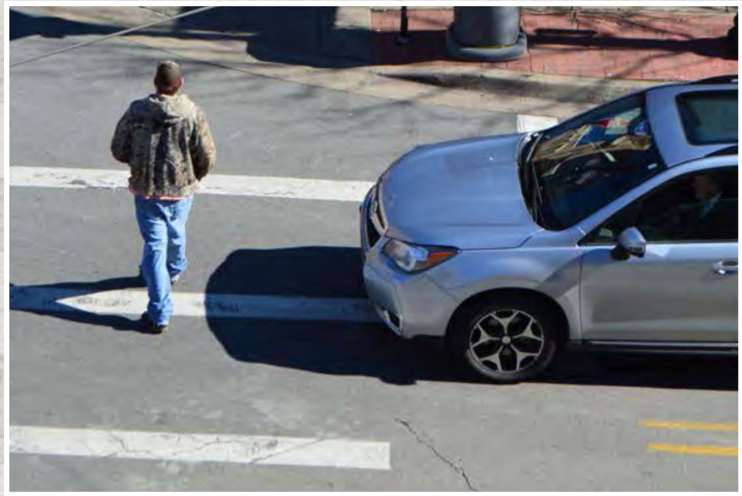
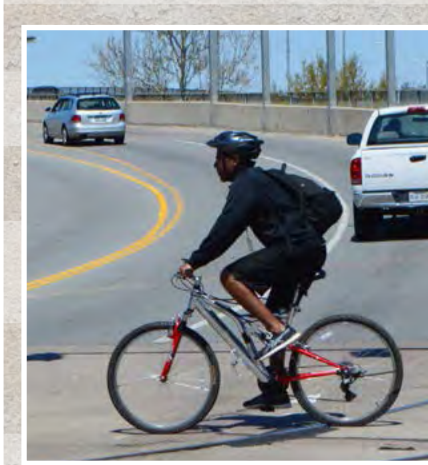
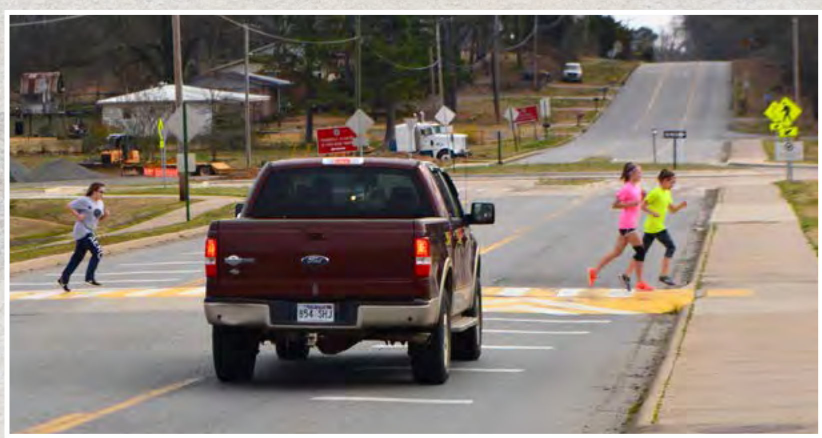
PEDESTRIAN/BICYCLIST CRASH ANALYSIS 2015







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CENTRAL ARKANSAS REGIONAL TRANSPORTATION STUDY

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Executive Summary

Each year within central Arkansas an average of 144 pedestrians and 47 cyclists are involved in crashes with vehicles, resulting in an average 107 serious injuries [1] and 13 fatalities. While this is a small percent of the total number of vehicle crashes, it represents 12% of the total number of fatalities and is a major concern for pedestrians and the bicycle community. Adding to the concern is that these crashes disproportionately affect a high number of minorities and youth and are often cited as the reason why individuals are less likely to use alternative forms of transportation. As a comparison, vehicle and train crashes, which are often cited as a regional concern, average 6 crashes and 0.71 fatalities per year[2].

CARTS Pedestrian/Bicycle Crash Analysis

Beginning in 2004, Metroplan began incorporating pedestrian and bicycle crashes into the regional planning efforts for pedestrian and bicycle facilities. This was primarily accomplished through the GIS mapping of crashes, as reported in the Arkansas State Police Database, and review of fatal crash reports. In 2006, Metroplan staff published the first regional comprehensive analysis of pedestrian and bicycle crashes from 1995 to 2004. The report was then updated again in 2012.

The purpose of this analysis is to evaluate pedestrian/bicyclist safety within the Central Arkansas Regional Transportation Study (CARTS) area and provide a comparative assessment to the baseline initially established in the previous study. Building on the previous study, this update seeks to identify specific intersections and roadway segments with the highest number of crashes and greatest levels of safety concern. To further the investigation of pedestrian and bicycle crashes, high crash locations are intended to be independently studied to identify design issues, funding priorities and/or safety policies needed to address safety concerns and improve the safety of pedestrians and bicyclists. Ultimately, safety projects are to be selected and incorporated in the Transportation Improvement Program.

Report Format

An overview of the total, type and severity of the crash is considered first; followed with examinations by risk group, geographic area, crash condition, and spatial relationship to determine if any trends were apparent. The analysis concludes with a discussion of the potential costs of such injuries to society. Appendices are included for future intersection and corridor studies.

Results

In general, the findings were consistent with national and other regional findings with respect to risk group, area type, and crash condition.

Black males under 18 had the highest pedestrian and bicyclist crash rate. However, black males 18 and over had the highest pedestrian fatality rate. Nearly 63% of pedestrian crashes were not at intersections, contrasting with the nearly 61% of bicycle crashes occurring at intersections.

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[1] Injury Severity Type 2 and 3

[2] FRA Highway-Rail Accident Database

Central Arkansas' ten year pedestrian fatality rate is higher than the national rate and the state's rate. Nearly 75% of pedestrian fatalities were not at the intersection and 67% of bicycle fatalities occurred at the intersection. Seventeen percent of the pedestrians were crossing the roadway when killed. About 82% of pedestrian crashes occurred during dark, dawn, or dusk conditions.

Intersections identified as having the highest number of pedestrian crashes are listed in 1. Nearly 40% of the highest pedestrian crash intersections were located in downtown Little Rock.

Table 1: Highest Pedestrian Crash Intersections 2004-2013

Intersection	Crashes
Broadway and 6th (LR)	8
Broadway and 2nd (LR)	7
Clinton and LaHarpe (LR)	7
Broadway and Capital (LR)	6
Baseline and Geyer Springs (LR)	6
32nd and University (LR)	6
University and Asher (LR)	5
Camp Robinson and Allen (NLR)	5
JFK McCain (NLR)	5
12th and Peyton (LR)	4
12th and Washington (LR)	4
Broadway and 8th (LR)	4
18th and Pike (NLR)	4
Broadway and Markham (LR)	4
Pike and Pershing (NLR)	4
McCain and Warden (NLR)	4

Analysis of the bicycle crashes at intersections yielded 28 intersections with 2 crashes.

Combining pedestrian and bicycle crashes, the following corridors listed in Table 2 were identified as having the highest crash rates.

Table 2: Highest Corridor Crash Rates 2004-2013

Corridors	Crashes	Mileage	Crash Rate
S Broadway (LR)	40	0.63	63.49
Pike Av (NLR)	35	0.77	45.45
Col Glenn (LR)	22	0.51	43.14
W 12th (LR)	23	0.55	41.82
Geyer Springs (LR)	25	0.74	33.78
Markham /Clinton (LR)	19	0.62	30.65
Camp Robinson (NLR)	24	0.88	27.27
E Broadway (NLR)	20	0.80	25.00
Baseline (LR)	27	1.13	23.89
Asher (LR)	29	1.57	18.47

