
ANNE ARUNDEL COUNTY
TRANSPORTATION
MASTER PLAN



TECHNICAL MEMORANDUM #5
Analysis of Traffic Crashes



Prepared for the Anne Arundel County Office of Transportation
March 2019 – Final



Note: The purpose of each Technical Memorandum prepared for the Office of Transportation is to present facts, analysis, ideas, issues and recommendations that will inform the Anne Arundel County Transportation Master Plan. The views expressed and recommendations offered in each memorandum are solely based on the consultant's judgment and should not be considered as endorsed by the Office of Transportation or any other County agency or officer.

When prioritizing funding for transportation improvements, one of the most important factors to be taken under consideration is increasing the safety of a facility for the user. This purpose of this Technical Memorandum is to examine the location and frequency of automobile accidents in Anne Arundel County. Accident data at County and sub-County level was compiled and analyzed, as well as an examination of specific high accident locations. The results of the analysis are intended to be used as one of several tools which can serve as an aid in choosing which projects need an allocation of funds.

This analysis uses data from crashes that occurred in 2015, 2016, and 2017. Data is compiled and maintained by the Department of Maryland State Police. The datasets are updated quarterly and only include approved crash reports. Incorrectly located/reported crashes have been removed from the analysis, and accuracy of crash locations are subject to a reasonable degree of human error in the field. Over 30,000 crashes were reported in Anne Arundel County between January 1, 2015 and December 31, 2017.

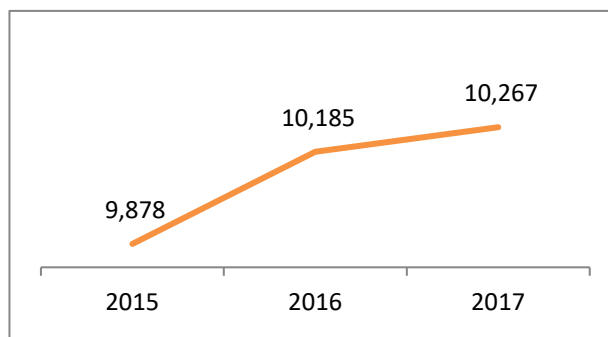
The data used in this analysis includes descriptive information regarding each individual crash collected in the official crash report. Information in the reports include; the specific latitude and longitude coordinate location of the crash, lighting and weather conditions at the time of crash, vehicle collision or fixed object collision type, circumstantial roadway obstructions, lane designation and position, and the extent of injuries resulting from the incident. Most reports also contain additional information about drivers and other persons involved in crashes as well as details about the vehicles involved and the responding Emergency Medical Technician team on scene, if applicable.

Crash Trends: 2015 – 2017

Figure 1 depicts the trend in the total number of accidents in the county in the years 2015, 2016 and 2017. The numbers of accidents increased slightly in each year.

Figure 2 depicts the spatial distribution of these accidents throughout the County. Most of them occurred in the City of Annapolis and its adjacent suburbs; or along the I-97 corridor between MD 100 and I-695. Additional findings related to these data are discussed in further sections of this report.

Figure 1. Total Crashes in Anne Arundel County



Further analysis of the combined years crashes revealed patterns of distribution that were consistent with crash distribution in individual years, shown below. Patterns and spatial distribution trends of crashes in Anne Arundel county will be discussed further in upcoming sections of this report. Crashes concentrate around Annapolis and its surround suburban areas and in northern Anne Arundel County near the Baltimore Beltway and Glen Burnie. Significant clusters and specific intersections with high crash rates will be discussed further in this report.

Crashes by Roadway Type

The Highway Location Reference (HLR) is a database maintained by the State Highway Administration (SHA) and the Maryland Transportation Authority (MdTA). In this database, accident data are included for all routes roads that are part of the state roadway network, regardless of responsible jurisdiction (Federal, State, County, etc). For the purpose of the following analysis, the facility types were consolidated into 1) Interstate roads and various interstate roadway components (ramps, etc), 2) State-owned and maintained roads, and 3) Local County and Municipal Roads. Figure 3 depicts the accident locations for by facility type.

The data were then summarized by category for years 2015, 2016 and 2017. Figure 4 shows the percentage of total accidents by facility type. Most accidents occurred on state routes, more than double the number that occurred on county and municipal routes.

