North Carolina Department of Transportation (NCDOT)

2023 Vulnerable Road User Safety Assessment

November 1, 2023

North Carolina is committed to the safety of all road users, reducing fatalities and serious injuries in half by 2035 and moving toward zero by 2050. The 2023 Vulnerable Road User Safety Assessment (VRUSA) is an expression of that commitment, a data-driven analysis of vulnerable road user safety in the State.

The following VRUSA is an honest assessment of the current state of VRU safety in the State, informed by crash data, outreach and consultations, and demographic considerations. Together with regional planning partners, the State identified opportunities to improve vulnerable road user safety across the State.

Through the Strategic Highway Safety Plan (SHSP) and the Highway Safety Improvement Program (HSIP), the State has safety ambitious goals that include pedestrians, bicyclists, and all road users, and the VRUSA is a new element to help deliver on those goals and targets. The Program of Strategies in the VRUSA is a roadmap for targeted, data-informed, and context-sensitive safety improvements on North Carolina roadways. The Executive Committee for Highway Safety (ECHS) will monitor progress on the implementation of the strategies in the VRUSA throughout the year.

Please join us as we work together to protect all road users in North Carolina and achieve our goal of reducing fatalities and serious injuries. By signing this document, the signatories agree to support the analysis and strategies laid out in the following Vulnerable Road User Safety Assessment.

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Date 11/15/2023

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I. Overview

Introduction

The North Carolina Vulnerable Road User Safety Assessment (VRUSA) is a key component of North Carolina's approach to monitoring and addressing the safety of vulnerable road users (herein referred to as VRUs[i]). In 2023, the Federal legislation "Infrastructure Investment and Jobs Act" (IIJA) enacted a requirement that each state develop a VRUSA as part of their Highway Safety Improvement Program (HSIP), a core Federal-aid program directed at reducing fatalities and serious injuries on all public roads. The IIJA requires that the VRUSA be a data-driven analysis of VRU safety that addresses equity by considering overrepresentation of demographic groups. The 2023 VRUSA is the first iteration of the VRUSA for North Carolina and it will be incorporated in the Strategic Highway Safety Plan 5-year updates. The VRUSA represents a comprehensive, data-driven approach to monitoring and addressing VRU safety and reducing fatal and serious VRU crashes in North Carolina.

VRU Safety in North Carolina

The VRUSA is a component of the North Carolina Strategic Highway Safety Plan (SHSP). North Carolina created the first SHSP in 2004 and has been updating this plan every five years, with the most recent update in 2019. The 2019 SHSP affirms the state's goal of reducing fatalities and serious injuries for all road users by half by 2035, moving toward zero by 2050. SHSP goals are developed through collaborative efforts of a diverse group of stakeholders including state, regional, and local partners. NCDOT sets annual safety performance targets, based on 5-year rolling average crash totals, that reflect these goals. The implementation of the state's Highway Safety Improvement Program (HSIP) aligns with these annual targets and SHSP goals. The 2019 SHSP includes "Pedestrians, Bicyclists, and Personal Mobility" as an Emphasis Area.

NCDOT is committed to reducing fatalities and serious injuries on North Carolina roads and is a national leader in data collection and analysis. For bicyclist and pedestrian crashes, NCDOT conducts a thorough review of each crash report, uses the Pedestrian and Bicycle Crash Analysis Tool (PBCAT) method of crash typing, and geolocates the crashes in a database that is publicly available. NCDOT publishes crash records regularly and updates the PBCAT review of records annually. NCDOT publishes crash data in Crash Dashboards for All Traffic and Pedestrian and Bicyclist.

As shown in Figure 1, North Carolina has experienced a steady decline in the number of bicyclists crashes over the past decade. Pedestrian crash totals have fluctuated, experienced a 10-year high in 2018, decreased in 2019 and 2020 and increased in 2021.

Figure 1 10-Year Pedestrian and Bicycle Crash History (All Injury)

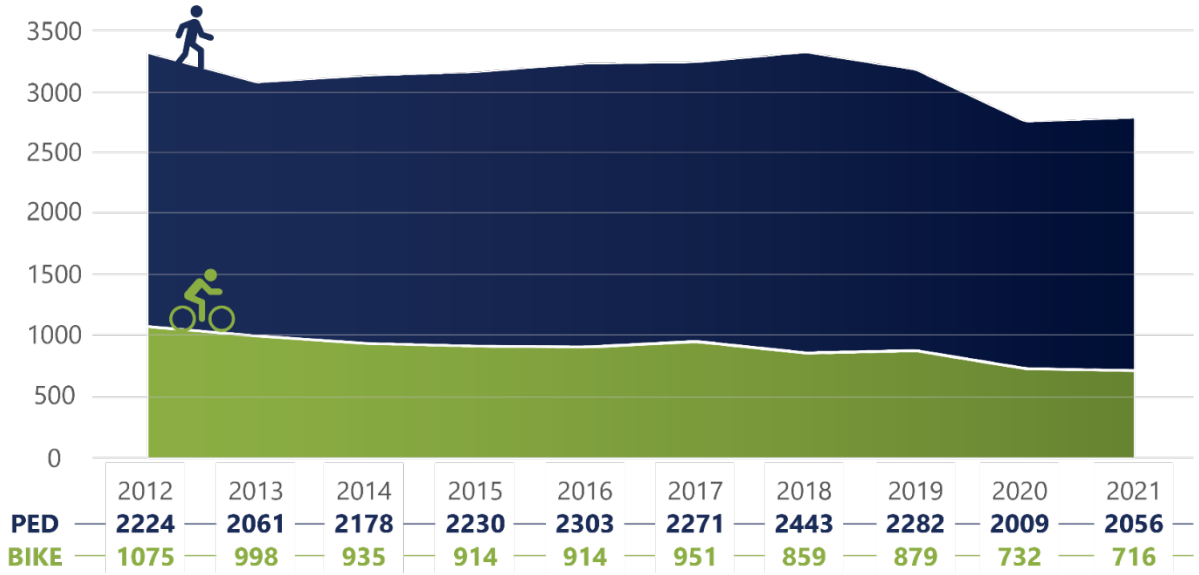


Figure 2 shows that, while North Carolina was experiencing steady or declining pedestrian and bicyclist total crash numbers, fatal (K) and serious injury (A) crashes were at a 10-year combined high in 2021. Bicyclist fatal and serious injury crash numbers are not following an overall 10-year declining trend, experiencing a 10-year high in 2020. In a similar timeframe, fatal and serious injury crashes for all traffic have experienced similar growth trends, as seen in Figure 3. In 2016, NCDOT redefined serious injury crashes to be more inclusive of specific types of injuries, which accounts for a large jump in (A) crashes between 2016 and 2017.