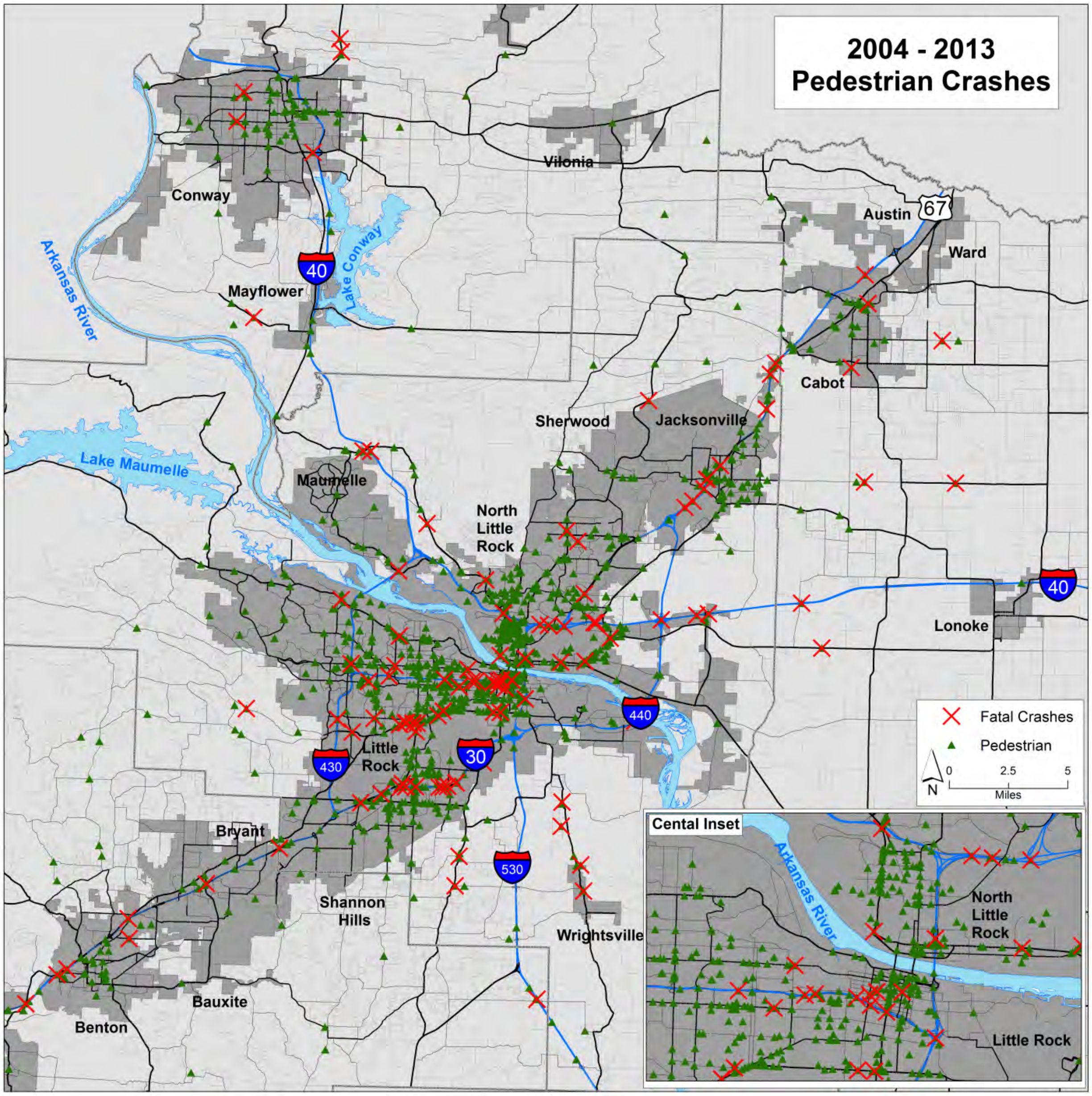

Figure 1: Pedestrian Crashes 2004 - 2014

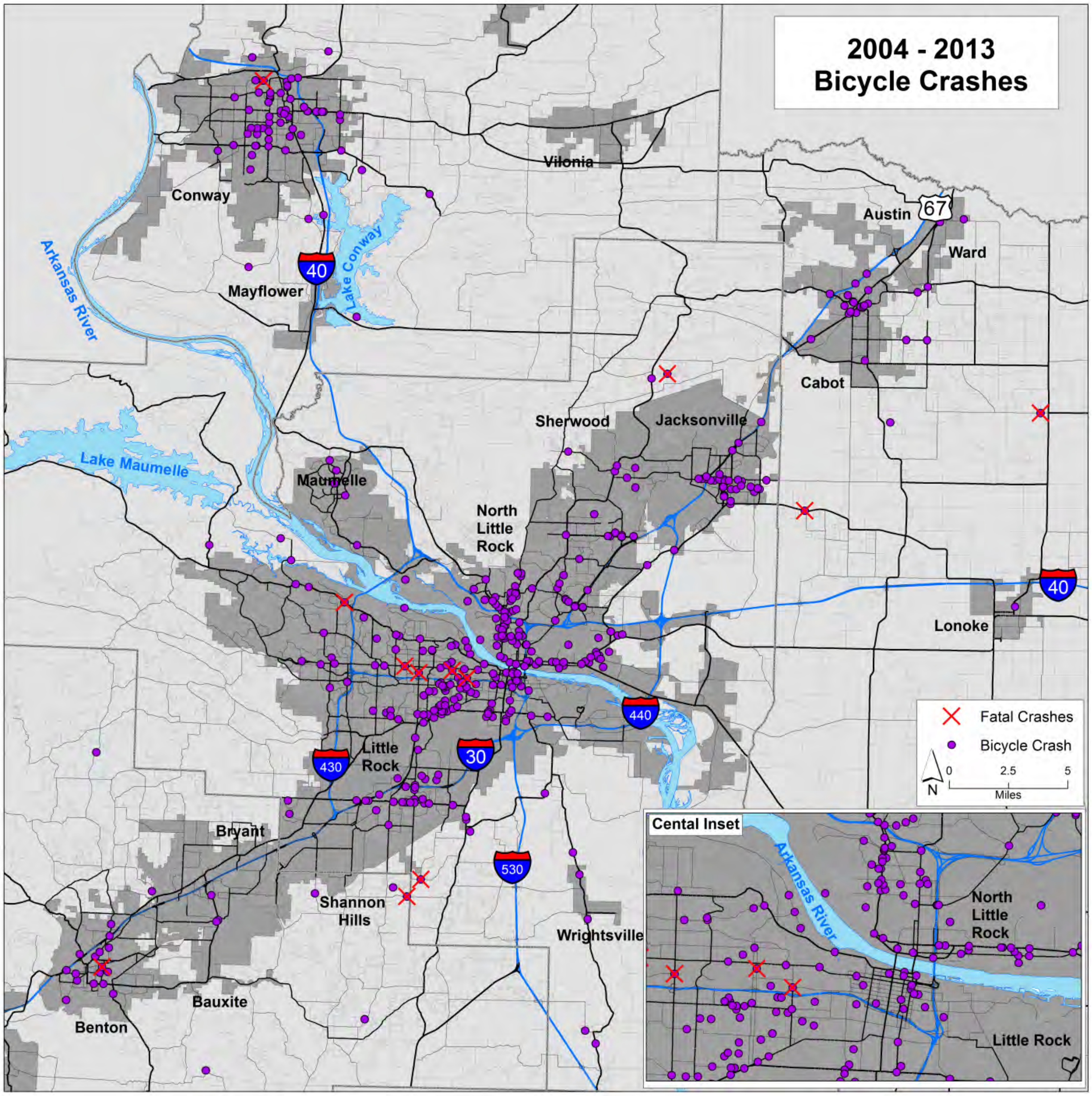

Figure 2: Bicycle Crashes 2004 - 2013

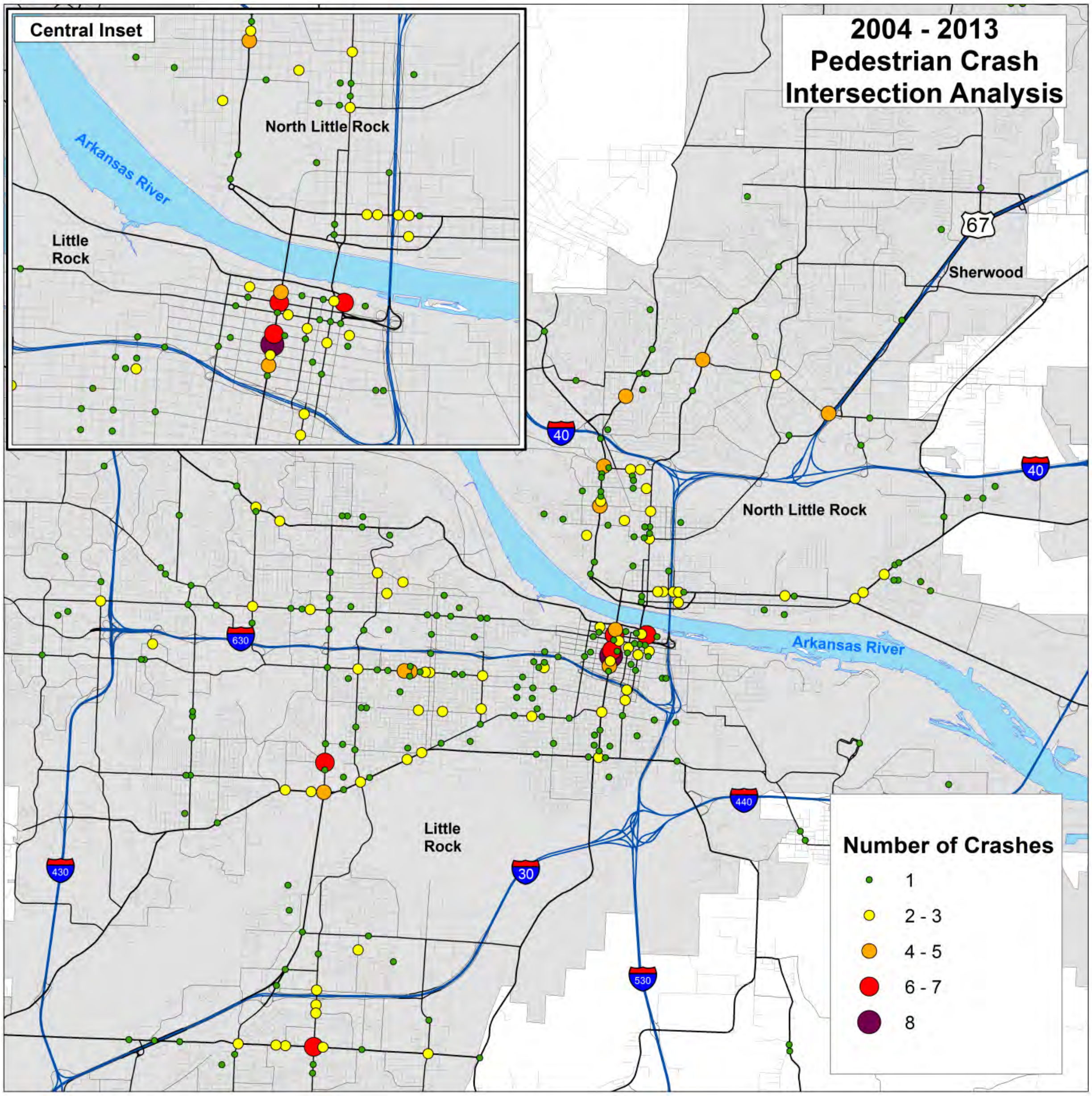

Figure 3: Pedestrian Crash Intersection Analysis

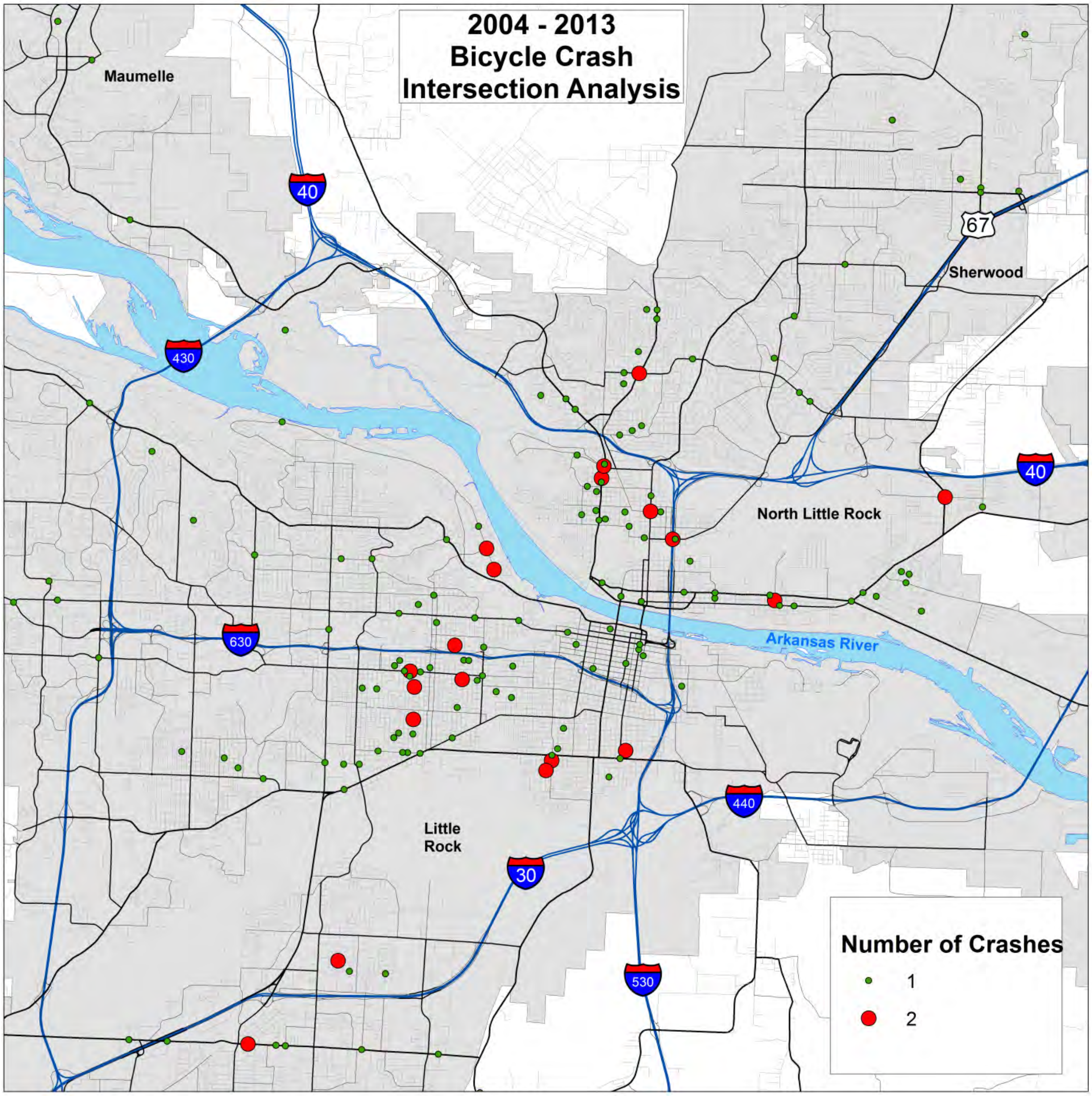

Figure 4: Bicycle Crash Intersection Analysis

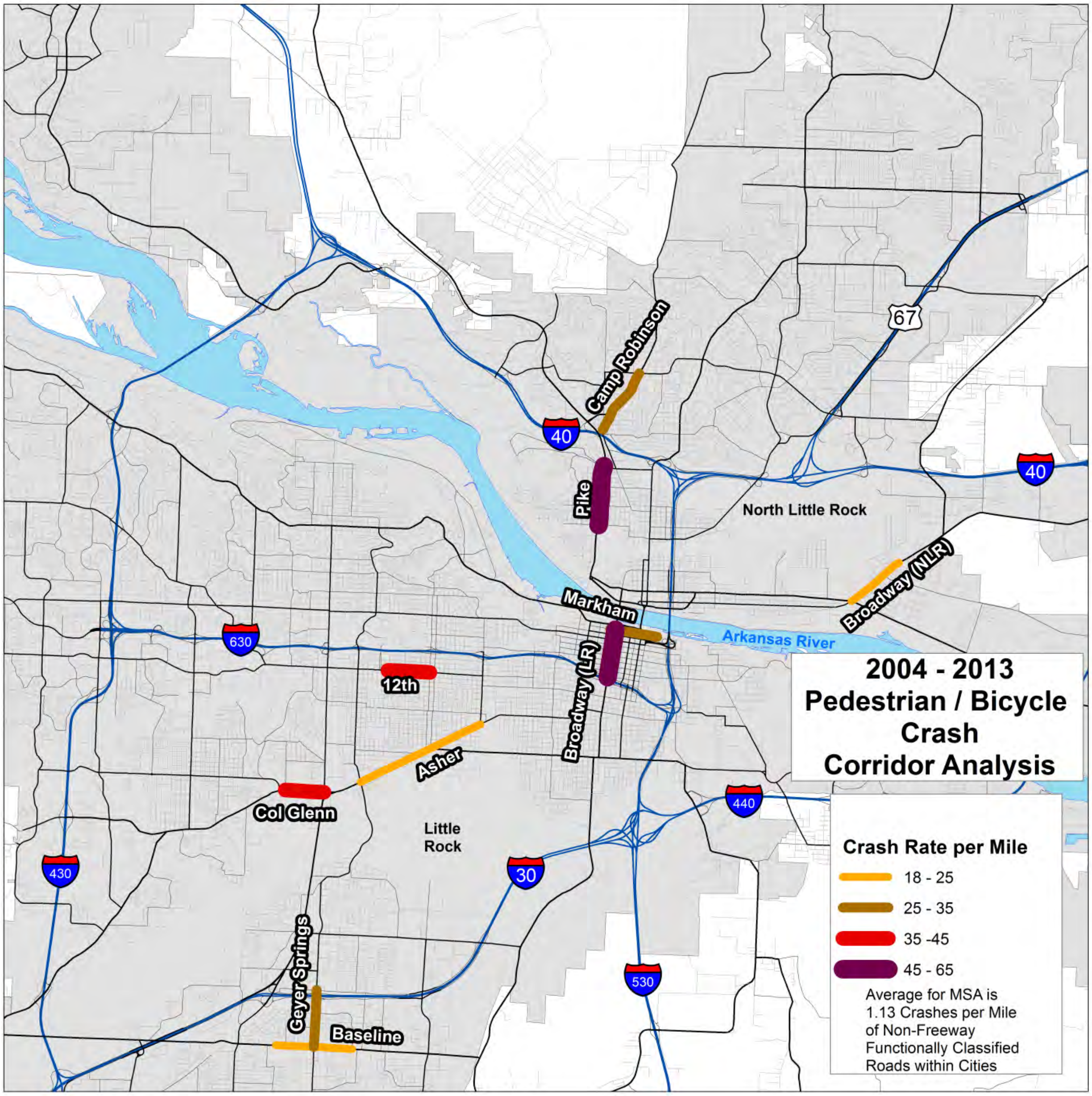

Figure 5: Pedestrian / Bicycle Corridor Crash Analysis

Overview

Using data provided by the Arkansas State Police, the number pedestrians and/or bicyclists involved in vehicular crashes were tabulated for the years 2004 to 2013 (only represents crashes that were located with GIS). These crashes were then separated for analysis because each group has unique characteristics and there were sufficient numbers of each crash type to be separated and analyzed. All available fatal crash reports were also collected and checked against crash data and reviewed carefully to garner more information that was not apparent in the crash data (e.g. pedestrian action or location, etc.).