For the following analysis, centerline data was downloaded from Maryland's Mapping & GIS Data Portal (MD iMap). Centerline data for roadways are maintained by the responsible jurisdictions—Federal Highway Administration, the Maryland Department of Transportation State Highway Administration, county governments and municipal governments.

The centerline data was grouped by facility type to determine the number of road miles in each category. The results are shown in Figure 5. According to centerline data, there are approximately 110 miles of Interstate roads, 528 miles of state roads, and there are more than 2,400 miles of local and municipal roads in Anne Arundel County. Of the total, 17% of the roadway miles in Anne Arundel County are State roads and 79% of roadway miles are local and municipal roads. Interstate routes only make up 4% of the County's roadway network.

Table 1. Number of Crashes by Roadway Type

	Number of Accidents
Interstate	2,816
State	18,771
County/Municipal	8,752

Figure 2. Spatial Distribution of Accidents by Roadway Type

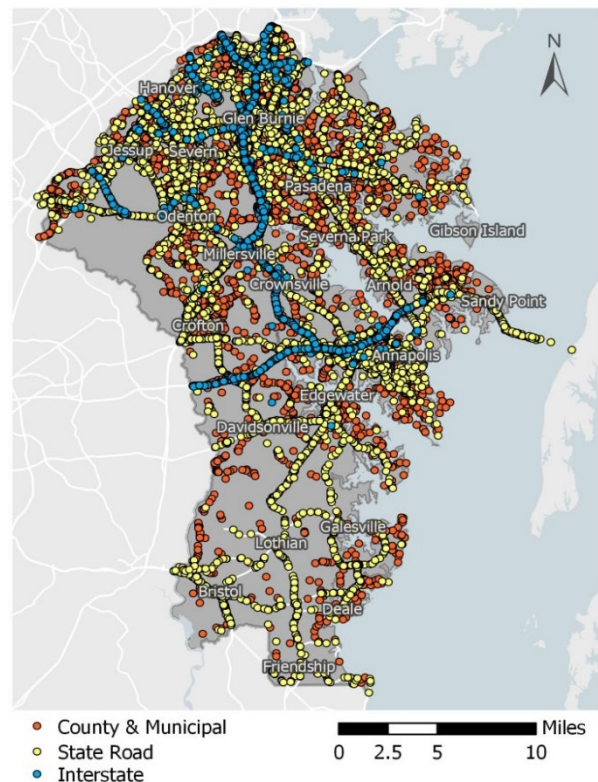


Figure 3.
Roadway Milage by Facility Type

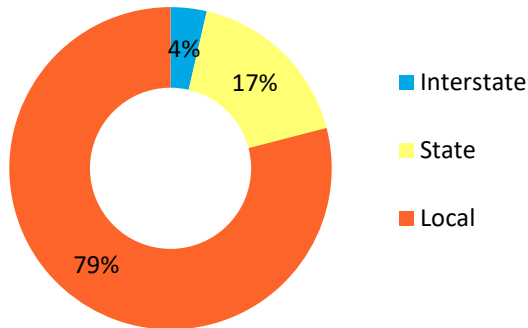


Figure 4
Accidents by Facility Type

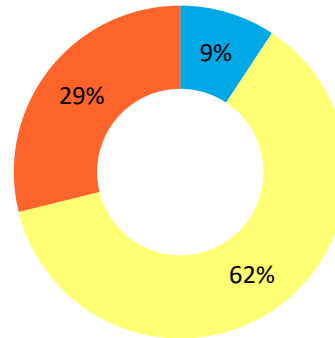


Table 2 shows a comparison of the percentage of route miles with accident data for each of the facility types. Of the three categories of road types, Interstates have the fewest accidents. This can be partially attributed to the low mileage of Interstate routes in the County. In contrast, 79% of roadway miles in Anne Arundel County are local roads county and municipal roads. They often have lower speed limits, are less frequently traveled, and are often residential with traffic calming measures. Therefore, while there are less than 550 miles of state-maintained roads, 62% of accidents occur on them. Only 29% of accidents occur on local roads.

