Special Study Update for ADECA 2023 HSP
Pedestrian-Involved Crashes (PIC) Using 2017-2021 Crash Data

Program Area: Pedestrian-Involved Crashes (PIC)

Description of Highway Safety Problems

The AOHS conducted a problem identification analysis for Pedestrian-Involved Crashes (PIC) in the State of Alabama to determine causal factors and evaluate potential countermeasures for this issue that has shown growth in the most recent years.

The first section below is a location analysis to determine where the pedestrian crashes are most often occurring, so that location-specific countermeasures (such as selective enforcement) can concentrate on the most critical areas. Following that is a section devoted to an overview of pedestrian crashes in general, e.g., all pedestrian crashes by severity. The next major section gets into determining what is different about pedestrian crashes from other crash types. It starts with the basic causes (Primary Contributing Circumstances) of Pedestrian Involved Crashes (PICs). After that it gets into characteristics of severity, geography, time, and then driver and pedestrian demographics.

PIC Location Analysis

Top Pedestrian Involved Crash Statewide Locations

FY2022 - Impaired	Hotspots
Mileposted Interstate Locations	7
State and Federal Routes	21
Intersections	82
Segments	23
TOTAL	133

FY2022 Top 7 Mileposted Interstate Locations (5 miles in length) in Alabama with 8 orMoreImpaired Driving Related Crashes Resulting in Injury or Fatality

Hotspot	County	City	Route	Beg MP	End MP	Total Crashes	Fatal Crashes	Injury Crashes	S/CRS	C/MVM	S/CRS	ADT	Agency ORI
1	Shelby	Alabaster	I-65	236.4	241.4	8	2	6	25	0.01	25	76550	Alabaster PD
2	Jefferson	Birmingham	I-59	123.8	128.8	13	3	10	24.62	0.01	24.62	123317	Birmingham PD
3	Jefferson	Rural Jefferson	I-65	266.8	271.8	9	2	7	23.33	0.01	23.33	91608	ALEA - Birmingham Post
4	Madison	Madison	I-565	6.6	11.6	8	1	7	17.5	0.02	17.5	58307	Madison PD
5	Montgomery	Montgomery	I-85	1.1	6.1	10	0	10	15	0.01	15	108679	Montgomery PD
6	Jefferson	Rural Jefferson	I-59	116.9	121.9	13	0	13	14.62	0.02	14.62	84068	ALEA - Birmingham Post
7	Jefferson	Bessemer	I-59	111.9	116.9	11	0	11	14.55	0.02	14.55	59039	Bessemer PD

FY2022 Top 21 Mileposted State and Federal Route Locations (5 Miles in Length) in Alabama with3 or More Impaired Driving Related Crashes Resulting in Injury or Fatality

Hotspot	County	City	Route	Beg MP	End MP	Total Crashes	Fatal Crashes	Injury Crashes	S/CRS	C/MVM	S/CRS	ADT	Agency ORI
1	Limestone	Rural Limestone	S-2	80.9	85.9	9	2	7	30	0.04	30	22743	ALEA - Decatur Post
2	Marshall	Boaz	S-1	278.5	283.5	10	0	10	25	0.03	25	32697	Boaz PD
3	Tuscaloosa	Rural Tuscaloosa	S-6	56.1	61.1	9	1	8	24.44	0.08	24.44	12010	ALEA - Tuscaloosa Post
4	Marshall	Boaz	S-205	0.7	5.7	9	0	9	22.22	0.22	22.22	4552	Boaz PD
5	Baldwin	Gulf Shores	S-59	1.9	6.9	9	1	8	22.22	0.02	22.22	48750	Gulf Shores PD
6	Calhoun	Anniston	S-21	253.2	258.2	9	0	9	22.22	0.03	22.22	34109	Anniston PD
7	Shelby	Rural Shelby	S-38	2.4	7.4	11	1	10	21.82	0.01	21.82	81454	Mountain Brook PD
8	Russell	Phenix City	S-1	110.6	115.6	12	0	12	21.67	0.04	21.67	36180	Phenix City PD
9	Madison	Rural Madison	S-1	341.4	346.4	13	0	13	21.54	0.05	21.54	29051	ALEA - Huntsville Post
10	Marshall	Albertville	S-1	283.5	288.5	9	0	9	21.11	0.03	21.11	29509	Albertville PD
11	Houston	Dothan	S-53	23	28	9	0	9	21.11	0.04	21.11	28134	Dothan PD
12	Mobile	Rural Mobile	S-42	10.5	15.5	11	0	11	20.91	0.05	20.91	24317	ALEA - Mobile Post
13	Jefferson	Hoover	S-150	7.3	12	10	0	10	19	0.03	19	35414	Hoover PD
14	Madison	Huntsville	S-53	318.7	323.7	13	0	13	18.46	0.06	18.46	24742	Huntsville PD
15	Baldwin	Daphne	S-42	35.4	40.4	11	0	11	18.18	0.04	18.18	34260	Daphne PD
16	Houston	Dothan	S-1	11.1	16.1	10	0	10	18	0.06	18	17424	Dothan PD
17	Shelby	Alabaster	S-3	251.4	256.4	10	0	10	18	0.03	18	31698	Alabaster PD
18	Morgan	Decatur	S-3	351.9	356.9	13	0	13	16.15	0.05	16.15	26396	Decatur PD
19	Madison	Madison	S-2	87.7	92.7	12	1	11	15.83	0.03	15.83	48129	Madison PD
20	Tuscaloosa	Tuscaloosa	S-215	2.7	7.7	9	0	9	15.56	0.04	15.56	23270	Tuscaloosa PD
21	Elmore	Millbrook	S-14	159.3	164.3	11	0	11	14.55	0.05	14.55	22510	Millbrook PD

