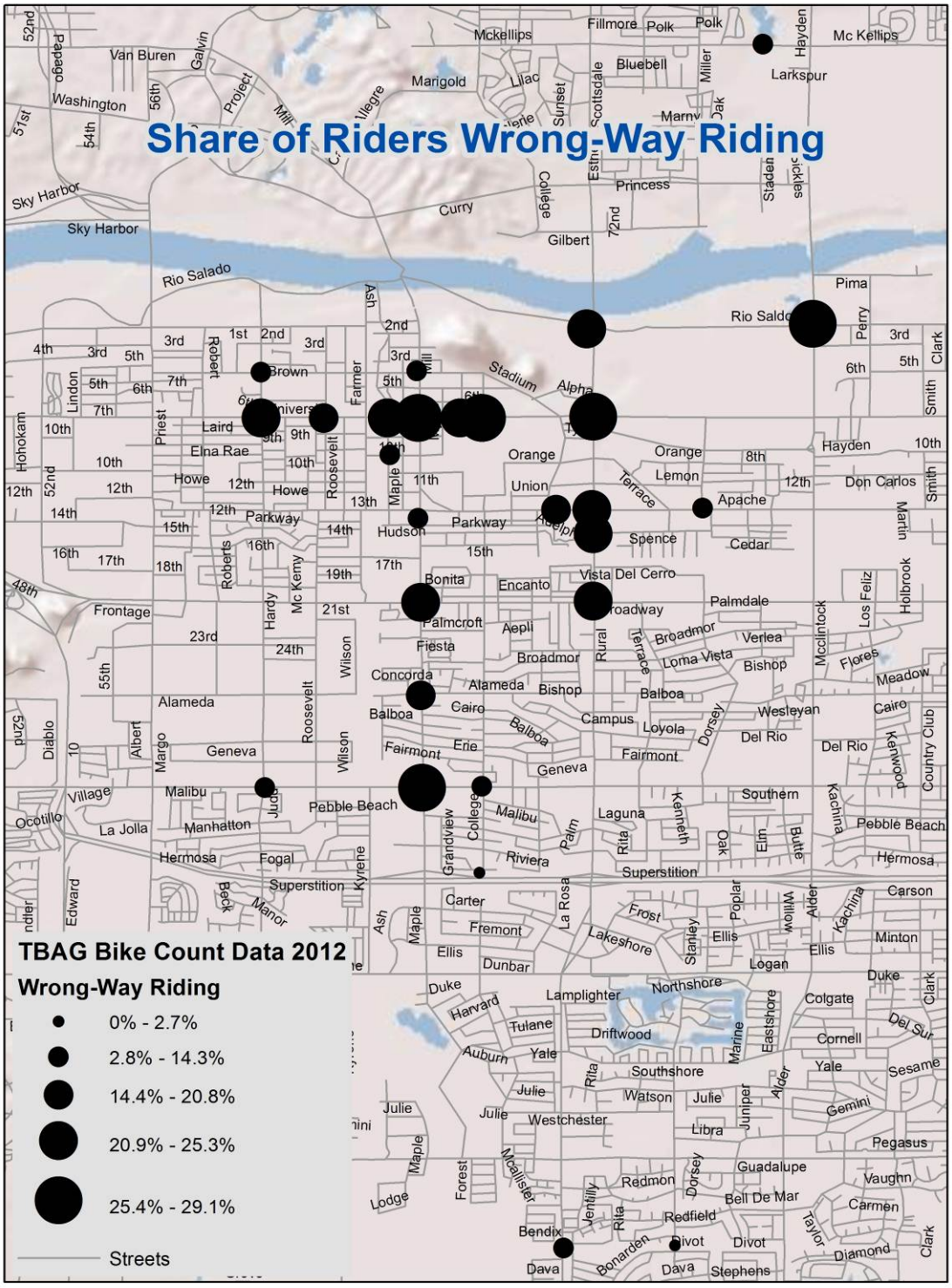


Figure A4 Share of riders riding the wrong way

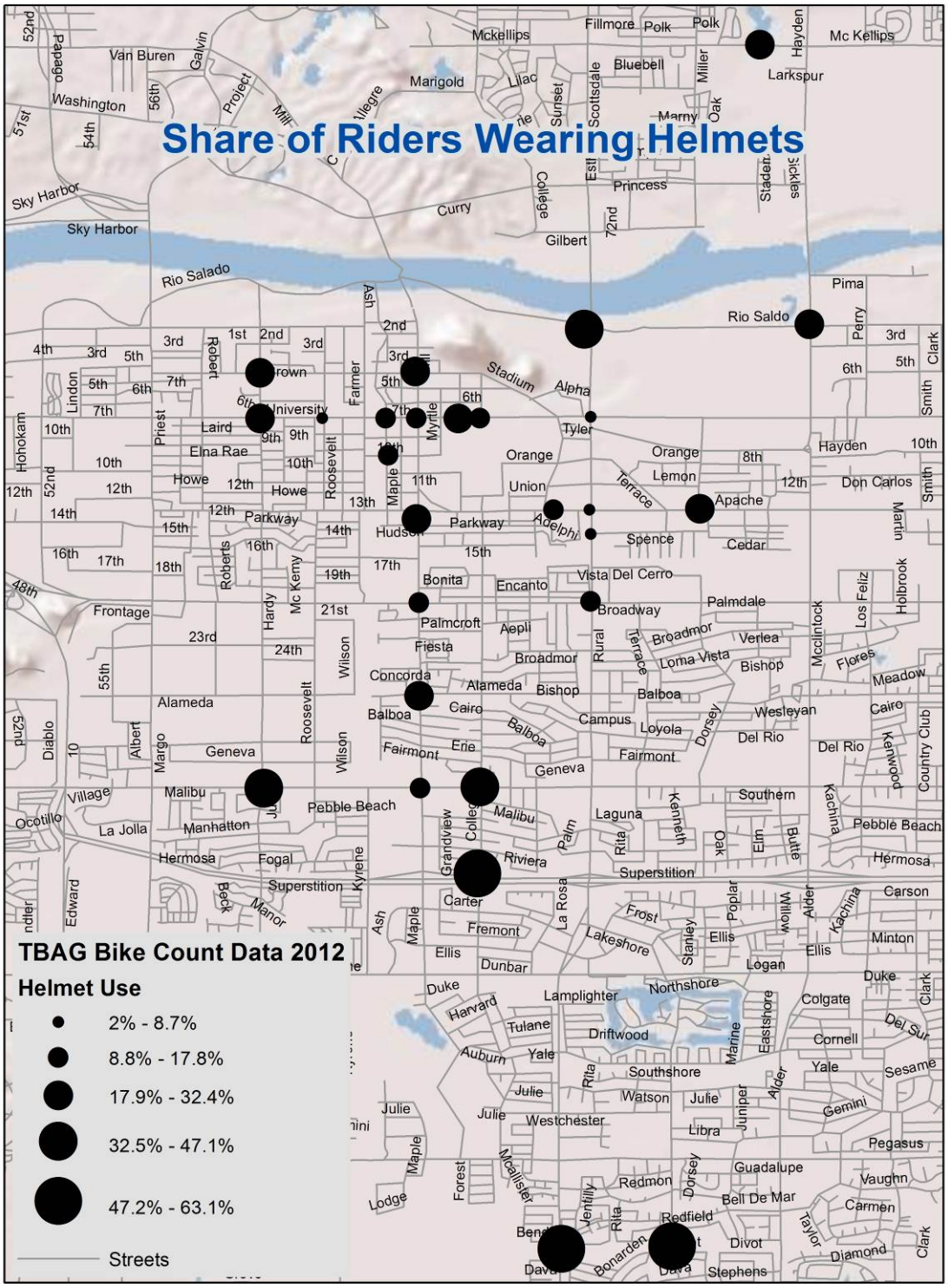


Figure A5 Share of riders riding wearing helmets

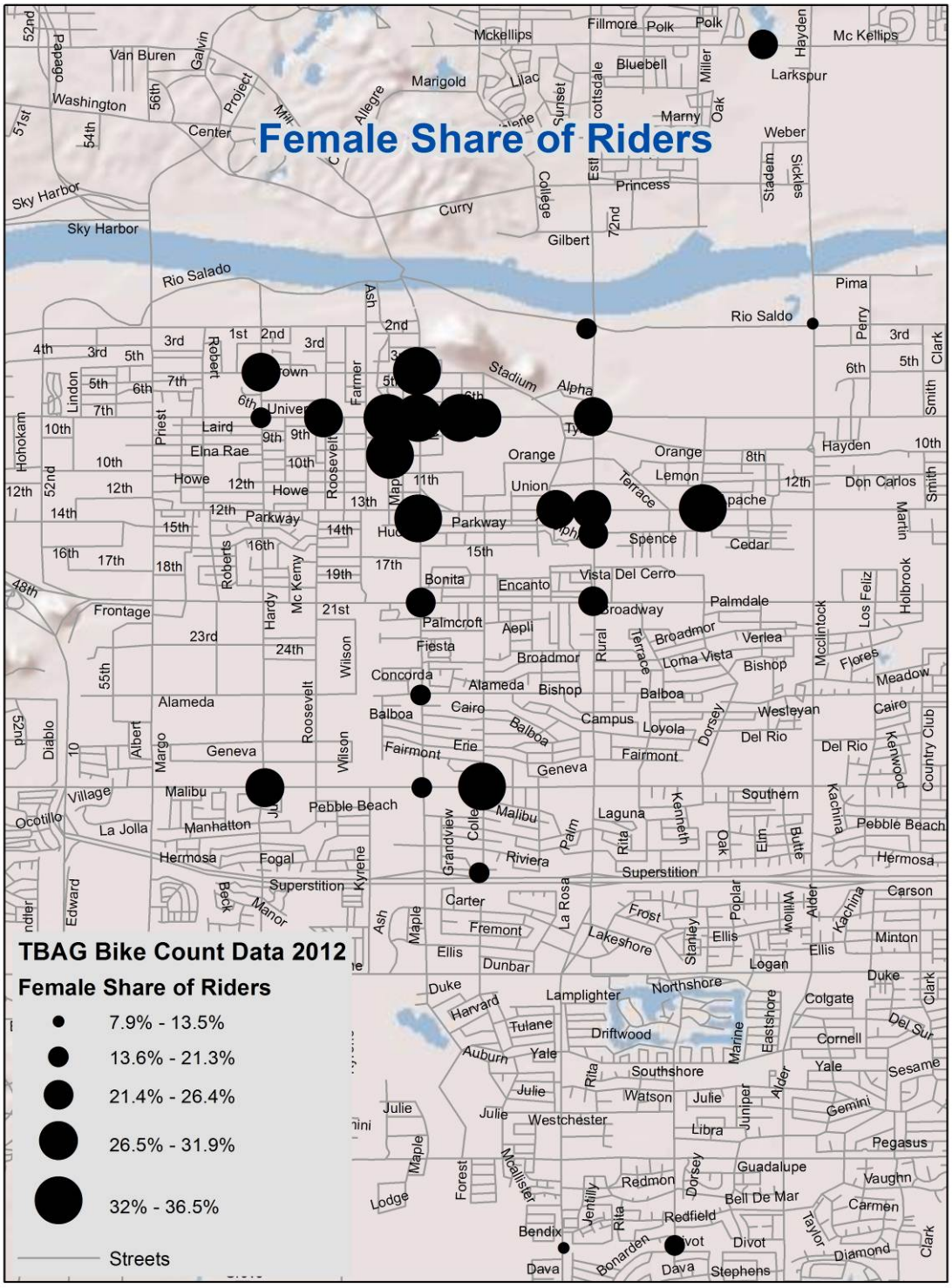


Figure A6 Share of riders riding who are female

Appendix B Methodology

Locations and times for collecting data were selected based on the following characteristics:

a. Highest estimated volume of bicycle traffic
b. Intersections
c. Establishment of cordon around (traffic in and out of) ASU
d. Coverage of a representative sample of the City of Tempe
e. Practicality of volunteer participation
f. Data collected during previous bike count

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 believed to include the peak time periods while also allowing volunteers to participate without interfering with their normal work schedules. Tuesday, Wednesday and Thursday were 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 was designed with 15 minute bins.