Figure 2 10-Year Pedestrian and Bicyclist Crash History (KA)

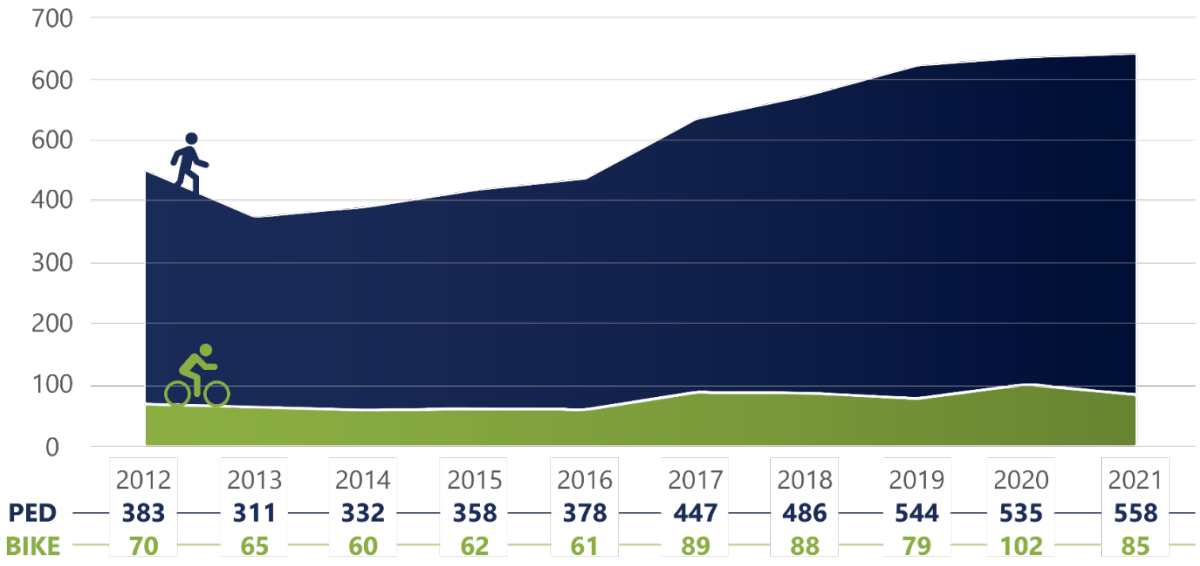
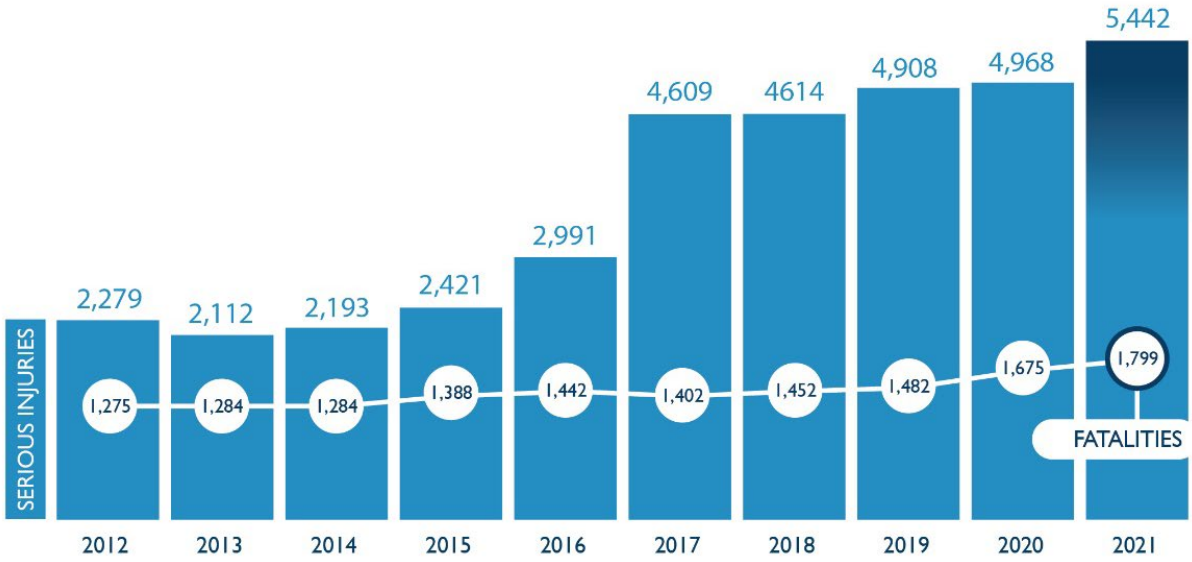


Figure 3 All Traffic 10-Year KA Crash History



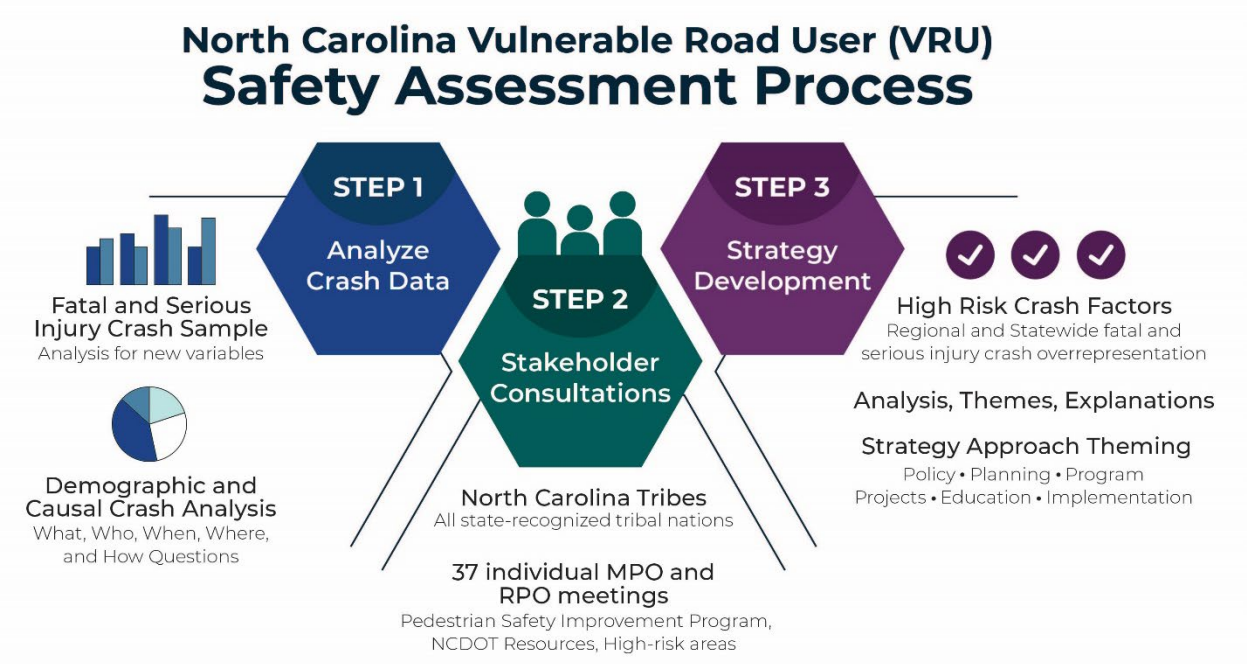
These VRU crash trends and other factors such as the SHSP goal and NCDOT's annual targets contributed to establishing and refining NCDOT's Pedestrian Safety Program (PSIP). The PSIP is an iterative, data-driven safety planning program that generates quarterly pedestrian safety projects for funding consideration and implementation. The PSIP reflects NCDOT's understanding and identification of high-risk characteristics and locations, as well as proven safety countermeasures. This process is the engine that drives the state's HSIP by continuously identifying, reviewing, and implementing low-cost safety countermeasures that NCDOT delivers at data-informed high-risk locations throughout the year through its HSIP. The PSIP will be a critical element in the delivery of the safety strategies outlined in this report. More information about the PSIP is included in the IV. Strategy Development section of this report.