Problem Identification Analysis Results for Pedestrian Crashes in the State of Alabama

Overall Pedestrian Involved Crashes (PICs) by Year

It is beneficial to get an overall view of how pedestrian crashes have been increasing or decreasing by severity over the years. The following table gives a comparison of total PIC crashes over CY2017-2021 by severity.

Pedestrian Crashes by Severity for Years 2017-2021

2017-2021 Alabama Integrated Crash Data | Pedestrian Involved | 1/ 1/2017

Suppress Zero Values: Rows and Columns | Select Cells: | Column: Year ; Row: Crash Severity

	2017	2018	2019	2020	2021	TOTAL
Fatal Injury	112	107	115	99	126	559
Suspected Serious Injury	182	169	202	188	202	943
Suspected Minor Injury	288	266	279	228	250	1311
Possible Injury	159	189	178	112	123	761
Property Damage Only	34	32	34	22	34	156
Unknown	51	53	61	54	41	260
TOTAL	826	816	869	703	776	**3990**

It is clear from considering the high total frequencies of fatal injury pedestrian crashes in 2021, that there is a significant increase in the fatality trend over the five years (2017-2021). Fatal pedestrian crashes also had a dramatic increase in 2019, while there has been a regression to the mean in the year that followed (2020), which could also have been caused by the COVID pandemic.

Considering crashes of all severities, the high year was 869 in 2019. While 2020 may have been affected by the COVID pandemic, there is no reason to believe that its effect when into 2021. Thus, 2021 should be considered as a relatively favorable year, with a reduction below the average of the previous three years (ignoring 2021) from the three-year average 837 to 776, which is 61 crashes. This is a significant 7.3% reduction.

Performing a comparable analysis over the Suspected Serious Injury and Suspected Minor Injury severities (combined) results in a total of 1,386 pedestrian injury crashes over the prior 3 years (2017 through 2019), which comes out to 462 severe non-fatal crashes per year. The reduction in 2021 is down to 452 (202=250) for that year, which is not significant. So, while there was a significant reduction in fatal pedestrian crashes, the comparison of non-fatal injury showed very little, if any, reduction.

Pedestrian Involved Crashes (PIC) Comparison Against Non-PIC Crashes for CY 2017-2021

The remaining sections will present the results of comparisons of PIC crash compared to non-PIC crash attributes in the most recent five-year period for which state data are available (CY2017-2021). An over-represented value of an attribute is a situation found where that attribute has a greater share of PIC crashes than would be expected if it were the same as that attribute for non-PIC crashes. Thus, the non- PIC crashes are serving as a control to which the PIC crashes are being compared. In this way any significant difference about PIC crashes surfaces, and it can be subjected to further analyses. These findings typically do not change from year to year as long as the normal influences on pedestrian crashes remain in effect.

