¡We Count!

Summer 2017

Report of the Inaugural Annual National Bicycle and Pedestrian Count for Las Cruces

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for Velo Cruces, Inc.

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Cover Photograph: Image shows Main Street near Madrid sidewalk and bike lane covered with automobile tire marks. *Photograph by Nathan Craig*.

Acknowledgement Page Photograph: Image shows corner of Main Street and Madrid intersection and depicts multiple automobile tire tracks that encroached into the sidewalk. *Photograph by Nathan Craig*.

Closing Photograph: Image shows parked automobile encroaching into the sidewalk along Madrid. *Photograph by Nathan Craig*.

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Executive Summary

On the week of Monday, September 11–Sunday, September 17, 2017, citizens of Las Cruces, working in collaboration with Velo Cruces, undertook a pedestrian and bicycle count at 12 locations throughout the city. This pedestrian and bicycle count was conducted as part of the National Bicycle and Pedestrian Documentation (NBPD) Project.

The Mesilla Valley Metropolitan Planning Organization's (MVMPO), Metropolitan Transportation Plan (MTP) identifies the need to "begin including pedestrian and bicycle traffic counts" (MVMPO 2015:63; LCMPO 2010:107). Beginning in 2012, and presumably continuing to the present, MVMPO has used electronic counters on multi-use paths (MVMPO 2015:28). Though the need for pedestrian and bicycle traffic counts was included in the original 2010 MTP report, the authors of this report are unaware of any systematic, recurring program to generate counts for bicycles and pedestrians in Doña Ana County, Las Cruces, or Mesilla. For the region, data collection efforts regarding pedestrian and bicycle use is well behind the quantification of automotive transportation. The current citizen-driven bicycle and pedestrian count seeks to begin developing better documentation of bicycle and pedestrian activity within the region.

The 2017 count focuses primarily on gathering quantitative information regarding the volume of bicycle and pedestrian use within Las Cruces. Screen line sampling was employed to count the number of bicyclists and pedestrians traversing a given location. Efforts were made to select locations where bicycle and pedestrian activity occurs regularly.

Thirteen volunteers visited 12 (Locations 7, 11 and 12 were not observed) sampling locations and generated 21 two-hour counts for a total of 42 observation hours. The Locations were:

- Location 1: Mesquite near Madrid
- Location 2: Hadley at Meerscheidt
- Location 3: Ave de Mesilla near Calle del Norte
- Location 4: W. Amador near Community of Hope
- Location 5: Hoagland near Mayfield High School
- Location 6: Solano near Idaho
- Location 8: W. Las Cruces near Central Elementary School
- Location 9: Espina near University
- Location 10: Triviz Multi-use Trail near University
- Location 13: Solano near Missouri
- Location 14: Idaho near Solano
- Location 15: Alameda near Las Cruces

For the duration of the week of documentation efforts, the 42 observation hours resulted in the tallying of 192 bicycle riders, 1031 pedestrians, and 14 other modes of active transportation. Aggregating all sample locations and counts, 4.5 cyclists and 24.5 pedestrians per hour were tallied.

For bicyclists the highest average use was recorded at Locations 9, 4, and 5 while the lowest average use was recorded at Locations 2, 10, and 15. For pedestrians the highest average use was recorded at Locations 3, 9, and 4 while the lowest average use was recorded at Locations 15, 10, and 8. For both bicyclists and pedestrians, weekdays saw heavier use than weekends and males were tallied more frequently than females.

Data from this report indicate that regularly used destinations like universities, social services, and schools see substantial bicycle and pedestrian use. This, coupled with greater use during the weekday rather than the weekend, underscores the importance of bicycling and walking as transportation, not just recreation. In the case of NMSU, some specific corridors to frequently visited destinations are more heavily used than others. The low usage of both the Triviz Multi-use Trail and Hadley at Meerscheidt is surprising given that these corridors are either existing or proposed cycling infrastructure. The disparity between patterns of use and either existing or proposed facilities is a cause for concern and underscores the need for pedestrian and bicycle studies when planning and implementing infrastructure to serve these transportation communities. If resources are limited, it is reasonable to suggest that planning and development efforts should prioritize areas that receive the greatest use. A second, and perhaps equal, priority would be to emphasize areas that are the most dangerous for bicyclists and pedestrians. Frequently used and dangerous areas should receive the highest priority.

Overall, the disproportionate representation of males appears stronger among bicyclists than among pedestrians. Entities seeking to promote walking and bicycling in Las Cruces should address the sex-based disparities revealed by this report.

Introduction

On the week of Monday, September 11–Sunday, September 17, 2017, citizens of Las Cruces, working in collaboration with Velo Cruces, undertook a pedestrian and bicycle count at 12 locations throughout the city. This pedestrian and bicycle count was conducted as part of the National Bicycle and Pedestrian Documentation (NBPD) Project. The impetus to organize individuals to participate in the 2017 NBPD arose from a Board of Director's meeting for the Velo Cruces cycling organization. Part of the desire to document pedestrian and bicycle use stemmed from the phrase “if you don’t count, then you don’t count”. Collectively, individuals at the meeting realized that quantification is key to documentation and demonstration.

Aim and Context of Study

This study aims to provide an initial quantification of bicycle and pedestrian use of Las Cruces city infrastructure. To understand the context in which this project was undertaken, it is helpful to review aspects of the regional transportation plan, especially those that pertain to bicycles and pedestrians.

The Mesilla Valley Metropolitan Planning Organization (MVMPO), charged with transportation planning in Doña Ana County, the city of Las Cruces, and the town of Mesilla, adopted a Metropolitan Transportation Plan (MTP) for the region. In its own words, the MTP is “the long-range transportation plan that guides planning, construction, operation and maintenance of an integrated, multi-modal transportation network” (MVMPO 2015:12). Such planning is informed by appropriate and adequate data on the multiple modes of transportation in the network.

The current MTP Transport 2040 Update (2015) reiterates the commitment stated in the 2010 Las Cruces Metropolitan Planning Organization (LCMPO) MTP report (LCMPO 2010) to the collection of data to help implement and evaluate the success of changes made in the transportation system through various measures. Table 1 lists the tools that are identified for producing performance measures for pedestrian, bicycle, and automobile modes of transportation (MVMPO 2015:54).

Table 1. Performance measures taken from the 2015 MTP, organized by similarity across categories

	Pedestrian	***Bicycle***	***Automobile***
Performance Measures	Safety: Crash Records	Safety: Crash Records	Safety: Crash Records
	Pedestrian Level of Service	Bicycle Level of Service	Level of Service
	Public Life Surveys		
	Walkability Rating		Corridor Impact Analysis
	Pedestrian Environmental Quality Index	Bicycle Environmental Quality Index	
	Minimal Delay at Crossings	Travel Time and Delay	Travel Time
	Foot Traffic Volume	Bicycle Counts	Automobile Counts

As described in the MTP, Level of Service (LOS) "is a traffic engineering term that describes traffic quality" (MVMPO 2015:68). When applied to pedestrians and bicyclists, it is a measurement of how the roadway meets a pedestrian or bicyclist's "perception of comfort, convenience, and safety" (MVMPO 2015:68). While not attempted by Velo Cruces this year, surveys following the model offered by the NBPD may be conducted in the future to directly gather data on pedestrian and bicyclist perceptions. We make this suggestion because, based on the MTP report, it is unclear what tools are currently being used to examine this measure.

According to the MTP, more work needs to be done to inventory the pedestrian infrastructure in the planning region, which "could be assisted through initiating neighborhood assessments of the pedestrian environment" (MVMPO 2015:27-28). The current Pedestrian System Priorities Plan map encourages ranking pedestrian infrastructure projects based on "public input, crash data, and proximity to parks, schools, and transit." Pedestrian counts are not represented in the Pedestrian System Priorities Plan map.

Regarding bicycle infrastructure, the MTP indicates that as of 2012 there are 140 miles of in-road bicycle facilities in the City of Las Cruces, and 15 miles of multi-use paths (MVMPO 2015:28). The Bicycle System Priorities Plan map emphasizes connectivity of in-road bicycle facilities. Bicycle counts are not represented in the Bicycle System Priorities Plan map.

In contrast, automobile traffic conditions are modeled on a variety of measures. Central to the modeling is "a traffic count program that provides data utilized by the public and a variety of stakeholders" (MVMPO 2015:33). In the Functional Classification Map that pertains to infrastructure used by motorized vehicles, usage, calculated in part using Annual Average Daily Traffic Volumes (i.e. counts), appears to be central to planning.

When comparing the data that are used to better plan the development of pedestrian, bicycle, and automobile or motorized vehicle infrastructure, it is clear that data collection efforts for pedestrian and bicycle usage are well behind those for automobiles or motorized vehicles. The resources and time put toward understanding bicycle and pedestrian facilities or activity patterns are minimal. This directly impacts the planning of infrastructure for bicyclists and pedestrians, resulting in facilities that are lacking or misguided.