Report Approach

NCDOT began developing the approach to the 2023 VRUSA in Fall 2022. This approach involved comprehensive data analysis, specialized data screening, robust stakeholder consultations, and developing informed safety strategies. The approach to the 2023 VRUSA had four main phases: 10-year VRU Causal Factor Crash Analysis, Fatal and Serious Pedestrian Crash Sample Analysis, Consultation, and Strategy Development. The first two phases involved new and traditional crash data analysis. Through consultations, NCDOT created custom crash summaries for 37 regional planning organizations in the state and met with other safety stakeholders. The final phase incorporated key findings from consultations and crash analyses into a program of strategies to inform NCDOT's safety planning process to reduce the number of fatal and serious injury VRU

crashes on North Carolina roadways. Figure 4 outlines the NCDOT process for the 2023 VRUSA. The summaries of each of these steps are detailed in the next sections.

Figure 4 NCDOT VRUSA Process



II. Summary of Quantitative Analysis

Causal Factor Analysis for Bicyclist and Pedestrian Crashes

Performing a causal factor analysis is fundamental to understanding the context of VRU safety in North Carolina and to tracking progress in the state's safety efforts. This type of analysis identifies factors that may contribute directly or indirectly to bicyclist and pedestrian-involved crashes through a long-term dataset analysis. NCDOT uses this type of analysis to identify patterns in factors present in bicyclist and pedestrian crashes across the state including roadway characteristics, socioeconomic and demographic characteristics, temporal and seasonal characteristics, and other contextual characteristics. The findings from this type of analysis create the foundation for the VRUSA.

Methodology

The causal factor analysis for the 2023 VRUSA included all crashes involving a bicyclist or pedestrian that occurred in the state of North Carolina between January 1st, 2012 and December 31st, 2021. This dataset included bicyclist and pedestrian crashes of all injury classifications reported in the state during the 10-year period — a total of 31,024 reported crashes. All VRU non-motorist categories described as a VRU by the FHWA are captured as a bicycle or pedestrian crashes by NCDOT.[ii]

Analysis was conducted at a statewide level and at an MPO and RPO level for crashes of all injury classifications (KABCO) and for fatal (K) and serious injury (A) crashes alone.[iii] For this analysis, all bicyclist and pedestrian crashes were combined as VRU crashes unless specified otherwise. The data used in this analysis is from the North Carolina Pedestrian and Bicycle Crash Analysis Tool (PBCAT), a geolocated database of bicycle and pedestrian crashes on roadways. The data in this tool comes from police-reported bicycle-motor vehicle and pedestrian-motor vehicle collisions that NCDOT has coded and geolocated. The data and data dictionaries can be accessed on the NCDOT GIS Portal.

A sociodemographic analysis was conducted to identify where crashes occurred and the population groups that live in those areas. This analysis used location data at the Census block group level from the 2017-2021 5-Year American Community Survey (ACS). By averaging population group percentages for all block groups in an MPO and RPO, this analysis identified block groups where population groups were higher, or more concentrated, than the regional average. Then, all injury and KA crash percentages were calculated for each block group to

identify potential disparities across traditionally underserved communities where crashes have occurred in the past ten years.

This analysis included data such as location, roadway functional classification, speed limit, time of day and demographics on persons and locations in order to identify areas that are "high-risk" to VRUs.[iv] NCDOT has experience collecting, updating, and analyzing the quantitative data used in this Causal Factor Analysis, creating a sustainable model for updating the VRUSA in subsequent years using this quantitative, data-proven process.

Table 1: Factors Analyzed in Causal Factor Analysis shows a full list of the factors analyzed and each factor's data source.

Table 1: Factors Analyzed in Causal Factor Analysis

Factor Category	Factor Analyzed	Data Source[v]
Context Characteristics	Rural or Urban	PBCAT
	Development Level	PBCAT
	Land Use Context	PBCAT
	Intersection or Non-intersection	PBCAT
Roadway Characteristics and Speed	Functional Classification	PBCAT
	Roadway Configuration	PBCAT
	Presence of Traffic Control Device	PBCAT
	Number of Travel Lanes	PBCAT
	Posted Speed Limit	PBCAT
Demographic (Person) Characteristics	Race and Ethnicity	PBCAT
	Sex	PBCAT
	Age	PBCAT
Demographic (Location) Characteristics	Race	ACS
	Hispanic or Latino ethnicity	ACS
	Age	ACS
	Gender	ACS
	Household Federal Poverty Level	ACS

	Limited English proficiency	ACS
	Access to a Vehicle	ACS
	Total Population	North Carolina OSBM, Standard Population Estimates, 2019
Time and Weather	Year	PBCAT
	Month	PBCAT
	Day of the Week	PBCAT
	Hour	PBCAT
	Time of Day	PBCAT
	Light Conditions	PBCAT
	Weather Conditions	PBCAT
	Road Conditions	PBCAT
Crash Type and Other Factors	Crash Severity[vi]	PBCAT
	Vehicle Type[vii]	PBCAT
	Pedestrian Position	PBCAT
	Bicyclist Position	PBCAT
	Crash Group	PBCAT
	Hit and Run	PBCAT
	Work Zone	PBCAT
	Pedestrian Impairment	PBCAT
	Bicyclist Impairment	PBCAT
	Driver Impairment	PBCAT
Other Data	All Vehicle Crash Totals	NCDOT Traffic Safety Unit (TSU)
	Roadway Mileage	NCDOT TSU

Key Findings

The 2023 VRUSA analyzed 31,024 reported crashes involving a vulnerable road user in North Carolina between 2012 and 2021. 22,057 (71.1%) of these crashes were pedestrian crashes, and 8,927 (28.77%) were bicyclist crashes. This section summarizes key findings from the analysis of these crashes. This section is divided into **Statewide Findings**, **MPO & RPO Trends**, and **Regional Trends**.

Statewide Findings

✓ ***VRU crashes were more likely to result in serious injury or death than crashes that did not involve a VRU.***

Between 2012 and 2021, 16% of bicyclist and pedestrian crashes resulted in a fatality (K) or serious injury (A). During the same time period, 1.5% of all vehicle crashes resulted in fatality (K) or serious injury (A).

Bicyclist and pedestrian crashes represented 1% of all traffic crashes, 17% of traffic fatalities, and 27% of K and A crashes in the state from 2012 to 2021.

✓ ***The distribution of KA crashes between rural and urban areas matched population distribution in North Carolina.***

Crashes classified as "urban" or "rural" occurred within or outside of municipal boundaries, respectively. 56% of VRU KA crashes occurred in urban areas and 44% occurred in rural areas. As of 2019, 57% of North Carolinians live in urban areas, or within municipal boundaries, and 43% of North Carolinians live in rural areas, or outside of municipal boundaries.