The numbers of pedestrians and bicyclists involved in crashes are summarized by county in Table 5 and

Note: Fatalities are in parenthesis.

Table 6, respectively (Appendix A). The numbers of pedestrians and bicyclists involved in crashes are summarized by crash severity in Figure 6 and Figure 7, respectively. During the ten year period a total of 1,435 pedestrians and 474 bicyclists were involved in crashes, a combined average of 190 per year. This resulted in 114 pedestrian fatalities and 12 bicyclist fatalities, a combined average of 13 per year. Overall, there were 1909 pedestrians or bicyclists involved in crashes.

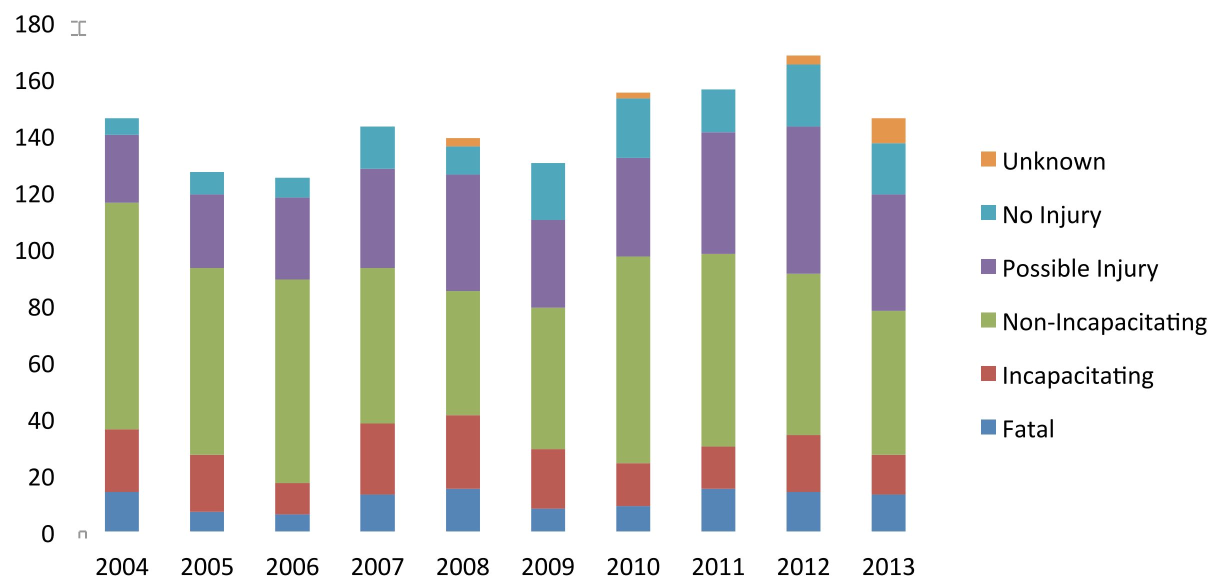

Figure 6: Number of Pedestrian Crashes 2004-2013

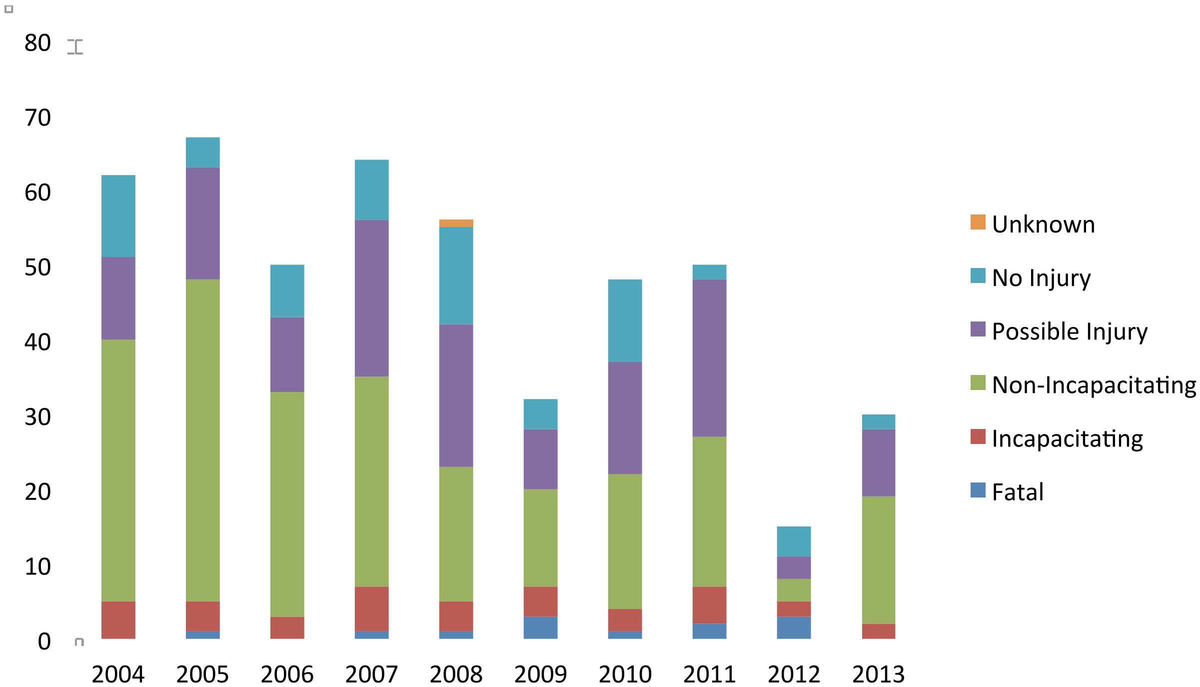

Figure 7: Number of Bicycle Crashes 2004-2013

Nearly 89% of the pedestrian crashes resulted in injuries or possible injuries. And, about 21% were either fatal or incapacitated. Similarly, about 86% of the bicycle crashes resulted in injuries or possible injuries and about 11% were either fatal or incapacitated. Approximately 26% (32) of the fatalities were alcohol or drug related.

Risk Groups

Crashes were examined by victims' age, race/origin, and sex and ten year annual average rates calculated to determine which demographic groups were at higher risk (Figure 8). Since an appropriate estimate of the number of people who walk or bike was not readily available, crash rates per population estimates for each group were calculated. Significant variations exist by age, race/origin, and sex and some general observations follow. Females had lower crash rates than their respective male counterparts. Overall, crash rates were significantly higher for blacks. Black males under 18 had the highest pedestrian and bicyclist crash rate.

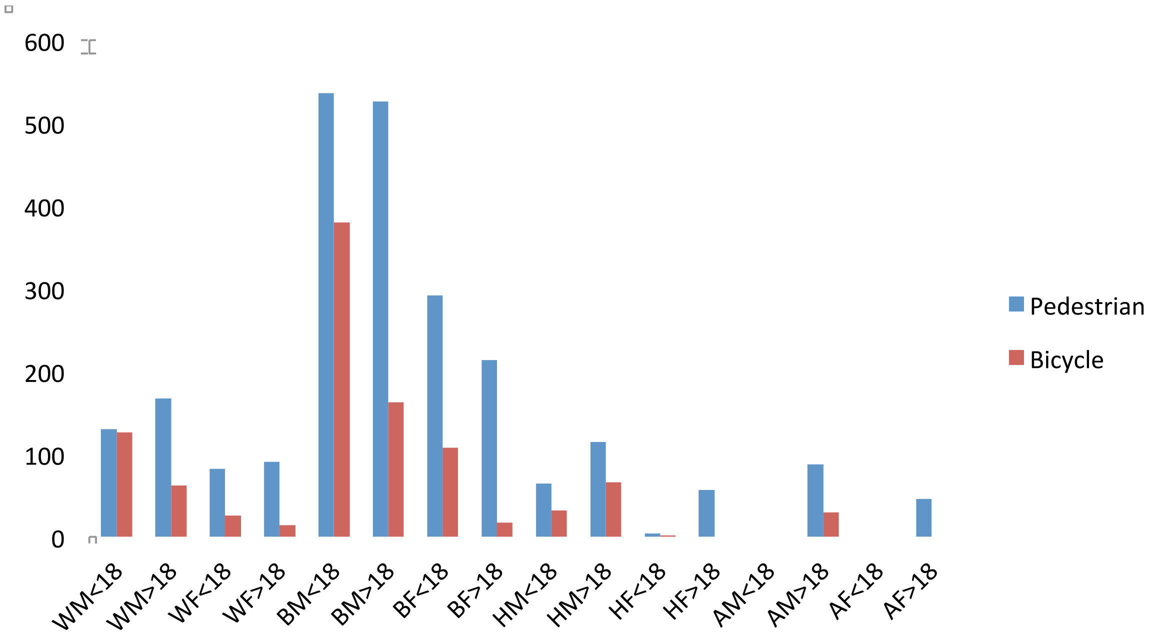

Figure 8: Pedestrian & Bicycle Crash Rate by Race, Sex, and Age 2004-2013

Similarly, Figure 9 shows that male pedestrians were more likely than females to get killed while walking. However, it was the pedestrian ages 18 and over that were at higher risk of fatal injuries. In fact, Black males 18 and over were 2.76 times as likely to be killed while walking as white males and 3.76 times as likely as Hispanic males in the same age group. Five demographic groups had no reported fatalities. Bicyclist fatalities were not investigated due to small sample size.

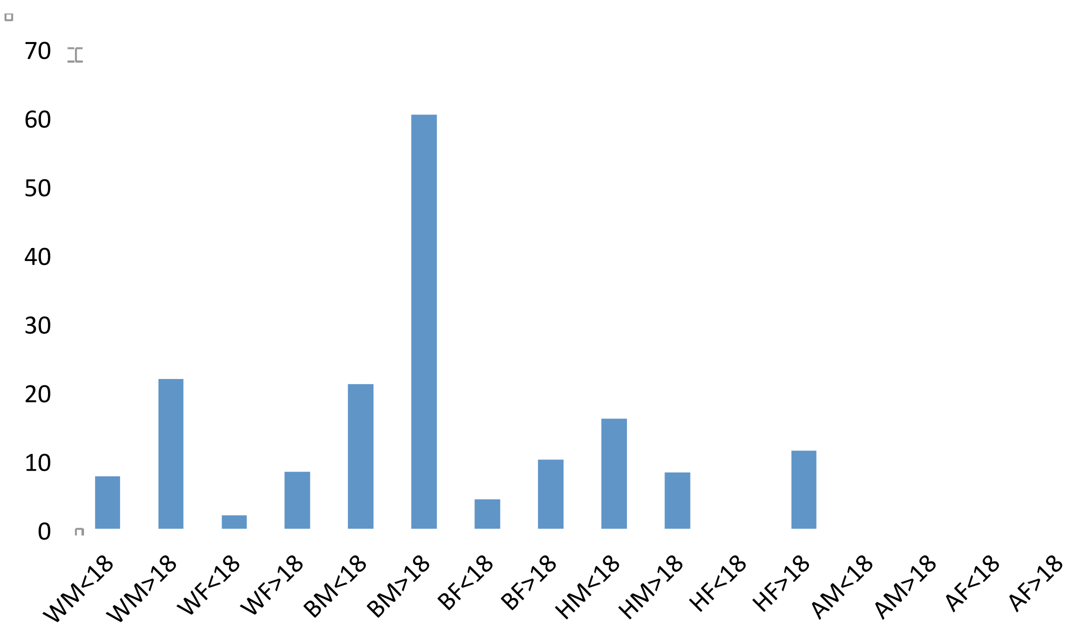

Figure 9: Pedestrian Fatality Rate by Race, Sex, and Age 2004-2013

Geographic Areas

Pedestrian/bicyclist crashes for each county and city were examined in order to develop subarea crash rates (per 100,000 population). Figure 10 shows the pedestrian crash rate by jurisdiction. North Little Rock had the highest crash rate among the cities with at least one crash and at least a population of 10,000. Maumelle had the lowest rate. This may be attributed, in part, to Maumelle's extensive off-road shared pedestrian/bicycle system, which almost universally separates motorized and non-motorized traffic. The unincorporated parts of Pulaski County, as well as the overall county (not shown), had the highest rate as compared to the other counties.