The MVMPO recognizes this gap in data. In fact, the MTP report calls for specific tasks, such as to "begin including pedestrian and bicycle traffic counts" (MVMPO 2015:63; LCMPO 2010:107). Beginning in 2012, and presumably continuing to the present, MVMPO has used electronic counters on multi-use paths (MVMPO 2015:28). Counts appear to be combined for bicycle and pedestrians, based on the table included in the report (MVMPO 2015:Figure 2-18). While the initiation of a trail count program on the multi-use trails is positive, we are unaware of any systematic, recurring program to generate counts for bicycles and pedestrians in other areas of Doña Ana County, Las Cruces or Mesilla. It is important to note that the call for inclusion of pedestrian and bicycle traffic counts was in the original report MTP dated to 2010.

Once source of data related to bicycle and pedestrian activity is the LCMPO Safe Routes to School (SRTS) 2012 Action Plan. This effort did not seek to quantify the number of students who commute by bicycling or walking, but rather sought to "evaluate school sites and safety concerns within the LCMPO area" (SRTS 2012: 2). The general goal of SRTS is to increase the number of bicycle and pedestrian commuters to and from school each day (SRTS 2012: 12). Working towards this goal, in 2009, a 10 question parent survey was conducted to determine some of the obstacles to children bicycling or walking to school. Survey results revealed that 36% of the respondents were concerned about the safety of intersections and crossings, and 36% of the respondents were concerned about high traffic volume along the routes to school (SRTS 1012: 33). These were the second and third highest rated concerns respectively. Bicycle and pedestrian counts would help to 1) establish if SRTS efforts to increase bicycle and pedestrian commuting to school are effective, and 2) evaluate another MPO program.

There are some data on bicycle and pedestrian activity provided through an app called STRAVA. Originally a fitness app, STRAVA data are now being widely used by planners to inform on usage of bicycle and pedestrian facilities. The data are crowd-sourced—that is, the data uploaded by users of the app are aggregated, made anonymous by STRAVA, and sold to planners as part of the STRAVA Metro service (www.metro.strava.com). The data are provided by athletes or those with a fitness focus who have the means of affording the technology to use the app, the means of uploading the data, and a willingness to overlook privacy concerns inherent in big data sharing. It is questionable that the data provide a representative sample of bicycle and pedestrian usage in our community.

According to the City of Las Cruces' website, in late 2014 the Bicycle Friendly America (BFA) program provided a report card and feedback for improving bicycling facilities. The BFA recommended that the city "regularly conduct research on bicycle usage," and specifically urged the city to "consider participating in the National Bicycle and Pedestrian Documentation Project" (NBPD). Nearly three years later, there appears to be more to do to meet these recommendations.

As the NBPD points out: "Without accurate and consistent demand and usage figures [on bicycle and pedestrian facilities], it is difficult to measure the positive benefits of investments in these modes [of travel], especially when compared to the other transportation modes such as the private automobile" (www.bikepeddocumentation.org). If transportation planning decisions are to be data-driven, then data collection must be prioritized.

When the issue of collecting these critical data was raised at a Bicycle and Pedestrian Advocacy Committee (BPAC) meeting on August 15, 2017, planners concurred that bicycle and pedestrian counts would be beneficial, but indicated that such data have been difficult to attain. Indeed, in the seven years that have passed since the initial MTP, and the two years that have passed since the MTP update, it is unclear what progress has been made toward collecting data on bicycle and pedestrian activity as modes of transport. Steps must be taken to ensure that adequate data are available for our community, especially the data on bicycles and pedestrians that are currently missing from planning efforts.

In order to help move these documentation efforts forward, Velo Cruces decided to organize a citizen-initiated count to coincide with the annual NBPD. There were several aims for this first year of the Las Cruces documentation project:

- assemble quantitative information on bicycle and pedestrian modes of transportation as a basis for measuring progress of advocacy efforts
- collect data to send to the NBPD as well as to local city and county planning entities for use in data-driven planning efforts
- ensure data collection focused on capturing a range of facilities users in our community in contrast to the narrow data on bicyclists and pedestrians currently being used
- provide a proof of concept for such a community-organized count

Methods

Protocols for the 2017 count of Las Cruces followed methods laid out in the NBPD (2010) Instructions. The 2017 Las Cruces count was organized on short notice. Within a span of roughly three weeks, the count was organized, training was held, and the count was conducted. Fortunately, the NBPD (2010) provided clear instructions that greatly facilitated the rapid implementation of the 2017 Las Cruces count.

The 2017 count focuses primarily on gathering quantitative information regarding the volume of bicycle and pedestrian usage within Las Cruces. Thus, among the various counting methods outlined in the NBPD (2010) Instructions Guide, screen line sampling was selected as the method for data collection. Instructions call for one sampling location per 15,000 residents (NBPD 2010:5). The estimated population of Las Cruces for 2016 is 101,759 (U.S. Census Bureau). For this documentation project, the population was rounded up to 102,000 individuals. Based on the NBPD suggested sampling density and the population estimate, seven locations would be a suitable number of samples for a city the size of Las Cruces.

To attract individuals who could perform counts at these seven sampling locations, Velo Cruces issued a press release and called for volunteers to participate in the 2017 count. A volunteer training session was conducted on September 5, 2017. During the training session, volunteers were directed to the NBPD Instructions, trained in the methods of screen line sampling, and provided with a list of recommended equipment. Deviating from NBPD Instructions, volunteers were asked to supply their own copies of the screen line sampling forms. Volunteers participating in the count included: Margaret Brown Vega, Brian Byrd, Jean Conway, Nathan Craig, Marcia Davis, Anissa Duarte, Renée Huber, John Landrum, George Pearson, Cindy Robbins, Gabriel Rochelle, Jess Waller, and Donald Wilson. Blake Stogner and Michael McAdams were also present at the volunteer training session and provided valuable input regarding the selection of sample locations.

Selection and Justification of Sample Locations

Prior to the September 5th training session, a list of potential sampling locations was established by the count co-managers. NBPD (2010: 5-6) acknowledges that random selection of sampling locations is the statistically preferred method, but that it “is likely to result in locations with little if any activity to count”. Following the NBPD (2010:7) guidelines, efforts were made to select locations where bicycle and pedestrian activity occurs regularly. During the training meeting, with input from community volunteers, 11 sampling locations were established. In selecting sampling locations, effort was made to ensure a relatively even distribution of locations throughout the city. Sample locations are mapped in Figure 1, and justifications for location selections are supplied in Table 2.

Volunteers signed up to generate counts on specific days and times for assigned locations. For organizational proposes, volunteer names, assigned locations, days and times were assembled in a master table. Prior to the start of the counting period, a follow-up reminder email was sent to volunteers. Some additional volunteers contacted the count co-managers after the training. These volunteers were supplied written orientation information and directed to both the NBPD (2010) Instructions and Standard Screen Line Count Form.

NBPD (2010:3) Instructions suggest conducting between one and three counts at each sampling location. For the sake of comparability across the entire nationwide sample, NBPD Instructions outline specific days and times during which counts should be conducted. These are Tuesday through Thursday from 5:00–7:00 PM and Saturday from 12:00-2:00 PM.

When assigning volunteers to sampling locations, efforts were made to ensure that counts were collected during at least one weekday and one weekend sample. Given the constraints of volunteer time, and that some volunteers were unable to conduct counts that they committed to perform, it was not possible to collect a weekend and weekday sample for all locations. Several individuals at the training meeting, including NMSU faculty, expressed concern that the 5:00–7:00 PM weekday sampling frame was too late to capture peak bicycle and pedestrian travel to and from the NMSU campus. Fortunately, one volunteer offered to do one supplemental count between 3:00–5:00 PM at Location 9: Espina near University.

Table 2. Sample location justifications

Sample Location	*Location Number*	*Sample Location Justification*
Mesquite near Madrid	1	Mesquite is a major N-S running bicycle friendly street. The location sampled use in NE area of Las Cruces. The location was close to Apodaca Park and near shopping areas.
Hadley at Meerscheidt (Solano)	2	Along proposed bike boulevard, in a major recreational complex, in front of a community center.
Ave de Mesilla near Calle del Norte	3	Supposed to be a major bicycle thoroughfare for traveling to the town of Mesilla. It was assumed that this was an area of high bicycle use.
W. Amador near Community of Hope (Compress)	4	Located near multiple social service organizations for low-income residents and individuals experiencing homelessness.
Hoagland near Mayfield High (Valley)	5	Located adjacent to a high school along a bicycle friendly street.
Solano near Idaho	6	Located adjacent to shopping area, low-income neighborhood, and purported high usage area.
W. Las Cruces near Central Elementary (Alameda)	8	Located adjacent to an elementary school.
Espina near University	9	Located along a major access corridor to NMSU.
Triviz Multi-use Trail near University	10	Located on dedicated bicycle and pedestrian infrastructure accessing NMSU.
Solano near Missouri	13	Location selected by volunteer for convenience.
Idaho near Solano	14	Collected simultaneously with Solano near Idaho.
Alameda near Las Cruces	15	Collected simultaneously with W. Las Cruces near Central Elementary

Figure 1. Map showing sample locations

Location numbers associated with plotted points correspond to the location numbers listed in Table 2. Sample locations with no numbers did not receive counts. There are three such locations. These are Location 7 Locust near Wyoming, Location 11 La Llorona Multi-Use Trail near W. Picacho, and Location 12 N. Motel Blvd at Picacho Middle School.