✓ ***VRU crashes most frequently occurred in commercial areas.***

Land use context, or the predominant type of development in the area in which the collision occurred, is divided into the following categories: (1) farms, woods, pastures, (2) residential, (3) commercial, (4) institutional, and (5) industrial.

44% of all VRU crashes occurred in commercial areas, and 39% of KA crashes occurred in commercial areas. Both are higher rates than any of the other land use contexts.

✓ ***VRU crashes in areas coded as farms, woods, and pastures more frequently end in a fatality or serious injury.***

Fatalities or serious injuries crashes occur on 34% of VRU crashes in farms, woods, and pastures. This is higher than all other land use categories: industrial (18%), commercial (15%), residential (14%), and institutional (7%).

✓ ***VRU crashes disproportionately occurred on all arterial roads, urban arterial roads, and interstates.***

North Carolina roads are categorized into 7 functional classes: Class 1: Interstate, Class 2: Other Freeways and Expressways, Class 3: Other Principal Arterial, Class 4: Minor Arterial, Class 5: Major Collector, Class 6: Minor Collector, and Class 7: Local.

8% of road miles in North Carolina are principal or minor arterials, while 41% of all bicyclist and pedestrian crashes and 46% of KA bicyclist and pedestrian crashes occurred on an arterial road. In urban areas, 44% of all bicyclist and pedestrian crashes and 54% of KA crashes occurred on an arterial road.

5% of road miles in North Carolina are urban arterials, and 29% of KA bicyclist and pedestrian crashes occurred on an urban arterial road.

1% of road miles in North Carolina are interstate, while 2% of all bicyclist and pedestrian crashes and 6% of KA bicyclist and pedestrian crashes occurred on an interstate.

✓ ***Black vulnerable road users were over-represented in VRU crashes.***

21% of the state population identifies as Black, while 41% of all pedestrian crashes and 35% of KA pedestrian crashes involved a Black pedestrian, and 31% of all bicyclist crashes and 28% of KA bicyclist crashes involved a Black bicyclist.

✓ ***Male vulnerable road users were over-represented in VRU crashes.***

While 49% of North Carolinians are male, 62% of all pedestrian crashes and 70% of KA crashes involved a male pedestrian and 79% of all bicyclist crashes and 82% of KA crashes involved a male bicyclist.

✓ ***66% of all VRU and 66% of KA crashes occurred in Census block groups where the percentage of households under 150% of the federal poverty level (FPL) is greater than the state average.***

The FPL is a metric used by many federal agencies, including the U.S. Census Bureau, to define an annual poverty threshold. 150% of the FPL is frequently used as a metric to assess household income levels and determine eligibility for certain federal aid programs. The 2023 VRUSA uses this common threshold metric to evaluate households living in poverty in the state. Households in poverty regularly have the highest usage of travel modes associated with VRU: carpool, transit, bike and walk.[viii]

✓ ***VRU KA crashes disproportionately occurred outside of an intersection.***

Crashes are coded as intersection or non-intersection based on a 200-foot buffer. Crashes that occurred within 200 feet of an intersection are considered intersection or intersection-related crashes.

While 56% of VRU crashes occurred at non-intersection locations, 73% of KA crashes occurred at non-intersection locations. Non-intersection locations are often associated with pedestrians walking along the roadway and crossing a roadway between long blocks.

✓ ***VRU KA crashes disproportionately occurred in dark or non-daylight conditions.***
40% of VRU crashes occurred during dark conditions, and 65% of VRU KA crashes occurred during dark conditions. When expanded to include "dawn" and "dusk", or all non-daylight options on crash reports, 45% of crashes occurred in non-daylight conditions, while 69% of KA crashes occurred in non-daylight conditions.

MPO & RPO Trends

Each MPO and RPO received a detailed summary of findings from the causal factor analysis. Based on these findings, the following factors emerged as common differentiators between MPOs and RPOs in North Carolina: Crash Severity, Intersection or Non-Intersection, Roadway Configuration, Number of Travel Lanes, Presence of a Traffic Control Device, Land Use Context, Pedestrian Crash Group, and Vehicle Type.

✓ ***RPOs had a higher percentage of VRU crashes that resulted in serious injury or fatality than MPOs.***
In RPOs, 23% of VRU crashes resulted in a fatality (K) or serious injury (A). In MPOs, 15% of VRU crashes resulted in a fatality (K) or serious injury (A).

✓ ***MPOs had a higher percentage of VRU crashes occurring at intersections than RPOs.***
In MPOs, 46% of all bicyclist and pedestrian crashes and 30% of KA crashes occurred at an intersection. In RPOs, 31% of all bicyclist and pedestrian crashes occurred at an intersection and 20% of KA crashes occurred at an intersection.

✓ ***RPOs had a higher percentage of VRU crashes that occurred on two-way roads without a median barrier (non-divided) than MPOs.***
In RPOs, 79% of all bicyclist and pedestrian crashes and 79% of KA crashes occurred on two-way, non-divided roads. In MPOs, 64% of all bicyclist and pedestrian crashes and 58% of KA crashes occurred on a two-way, non-divided road.

✓ ***MPOs had a higher percentage of VRU crashes that occurred on 4 & 5 lane roads than RPOs.***
While VRU crashes were most likely to occur on 2 lane roads in both MPOs (48%) and RPOs (65%), a higher percentage of VRU crashes in MPOs occurred on 4 & 5 lane roads compared to RPOs. In MPOs, 29% of all bicyclist and pedestrian crashes and 36% of KA crashes occurred on 4 & 5 lane roads. In RPOs, 20% of all bicyclist and pedestrian crashes and 25% of KA crashes occurred on 4 & 5 lane roads.

✓ ***MPOs had a higher percentage of VRU crashes that occurred at a traffic signal than RPOs. RPOs had a higher percentage of VRU crashes that occurred at a double yellow line (no passing zone) than MPOs.***

In both MPOs and RPOs, about 50% of VRU crashes occurred where no traffic control device was present, and about 45% of VRU crashes occurred with a traffic control present (5% unknown). In VRU crashes where traffic controls were present, crashes in MPOs most frequently occurred near a stop and go signal (54%) and crashes in RPOs most frequently occurred in the presence of a double yellow line where passing is not allowed (46%).

✓ ***RPOs had a higher percentage of VRU crashes that occurred near farms, woods, and pastures than MPOs.***

While the majority of VRU crashes occurred in residential or commercial land use contexts for both MPOs and RPOs, 30% of all bicyclist and pedestrian crashes and 47% of KA crashes in RPOs occurred near farms, woods, and pastures, whereas 8% of all bicyclist and pedestrian crashes and 17% of KA crashes in MPOs occurred in this land use context.

✓ ***VRU crashes in MPOs most frequently occurred when a pedestrian was crossing the roadway and VRU crashes in RPOs most frequently occurred when a pedestrian was walking along the roadway.***

Pedestrian crash group describes the circumstances of a pedestrian crash. In MPOs, pedestrian crashes most frequently occurred when a pedestrian was crossing the roadway and they were struck by a vehicle not turning (21%). In RPOs, pedestrian crashes most frequently occurred when a pedestrian was walking along the roadway (26%).