The set of instructions conveyed to recorders is shown in Appendix D. Three training sessions were held.

Bicycle count data was collected for each of the directions (typically 4) of each intersection. For analysis, the two opposite direction counts were added, e.g., east was added to west.

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

There were 13 total errors detected out of 1240 data points. The errors came from 7 data sheets. Based on this low percentage of errors, there does not appear to be any procedural errors by this method of error detection. The errors were reviewed case by case and all appear to be accidental errors rather than procedural. All errors were corrected. Of the 9 errors where comparisons could be made with the count sheets, 8 were transcription errors. For the remaining errors the count was increased to match the attribute data (presumed to be accidental recording error).

Average bike count per hour vs. time of day, as shown Figure 6, indicates that the peak, for the times counted, was reached in the 8:45 – 9:00 am bin. The morning 2-hour recording period started well

before the morning peak. Since these are aggregate counts, it is possible that some areas have peak ridership at other times. The data is expected to be influenced by class schedule at ASU.

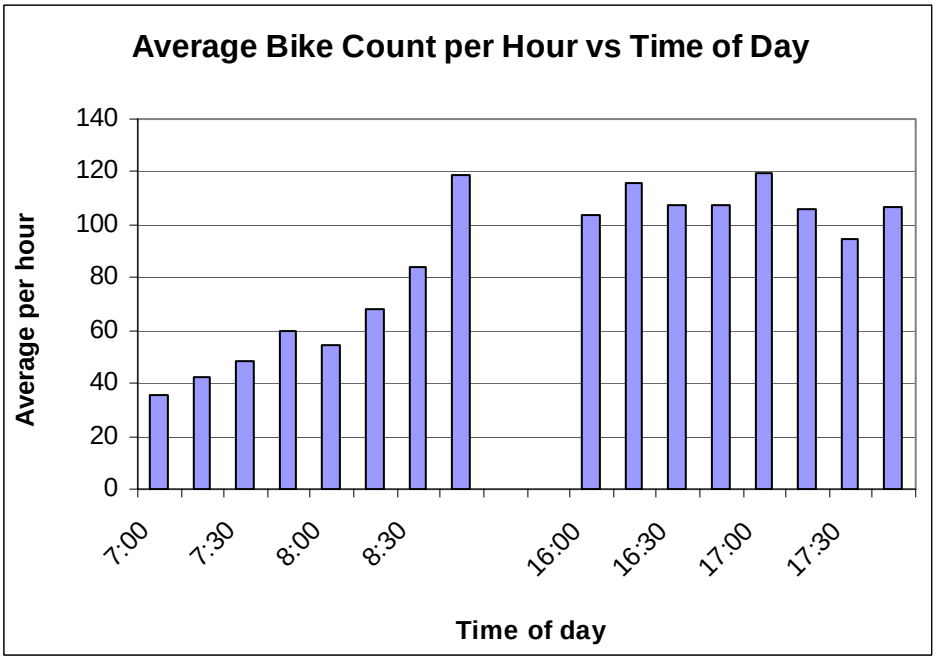


Figure 6 Average bike count per hour vs. time of day

Traffic count was obtained from City of Tempe data [3]. 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.