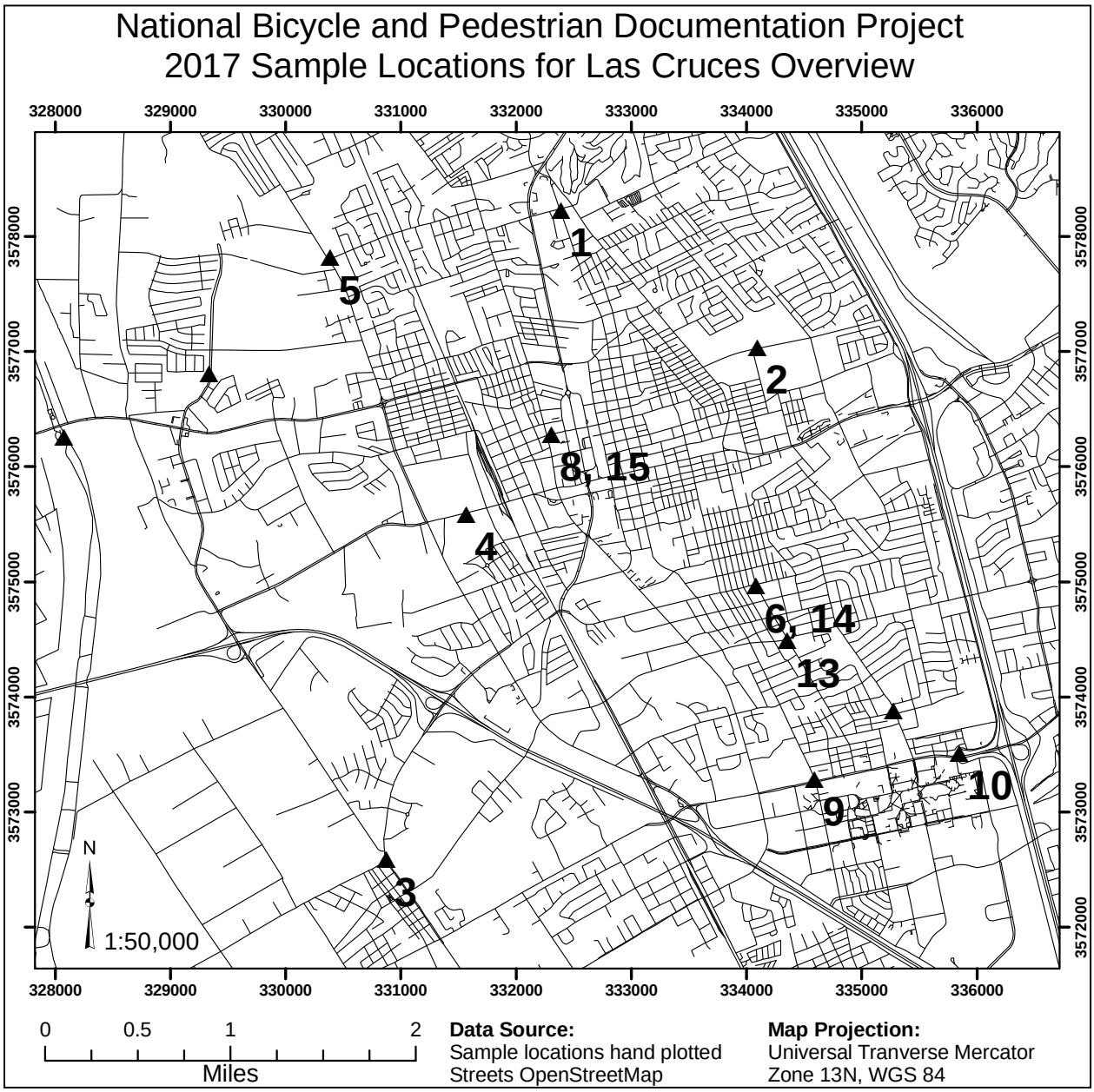


Figure 2. Northern Las Cruces detail map showing sample Locations 1 and 5

Location numbers associated with plotted points correspond to the location numbers listed in Table 2.

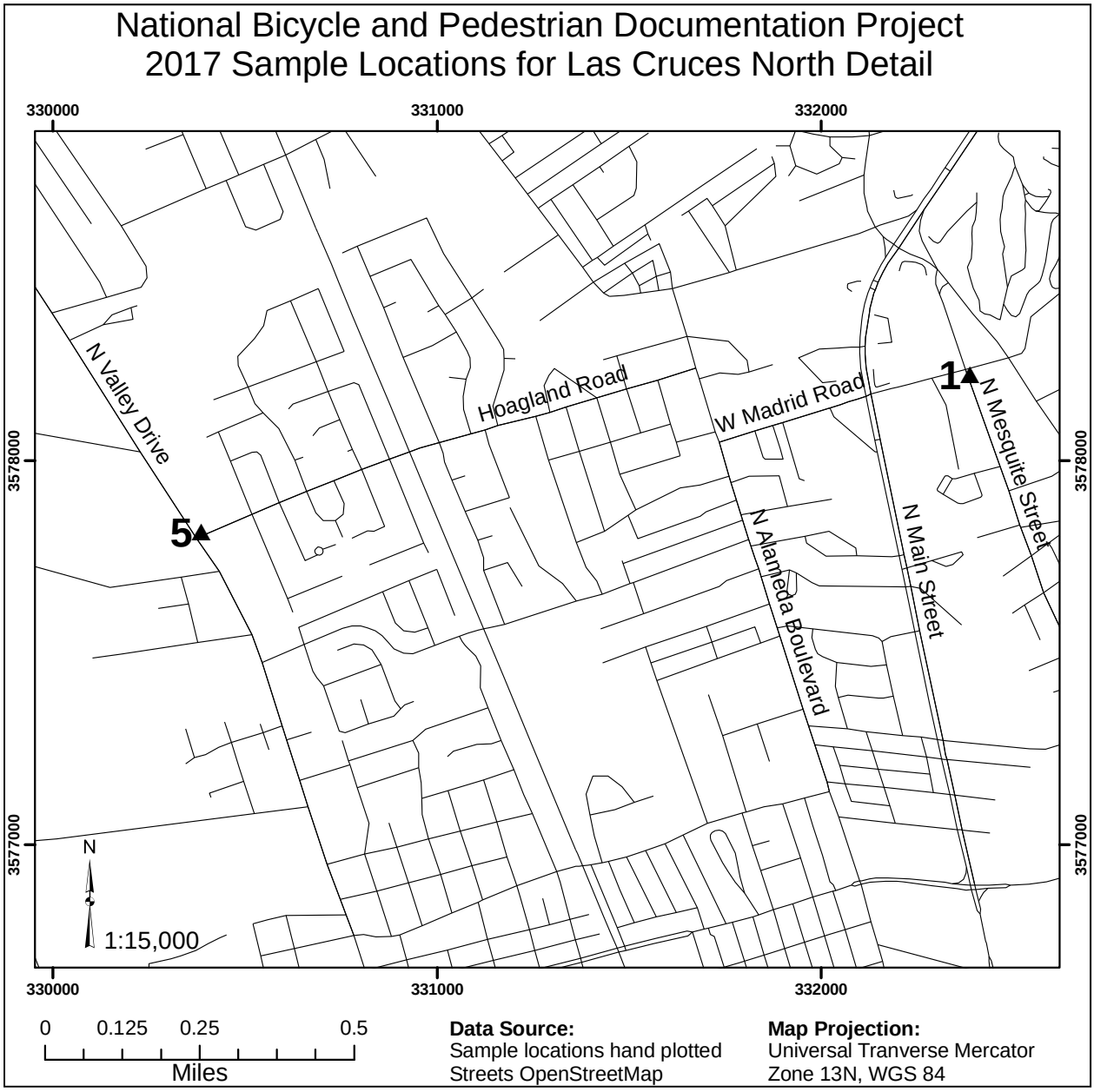


Figure 3. Central Las Cruces detail map showing sample Locations 2, 4, 8, and 15

Location numbers associated with plotted points correspond to the location numbers listed in Table 2.