✓ ***RPOs had a higher percentage of VRU crashes that involved a large vehicle than MPOs.***

Vehicle type describes the kind of vehicle that was involved in the collision with a bicyclist or pedestrian. Vehicle types were classified as:

- **Small**: motorcycles, mopeds, motor scooters or motor bikes, pedal cycles, pedestrians, all-terrain vehicles.
- **Mid**: passenger cars, taxicabs.
- **Large**: pickups, light trucks (mini-van, panel), sport utility vehicles, vans.
- **Bus/Truck**: all buses, single unit trucks, truck/trailers, tractor/semi-trailers, tractor/doubles, unknown heavy trucks, motor homes, recreational vehicles.
- **Industrial**: farm equipment, farm tractors.
- **Government**: firetrucks, EMS vehicles, ambulances, military, police.
- **Other**: other vehicle not listed above.

In MPOs, 50% of all bicyclist and pedestrian crashes involved a mid-sized vehicle and 33% of all bicyclist and pedestrian crashes involved a large vehicle. In RPOs, 43% of all bicyclist and pedestrian crashes involved a mid-sized vehicle and 41% involved a large vehicle.

Regional Trends

While North Carolina's communities vary significantly across the state, regional trends emerged in the causal factor analysis findings. This section identifies trends across MPOs and RPOs in three regions: Coastal Plain, Piedmont, and Mountain.

Table 2: MPOs and RPOs of NC by Region

Coastal Plain	Piedmont	Mountain
Albemarle RPO	Burlington-Graham MPO	Foothills RPO
Cape Fear RPO	Cabarrus-Rowan MPO	French Broad River MPO
Down East RPO	Capital Area MPO	High Country RPO
East Carolina RPO	Charlotte Regional TPO	Land of Sky RPO
Fayetteville MPO	Durham-Chapel Hill-Carrboro MPO	Southwestern RPO
Goldsboro Urban Area MPO	Gaston-Cleveland-Lincoln MPO	
Grand Strand Area Transportation Study	Greater Hickory MPO	
Greenville Urban Area MPO	Greensboro Urban Area MPO	
Jacksonville Urban Area MPO	High Point Urban Area MPO	
Lumber River RPO	Kerr-Tarr RPO	
Mid-Carolina RPO	Northwest Piedmont RPO	
Mid-East RPO	Piedmont Triad RPO	
New Bern MPO	Rocky River RPO	
Peanut Belt RPO	Triangle Area RPO	
Rocky Mount Urban Area MPO	Winston-Salem Urban Area MPO	
Upper Coastal Plain RPO		
Wilmington MPO		

Coastal Plain Region

Much of the Coastal Plain region is comprised of rural, agricultural communities, contrasted by coastal beach towns. Coastal towns receive high tourism activity throughout the year. There are two large state universities, one in Greenville and one in Wilmington, and several military bases in this region. The largest city in the region is Wilmington.

✓ ***MPOs in the Coastal Plain Region generally had a higher KA crash rate than all MPOs in North Carolina.***
Across the state, MPOs had a KA crash rate of 15% and RPOs had a KA crash rate of 23% in VRU crashes. MPOs in the Coastal Plain Region had a KA crash rate of 18%.

✓ ***MPOs in the Coastal Plain Region had a higher percentage of VRU crashes on 4 & 5 lane roads than most other MPOs in North Carolina.***
At a statewide level, MPOs have a higher percentage of VRU crashes on 4 & 5 lane roads than RPOS. In the Coastal Plain Region, this trend is more pronounced, as several MPOs had higher percentages of KA crashes occurring on 4 & 5 lane roads than most other MPOs in North Carolina.

✓ ***American Indians were over-represented in VRU crashes in the Lumber River RPO.***
In the Lumber River RPO, 20% of the population identifies as American Indian, while 27% of all pedestrian crashes and 41% of KA pedestrian crashes involved an American Indian pedestrian, and 33% of all bicyclist crashes and 38% of KA bicyclist crashes involved an American Indian bicyclist.

Statewide, 1.1% of the population identifies as American Indian. 0.97% of all pedestrian crashes, and 1.73% of all KA pedestrian crashes involved an American Indian pedestrian, and 1.03% of all bicyclist crashes and 2.1% of KA bicyclist crashes involved an American Indian bicyclist.

Piedmont Region

The Piedmont region contains a large portion of the state's population and is characterized by metropolitan areas, a concentration of universities and hospitals, economic centers, and suburban residential uses. There are rural areas and some rural areas experiencing suburban development patterns. The largest cities in the region are Raleigh and Charlotte. The state's two largest MPOs contain Raleigh and Charlotte.

The Charlotte Regional TPO (CRTPO) contains Charlotte, the most populous city in North Carolina, and the surrounding metro area. The Capital Area MPO (CAMPO) contains Raleigh, the second most populous city in North Carolina, and the surrounding metro area. As of 2020, 27%

of the state population resides in these two MPOs. These MPOs accounted for 31% of all reported bicyclist and pedestrian crashes that occurred in North Carolina between 2012 and 2021. Due to the large percentage of VRU crashes in these MPOs, trends emerged in the causal factor analysis that differentiated them from other MPOs in the state.

- ✓ ***MPOs in the Piedmont Region had a higher percentage of pedestrian crashes where a pedestrian was struck while in a crosswalk than the rest of North Carolina.***
  At a statewide level, 12% of pedestrian crashes involve a pedestrian being hit while in the crosswalk. In the piedmont region, MPOs generally have higher percentages, with some as much as 2.5x the statewide MPO rate.

- ✓ ***CRTPO and CAMPO had a higher percentage of crashes where the pedestrian was struck when crossing a roadway and a smaller percentage of crashes where the pedestrian was walking along the roadway than all MPOs in North Carolina.***
  At a statewide MPO level, 40% of all pedestrian crashes and 38% of pedestrian KA crashes occurred when a pedestrian was crossing a roadway. 14% of all pedestrian crashes and 15% of pedestrian KA crashes occurred while a pedestrian was walking along the roadway.

  In these MPOs 44% of all pedestrian crashes and 39% of pedestrian KA crashes occurred when a pedestrian was crossing a roadway while 10% of all pedestrian crashes and 11% of pedestrian KA crashes occurred while a pedestrian was walking along the roadway

- ✓ ***CRTPO and CAMPO had a higher percentage of KA crashes that occurred on dark roadways with lighting compared to all other MPOs and RPOs in North Carolina.***
  At a statewide MPO level, 30% of VRU KA crashes occurred on dark roadways with lighting.

  In these MPOs, 34% of VRU KA crashes occurred on dark roadways with lighting.

Mountain Region

The Mountain Region of North Carolina is characterized by rural mountain roads, high tourism activity, and cities experiencing population growth. The largest city in this region is Asheville. The Eastern Band of the Cherokee Indians is a federally recognized tribe in this region, and due to their sovereignty, the state does not have crash data for their jurisdiction.