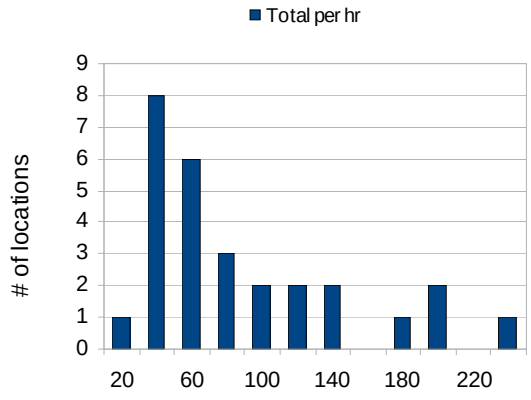
Appendix C - Bike Count Form

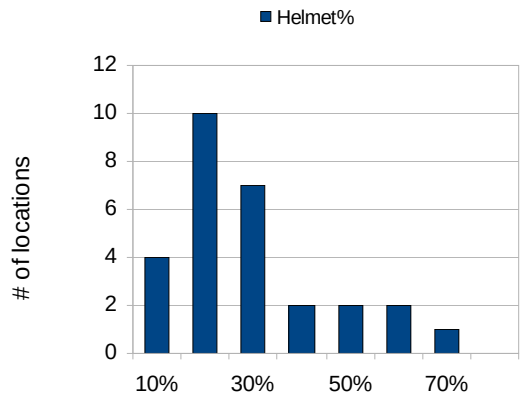
Name:			Count Sheet		page #:	
Date:		Location ID#:	Intersection of streets:			
		Check for every cyclist:	Also check all that apply:			
Hour	Approach			Wearing	Wrong Way	
_AM _PM	Direction	COUNT	FEMALE	HELMET	Riding	Riding on Sidewalk
	NB					
:00	SB					
	EB					
	WB					
	NB					
:15	SB					
	EB					
	WB					
	NB					
:30	SB					
	EB					
	WB					
	NB					
:45	SB					
	EB					
	WB					
Observations/ Notes:						
Construction etc.						
		Return all completed sheets to Boulders on Broadway (we want the original copies!) or mail to Scott Walters, PO Box 692, Tempe, AZ 85280. Optionally enter your own sheet's data on the form linked from http://biketempe.org/events/bike-count or else send a scan or readable photo to scrottie@biketempe.org. Thank you for your participation!				

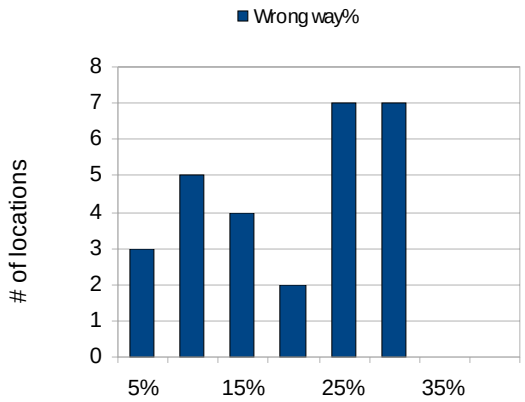
Appendix D - Bike Count Instructions

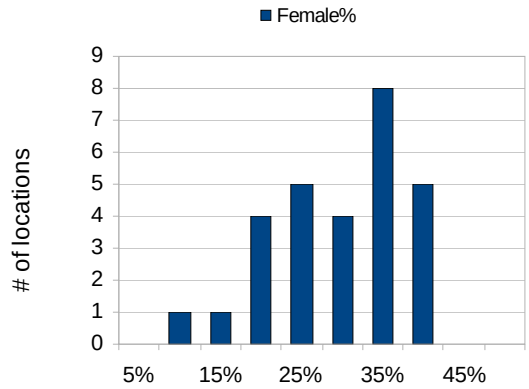
1. **Count Form Structure.**
    a. 1 hr: each form tracks 1 full hr of activity, broken into 15 minute increments.
    b. Total # of Cyclists recorded in "Count" Column. Attributes broken out in following columns.
2. **Fill In:** - Important please include the following info on each tracking sheet.
    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 & Pedestrians)
5. Columns **"Count"** = Total # Cyclists and **"Pedestrians"** = Total # of pedestrians
    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.