Primary Contributing Circumstances

The following are the highest causes (Primary Contributing Circumstances) of pedestrian crash frequency; the frequency and its percentage of the total over five years are in parenthesis):

- Improper Crossing 840, 21.05%
- Unseen Object/Person/Vehicle 694, 17.39%
- Failed to Yield the Right-of-Way 437, 10.95%
- Not Visible 203, 5.09%
- Pedestrian Under the Influence 139, 3.48%
- Lying or Sitting in Roadway 58, 1.45%

The largest potential for pedestrians to reduce their probability of being struck is to make sure that they cross streets in as safe a manner as possible. A second crash reduction benefit will be obtained by making sure that they are walking against traffic, and that they are as visible as possible. It is highly recommended: that they carry a flashlight after dark. The following summarizes pedestrian actions at the time of the crash, giving a slight difference in the pedestrian crash causation: (#1 and #2 combined):

- Improper Crossing 824, 16.99%
- In Roadway (Standing/On Knees/Lying) 427, 7.87%
- Not Visible (Dark Clothing) 318, 3.28%
- Failure to Yield Right-Of-Way 198, 3.08%
- Darting 164, 2.41%

Severity Comparisons

- In a comparison, over the most recent five-years of data, all PIC crashes resulted in 559

fatal crashes, which was 14.01% of all PIC crashes (one crash in every 7.14 crashes was fatal.) This compares to one fatal in every 200 for crashes in general. This works out to be close to a 30 (28,253) times higher probability of death as a result of a pedestrian involved crash.

- Suspected Serious Injury (SSI) and Suspected Minor Injury (SMI) crashes were also highly overrepresented with an Odds Ratio for SSI of 8.4 times its expectation for non-PIC, and the Odds Ratio for SMI being 4.2 times its non-PIC expectation.

Factors Affecting Severity

The following are some of the characteristics that increase the severity (probability of death) in pedestrian involved crashes (PICs):

- Impaired Walking – This is a very significant factor not only in causing the PIC, but in increasing its severity. PIC victims were found to be under the influence of alcohol 5.377 times the proportion of drivers in general that were found to be under the influence of alcohol. They were also 5.513 times the expected proportion of those were determined to be under the influence of non-alcohol drugs. It was also found that those under the influence of alcohol had a one in 3.26 chance of being killed, while those that were sober had less than a one in 8 chance of being killed. The reason attributed to this is the lack of those who are inebriated to take actions to defend themselves when they recognize the inevitability of being hit by a motor vehicle. In many cases there may not even be such a recognition.
- Number Injured (Including Fatalities) – Not only are PIC crashes generally more severe to the victims, but many of these crashes have multiple injuries. The following gives the summary for the last five years:

Number Injured in Crash	**Frequency**
1	3,847
2	118
3	18
4	4
5	1
7	1
12	1

This might have something to do with the preference of those walking to takesome of their friends with them. Generally, this is a good practice to improve safety. However, it is critical that all members of the group not engage in the same unsafe practices.

- Adjusted EMS Arrival Delay – The very shortest arrival times had the highest over-representations, clearly indicating that the problem of PIC crashes being generally of greater severity is not a problem with EMS arrival delay.

Geographical Factors

[Terminology: *expected numbers* (or expectations) for attribute items below are obtained fromthe proportion for non-PIC crashes.]