- ✓ ***In RPOs in the Mountain Region, VRU crashes most frequently occurred in the presence of a double yellow line where passing is not allowed.***
  At a statewide level, VRU crashes in RPOs most frequently occurred where no traffic control device was present. In the RPOs of the Mountain Region, VRU crashes most frequently occurred in the presence of a double yellow line where passing is not allowed. 39% of all bicyclist and pedestrian crashes occurred in the presence of this traffic control device.

Furthermore, 55% of KA crashes in the RPOs of this region occurred in the presence of a double yellow line where passing is not allowed, compared to 33% of KA crashes in RPOs statewide.

✓ ***RPOs in the Mountain Region had a higher percentage of VRU crashes that involved a large vehicle compared to all RPOs in North Carolina.***

At a statewide RPO level, 43% of VRU crashes involved a mid-sized vehicle and 41% of VRU crashes involved a large vehicle. In Mountain Region RPOs, VRU crashes were instead more likely to involve a large vehicle (48%) than a mid-sized vehicle (39%). 51% of KA crashes in the Mountain Region RPOs involved a large vehicle.

Fatal (K) and Serious Injury (A) Pedestrian Crash Sample Review

In addition to a causal factor analysis, a method of data-driven analysis familiar in the state of North Carolina, the 2023 VRUSA included an in-depth analysis of risk factors on a sample of pedestrian fatality (K) and serious injury (A) crashes. The purpose of this sample analysis was to assess and quantify crash data that are not recorded in more traditional crash summaries (FARS, PBCAT, etc.). The KA pedestrian crashes included in this sample took place across North Carolina between **January 1st, 2016 and December 31st, 2020**.

The methodology followed for selecting the sample of crashes and data collected for crash locations is explained in the appendix. This assessment captured information about the site not typically included in crash reports, including the following:

- Presence of a Sidewalk
- Presence of a Curb
- Presence and Type of Transit Facility (i.e. Bus Stop)
- Presence and Type of Bicycle Facility
- Building Setback
- Land Use Context
- Signal Phasing
- Presence and Type of Lighting
- Operating and Impact Speed
- Parking Facilities
- Distance From Home Address
- Vehicle Type

Key Findings

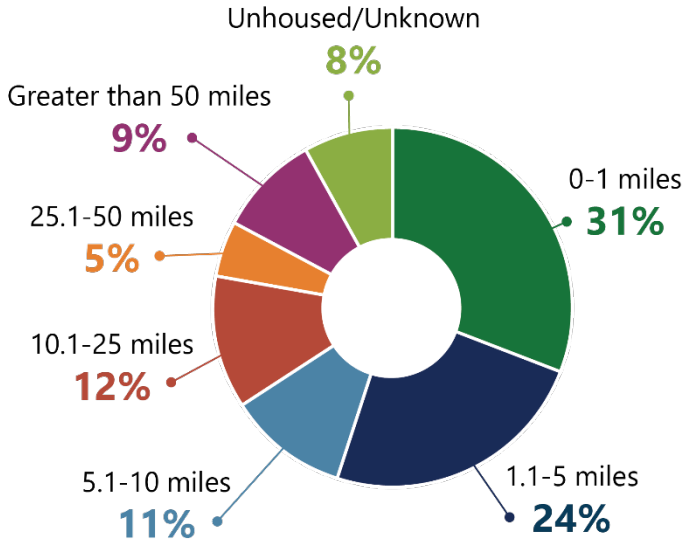
Due to the unique data collected and analyzed for this crash sample review, NCDOT published an online Storymap that presents key findings from this analysis: VRU Data Viewer. This Storymap allows users to see the crash sample methodology and view key data related to sidewalks, crosswalks, speeds, transit, and lighting. The following section further explores some of the key findings from this analysis. Additional key findings are presented on page A-1.

Distance from Home Address

55% of KA crashes occurred within 5 miles of the pedestrian's home address, with a median distance of 3.3 miles between the crash site and the pedestrian's home. Of crashes that occurred

within 5 miles of the pedestrian's home address, more than half (57%) were within 1 mile of the pedestrian's home address.

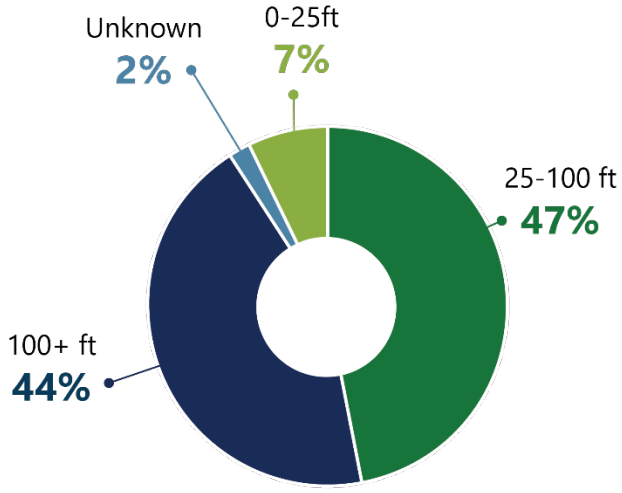
Figure 5: Proximity to Pedestrian Home Address for Pedestrian KA Crashes



Setback

Setback is measured as the distance from the edge of the pavement to the façade of the buildings in the vicinity of the crash. The vast majority (91%) occurred where buildings were set back more than 25 feet from the road. Only 7% of crashes occurred in areas where buildings were within 25 feet of the road.

Figure 6: Setback Distance for Pedestrian KA Crashes



Sidewalk Presence & On-Street Parking

Pedestrian KA crashes occurred most frequently (66%) where no sidewalk was present. Areas with on-street parking, where vehicles can park on or along the curb of a street, account for only 4% of pedestrian KA crashes.

Figure 7: Sidewalk Presence for Pedestrian KA Crashes

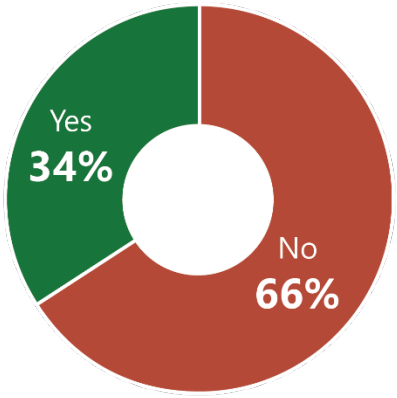
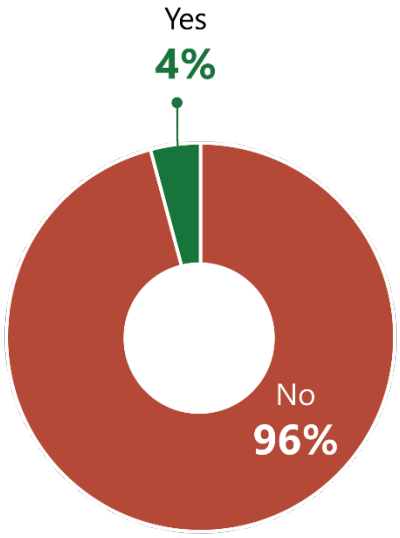