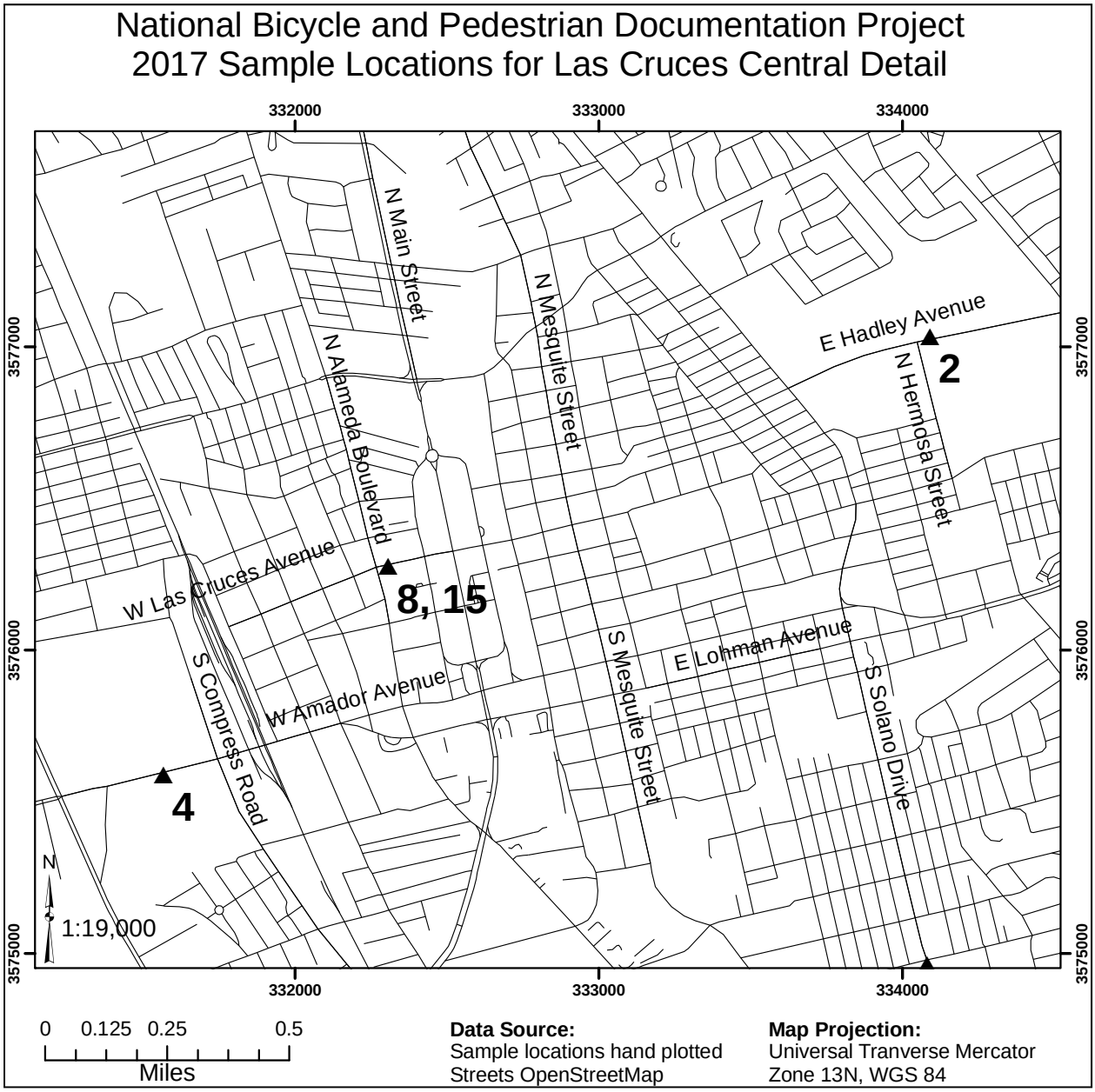


Figure 4. Southern Las Cruces detail map showing sample Locations 6, 9, 10, 13, and 14

Location numbers associated with plotted points correspond to the location numbers listed in Table 2. Sample locations with no numbers did not receive counts.

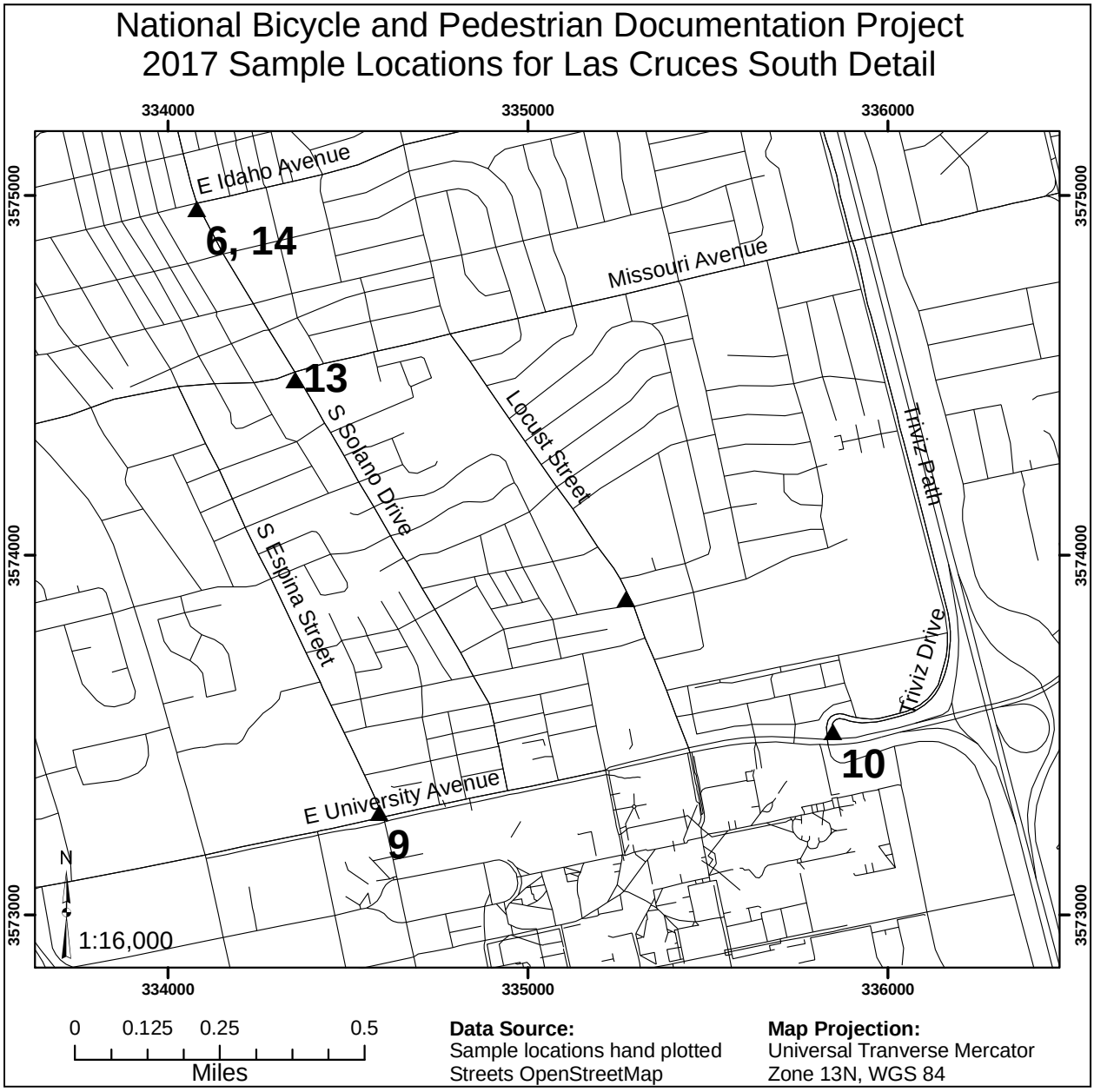
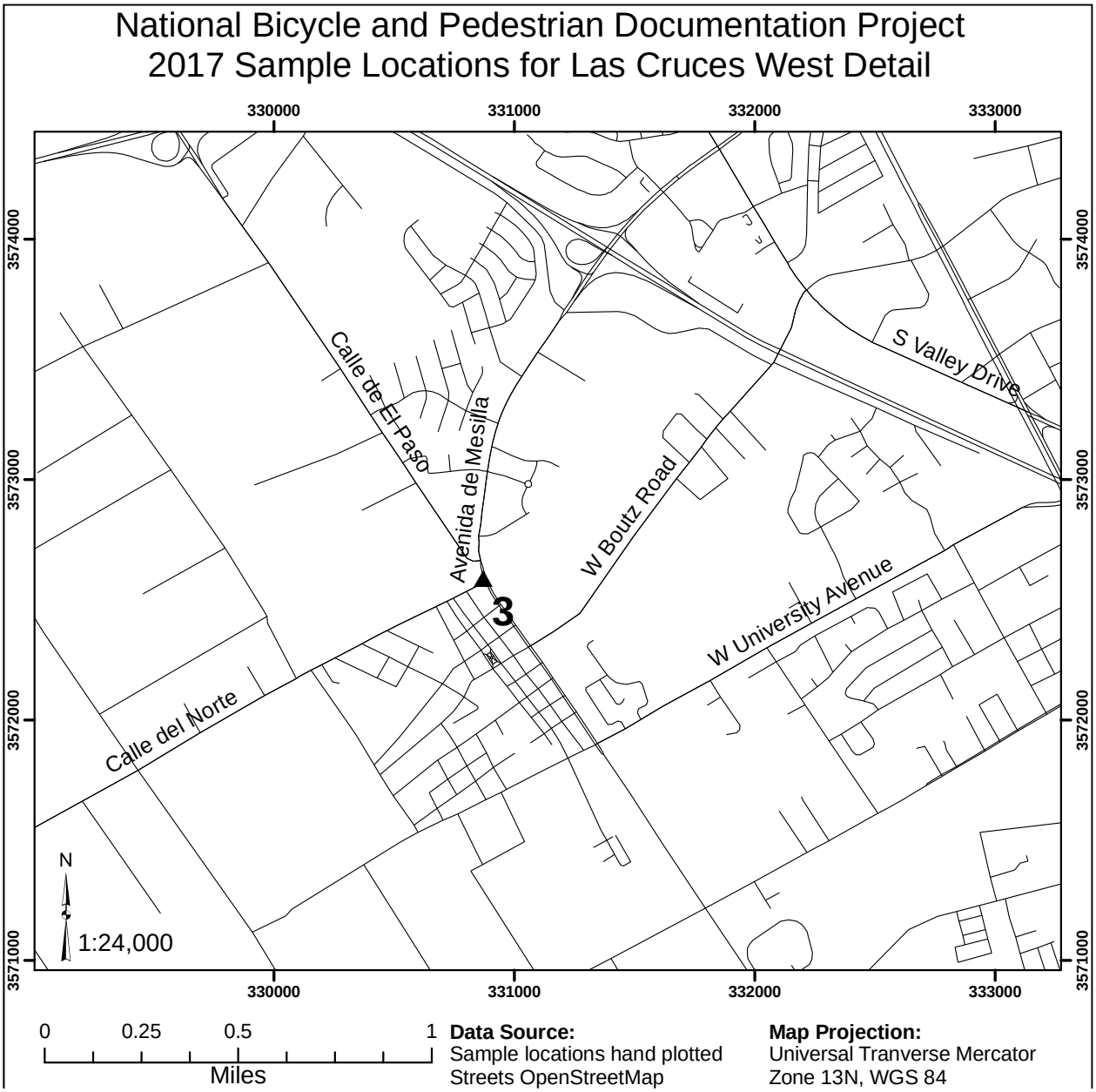