- County - Generally, the overrepresented counties are those with large urban areas (big cities). It is reasonable that more pedestrian crashes will occur in areas of both heavy motor and pedestrian traffic. The largest potential for pedestrian crash reductions were in Mobile, Montgomery and Jefferson counties.
- City Comparisons of PIC crashes to Non-PIC Crash Proportions. There is little surprise in this result, which generally tracks the rural areas in the counties by population. Traffic safety professionals should look for any locations that fall counter to this trend. The cities with the highest potentials for PIC crash reduction generally track the population of the cities: Birmingham, Montgomery, Mobile, Rural Mobile, Huntsville and Tuscaloosa.
- Rural/Urban PIC Crash Frequency – The more general Rural/Urban analysis confirms the initial county and city findings. The Urban to Rural breakdown is about 80% Urban and 20% rural.
- Severity of PIC Crashes by Rural-Urban – While only about 19.9% of PIC crashes occur in rural areas, 28.21.7% of their fatal crashes occur there. Similar results are found for the highest severity non-fatal crashes (Suspected Serious Injury), where the proportion is 31.36% (as compared with the 19.9% rural). This seems clearly to be the result of higher speeds and accompanying loss of control in the rural areas. Increased speeds might also be the result of less enforcement in the rural areas.
- Highway Classifications – The most dramatic over-representation was found on Private Property, where close to four (3.832) times the expected number of PIC crashes occurred as compared to the non-PIC proportion. Private Property includes parking lots, and that is where most of these crashes are occurring. The only over-represented Highway Classification was Municipal roads, with close to 18% more crashes than expected. All other highway classifications were under-represented. A very alarming statistic was that Interstate highways had 97 fatal pedestrian crashes over the five-year period, which was about three times higher than would be expected compared to Interstate crashes in general. Very few people walk along the Interstates, and we conclude that these fatalities are due largely to disabled motorists. It is important that disabled vehicles be parked as far off the traffic way as possible when such is necessary, and that those forced to walk at night carry a flashlight.
- Locale – Reflecting the more urban over-representations, residential roadways show an over-representation (1.389 Odds Ratio). More troubling is the 2.573 over-representation of the School locale. While this was only 128 PIC crasher (3.21%), the fact that it is over-represented should provide a warning to all school administrators.

Time Factors

- Year – see ***Overall PIC Crashes by Year*** **above.**
- Month – PIC crashes were significantly higher than expected in September, October and November, reflecting potential issues in school zones as students who walk to school would be more exposed during these months (see Locale above).
- Day of the Week – The only two days of the week that are over-represented are Saturday and Sunday, probably because of the normally increased pedestrian traffic during these days. This analysis is not only useful for the typical work week, but it also reflects the typical "holiday (virtual) weekend" patterns, which is discussed below.
- "Holiday Weekends" – these can be viewed as a sequence of the weekend-pattern days. Forexample, the Wednesday before Thanksgiving would follow the Friday pattern assuming most are at work on Wednesday (which has not been typical recently). The Thanksgiving Thursday, Friday and Saturday would follow the Saturday pattern of people being off work. The day at the end of the weekend off period would follow the typical Sunday pattern. This is the reason long holiday events (i.e., several days off) can be more prone to PIC crashes (or for that matter, crashes in general) than the typical weekend.
- Time of Day – The extent to which nighttime hours are overrepresented is quite striking. Optimal times for PIC enforcement would start immediately following any rush hour details and would continue at least through 1:59 AM (odds ratio 2.023 times the expected proportion for non-PICs). Clearly pedestrians are harder to see at night especially if they are not wearing reflective clothing. Problems have also been detected in many of them walking with (as opposed to against) traffic.
- Time of Day by Day of the Week – This cross-tabulation quantifies the extent of the PIC crash concentrationson on (1) Friday nights, (2) Saturday mornings, Saturday nights, and (3) early Sunday mornings. This is a very useful summary for deploying selective enforcement details, especially during weekend hours.

Driver and Pedestrian Demographics

- Pedestrian Age – The following is the pedestrian age distribution for those cases in which ages are available:

4 to 5 Years	18
6 to 8 Years	39
9 to 12 Years	38
13 to 15 Years	47
16 to 20 Years	294
21 to 25 Years	317
26 to 64 Years	1847
65 or Older (senior)	392

- Pedestrian Victim Gender – The gender breakdown for pedestrian involved crashes is 1,978 Males (62.46 and 1,189 Females (37.54%).

- Causal Driver Age – (for cases where the pedestrian did not cause the crash) – The following is the causal distribution of PIC crashes (frequencies, and percentage of all drivers):
  - 16 to 20 Years 177 4.44
  - 21 to 25 Years 175 4.39
  - 26 to 30 Years 142 3.56
  - 31 to 35 Years 138 3.46
  - 36 to 40 Years 126 3.16
  - 41 to 45 Years 108 2.71
  - 46 to 50 Years 141 3.53
  - 51 to 55 Years 112 2.81
  - 56 to 60 Years 109 2.73
  - 61 to 65 Years 99 2.48
  - 66 to 70 Years 84 2.11
  - 71 to 75 Years 66 1.65
  - 76 to 80 Years 42 1.05
  - 81 to 85 Years 29 0.73
  - 86 to 90 Years 14 0.35
  - 91 to 95 Years 2 0.05