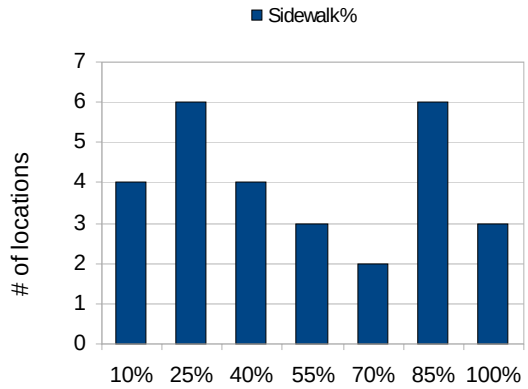
Appendix E – Additional Graphs











Appendix F Data Summary

Loc ID	Location or Intersection: E/W	Location or Intersection: N/S	Total per hr	AM per hr	PM per hr	Helmet%	Wrong way%	Sidewalk%	Female%	Traffic Count	Traffic Dir	Loc to ASU	Lane in Dir	Dir
103	Rio Salado Pkwy	Rural Rd	29.5	29.5		35.6%	23.7%	93.2%	0.24	14634		0	0	NS
104	Rio Salado Pkwy	McClintock Dr	11	11		18.2%	31.8%	90.9%	0.14	20597		1	0	NS
106	5th St	Mill Ave	43.5	43.5		44.8%	12.6%	11.5%	0.25	14225	14225	0	1	NS
109	5th St	Hardy Dr	17	17		20.6%	20.6%	14.7%	0.29	6409	6409	0.72	1	NS
111	10th St	Mill Ave	36.25	29	43.5	25.5%	23.4%	55.2%	0.32	28184	28184	0	0	NS
112	60 Fwy	College Ave	27.75	25.5	30	63.1%	2.7%	1.8%	0.2	1774	1774	2	1	NS
113	13th St	Mill Ave	13	13		26.9%	26.9%	34.6%	0.35	28184	28184	0	1	NS
115	University Dr	College Ave	113.5	70.5	156.5	11.0%	24.4%	30.4%	0.29	26482	5044	0	1	NS
117	University Dr	Rural Rd	53.5		53.5	8.4%	30.8%	99.1%	0.3	51380	51380	0	0	NS
118	University Dr	Mill Ave	54.75	38	71.5	21.9%	25.1%	50.2%	0.3	28184	28184	0	1	NS
119	University Dr	Ash Ave	23.5	23.5		8.5%	6.4%	23.4%	0.45	27003		0.11	1	NS
120	University Dr	Roosevelt St	12		12	0.0%	12.5%	37.5%	0.29	27003		0.43	1	NS
121	University Dr	Hardy Dr	13.5		13.5	29.6%	25.9%	48.1%	0.04	27003	9690	0.72	1	NS
122	McKellips Rd	Greenbelt Path	30	18	42	28.3%	0.0%	0.8%	0.23	14788		2.2	1	NS
123	Western Canal	Rural Rd	16		16	40.6%	25.0%	68.8%	0.09	29395	29395	4	0	NS
125	Western Canal	Lakeshore Dr	9		9	38.9%	0.0%	0.0%	0.33			4.5	1	NS
131	Apache Blvd	Rural Rd	93.5		93.5	7.5%	22.5%	92.0%	0.21	44120	44120	0	0	NS
133	Apache Blvd	College Ave	182.5	166	199	26.0%	6.7%	8.5%	0.34	22165	4997	0	1	NS
134	Apache Blvd	Paseo Del Saber	40	40		5.0%	0.0%	100.0%	0.38	22165		0	1	NS
136	Spence St	Rural Rd	99.5	68.5	130.5	6.8%	18.1%	96.2%	0.24	44120	44120	0	0	NS
138	Broadway Rd	Rural Rd	45.75	28	63.5	12.6%	18.0%	95.6%	0.22	44120	44120	0.5	0	NS
141	Southern Ave	College Ave	58	58		43.1%	6.0%	8.6%	0.38	35372	4442	1.5	1	NS
143	Southern Ave	Hardy Dr	13.5	13.5		59.3%	0.0%	37.0%	0.41	28429	13469	2.22	1	NS
144	Southern Ave	Mill Ave	19.75	15.5	24	12.7%	32.9%	92.4%	0.16	35372	34482	1.5	1	NS
145	Alameda Dr	Mill Ave	18	18		19.4%	22.2%	33.3%	0.22	1841		1	1	NS
146	Broadway Rd	Mill Ave	23.5	22	25	21.3%	24.5%	70.2%	0.23	31585	25849	0.5	1	NS
151	University Dr	Forest Ave	39.75	13	66.5	10.7%	19.5%	34.0%	0.35	26482		0	0	NS
152	Tempe Lake	TCA Bridge	11.5		11.5	26.1%	0.0%	0.0%	0.26			0.8	0	NS