Table 2. Comparison of Crash Types by Roadway Type and Miles

	Total Crashes 2015-2017	Percentage of Total Crashes	Total Roadway Miles	Percentage of Total Roadway Miles
Interstate	2,816	9%	110	4%
State	18,771	62%	528	17%
County/Municipal	8,752	29%	2404	79%

Normalization by Vehicle Miles Traveled

In 2015, the total Vehicle Miles Traveled (VMT) in Anne Arundel County was 5.9 billion. This is arrayed against the total number of accidents by roadway category in Table 3. Assuming the percentage of total roadway miles is proportional to total VMT, 235.7 million VMT occurred on Interstate Roads, 1 billion VMT occurred on State Roads, and 4.7 billion VMT occurred on Local or Municipal roads. Crashes per 100 Million VMT on each road type were: 1,195 on interstate routes, 1,874 on state routes, and 188 on local roads.

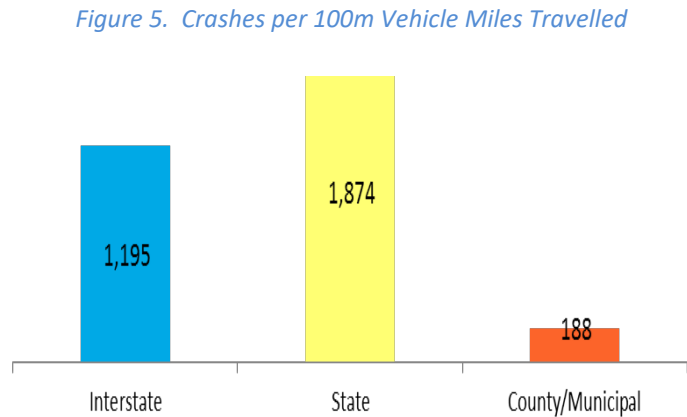


Table 3. Crashes per Vehicle Miles Travelled (VMT)

	Percentage of Total Roadway Miles	Total VMT (millions)	Total Crashes 2015-2017	Crashes per 100 Million VMT
Interstate	4%	235,680	2,816	1,195
State	17%	1,001,640	18,771	1,874
County/Municipal	79%	4,654,680	8,752	188

Crashes are nearly 10 times more likely to occur on state roads than local roads. Crashes are roughly two-thirds more likely to occur on state roads than on interstate roads.

Cluster Density Analysis

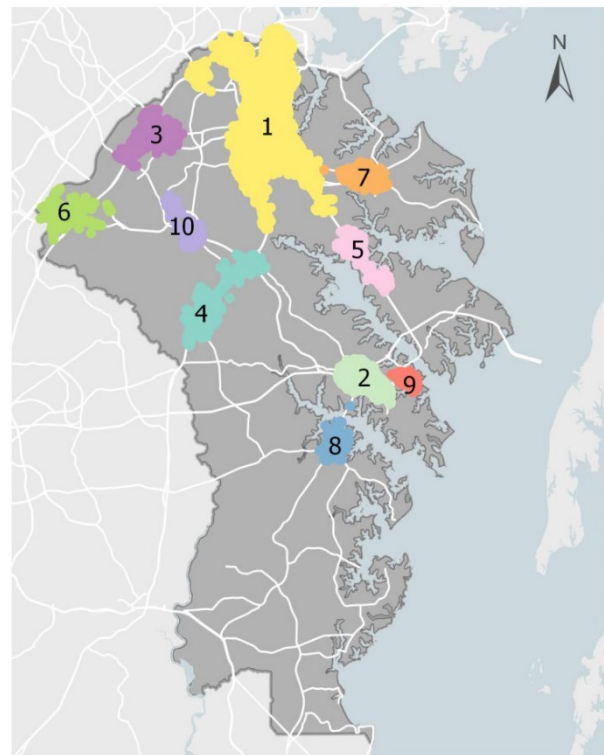
To assist in further defining locations where a significant number of accidents occur, a cluster density analysis was performed. Natural clusters were found using a self-adjusting method. Clusters must contain a minimum of 300 accidents. Any accidents that are not considered part of clusters, or clusters that are less than 300 accidents are considered noise and are not shown on this map. The locations of the clusters are shown in Table 4 and in Figure 6.