Figure 5. Western Las Cruces detail map showing sample Location 3

Location numbers associated with plotted points correspond to the location numbers listed in Table 2.



Screen Line Sampling

Screen Line sampling is designed to "identify general trends in volumes, and to see how demographics, land use, and other factors influence walking and bicycling" (NBPD 2010: 5). The Standard Screen Line Count Form itemizes the details of how to properly conduct a screen line count. Counters are instructed to tally all cyclists and pedestrians who cross the counter's screen line in 15-minute increments for a total duration of two hours. Cyclists who ride on the

sidewalk are counted. Counters tally the number of individuals on a bicycle, not the number of bicycles. For example, two individuals on a tandem count as two rather than one cyclist. Pedestrians include individuals in wheelchairs, those who rely on other assistive devices (children in strollers, etc.). Individuals traveling on skateboards, rollerblades or other equipment are tallied as other.

Figure 6. Screen line count being conducted at Location 2: Hadley at Meerscheidt

Note numerous individuals on the playing field. The counter at Location 2 observed nearly all visitors to the park facility arrive by automobile. Note also that there are no lane lines painted on the street. Signage indicates the presence of a bicycle lane, but no lane line is painted to indicate the extents of the bicycle lanes.

Photograph by Nathan Craig

Count Results

While 11 count locations were established at the volunteer orientation, some volunteers elected to either move sampling locations or collect supplemental counts on adjacent cross streets (see Figure 1). Once the count location forms were collated and tallied, it was determined that 13 volunteers visited 12 sampling locations and generated 21 two-hour counts for a total of 42 observation hours (see Tables 3 and 4). Of the counts, 13 were collected on a weekday and eight were collected during the weekend (Table 4). For the duration of the week of documentation efforts, the 42 observation hours resulted in the tallying of 192 bicycle riders, 1031 pedestrians, and 14 other modes of active transportation (Table 5). Aggregating all sample locations and counts, 4.5 cyclists and 24.5 pedestrians per hour were tallied.

Three sampling locations were not counted (Locations 7, 11, and 12; see Figure 1). Some sampling locations were counted between one and three times (Table 3). Two of the sampling locations received three counts (Locations 6 and 9). Five sampling locations received two counts (Locations 1, 2, 4, 8, and 14). The remaining five sampling locations each received single counts (Locations 3, 5, 10, 13, and 15). Average results for each of the 12 sampling locations are reported in Table 6. Locations having single counts are obviously not true averages, but rather reports of single counts. However, given that some sampling locations received different numbers of counts, averages provide a means to normalize tallies for comparative purposes.

Table 3. List of final sample locations, sample location numbers, number of counts conducted and notation of weekday (wkday) or weekend (wkend) counts.

Sample Location	*Location Number*	*Number of counts*	*Count days (wkday/wkend)*
Mesquite near Madrid	1	2	wkday, wkend
Hadley at Meerscheidt (Solano)	2	2	wkday, wkend
Ave de Mesilla near Calle del Norte	3	1	wkend
W. Amador near Community of Hope (Compress)	4	2	wkday, wkend
Hoagland near Mayfield High (Valley)	5	1	wkend
Solano near Idaho	6	3	wkday, wkend
W. Las Cruces near Central Elementary (Alameda)	8	2	wkday, wkend
Espina near University	9	3	wkday, wkend
Triviz Multi-use Trail near University	10	1	wkend
Solano near Missouri	13	1	wkday
Idaho near Solano	14	2	wkday
Alameda near Las Cruces	15	1	wkday

Table 4. Individual sample location count tallies

O = Other; ♀= Female; ♂= Male. Count values shaded in in grey were generated on weekday observation times. Counts values not shaded in grey were generated during a weekend observation time.

	Count 1					***Count 2***					***Count 3***				
	Bicycle		***Pedestrian***		***O***	***Bicycle***		***Pedestrian***		***O***	***Bicycle***		***Pedestrian***		***O***
Location Number	♀	♂	♀	♂		♀	♂	♀	♂		♀	♂	♀	♂	
1	2	1	7	27	0	0	6	13	13	0					
2	0	1	12	29	0	1	1	12	7	0					
3	0	3	120	88	0										
4	2	14	17	55	0	0	6	2	37	0					
5	2	6	7	15	0										
6	0	3	5	1	0	0	2	7	14	0	0	4	0	19	0
8	0	6	3	3	0	0	2	7	6	0					
9	11	27	75	82	2	20	38	95	125	10	3	14	34	24	0
10	1	1	1	2	0										
13	1	5	5	22	0										
14	0	2	3	5	0	0	5	11	19	2					
15	0	2	1	1	0										

Table 5. Summary counts for sampling locations

		Count 1		*Count 2*		*Count 3*	
Location Number	***Number of Counts***	***Bicycle Sum***	***Pedestrian Sum***	***Bicycle Sum***	***Pedestrian Sum***	***Bicycle Sum***	***Pedestrian Sum***
1	2	3	34	6	26		
2	2	1	41	2	19		
3	1	3	208				
4	2	16	72	6	39		
5	1	8	22				
6	3	3	6	2	21	4	19
8	2	6	6	2	13		
9	3	38	157	58	220	17	58
10	1	2	3				
13	1	6	27				
14	2	2	8	5	30		
15	1	2	2				

Grand Total Bikes	192
Grand Total Pedestrian	1031
Grand Total Other	14

Table 6. Summary of mean bicycle and pedestrian counts for the 12 sampling locations
Count values shaded in grey represent the Locations with the highest mean values. Count values shown in bold numbers represent the locations with the lowest mean values.

	Bicycle			***Pedestrian***			***Other***
Location Number	♀	♂	♀+♂	♀	♂	♀+♂	
1	1.00	3.50	4.50	10.00	20.00	30.00	0.00
2	0.50	1.00	**1.50**	12.00	18.00	30.00	0.00
3	0.00	3.00	3.00	120.00	88.00	208.00	0.00
4	1.00	10.00	11.00	9.50	46.00	55.50	0.00
5	2.00	6.00	8.00	7.00	15.00	22.00	0.00
6	0.00	3.00	3.00	4.00	6.33	15.33	0.00
8	0.00	4.00	4.00	5.00	4.50	**9.50**	0.00
9	11.33	26.33	37.67	57.67	77.00	145.00	23.33
10	1.00	1.00	**2.00**	1.00	2.00	3.00	0.00
13	1.00	5.00	6.00	5.00	22.00	27.00	0.00
14	0.00	3.50	3.50	7.00	12.00	19.00	1.00
15	0.00	2.00	**2.00**	1.00	1.00	**2.00**	0.00

Ranked Average Use

For bicyclists, the sampling locations with the highest average use were (Figure 1 and Table 5):

- Location 9: Espina near University (18.83 bicyclists/hr)
- Location 4: Community of Hope and Las Cruces Gospel Rescue Mission (5.5 bicyclists/hr)
- Location 5: Mayfield High School (4 bicyclists/hr)

For pedestrians the sampling locations with the highest average recorded use were:

- Location 3: Ave de Mesilla near Calle De Norte (104 pedestrians/hr)
- Location 9: Espina near University (72 pedestrians/hr)
- Location 4: Community of Hope and Las Cruces Gospel Rescue Mission (27.75 pedestrians/hr)

Other forms of transportation were only noted at two places: Location 9: Espina near University (11.65 other/hr) and Location 14: Idaho near Solano (1 other/hr).