Figure 8: On-Street Parking Presence for Pedestrian KA Crashes



Transit Stop Presence

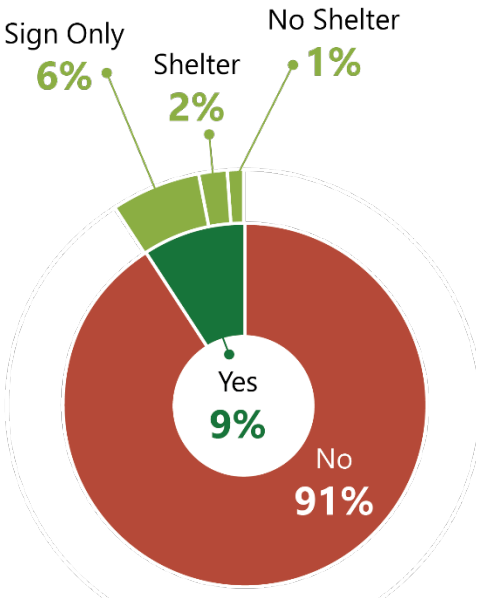
When analyzing transit stop presence at KA pedestrian crash sites, transit stops were tiered into 4 categories:

- **Shelter**: transit stop with shelter for waiting users.
- **No shelter**: transit stop with other facilities for users, such as a bench, but no shelter.

- **Sign only**: transit stop with a sign but no other facilities for waiting users.
- **LRT**: light rail transit stop.

9% of pedestrian KA crashes occurred within 50 feet of a transit stop. Of the KA crashes associated with transit stops, crashes most frequently occurred (66%) at stops with a sign only. No pedestrian KA crashes analyzed occurred at LRT stops.

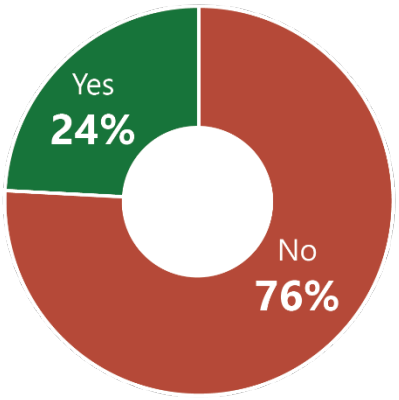
Figure 9: Transit Stop Presence for Pedestrian KA Crashes



Median Presence

In 76% of pedestrian KA crashes, there was no median present. For this summary, a median is defined as a refuge that is between opposing lanes of traffic with a width of at least 3 feet.

Figure 10: Median Presence for Pedestrian KA Crashes



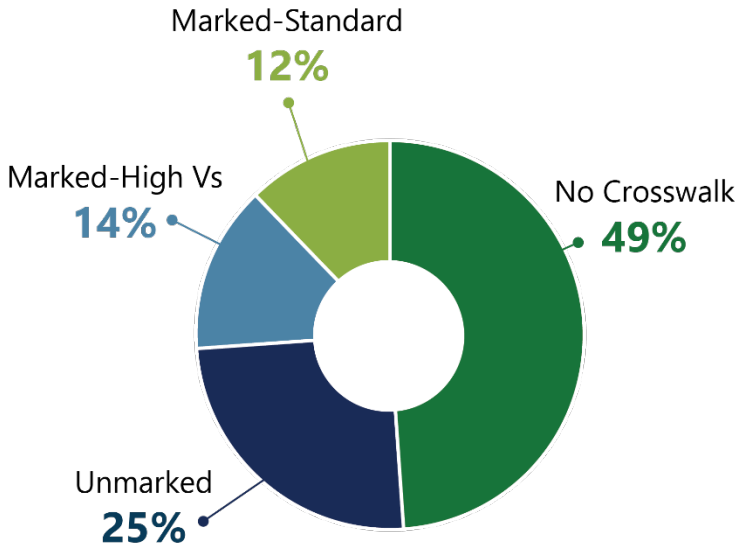
Crosswalk Presence

The characteristics of crosswalks at intersections were divided into three categories and defined as follows:

- **Marked – Standard**: a crosswalk marked with two parallel lines or series of white blocks running across the street.
- **Marked – High Vis**: a crosswalk with markings that give high visibility beyond the standard two-line markings.
- **Unmarked**: even when unmarked, there is an implied crosswalk at intersections. This includes whenever sidewalk ends at an intersection and continues to the other side and intersections with no traffic signals where pedestrians have the right of way.

49% of pedestrian KA intersection crashes occurred at locations with no crosswalks.

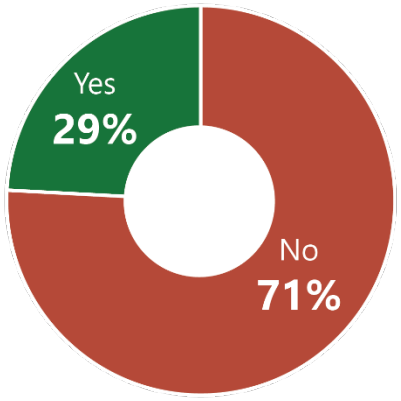
Figure 11: Crosswalk Presence for Pedestrian KA Crashes



Pedestrian Signal Head Presence

Pedestrian signal heads are a traffic-control device installed at signalized intersections to provide guidance and right of way control. These signals were not present in 71% of pedestrian KA crashes at signalized intersections.

Figure 12: Pedestrian Signal Head Presence at Signalized Intersection for Pedestrian KA Crashes



III. Summary of Consultation

Approach

NCDOT's Traffic Safety Unit (TSU) and consultants conducted Vulnerable Road User Safety Consultations with each Metropolitan Planning Organization (MPO) and Rural Planning Organization (RPO) in the state. Additionally, NCDOT's TSU reached out to all federally- and state-recognized tribes for consultation on the VRU Safety Assessment (VRUSA). The tribes did not respond with requests for further meetings in the development of the VRUSA, and NCDOT will continue to work with and consult all federally- and state-recognized tribes in the delivery of VRU safety programs.

For regional planning organization consultations, MPOs and RPOS were initially contacted in the form of a survey to provide information about the VRU Safety Assessment and to identify areas of concern for vulnerable road users within the MPO or RPO region. The full text of the survey can be found in the appendix.

NCDOT TSU and consultants met with each MPO and RPO representatives for a 90-minute video call. The calls began with introductions and a brief presentation from consultants and TSU staff. The presentation explained why and how NCDOT would conduct the Vulnerable Road User Safety Assessment, as well as how the assessment would fit into larger NCDOT safety planning efforts. NCDOT staff also reviewed the Pedestrian Safety Improvement Program (PSIP) and its approach to addressing safety improvements throughout the state. The presentation concluded with the consultant team going over the Safe Streets for All (SS4A) grants and Strategic Safety Planning, as well as introducing data tools available online to track bicycle and pedestrian crashes.

During the consultations, MPO and RPO staff asked questions about specific safety concerns in the region and identified areas of concern or barriers to safety planning for vulnerable users. Consultations identified unique obstacles and opportunities for each MPO or RPO. The presentation used in the VRU consultation can also be found in the appendix.

Key Findings

Staff from MPOs and RPOs shared challenges to their safety planning efforts during the consultations. Consultations also included discussion about opportunities and needs. Some of the common areas of concern and opportunities across regional planning organizations are summarized below.