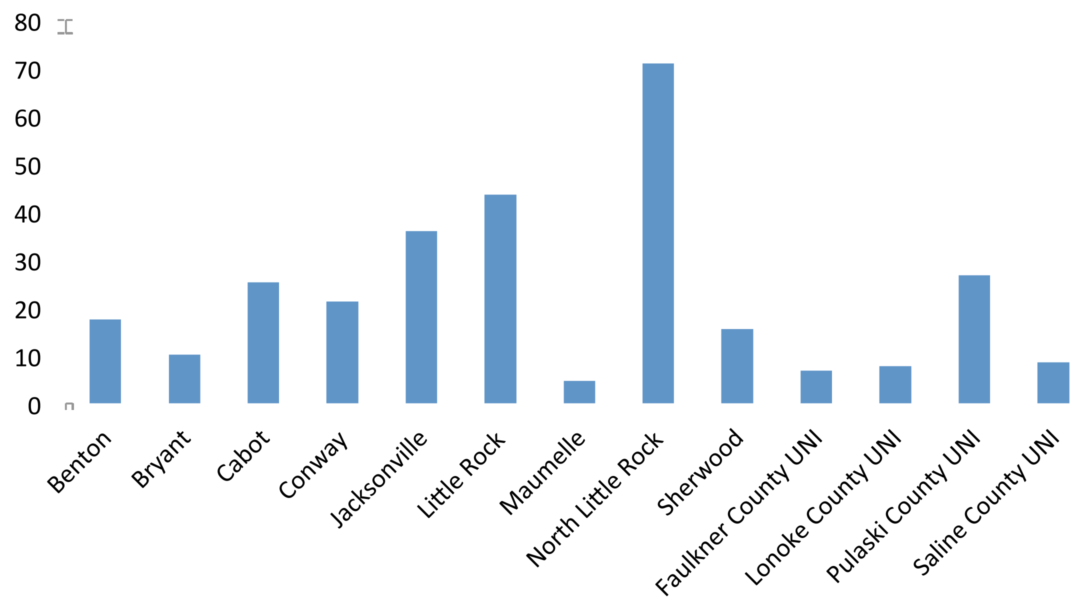

Figure 10: Pedestrian Crash Rate by Jurisdiction 2004-2013

Figure 11 shows the pedestrian fatality rate by jurisdiction. Of the cities that had at least 10,000 average population and at least one fatality, Little Rock had the highest fatal injury rate, while Maumelle had the lowest fatality rate. Again the unincorporated parts of Pulaski County had the highest rate of all areas.

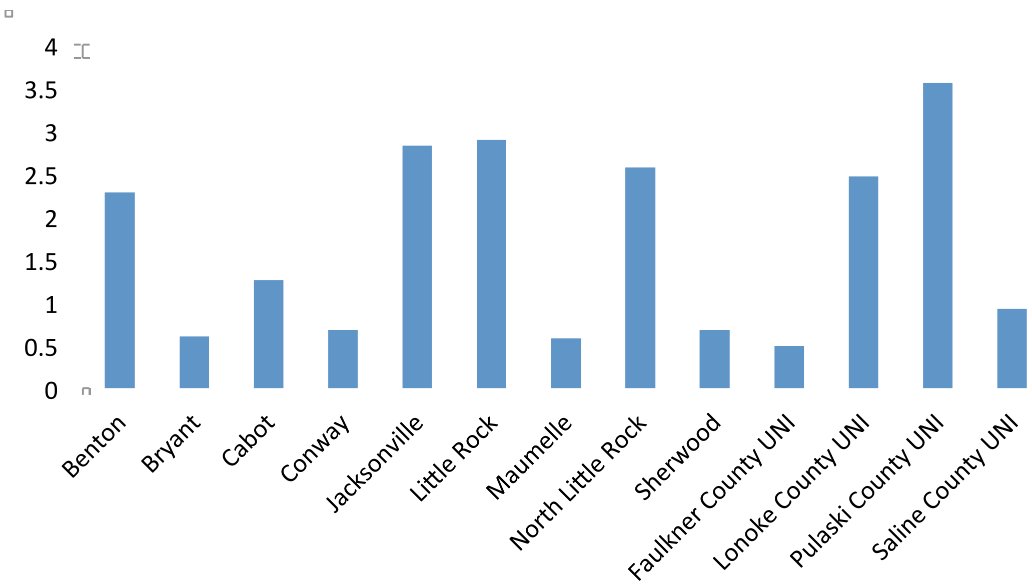

Figure 11: Pedestrian Fatality Rate by Jurisdiction 2004-2013

By comparison, the central Arkansas area's ten year average pedestrian fatality rate is higher than the national and state rate, as shown in Figure 12.

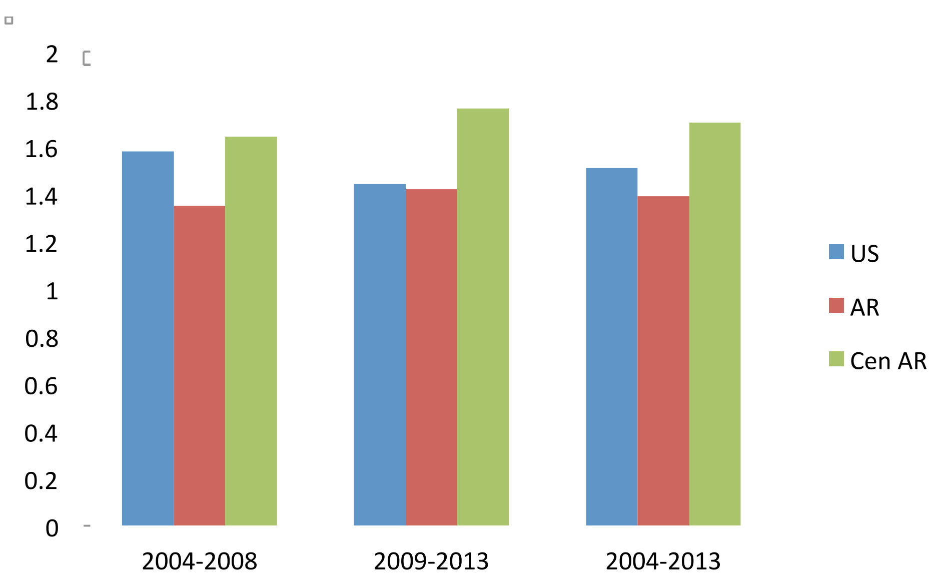

Figure 12: Comparison of Pedestrian Fatality Rates (per 100,000 population)

Figure 13 shows the bicyclist crash rate by jurisdiction. North Little Rock again had the highest bicyclist crash rates, while Maumelle had the lowest bicyclist crash rates. Similarly, the unincorporated parts of Pulaski County, as well as the overall county, had the highest rate as compared to the other counties. No bicycle fatality rates were calculated due to small sample size.

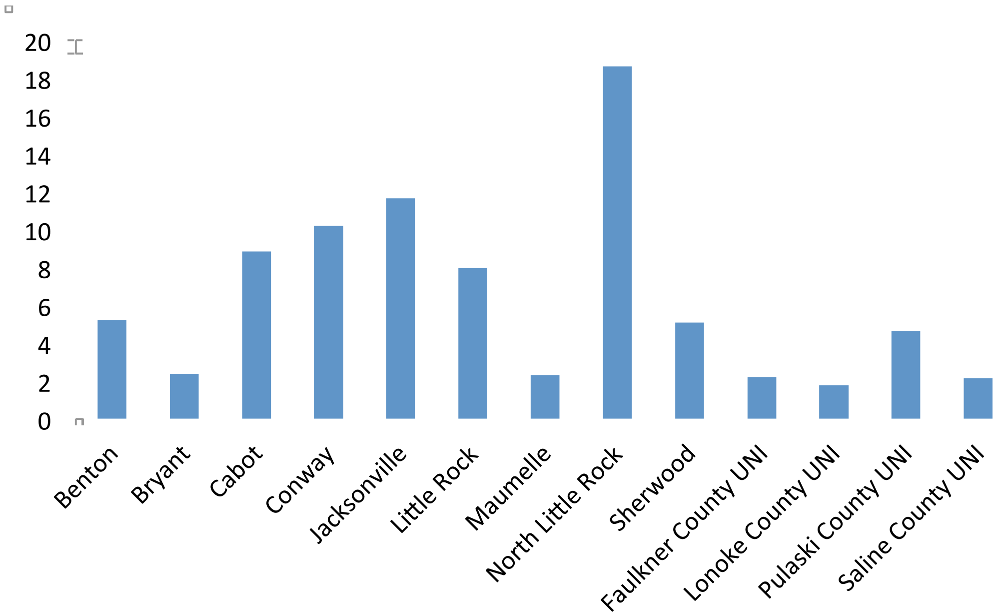

Figure 13: Bicyclist Crash Rate by Jurisdiction 2004-2013

Crash Conditions

The relation to intersection, traffic control devices, pedestrian action/location, and lighting condition fields were examined to see if there were any identifiable trends with respect to the conditions that occurred with each crash.

As Figure 14 shows, about 60% of pedestrian crashes on surface streets were not at intersections, contrasting with the nearly 63% of bicyclists crashes occurring at intersections. This trend is more pronounced with fatalities, with nearly 80% of pedestrian fatalities not at the intersection and 75% of bicycle fatalities occurring at the intersection. Of all “at intersection” crashes, about 30%, including two pedestrian fatalities and three bicyclist fatalities, were controlled by a traffic signal or pedestrian signal.

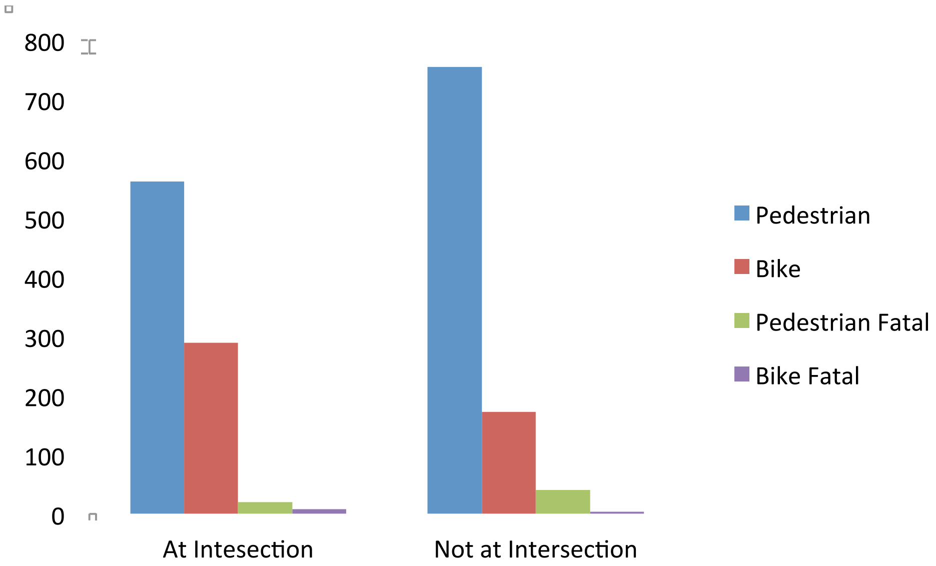

Figure 14: Pedestrian and Bicyclist Crashes and Fatalities by Relation to Intersection 2004-2013

To gain further insight into the pedestrian fatalities, the action or location of the pedestrians as described in the available crash reports was also examined. Figure 15 shows that 12% of the pedestrians were crossing the roadway as opposed to the 19% walking on the roadway when killed. Note that "other in rdwy" category included coming from behind parked cars, playing and standing in roadway when hit.