For bicyclists, the sampling locations with the lowest average use were:

- Location 2: Hadley at Meerscheidt (0.75 bicyclists/hr) (Figure 6)
- Location 10: Triviz Multi-use Trail near University (1 bicyclist/hr)
- Location 15: Alameda near Las Cruces (1 bicyclist/hr)

For pedestrians the sampling locations with the lowest average use were:

- Location 15: Alameda near Las Cruces (1 pedestrian/hr) (Figure 7)
- Location 10: Triviz Multi-use Trail near University (1.5 pedestrians/hr)
- Location 8: W. Las Cruces near Central Elementary (4.75 pedestrians/hr)

Locations 8 and 15 were counted simultaneously from the same counting station (see Sample Idiosyncrasies below).

Figure 7. Family of pedestrians crossing at Locations 8: W. Las Cruces near Central Elementary and 15: Alameda near Las Cruces

Photograph by George Pearson

Comparing Weekday to Weekend Use

Five Locations were sampled on both weekdays and weekends (Locations 1, 2, 4, 6, and 9), permitting a comparison of weekday to weekend usage. The strength of the difference in usage is expressed as the ratio of the day of greater use divided by the day of lesser use. This ratio is assigned the variable “D”.

For bicycles, four locations showed more use during the weekday. In order of the strength of the difference these are (Table 4):

- Location 8: W. Las Cruces near Central Elementary (D=3)
- Location 9: Espina near University (D=2.8)
- Location 4: W. Amador near Community of Hope and Las Cruces Gospel Rescue Mission (D=2.67)
- Location 2: Hadley at Meerscheidt (D=2)
- Location 6: Solano near Idaho (D=1.3)

For bicycles, only one location showed more use during the weekend. This was Location 1: Mesquite near Madrid (D=3).

For pedestrians, four locations showed heavier usage during weekdays. In order of the strength of the difference these are (Table 4):

- Location 9: Espina near University (D=3.3)
- Location 2: Hadley at Meerscheidt (D=2.2)
- Location 4: W. Amador near Community of Hope and Las Cruces Gospel Rescue Mission (D=1.8)
- Location 1: Mesquite near Madrid (D=1.3).

Only a single location showed more usage during the weekend—Location 6: Solano near Idaho (D=1.4).

Comparison of Male and Female Usage

NBPD Screen line count protocols call for tallying males and females separately. Without interviewing each counted individual there is a potential for mis-assignment on the part of the counter. Sex, let alone the more complicated categories of gender, are better determined through interview. While tallying bicyclists and pedestrians by a visual assignment to either the male or female sex has obvious limitations, like mis-assignment, the resulting data do hold some potential to reveal patterns of use by males and females.

To compare sampling locations with different numbers of counts, differential use patterns by males and females were estimated based on averages (Table 7). Sample locations with single counts are not true averages.

Table 7 Differences in average bicycle and pedestrian use by sex

Location count averages are taken from Table 6 . ♀= Female; ♂= Male. S ratio values shaded in grey indicate sample locations where female use was greater than male use.

Location Number	***Mean Bicycle (S ratio= ♀/♂)***	***Mean Pedestrian (S ratio=♀/♂)***
1	0.29	0.50
2	0.50	0.67
3	0.00	1.36
4	0.10	0.21
5	0.33	0.47
6	0.00	0.63
8	0.00	1.11
9	0.43	0.75
10	1.00	0.50
13	0.20	0.23
14	0.00	0.58
15	0.00	1.00

Dividing average female use by average male use produces a ratio that can be used to estimate sex based differences in bicycle and pedestrian transport. This ratio is assigned the variable "S". S is not suitable for comparisons when one sex is not observed, because irrespective of the count of the other category the result is always zero, obscuring changes in the amplitude of difference.

For bicyclists, all sampling locations except for Location 10 showed greater use by males than females. Sample Location 10: Triviz Multi-use Trail near University showed low overall use with even use by males and females. All counts at all sampling locations tallied at least one male cyclist. Five of the 11 locations showed no use by female cyclists: Location 3: Ave de Mesilla near Calle del Norte, Location 6: Solano near Idaho, Location 8: W. Las Cruces near Central Elementary, Location 14: Idaho near Solano, and Location 15: Alameda near Las Cruces. Collectively, these five locations were sampled by nine counts representing 18 hours of observation. These same counts at the same five sampling locations resulted in the tallying of 27 male bicyclists producing a total ratio of 0 female to 27 male cyclists (Table 4).

Since no female cyclists were observed at these five locations, the S ratio is always zero. For sampling locations where female cyclists were observed but in lower numbers than males, the greatest disparity in use by sex was at Location 4: W. Amador near Community of Hope and Las Cruces Gospel Rescue Mission (S=0.1), Location 13: Solano near Missouri (S=0.2), and Location 1: Mesquite near Madrid (0.3).

For pedestrians, all locations and all counts except Count 3 at Location 6: Solano near Idaho tallied at least one male and one female pedestrian (Table 4). Nine of the 12 sampling locations showed greater use by males than females (Locations 1, 2, 4, 5, 6, 9, 10, 13, 14, and 15). Among these the greatest disparity in pedestrian use by sex was at Location 4: W. Amador near Community of Hope and Las Cruces Gospel Rescue Mission (S=0.2), Location 13: Solano near Missouri (S=0.2), Location 5: Hoagland near Mayfield High (S=0.5). Two locations indicated greater average pedestrian use by females rather than males (Table 7): Location 3: Ave de Mesilla near Calle del Norte (S=1.4) and Location 8: W. Las Cruces near Central Elementary (S=1.1). Location 15: Alameda near Las Cruces showed low pedestrian use in general but even use between males and females.

Figure 8. Two pedestrians crossing at Location 8: W. Las Cruces near Central Elementary
Note school zone sign. The Location 15 count was collected simultaneously with the Location 8 count.

Photograph by George Pearson

Sample Idiosyncrasies

Several sample location and count idiosyncrasies warrant mention. Two of these involve special events that were held during the count. The other idiosyncrasy involves two sets of sampling locations that are paired.

Events occurred near two of the sampling locations on days when counts were conducted. On Saturday, September 16, there was a football game at NMSU. Kickoff for the game was at 6:00 PM. Location 9: Espina near University Count 3 and Location 10: Triviz Multi-use Trail near University Count 1 both occurred from 12:00-2:00 PM on this day. Neither count appears skewed or inflated. We suspect that there was not sufficient temporal proximity to the event to inflate the counts. Also on Saturday, September 16, the town of Mesilla held an event to celebrate Mexican Independence day. The event spanned two days and seems to have substantially increased the number of pedestrians tallied at Location 3 Count 1.

Two volunteers opted to simultaneously count bicycle and pedestrian traffic at cross streets. This resulted in two sets of paired sampling locations. One paired set consists of Location 6: Solano near Idaho and Location 14: Idaho near Solano. The second paired set consists of Location 8: W. Las Cruces near Central Elementary (Alameda) and Location 15: Alameda near Las Cruces. While the effort to collect additional data is appreciated, the close proximity of the paired samples can cause complications for density mapping (not implemented in this report). To create a more even sampling density for such mapping purposes, it may be useful to average the two simultaneously collected paired locations.

Discussion

Over the course of a week counters at 21 locations tallied 192 bicycle riders, and 1,031 pedestrians. Extrapolating from this sample, the 12 locations, if examined throughout the year, hold the potential to count 9,984 cyclists and 53,612 pedestrians. Despite a small number of locations and short duration of the counting period, the all-volunteer effort documented substantial bicycle and pedestrian use within Las Cruces.

High Use Areas and Times

Among the sampled locations, bicycle and pedestrian usage was not uniform. Rather, use was concentrated at some locations and sparse at others.