Table 4. Cluster Density Analysis

	Cluster Area	Number of Crashes Included in Cluster	Percentage of Total Crashes
1	Glen Burnie	8,843	29%
2	Annapolis – Parole	2,340	8%
3	Jessup/Severn	1,667	5%
4	Millersville/Crofton	1,507	5%
5	Severna Park	840	3%
6	Laurel	665	2%
7	Pasadena	618	2%
8	Edgewater	553	2%
9	Annapolis-Naval Academy	485	2%
10	Odenton	315	1%
TOTAL:		17,833	59%

The largest clustering of accidents occurs in the Glen Burnie area. This area contains dense concentrations of accidents, and it has a consistent number of accidents in close proximity. This cluster contains 29% of the total accidents included in the analysis. Annapolis is broken down into two clusters. The second largest cluster is the western part of Annapolis, called “Annapolis-Parole”, and the eastern and significantly smaller cluster is called “Annapolis-Naval Academy.” Naturally, as accidents occur along roadway corridors, clusters tend to spread along these routes. These tend to have oblong shapes. The “Millersville/Crofton” cluster along Route 3 and the “Severna Park” cluster along Route 2 are two examples.

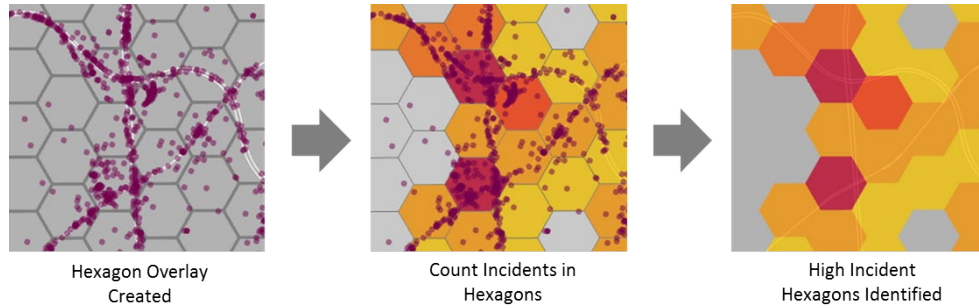
Figure 6. Top 10 Crash Clusters



Top 10 Crash Locations on Interstate and State Routes

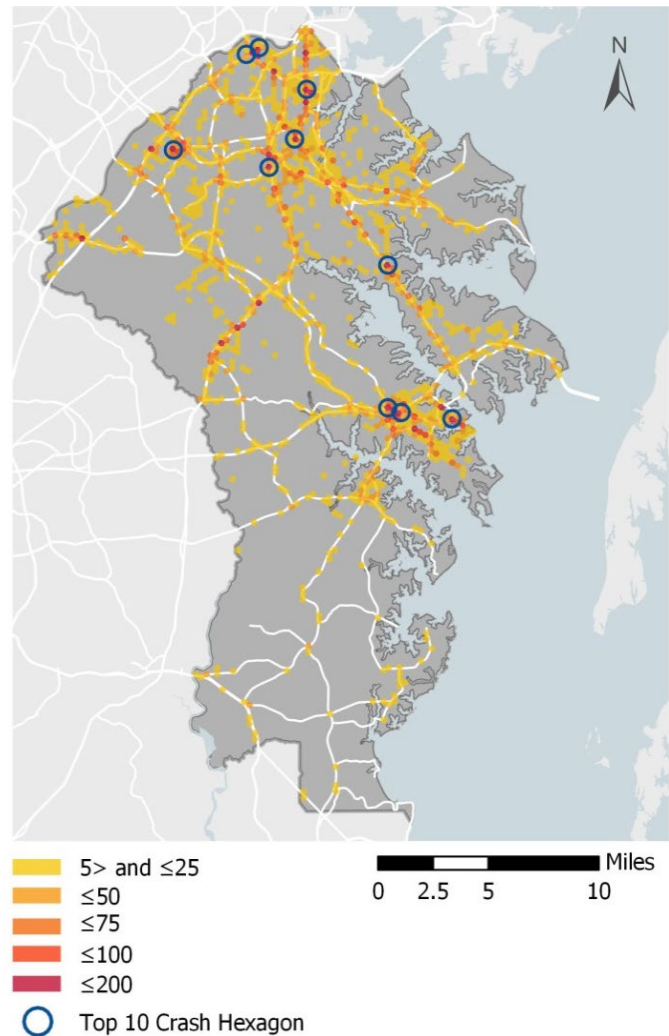
The top 10 crash locations on Interstate and state routes in the County were determined by using an optimized hot spot analysis to aggregate incident data using a hexagonal grid overlaying a county layer.