Loc ID	Location or Intersection: E/W	Location or Intersection: N/S	Total per hr	AM per hr	PM per hr	Helmet%	Wrong way%	Sidewalk%	Female%	Traffic Count	Traffic Dir	Loc to ASU	Lane in Dir	Dir
103	Rio Salado Pkwy	Rural Rd	14	14		71.4%	28.6%	46.4%	0.14	14634	14634	0	1	EW
104	Rio Salado Pkwy	McClintock Dr	8	8		43.8%	18.8%	56.3%	0	20597	20597	1	1	EW
106	5th St	Mill Ave	47.5	47.5		21.1%	7.4%	10.5%	0.4	14225	6739	0	1	EW
109	5th St	Hardy Dr	14.5	14.5		17.2%	3.4%	17.2%	0.31	6409	3747	0.72	1	EW
111	10th St	Mill Ave	101.5	84	119	10.8%	4.4%	8.1%	0.36	28184		0	1	EW
113	13th St	Mill Ave	18.5	18.5		21.6%	5.4%	10.8%	0.38	28184	3917	0	1	EW
115	University Dr	College Ave	60	56	64	8.3%	33.3%	49.2%	0.31	26482	26482	0	1	EW
117	University Dr	Rural Rd	127.5		127.5	5.9%	27.8%	63.9%	0.3	51380	30015	0	1	EW
118	University Dr	Mill Ave	62	45.5	78.5	8.1%	32.7%	50.8%	0.36	28184	27003	0	1	EW
119	University Dr	Ash Ave	37	37		14.9%	35.1%	50.0%	0.27	27003	27003	0.11	1	EW
120	University Dr	Roosevelt St	38.5		38.5	2.6%	23.4%	53.2%	0.31	27003	27003	0.43	1	EW
121	University Dr	Hardy Dr	21.5		21.5	16.3%	20.9%	53.5%	0.28	27003	27003	0.72	1	EW
122	McKellips Rd	Greenbelt Path	10.5	6.5	14.5	7.1%	31.0%	33.3%	0.21	14788	14788	2.2	1	EW
123	Western Canal	Rural Rd	28.5		28.5	64.9%	3.5%	80.7%	0.16	29395		4	1	EW
125	Western Canal	Lakeshore Dr	33.5		33.5	61.2%	0.0%	0.0%	0.12			4.5	1	EW
131	Apache Blvd	Rural Rd	97		97	9.8%	21.6%	60.8%	0.37	44120	22165	0	1	EW
133	Apache Blvd	College Ave	50.5	64	37	9.9%	15.8%	34.2%	0.45	22165	22165	0	1	EW
134	Apache Blvd	Paseo Del Saber	62	62		15.3%	28.2%	48.4%	0.28	22165	22165	0	1	EW
136	Spence St	Rural Rd	35	14.5	55.5	12.1%	37.1%	64.3%	0.28	44120		0	1	EW
138	Broadway Rd	Rural Rd	19.5	18.5	20.5	10.3%	39.7%	97.4%	0.23	44120	30063	0.5	0	EW
141	Southern Ave	College Ave	11.5	11.5		13.0%	21.7%	65.2%	0.26	35372	35372	1.5	0	EW
143	Southern Ave	Hardy Dr	9.5	9.5		15.8%	26.3%	84.2%	0.16	28429	28429	2.22	0	EW
144	Southern Ave	Mill Ave	27.75	19.5	36	14.4%	25.2%	93.7%	0.2	35372	35372	1.5	0	EW
145	Alameda Dr	Mill Ave	5.5	5.5		45.5%	9.1%	0.0%	0.18	1841	1841	1	1	EW
146	Broadway Rd	Mill Ave	13	9.5	16.5	11.5%	26.9%	92.3%	0.23	31585	31585	0.5	0	EW
151	University Dr	Forest Ave	50.5	34.5	66.5	12.4%	23.3%	40.1%	0.36	26482	26482	0	1	EW
152	Tempe Lake	TCA Bridge	24.5		24.5	22.4%	0.0%	0.0%	0.27			0.8	0	EW