For cyclists, the most heavily used areas are Location 9: Espina near University (18.83 bicyclists/hr), Location 4: Community of Hope and Las Cruces Gospel Rescue Mission (5.5 bicyclists/hr), and Location 5: Mayfield High School (4 bicyclists/hr). These locations represent destinations that individuals visit and use on a regular basis. Thus, high use at these locales is

not surprising. It is also noteworthy that despite their high use, to the best of the authors' knowledge, none of these locations is accessible by either a dedicated multi-use trail or proposed bikeway. For cyclists the least heavily used areas are Location 2: Hadley at Meerscheidt (0.75 bicyclists/hr), where there is a proposed Bike Boulevard, and Location 10: Triviz Multi-use Trail near University (1 bicyclist/hr). The low usage of both the Triviz Multi-use Trail and Hadley at Meerscheidt is surprising given that these corridors are either existing or proposed cycling infrastructure. A long-time and experienced cyclist consulted for this report stated that the intersection of the Triviz trail and University has always had a problematic interface between the trail and the street. Along Hadley, especially at the Hadley Recreational Complex, heavy use by motorized vehicles accessing and parking at the complex may be deterrents to greater cycling and pedestrian use. Both locales indicate that better infrastructure may be in order at such spots, even if there are already existing facilities.

For pedestrians, the most heavily used areas are Location 3: Ave de Mesilla near Calle De Norte (104 pedestrians/hr), Location 9: Espina near University (72 pedestrians/hr), and Location 4: Community of Hope and Las Cruces Gospel Rescue Mission (27.75 pedestrians/hr). High use of Locations 9 and 4 are not surprising in light of the fact that they constitute destinations that individuals visit and use on a regular basis. Heavy use at Location 3 was impacted by a local annual community celebration, likely increasing the numbers tallied. Still, such infrastructure appears to be critical to accommodating periodic community events that draw large crowds who walk to or ride their bicycles to such events. For pedestrians, one of the least heavily used areas included Location 10: Triviz Multi-use Trail near University (1.5 pedestrians/hr). Low use of this location is surprising given that it is a major dedicated mixed use bicycle-pedestrian facility in the city. Again, the difficult transition from the trail to the street may make this particular area of the route less used than other parts of the trail.

The disparity between patterns of use and either existing or proposed facilities is a cause for concern and underscores the need for pedestrian and bicycle studies when planning and implementing infrastructure to serve these transportation communities. For example, few cyclists or pedestrians access NMSU by means of Location 10: Triviz Multi-use Trail near University yet many individuals access campus via Location 9: Espina near University.

While the highest usage at NMSU is expected during the weekday, the only count from Location 10: Triviz Multi-use Trail near University was collected during the weekend. Fortunately, Location 9: Espina near University was also counted on the weekend. This count indicated substantial bicycle and pedestrian use indicating that individuals use this corridor to access the NMSU campus on weekends. The weekend count from Location 10: Triviz Multi-use Trail near University showed a very low level of use. Comparing Locations 9 and 10 suggest that Triviz is not widely used to access NMSU while Espina is used with considerable frequency.

At Location 9: Espina near University there is neither a dedicated nor in-road bicycle facility along Espina until one crosses into campus. Otherwise, crosswalks are not clearly marked. Paint is heavily worn on several sections of crosswalk in this intersection. The present study focused on patterns of usage and did not include safety observations. Safety represents an important additional focus for future counts. Yet even in the absence of safety information, given that Espina is so heavily used, "green zone" crosswalks and bike lanes to clearly alert cars of bicycle and pedestrian traffic are suggested.

Comparing the use of Triviz and Espina raises a more general point. Data from this report indicates that regularly used destinations like universities, social services, and schools see substantial bicycle and pedestrian use. Further, usage is greater during the weekday than it is on the weekend. This further underscores the importance of bicycling and walking as transportation, not just recreation. Moreover, as in the case of NMSU, some specific corridors to frequently used destinations are more heavily used than others. These patterns of use to certain destinations and the selection of specific routes to these destinations underscores the need to study how bicyclists and pedestrians travel.

If resources are limited, it is reasonable to suggest that planning and development efforts should prioritize areas that receive the greatest use. A second, and perhaps equal, priority would be to emphasize areas that are the most dangerous to bicyclists and pedestrians. Areas that are frequently used and dangerous should receive the highest priority.

Male and Female Usage

The 2017 sample count averages indicate that males are consistently bicycling and walking at higher rates than females. At Locations 10 and 15, each involving low overall usage, counts were the same for male and female cyclists and pedestrians. There were no sample location counts that tallied more female than male cyclists, and five sample location counts tallied no female cyclists.

Only two counts tallied greater numbers of female rather than male pedestrians. These were at Location 3: Ave de Mesilla near Calle del Norte and Location 8: W. Las Cruces near Central Elementary. The count for Location 3, which showed the highest proportion of female pedestrians, was associated with people walking to the celebration of Mexican Independence Day.

Overall, the disproportionate representation of males appears stronger among bicyclists than it does among pedestrians. In both cases the difference is troubling. The last U.S. census indicates that females constitute 51.3% of the Las Cruces population (https://www.census.gov/quickfacts/fact/table/lascrucescitynewmexico/RHI125216). Thus

while females make up slightly over half the population, they are substantially under-represented by the bicycle and pedestrian counts.

Entities seeking to promote walking and bicycling in Las Cruces should address the sex based disparities revealed by this report. As with any social issue, speaking to the impacted individuals is a good place to start. Surveys have been conducted in other parts of the country to assess women's walking and cycling experiences, and determine what the barriers may be to such activities (Broache 2012, Sibley 2010). Such experiences and perceptions will vary by community, and within communities. Advocacy events do exist in Las Cruces, including women-supportive bicycle rides (Women's Introduction to Road Biking) advertised on social media. Such important initiatives should be continued. Through surveys and other tools, we suggest that a group take up the task of beginning to understand why women in Las Cruces are apparently not out walking and cycling as much as men. Because gender is only one aspect of an individual's experience, a local study of women's cycling would need to pay attention to differences in race, ethnicity, and socioeconomic status. Information learned from such a study would help local advocates better shape programs for encouraging women to walk and cycle more, and ensuring that programs are rooted in an understanding of the range of local women's needs and concerns.

Socio-Economic Considerations

The greatest number of bicyclists and pedestrians were traveling to regularly visited destinations and traveling in greater numbers during the week day. These results indicate that bicycling and walking for transportation, rather than purely for recreation, are important factors driving usage in Las Cruces. Given that U.S. census data indicates that over 24% of the population of Las Cruces lives in poverty (https://www.census.gov/quickfacts/fact/table/lascrucescitynewmexico/RHI125216), low cost forms of transportation like bicycling and walking are particularly important to consider. While students traveling to NMSU are not likely living under the poverty line, many students have highly constrained budgets. Many of the individuals visiting Community of Hope and Las Cruces Gospel Rescue Mission are likely living under the poverty line, a fact that makes traveling by bicycle or on foot attractive. These and other economic factors related to low-cost forms of transportation should be taken into consideration when planning and developing bicycle and pedestrian infrastructure.

Consideration of STRAVA Data in Light of the 2017 NBPD Count of Las Cruces

As indicated in the “Aim and Context of the Study”, MVMPO has used STRAVA data. However, STRAVA data are not specifically mentioned in either the Metropolitan Transportation Plan (LCMPO 2010) or the MTP Transport 2040 Update (MVMPO 2015). Thus, it

is not entirely clear for how long or in what ways STRAVA data were or are used by MVMPO. Prior to this report, STRAVA tracks appear to be one of the few forms of quantitative data available for bicycling in Las Cruces.

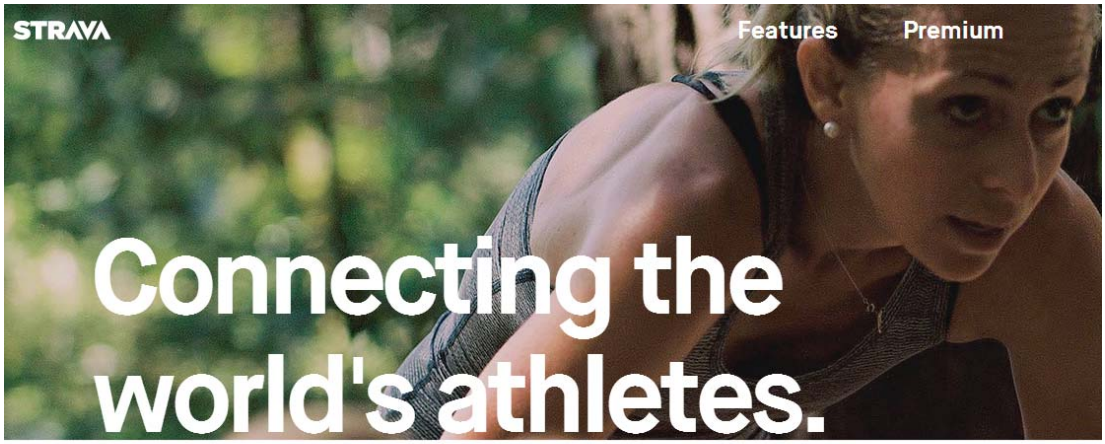
The 2017 NBPD Las Cruces count co-managers were supplied with an unofficial draft map entitled "Mesilla Valley Metropolitan Planning Organization Strava Cycling Heatmap" (Figure 9). It is a map of STRAVA data from October 2015 through March 2016, five months worth of accumulated STRAVA data. Careful consideration of this map and comparison of it to results obtained from the 2017 NBPD Las Cruces count raises a number of concerns.