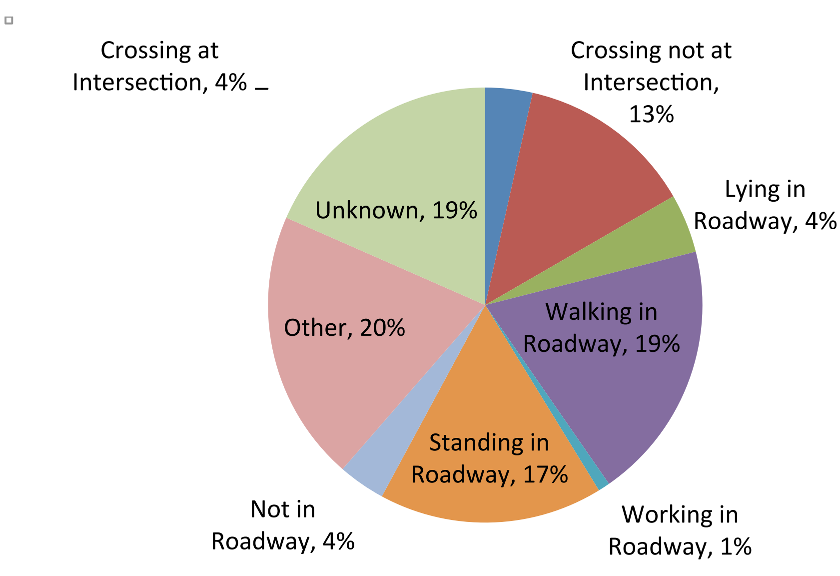

Figure 15: Action or Location of Pedestrian Fatalities 2004-2013

Figure 16 shows that about 56% of pedestrian crashes occurred during daylight, whereas nearly 83% of pedestrian fatalities occurred during dark, dawn, or dusk conditions. It also shows that nearly 74% of the bicyclist crashes occurred during daylight conditions.

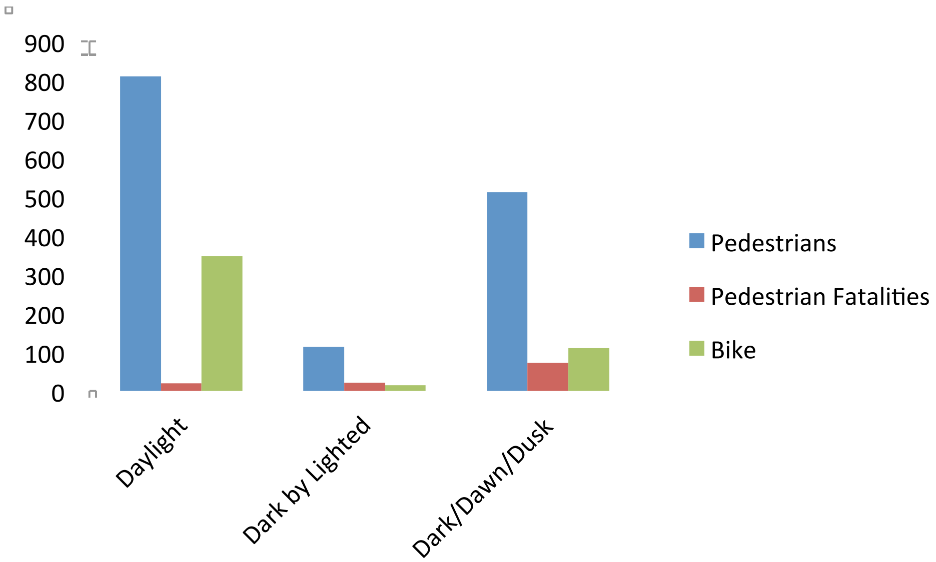

Figure 16: Pedestrian or Bicyclist Crashes by Light Condition 2004-2013

Spatial Relationships

In order to further analyze these crashes, the approximate locations of the crashes were mapped when possible (see Appendix B). Numerous geographic information systems (GIS) operations were performed on these locations to determine if any spatial patterns existed.

Crash rates by the roadways' functional classification are shown in Figure 17. With the exception of the interstate/freeway, there was a decrease in the total crash rate with lower functional classified roadways (i.e. arterials had higher crash rates than collectors and local roads).

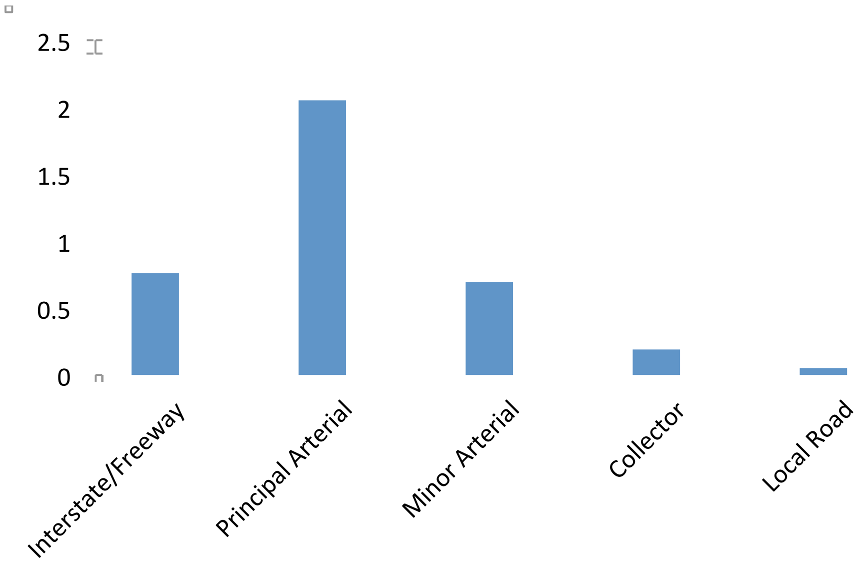

Figure 17: Crash Rate per mile by Functional Class 2004-2013

A similar operation to the functional classification analysis was performed to determine which crashes occurred on the Regional Arterial Network (RAN). The RAN is a system of highly functioning roadways that provide feasible alternatives to the area's freeways (See Appendix A). Because a significant portion of the metropolitan planning organization's transportation funding is dedicated to improving/implementing this system, it is imperative to look at its safety impacts on pedestrians and bicyclists, as well as motor vehicles. Approximately 40% of the pedestrian/bicyclist crashes occurred on existing parts of the RAN even though it only makes up 12% of the total roadway miles but carries 52% of the vehicle miles traveled (VMT) within the CARTS area on non-freeway roads. Figure 18 shows that nearly 69% of persons involved were injured or possibly injured, and 19% were fatal or incapacitated.

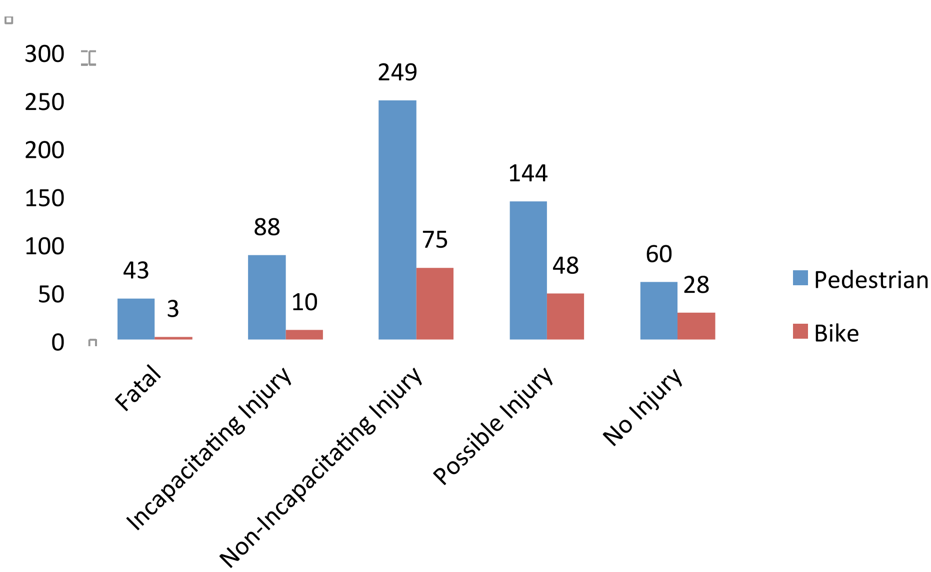

Figure 18: Pedestrian & Bicyclist Injury Severities on Regional Arterial Network 2004-2013

The presence of sidewalks was also considered in relation to non-freeway pedestrian related crashes. All known sidewalks were buffered 50 feet and intersected with these crash locations. The results show that sidewalks were only present in 61% of pedestrian related crashes between 2004 and 2013 that were mapped. Additionally, the injury severity was examined for all pedestrian crashes with and without sidewalks, which is shown in Figure 19. Crashes with fatal injuries accounted for 3% of the total crashes with sidewalks, while they accounted for nearly 7% of the total crashes without sidewalks.

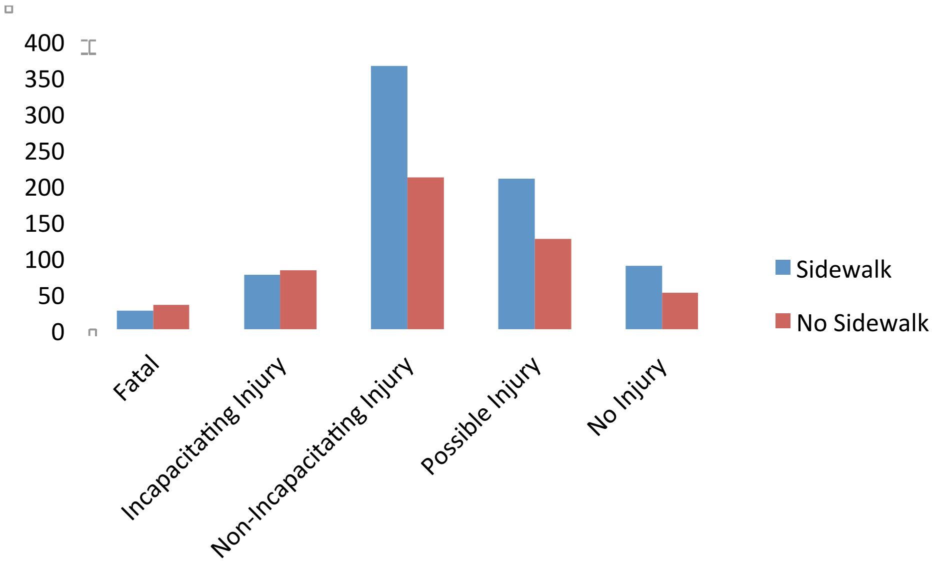

Figure 19: Sidewalk Coverage by Injury Severity 2004-2013

Crosswalk coverage was also analyzed similarly to sidewalk coverage. Crosswalks were only present in 23% of all pedestrian crashes. Again, the injury severity was examined for all pedestrian crashes with and without crosswalks, which is shown in Figure 20. Crashes with fatal injuries accounted for nearly 2% of the total crashes with crosswalks, while they accounted for 6% of the total crashes without crosswalks.

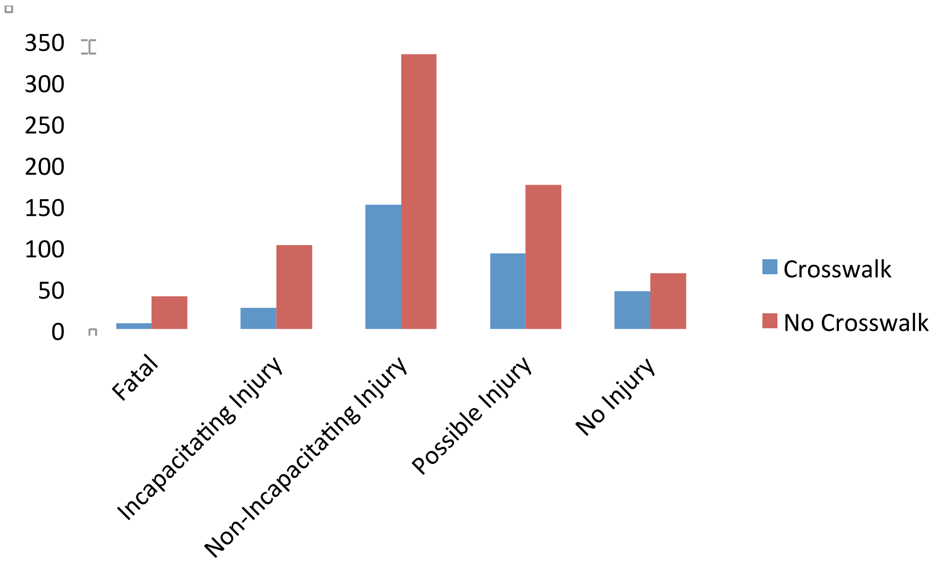

Figure 20: Crosswalk Coverage by Injury Severity 2004-2013

Speed is a major contributing factor in crashes of all types. Faster speeds increase the likelihood of a pedestrian being hit and has more serious consequences. A pedestrian hit at 40 miles per hour (mph) has an 85% chance of being killed as opposed to only 5% at 20 mph (Harkey and Zeeger 2004). Of the 114 fatal pedestrian crashes, 47% (54) were on roadways with a posted speed of 60 mph or greater.

Corridor/Intersection Analysis

The crash data was also analyzed using ArcGIS to determine spatial patterns. The analysis consisted of three approaches: crash clustering, crashes at road intersections, and crashes along road corridors. Only crashes from the years 2004 to 2013 were used in the analysis.