Figure 7. Hexagonal Analysis Description



Each hexagon is approximately 175,000 square feet, or about 4 acres. The number of crashes, or incidents, in each hexagon are totaled. Hexagons with a higher count of incidents are hot spots for crashes. The approximate intersections, roadway segments, or interchanges where crashes are likely to occur on or near are calculated based on these hexagons.

Figure 8. Top 10 Crash Locations – State Routes and Interstates



Top 10 Crash Locations in Anne Arundel County 2015-2017

1. 695 and 295 (Exit 7B) **189**
2. US 50/MD 301 at West St (Exit 23/ 23B) **184**
3. I-97 and Quarterfield Rd (Exit 13) **148**
4. Arundel Mills Circle/Parking Lot Area **142**
5. Church Circle, Annapolis **140**
6. Ritchie Hwy & Baltimore Annapolis Blvd **139**
7. US 2, Riva Rd, Annapolis Towne Center **135**
8. Ritchie Hwy & Robinson Rd **127**
9. Ritchie Hwy just N of Ordinance Rd **124**
10. 695 and 295 (Exit 7A) **123**

Concentrations of accidents are likely to occur on major roadways, particularly near on and off ramps. Additionally, busy intersections or where many roads converge create dense concentrations of crashes.

Top 10 Crash Locations on Local Routes

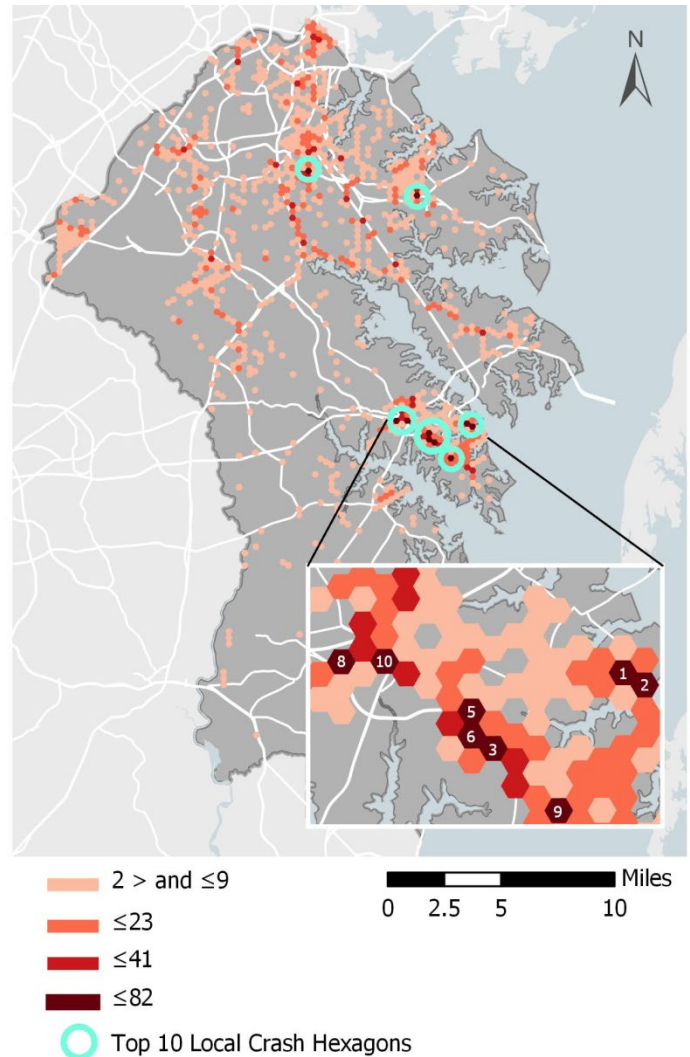
The same methodology was used to determine the major accident locations on local streets and roadways. They are depicted below and in Figure 9.