Figure 9. Mesilla Valley Metropolitan Planning Organization Strava Cycling Heatmap

First, based on how STRAVA markets its products to consumers, the bicycling data produced by STRAVA users likely reflects a very narrow range of individuals consisting of performance or fitness cyclists that are monitoring their training progress (Figure 10). While the data may be easy to access, the patterns of use captured in STAVA logs are extremely unlikely to reflect the diversity of Las Cruces bicyclists (Figures 11 and 12), especially those using bicycles for transportation purposes.

Figure 10. Screen capture from the Strava.com homepage

The website is advertised as a social network for athletes who want to self monitor and analyze their performance.



If you're active, Strava was made for you. Our mobile app and website enhance the experience of sport and connect millions of athletes from around the world. We're the social network for those who strive. Join us.

Figure 11. Adult and juvenile cyclists crossing at Location 8: W. Las Cruces near Central Elementary

Note the youth cyclist is employing training wheels. This is likely a different kind of training that what is reflected by most STRAVA users.

Photograph by George Pearson

Figure 12. Adult cyclist crossing at Location 8: W. Las Cruces near Central Elementary

Photograph by George Pearson

Second, though the aforementioned STRAVA map (Figure 9) presumably represents the accumulation of all STRAVA recorded rides for a five month period, areas of high STRAVA use do not correspond to areas of high use documented in the present screen line sample. For example, Location 9: Espina near University and Location 4: W. Amador near Community of Hope were among the highest used areas (Tables 4 and 5), but are among the least traveled routes by STRAVA users. Even under the constraints of a short planning period, the 2017 NBPD count of Las Cruces was able to specifically target areas that experienced bicyclists and pedestrians knew were heavily used. Based on a careful review of Figure 2, most of these heavily used transportation corridors are not regularly traveled by STRAVA users. It should come as no surprise that performance athletes do not use the same routes that are used by students heading to NMSU, low-income individuals traveling to service centers, or young adults headed to high school. Yet, the latter three categories of Las Cruces cyclists are likely to far outnumber performance athletes.

Third, the 2017 NBPD count found that some areas frequently traversed by STRAVA users were among the least used sample locations. For example, Location 10: Triviz Multi-use Trail near University was among the least used locations in the 2017 NBPD sample, yet the Triviz Multi-use trail is among the most heavily traversed by STRAVA users.

Since STRAVA anonymize data before sales, it is difficult to determine how many users are actually reflected by high counts. Given that STRAVA data are typically produced by cyclists who are training and are attempting to track performance changes, it is expected that cyclists will replicate the same routes regularly.

Given this expected pattern of use, relatively few individuals could create a substantial number of STRAVA counts in a short period of time. For example, the category with the highest counts in Figure 9 is composed of between 267-523 “Users”. Five months of data constitutes 20 weeks. A single rider training on the same route only three times a week for 20 weeks would create 60 routes alone. At this rate of use, the highest counts on the map would represent nine individuals following the same route repetitively. In contrast, during any given two-hour screen line count, any of these riders is likely to be counted either once or perhaps twice if observed returning home.

Sample Location 9 Count 1 produced 38 bicyclists and Count 2 produced 58 bicyclists. These were both weekday counts. Five days a week for 20 weeks results in 100 instances. At this rate, over five months, Counts 1 and 2 hold the potential to tally 380 and 580 bicycling trips respectively. Again, this is under a two-hour time frame whereas STRAVA presumably represents the accumulation of all reported trips during a five month period.

STRAVA data do have a role to play in quantifying patterns of bicycling in Las Cruces. However, this role is limited to documenting the routes traveled by fitness cyclists who are actively training and documenting their own performance. STRAVA is unlikely to reflect any other use category outside of this very narrow frame. For planning and development purposes, STRAVA data should be used for the specific purpose of quantifying sport cycling and employed as a supplement to a more carefully designed sampling scheme that seeks to quantify the full range of Las Cruces cyclists. STRAVA is not a replacement for conventional methods of counting bicycling activity.

Recommendations for Future Counts

While the bicycle and pedestrian count was organized and implemented over a short timeframe, the effort was successful on many levels, especially regarding initial aims. This success was made possible by ready-made instructions and materials provided by the NBPD, and enthusiastic volunteers who were willing to contribute their time and energy. To help improve future counting efforts, some practical recommendations are warranted. These are based on lessons learned in organizing this year's count.

1. A minimum of two months of planning time for future counts is recommended. Continued participation in the annual NBPD count should be a priority. The count typically takes place in September. Given the date, preparing for the count beginning in early July would allow

sufficient time for planning. Once a count manager is identified, an initial planning meeting should take place, with the selection of count leaders as necessary.

2. Times for the 2017 sample counts followed NBPD recommendations. Feedback from several participants, however, indicates that movement patterns in Las Cruces may benefit from sampling at different times, especially during the week. In addition, local community events that may have an impact on counts at certain locations must be taken into account (for example, a football game or parade). As part of future planning efforts, selection of appropriate blocks of time for sample counts should take into account these other factors.
3. Feedback on appropriate sample locations should be used, as well as continued discussion on where to sample, for the selection of future sampling locations. Data on collisions involving bicyclists and/or pedestrians might be used to inform on the choice of sample locations.
4. On very short notice volunteers came together at a combined planning/training session to make the count happen. However, a separate, detailed training session a week before the scheduled count would eliminate some idiosyncrasies in data collection, as well as some confusion that resulted from the brief training conducted this year. Attendance of the training session should be required for participation as a project counter. Planning sessions should take place well ahead of the training session.
5. Though forms for the count are provided by NBPD, we encourage discussion and development of modified forms. The Standard Screen Line Count Form that was used should be used as a foundation for any modifications.
6. To ensure timely processing of count data, all forms should ideally be collected the day a count is made. This would also eliminate the possibility of lost forms (which did not happen this time, but remains a possibility). Receipt of emailed digital copies of forms proved cumbersome during data entry and collating. We recommend using the original paper forms, rather than digital formats, to assemble the data after the counts are completed.
7. Goals for future counts should stem from reflection and feedback of a prior count, and be used to drive planning. For example, a desire for data on intersections where safety is a concern may prompt the adoption of other data collection methods not discussed in this report. The same is true if more qualitative information derived from surveys is desired.
8. Participants stemmed primarily from Velo Cruces, though others from Bike and Chowder, the City of Las Cruces, and interested individuals who heard about the count also contributed. We suggest recruiting volunteers from various bicycle and pedestrian advocacy groups to participate in future counts as a way to continue building a stronger coalition of community members working toward the shared goal of creating a vibrant bicycle and pedestrian community.

Beyond providing advice for future counts, it is possible to make a specific recommendation for the MVMPO. The MVMPO has provided multiple opportunities for public input toward local transportation planning. The data provided by Velo Cruces and community participants in a citizen-initiated count is simply one more opportunity for public input. Going forward, the Board Members of Velo Cruces have expressed interest in conducting a count on at least a yearly basis. It would be prudent for the MVMPO to include an annual bicycle and pedestrian count, such as this citizen initiative which can be accomplished in collaboration with MVMPO planners, in the Public Participation Plan (PPP) of the MTP.

References Cited

Broache, Anne. 2012. “Perspectives on Seattle Women's Decisions to Bike for Transportation.” Master's Thesis, University of Washington.

LCMPO. 2010. “Transport 2040: 2010 Metropolitan Transportation Plan 2010-2040.” Report by Las Cruces Metropolitan Planning Organization (LCMPO). 260 pg. URL= “https://donaanacounty.org/sites/default/files/pages/LC_MPO_Transport_2040.pdf” Accessed 18 September 2017.

MVMPO. 2015. “Transport 2040: Metropolitan Transportation Plan Update.” Report by Mesilla Valley Metropolitan Planning Organization (MVMPO). 87 pg. URL= “http://mesillavalleympo.org/wp-content/uploads/2016/01/ mtpupdate2015finaladopted.pdf” Accessed 18 September 2017.

NBPD. 2010. “Instructions” Document provided by National Bicycle and Pedestrian Documentation Project (NBPD).” 15 pg. URL= “http://bikepeddocumentation.org/application/files/3314/6671/8088/NBPD_ Instructions_2010.pdf” Accessed 20 July 2017.

Sibley, Anna. 2010. “Women's Cycling Survey: Analysis of Results.” URL = “http://c.ymcdn.com/sites/www.apbp.org/resource/resmgr/downloads/womens_cycling_survey_091420.pdf” Accessed 10 November 2017.

SRTS. 2012. “Safe Routes to School Action Plan.” Report by Safe Routes to School (SRTS). URL = “http://mesillavalleympo.org/wp-content/uploads/2016/01/srts_action%20_plan_2012.pdf” Accessed 19 October 2017.

U.S. Census Bureau. 2016. "Annual Estimates of the Resident Population: April 1, 2010-July 1, 2016." URL= "https://factfinder.census.gov/faces/tableservices/jsf/pages/ productview.xhtml?src=CF" Accessed 20 July 2017.