Crash Clustering

Crash clustering was developed by using a 1000 foot search radius around each crash location and calculating the number of crashes within the vicinity. The output from this process is a raster map that shows where crashes are clustered. The crash clustering analysis was done separately for pedestrian crashes and bicycle crashes. Appendix B, Figure 23 and Figure 24, show the clustering of pedestrian crashes. The highest density of crashes occurred in downtown Little Rock. Other areas that also had concentrated crashes were: the area along Pike Avenue in North Little Rock, the area around Geyer Springs and Baseline Roads in Little Rock, areas around Asher and University Avenues in Little Rock, and the areas near 12th Street in Little Rock. Appendix B, Figure 25 shows the clustering of bicycle crashes. The highest clustering of bicycle crashes occurred along Pike Avenue in North Little Rock. Other areas that had higher crash concentrations were: areas around East Broadway in North Little Rock and areas along 12th Street in Little Rock.

Intersections

Appendix B, Figure 26 shows the results of the pedestrian intersection crash analysis. The highest crash pedestrian intersections are listed in the Table 3. One third of the highest pedestrian crash intersections were located in downtown Little Rock.

Table 3: Highest Pedestrian Crash Intersections 2004-2013

2004-2013 Pedestrian Intersection Crashes	Number
Broadway and 6th (LR)	8
Broadway and 2nd (LR)	7
Clinton and LaHarpe (LR)	7
Broadway and Capital (LR)	6
Baseline and Geyer Springs (LR)	6
32nd and University (LR)	6
University and Asher (LR)	5
Camp Robinson and Allen (NLR)	5
JFK McCain (NLR)	5
12th and Peyton (LR)	4
12th and Washington (LR)	4
Broadway and 8th (LR)	4
18th and Pike (NLR)	4
Broadway and Markham (LR)	4
Pike and Pershing (NLR)	4
McCain and Warden (NLR)	4

Analysis of the bicycle crashes at intersections yielded and 28 intersections with 2 crashes. Appendix B, Figure 27 shows the results of the intersection analysis for bicycle crashes.

Corridors

Corridors were identified by intersecting the point crash data with the centerline of roadways to create a frequency of a frequency of crashes per road segment. Both pedestrian and bicycle crashes were used in the corridor analysis. The analysis. The minimum length of the corridors was established at a half of a mile. The crash rate for the corridors was corridors was calculated by dividing the crashes by the road mileage. Appendix B, Figure 28 shows the location of the corridors. The highest crash rate corridors are listed in

Table 4.

Table 4: Highest Corridor Crash Rates 2004- 2013

Corridors	Crashes	Mileage	Crash Rate
S Broadway (LR)	40	0.63	63.49
Pike Av (NLR)	35	0.77	45.45
Col Glenn (LR)	22	0.51	43.14
W 12th (LR)	23	0.55	41.82
Geyer Springs (LR)	25	0.74	33.78
Markham /Clinton (LR)	19	0.62	30.65
Camp Robinson (NLR)	24	0.88	27.27
E Broadway (NLR)	20	0.80	25.00
Baseline (LR)	27	1.13	23.89
Asher (LR)	29	1.57	18.47

Economic and Comprehensive Costs to Society

The economic cost is an estimate of the productivity lost and expenses incurred because of these crashes. The comprehensive cost is the economic cost plus what society is willing to pay to prevent these injuries. Typically, the latter cost is used to determine a benefit cost ratio for evaluation of possible mitigation measures (Injury Facts 2010). The estimated economic and comprehensive costs of the 10 pedestrian and bike fatalities for 2010 are $14.1 million (M) and $43.6 M, respectively. The estimated economic and comprehensive costs of all injuries, including fatalities, are $15.1 M and $46.7M, respectively.

Conclusions

Between 2004 and 2013, 1,435 pedestrians and 474 bicyclists were involved in motor vehicle crashes, a combined average of 190 per year. Of these, there were 126 fatalities, with 34 being alcohol or drug related. The following are key findings.

- Nearly 89% of the pedestrian crashes resulted in injuries or possible injuries, with 21% either fatal or incapacitated. Similarly, about 86% of the bicycle crashes resulted in injuries or possible injuries, with 11% either fatal or incapacitated.
- Black males under 18 had the highest pedestrian and bicyclist crash rate.
- Black males 18 and over had the highest pedestrian fatality rate.

- North Little Rock had the highest pedestrian and bicyclist crash rates. Whereas Maumelle had the lowest pedestrian crash rate the lowest bicycle crash rate. The unincorporated parts of Pulaski County were the highest among the counties.
- North Little Rock had the highest pedestrian fatality rate among cities with at least one fatality and 10,000 average population. The unincorporated parts of Pulaski County were the highest among the counties.
- The central Arkansas area's ten year average pedestrian fatality rate is higher than the national rate and higher than the state's rate.
- Nearly 60% of pedestrian crashes on surface streets were not at intersections, contrasting with the nearly 63% of bicycle crashes occurring at intersections. This trend is more pronounced with fatalities, with nearly 80% of pedestrian fatalities not at the intersection and 75% of bicycle fatalities occurring at the intersection. Of all "at intersection" crashes, about 30%, including two pedestrian fatalities and three bicyclist fatalities, were controlled by a traffic signal or pedestrian signal.
- About 12% of the pedestrian fatalities occurred while crossing the roadway as opposed to 19% walking on the roadway.
- About 56% of pedestrians were injured during daylight, whereas nearly 83% of pedestrian fatalities occurred during dark/dawn/dusk conditions.
- There was a decrease in the crash rate with lower functional classified roadways, except for the interstates/freeways.
- 40% of the pedestrian/bicyclist crashes occurred on existing parts of the RAN. Nearly 69% were injured or possibly injured, and 19% were fatal or incapacitated.
- Sidewalks were present in 61% of all pedestrian related crashes. Crashes with fatal injuries accounted for 3% of the total crashes with sidewalks, while they accounted for nearly 7% of the total crashes without sidewalks.
- 54 pedestrians were killed on roadways with a posted speed of 60 mph or greater.
- The estimated economic and comprehensive costs of all injuries for the year 2010 are $15.1 M and $46.7 M, respectively.

Recommendations

Although this analysis established a good comparison to the initial baseline, further research is still needed to investigate specific locations. It is recommended that staff, with the assistance from local jurisdictions, conduct corridor studies for the following locations:

- Broadway (LR) – Study Complete
    - Markham, 2nd, Capitol, 6th, 7th
- Pike Avenue (NLR) – Study Complete
    - Pershing
- Camp Robinson (NLR)
    - Allen
- Colonel Glenn/Asher (LR)
- Geyer Springs (LR)
    - Baseline

- W. 12th (LR)
    - Washington
- Hwy 89/Polk Street (Cabot)
- Oak Street (Conway)
- Military (Benton)
- South First Street (Jacksonville)

Furthermore, it is recommended that Metroplan staff, with the assistance from local jurisdictions, conduct intersection studies for the following locations:

- La Harpe and Markham
- University and Town & County
- Magnolia and Broadway

Additional corridor and intersection recommendations will be provided with the completion of the studies listed above.

Appendix A

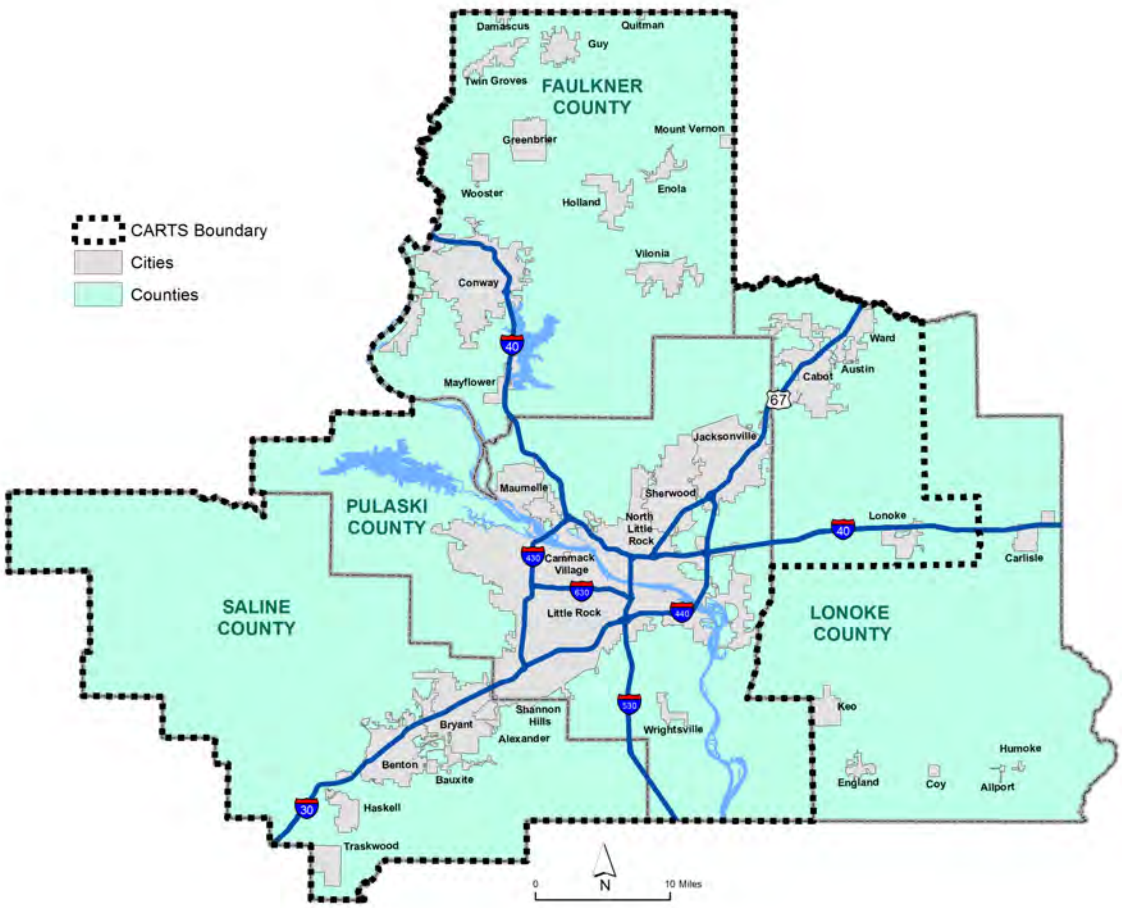

Figure 21: CARTS Study Area

Table 5: Number of Pedestrians Involved in Crashes 1995-2010

	Faulkner	Lonoke	Pulaski	Saline	**Total**
2004	8 (1)	8	117 (9)	13 (4)	**146 (14)**
2005	5	9 (4)	106 (3)	7	**127 (7)**
2006	11 (1)	4	98 (5)	12	**125 (6)**
2007	11	3	119 (12)	10 (1)	**143 (13)**
2008	14	5 (1)	116 (14)	4	**139 (15)**
2009	3 (1)	6	114 (7)	7	**130 (8)**
2010	7	7	133 (8)	8 (1)	**155 (9)**
2011	18	2	129 (15)	7	**156 (15)**
2012	5 (1)	9 (1)	150 (11)	4 (1)	**168 (14)**
2013	13 (2)	6 (2)	121 (7)	6 (1)	**146 (12)**
Total	95 (6)	59 (8)	1203 (91)	78 (8)	**1435 (113)**

Note: Fatalities are in parenthesis.

Table 6: Number of Bicyclists Involved in Crashes 2004-2013

	Faulkner	Lonoke	Pulaski	Saline	**Total**
2004	7	5	47	3	**62**
2005	10	6	48 (1)	3	**67 (1)**
2006	6	3	39	2	**50**
2007	13	6 (1)	37	8	**64 (1)**
2008	11	4	34	7 (1)	**56 (1)**
2009	1	3	28 (3)	0	**32 (3)**
2010	7	0	40 (1)	1	**48 (1)**
2011	8 (1)	1	40 (1)	1	**42 (2)**
2012	6	6 (1)	1 (1)	2 (1)	**15 (3)**
2013	2	1	27	0	**30**
Total	71 (1)	35 (2)	341 (7)	27 (2)	**466 (12)**

Note: Fatalities are in parenthesis.