Top 10 Local Route Crash Locations in Anne Arundel County 2015-2017

1. *Maryland State House Area, Annapolis* **82**
2. *Main St Annapolis* **79**
3. *Forest Dr & Hilltop Ln* **69**
4. *Oakwood Dr near Rt 100 (BWMC)* **65**
5. *Forest Dr & Bywater Rd* **60**
6. *Forest Dr & S Cherry Grove Ave* **51**
7. *Edwin Raynor Blvd & Mountain Rd* **48**
8. *Riva Rd near Rt 665* **46**
9. *Forest Dr & Tyler Ave* **45**
10. *Forest Dr & Solomons Island Rd* **42**

Five of the top ten local route crash hot spots occur on Forest Drive in Annapolis, making up 45% of the crashes. Eight of the top ten high crash concentration locations were in or near Annapolis. Outliers were in Pasadena near a shopping center, and in Glen Burnie, near the University of Maryland Baltimore Washington Medical Center.

Figure 9. Top 10 Local Route Crash Locations



Pedestrian & Bicycle Crashes

Between 2015 and 2017 there were 100 documented crashes involving pedestrians and 27 involving bicycles across the county. 58% of pedestrians were involved in crashes that occurred on State roads, and 41% of pedestrian involved crashes occurred on local roads. Local roads were slightly more dangerous for bicyclists—59% of bicycle involved crashes occurred on local roads, and 37% occurred on state roads. There were two crashes reported on interstate highways; a bicycle involved accident on a ramp, and a pedestrian involved accident on an interstate.

Figure 10. Bicycle and Pedestrian Crashes

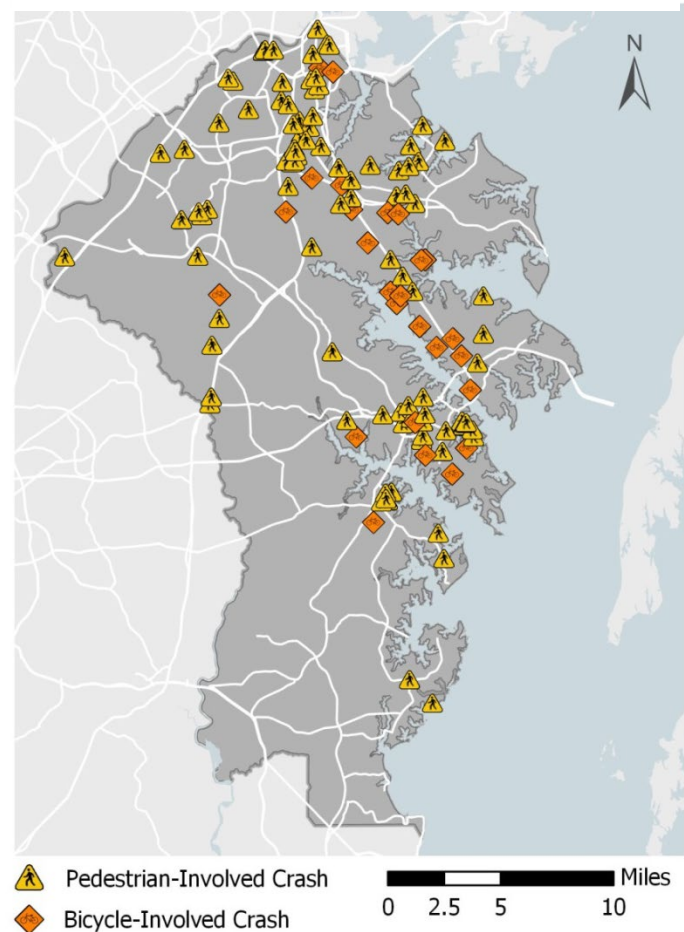


Table 5. Total Pedestrian and Bicycle Crashes

Road Type	Pedestrian Involved Crashes	Bicycle Involved Crashes
State	58%	37%
Local	41%	59%

Table 6. Injury Severity – Pedestrian and Bicycle Crashes

Injury Severity	Pedestrian Involved Crashes	Bicycle Involved Crashes
No Injury	67%	74%
Non-Incapacitating Injury	8%	7%
Possible Incapacitating Injury	21%	19%
Incapacitating/Disabling Injury	4%	-