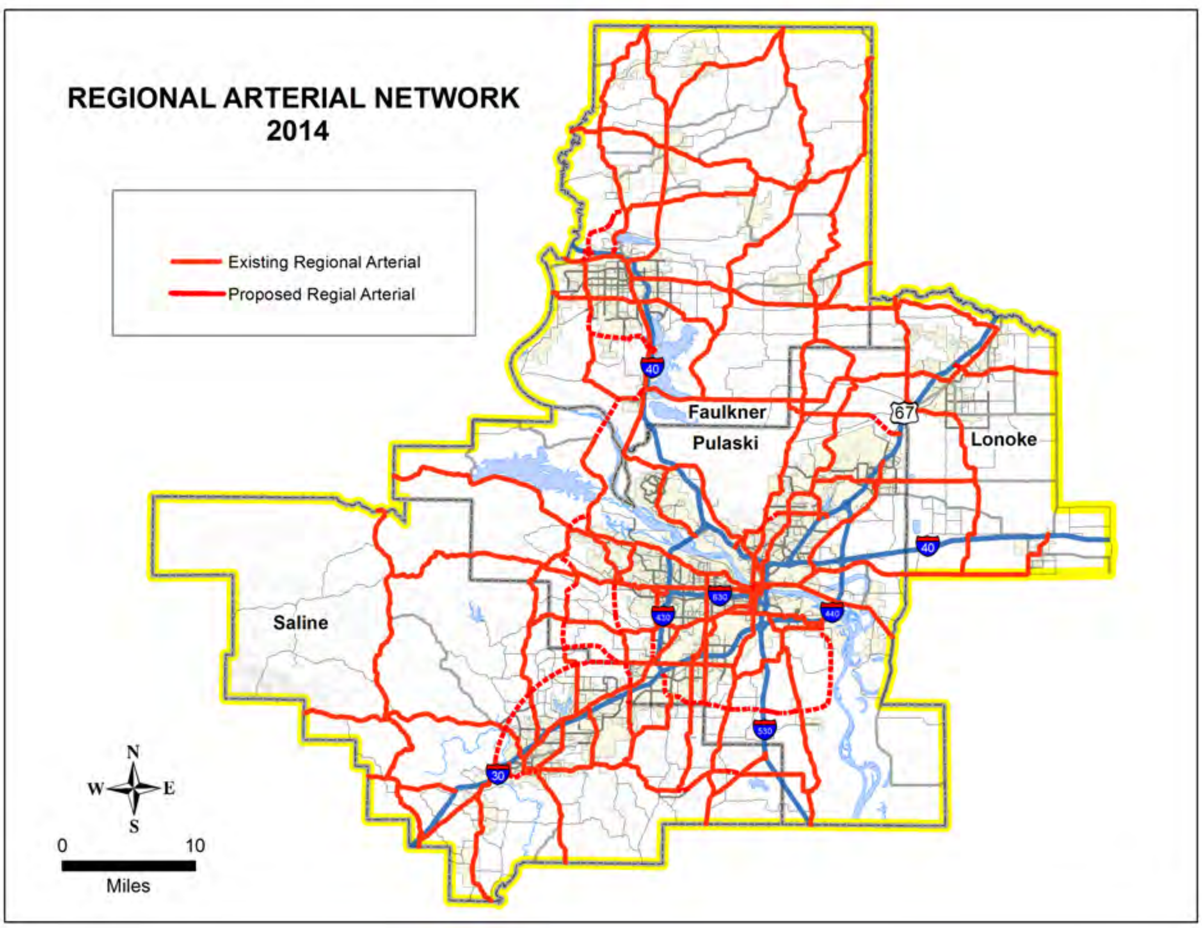

Figure 22: Regional Arterial Network

Appendix B

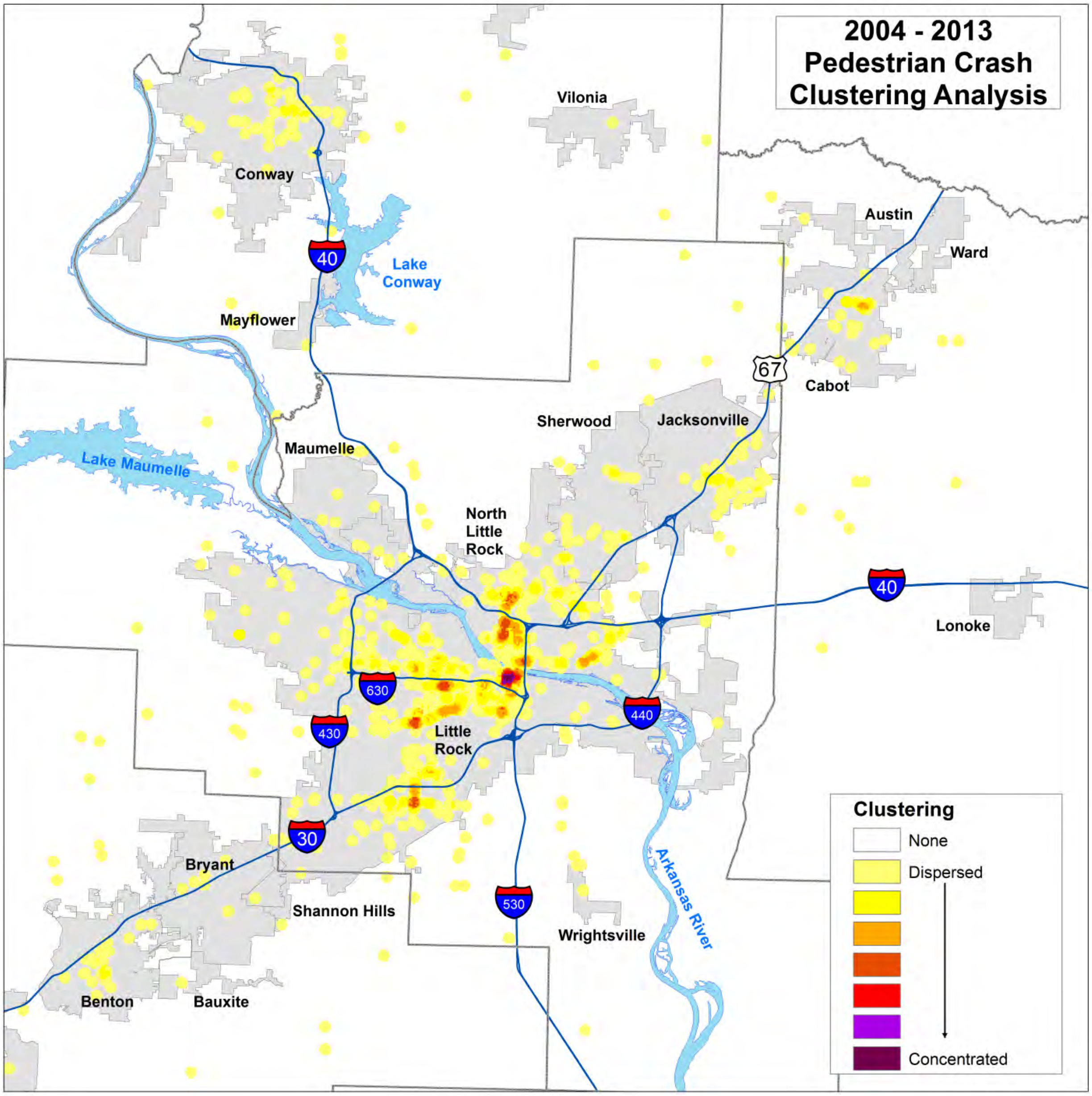

Figure 23: Pedestrian Crash Clustering Analysis

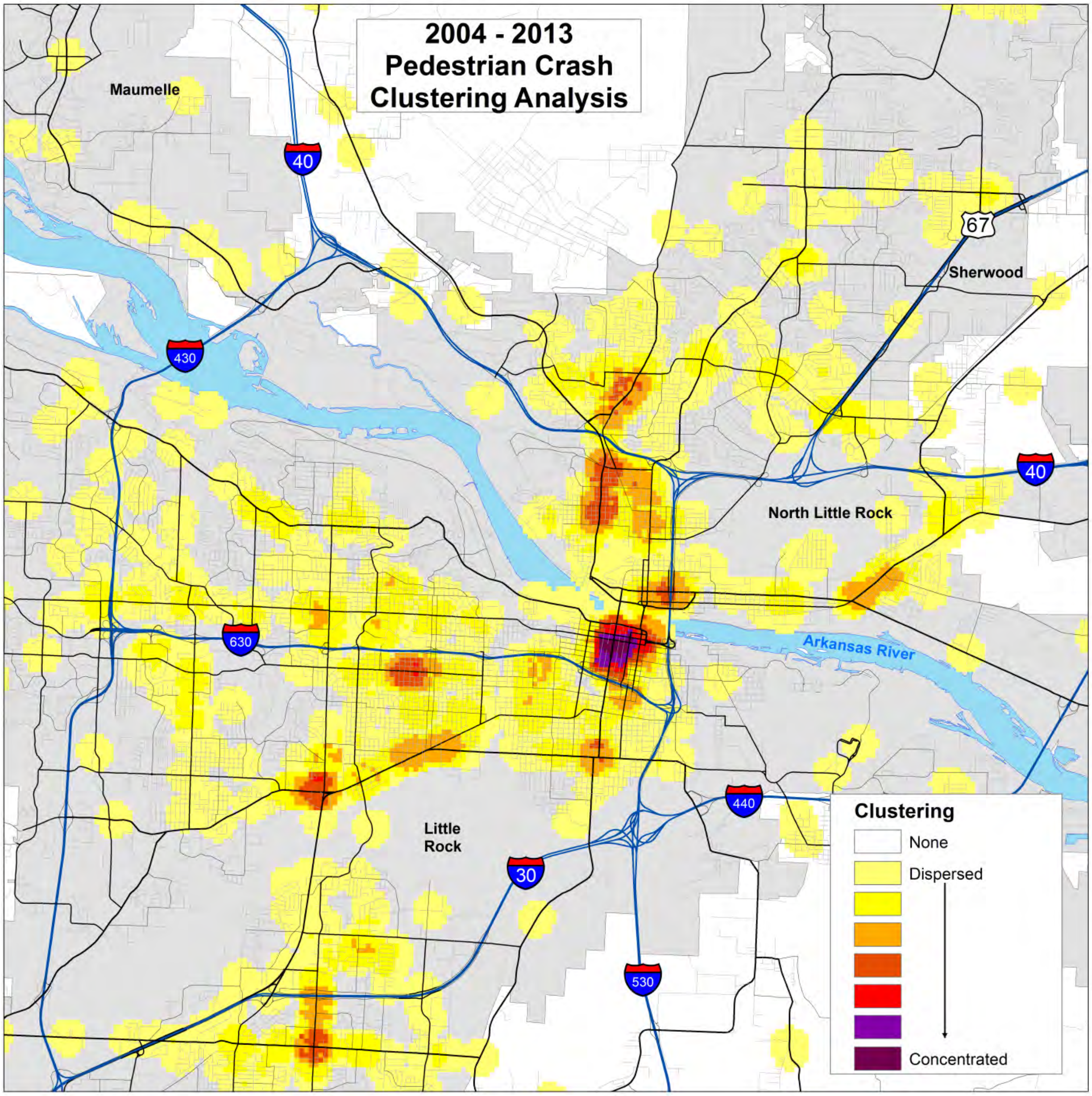

Figure 24: Pedestrian Crash Clustering Analysis (Central Area)

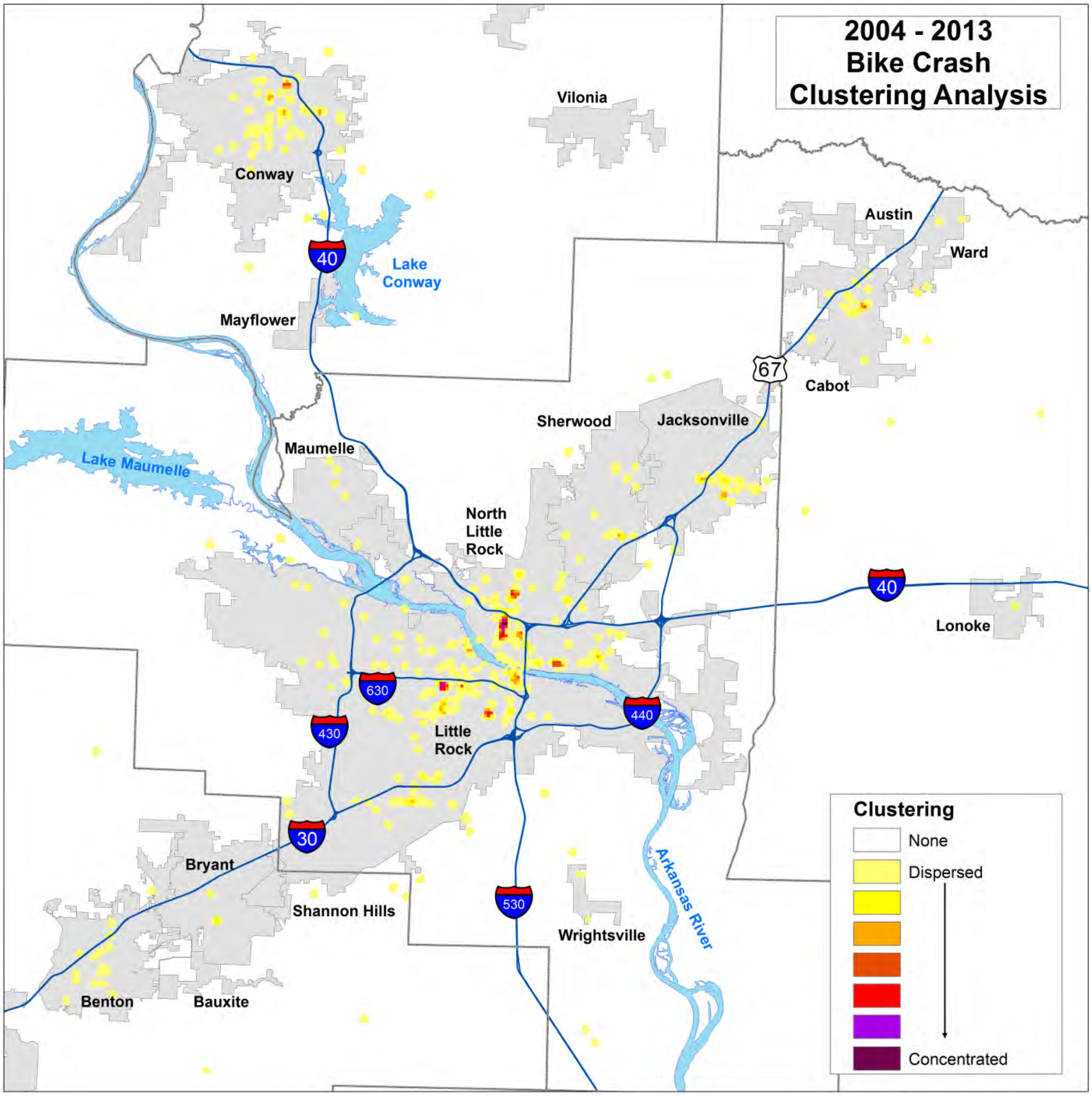

Figure 25: Bicycle Crash Clustering Analysis

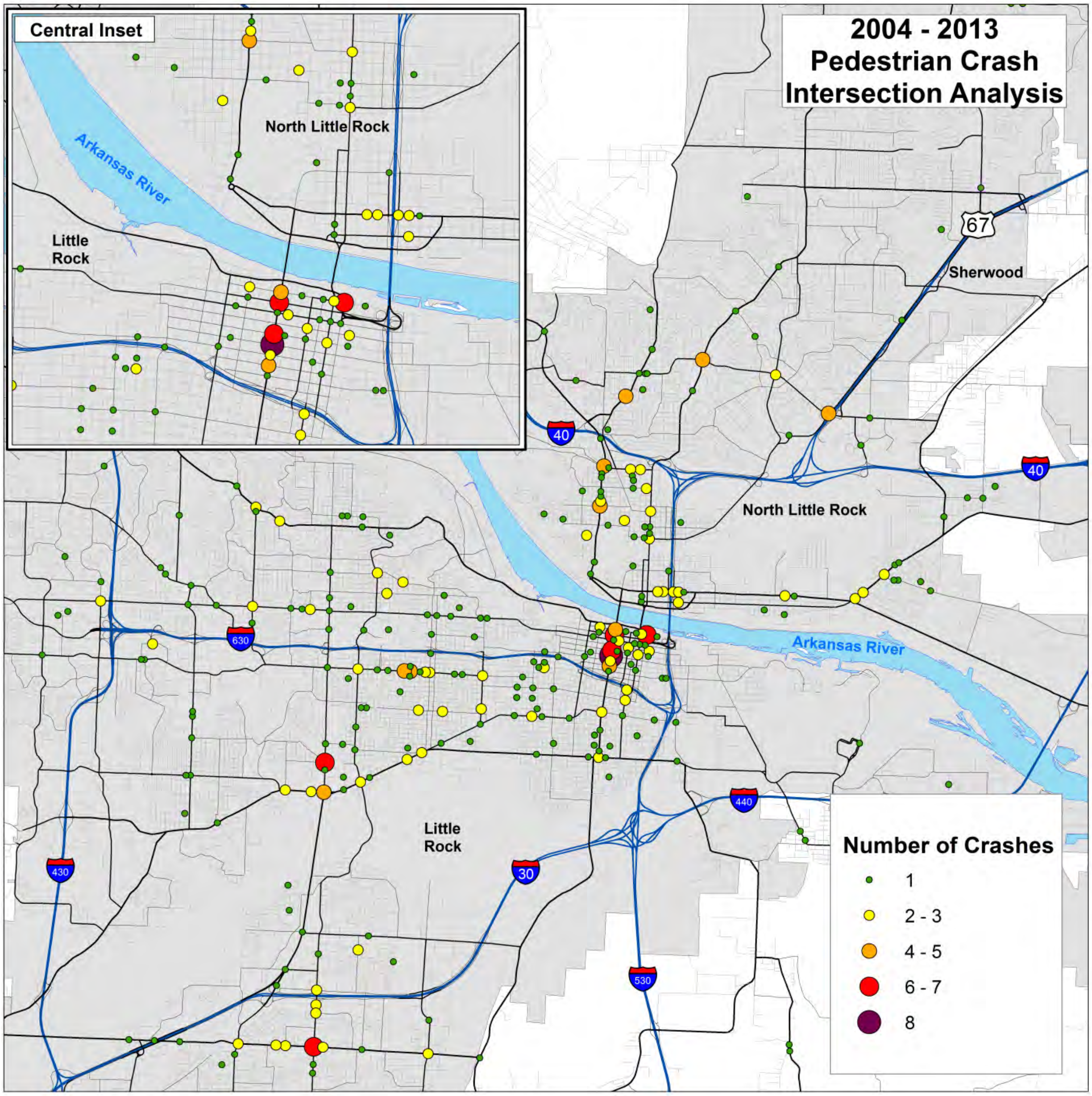

Figure 26: Pedestrian Crash Intersection Analysis

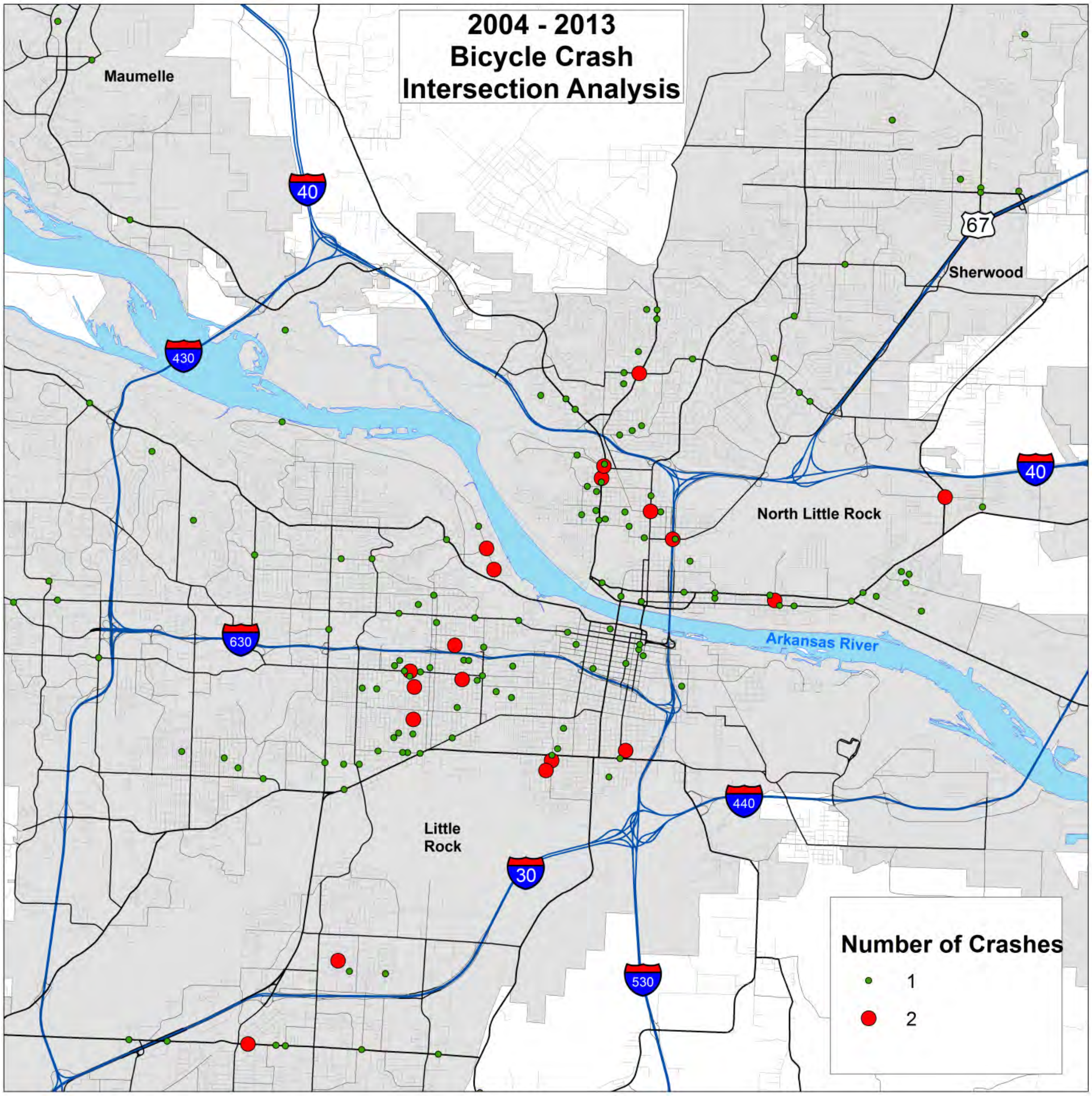

Figure 27: Bicycle Crash Intersection Analysis

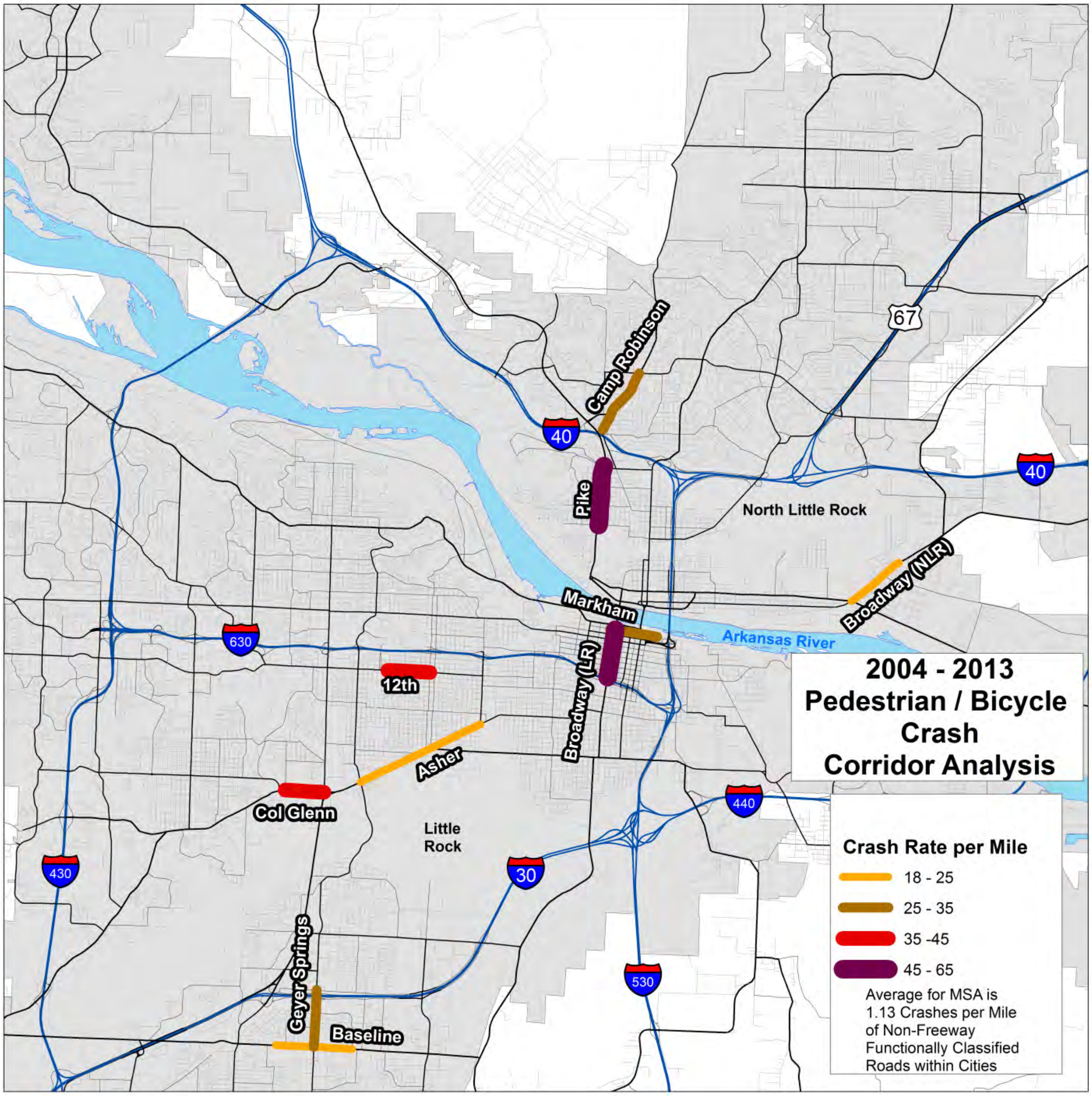

Figure 28: Pedestrian / Bicycle Corridor Crash Analysis

Appendix C

(Corridor and Intersection Studies)

References

Harkey, D., Zeeger, C., (2004). *Pedestrian Safety Guide and Countermeasure Selection System*, FHWA-SA-04-003, Federal Highway Administration, Washington DC.

Injury Facts 2012 Edition, Estimating Motor-Vehicle Crash Costs (page 107), National Safety Council, Itasca, IL.

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