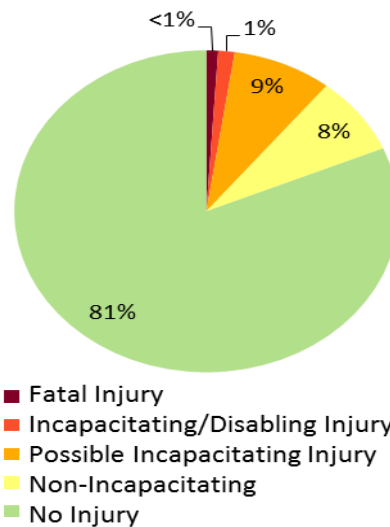
Auto-Involved Crash Severity

Table 7 and Figure 11 provide a breakdown of auto-involved injuries and fatalities. There were 53 fatal crashes in Anne Arundel County during the three-year period. Fortunately, most accidents, 81%, resulted in property damage only and did not result in officially reported injuries.

Table 7. Auto-Involved Crash Injuries and Fatalities

Injury Severity	Number of Reports	Percentage of Crashes	Injury Rate Per 100 Million VMT
No Injury	24,972	81%	423.8
Non-Incapacitating Injury	2,405	8%	40.8
Possible Incapacitating Injury	2,576	9%	43.7
Incapacitating/Disabling Injury	333	1%	5.7
Fatal Injury	53	<1%	0.9

Figure 11. Percentage of Auto-involved Crash Injuries and Fatalities



15 fatal crashes occurred on local county and municipal roads, 32 fatal accidents occurred on state roads and 6 fatal accidents on interstate roads. A fatal accident distinction means that there was at least one fatality resulting from the accident. The number of fatal accidents may not equal the total number of fatalities caused by vehicle accidents in Anne Arundel County.

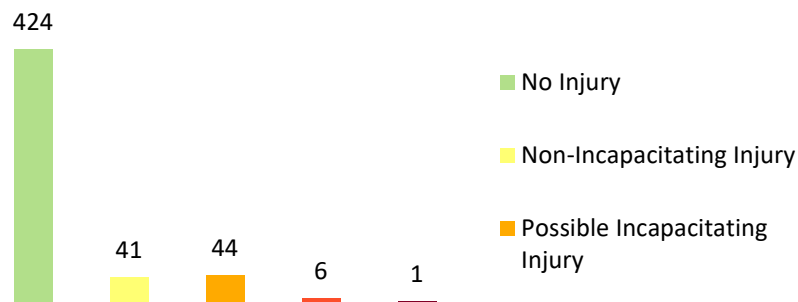
In terms of injury severity, no route type is significantly more dangerous than others. Crash severity is distributed proportionally for each route type. Less than 1% of all crashes on local roads are fatal. 28% of fatal crashes occur on local roads. Less than 1% of all crashes on state roads are fatal. 60% of fatal

crashes occur on state roads. Less than 1% of all interstate crashes are fatal. 11% of fatal crashes occur on interstate roads.

Normalization by Vehicle Miles Traveled

A comparison of total crashes having been normalized by the total Vehicle Miles Traveled (VMT) is shown in Figure 12. The total VMT in 2015 in were 5.9 billion. For every 100 Million VMT in Anne Arundel County, approximately 423.8 non-injury crashes occurred, 5.7 crashes resulting in serious injuries occurred, and one fatal accident occurred.

Figure 12.
Severity of Auto Crashes Per 100 Million VMT



Anne Arundel County has slightly fewer fatal crashes than the national average. The accident fatality rate in Anne Arundel County for 2015 to 2017 is approximately 0.9 per 100 Million VMT. The national average accident fatality rate for 2015 was 1.12 per 100 Million VMT, according to the NHTSA. The County's rate is similar to the state's average. In 2015, Maryland's statewide total fatal crashes per 100 Million VMT was 0.89.

Sources:

<https://data.maryland.gov/Public-Safety/Maryland-Statewide-Vehicle-Crashes-CY2015-Quarter-/x8nz-kacb>

http://www.aacounty.org/departments/transportation/forms-and-publications/2013_Pedestrian_Bicycle_Master_Plan.pdf

<https://cdan.nhtsa.gov/STSI.htm#> > Maryland > Anne Arundel County

<https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812318> Fatal Crashes VMT

<http://www.iihs.org/iihs/topics/t/general-statistics/fatalityfacts/state-by-state-overview/2015> State Fatal Crashes VMT