Location Areas of Concern

- High-speed, high-volume roadways, including 5-lane roads with adjacent commercial land uses and activity generators.
- Crossings, including limited marked pedestrian crossings at intersections and high activity sites leading to mid-block crossings.
- State and US highways that travel through city and town downtown cores – high volumes of through-traffic vehicles.
- Increase in pedestrians walking along train tracks.
- Transit stop locations, including those on rural roadways.

Demographics Areas of Concern

- Population growth and development pressures, including rural areas experiencing growth from neighboring cities, becoming more suburban, and experiencing increased bicycle and pedestrian activity on existing roadways.
- Residential areas with concentrations of zero-car households along roadways with no facilities
- Concentrations of low income and zero car households that are missing or hard to capture in large census block groups.
- Low-income populations moving to previously rural areas as housing prices in the cities increase, creating concerns about safety along narrow, rural mountain roads lacking pedestrian or bicycle infrastructure.

Other Areas of Concern

- Barriers to safety planning and implementation, including increasing construction costs, staffing shortages, securing matching funds, ongoing facility maintenance, and the complexity of managing federal grants.
- Vehicle speeds, distracted driving, and driver education
- Tourism-related vehicle, pedestrian, and bicyclist behavior and education.

Resource and Data Opportunities

- Guidance and resources for staff on walk audits, bicycle and pedestrian counts, and safety countermeasures
- Data and resources to collect and track data for historical crashes and crash risk.

IV. Strategy Development

Strategy Development is the culmination of the quantitative analysis and consultations conducted for the 2023 VRUSA described in the preceding sections. The VRUSA Strategies represent a comprehensive analysis of VRU safety risks in North Carolina and an approach to addressing and reducing these risks on a continual basis. NCDOT's Pedestrian Safety Improvement Program (PSIP), introduced in the Overview section of this Report, is the primary method of delivery for the strategies laid out in this section. NCDOT created the PSIP to be a continually renewing model for low cost, high benefit safety projects across the state. The PSIP is an effective delivery tool for safety projects. The 2023 VRUSA development provided a quantitative and qualitative analytical basis for the PSIP, such that NCDOT can continue to deliver safety projects focused on the highest risk profiles. These risk profiles are captured in the 2023 VRUSA Program of Strategies.

Safe System Approach

NCDOT's PSIP and the following Program of Strategies are grounded in a Safe System Approach (SSA). An SSA addresses the safety of all road users, including vulnerable road users, and emphasizes minimizing the risk of injury or fatality to road users. Successful components of an SSA that are captured in this Program of Strategies include planning, programming, and project decisions that create a culture of safety by proactively identifying systemic safety risks and building redundancies in the system to prioritize safety.

Program of Strategies

The Program of Strategies captures the necessary elements for a successful safety program in North Carolina. Reflecting input from VRUSA consultations and quantitative analysis, the Program of Strategies identifies the importance of continuously developing and refining policy, improving data systems, and strengthening safety planning and partnerships with regional planning agencies and stakeholders. The Program of Strategies also reflects the importance of continued training and education and acknowledges that there are areas where additional research is needed to continually improve safety program implementation. Each of these elements contribute to North Carolina's safety program and the implementation of successful, informed safety projects as strategies of a Safe System Approach across the state.

The Program of Strategies is organized into six groupings: **Policy**, **Planning**, **Program**, **Projects**, **Education**, and **Implementation**. Each grouping is organized with one objective and 2-4 approaches. The development of these strategies is designed to be congruent with the structure of the 2024 North Carolina Strategic Highway Safety Plan (SHSP), of which the VRUSA is a new

feature in 2023, and the PSIP. A successful PSIP in North Carolina will consider each of the six groupings and the associated approaches identified in the Program of Strategies.

The following worksheet, **2023 NCDOT VRUSA Strategy Worksheet**, details the Program of Strategies.

V. Beyond the Plan

The 2023 VRUSA is the first iteration of the VRUSA for North Carolina and it will be incorporated in the 2024 Strategic Highway Safety Plan. After this, the VRUSA will be updated during the statutorily required 5-year updates to the SHSP. While the VRUSA will not be updated until the 2029 SHSP, NCDOT's Pedestrian Safety Improvement Program, as the delivery mechanism for NCDOT safety programs, will be responsive to changing circumstances over the five-year SHSP period.

Beyond the Plan recognizes that there will be opportunities, information, gaps, and points of interest that arise during the SHSP period that will inform the next update to the VRUSA and will also require continual assessment of the approaches laid out in the 2023 Program of Strategies. An increasing number of regional safety assessments, as prioritized in the Program of Strategies and through USDOT funding sources such as the Safe Streets and Roads for All grant opportunity, could require an expanded assessment of regional safety plan integration over the five-year period, for instance. NCDOT is committed to reducing fatalities and serious injuries on North Carolina roads. As such, a successful PSIP will go Beyond the Plan, and be responsive to these circumstances throughout the SHSP period and in anticipation of the next update to the VRUSA.

North Carolina Department of Transportation (NCDOT)

2023 VRUSA

Strategy Worksheet

POLICY

Policy plays a crucial role in pedestrian safety programs as it provides a framework for when, where, and how to implement effective safety measures to protect VRUs as part of a Safe System Approach. During VRUSA consultations, MPO and RPO partners inquired about policy and guidance available to support pedestrian and bicyclist safety. Policies ensure consistency and accountability in VRU safety initiatives. The implementation of well-designed policies is essential for creating safer streets, creating redundancies, and reducing VRU serious injuries and fatalities.

OBJECTIVE: Create and publish guidance for developing and implementing more safety projects for vulnerable road users.

APPROACH:

- Review gaps and provide training for policies and guidance that address vulnerable road user safety and provide support for the application of these.
- Apply guidance to identify safety needs at trail crossings, signalized intersections, and transit corridors.
- Standardize pedestrian crossing guidance application in STIP project review.
- Develop guidance for target speeds and assess needs for incorporation in high-risk areas for vulnerable road users.

PLANNING

Creating safety plans and studies for VRUs allows for a systematic approach to identifying and addressing safety risks in support of a Safe System Approach. Safety plans outline specific strategies and actions that can be taken to improve VRU safety. Having well-defined plans in place enhances the ability to prioritize and allocate resources effectively, ensuring that efforts are focused on areas with the highest risk and need by taking a multidisciplinary approach for VRU safety. North Carolina MPOs and RPOs are planning to develop comprehensive safety action plans, and during VRUSA consultations these local partners discussed looking for technical support in planning processes.

OBJECTIVE: Partner with regional planning organizations and local agencies to develop safety plans and studies across all high-risk contexts

APPROACH:

- Provide financial and technical support for local and regional roadway safety plans. These safety plans should include vulnerable road user safety.
- Review bicycle and pedestrian network plans for crossing safety enhancements. Incorporate trail crossing guidance to network plans and integrate these plans into project development processes.
- Conduct pedestrian and bicycle safety studies, including corridor studies and Road Safety Assessments, on urban arterials.
- Establish an approach to speed management planning in urban areas that is context-sensitive and considers target speeds and operating speeds.

PROGRAM

Program delivery is an essential strategy for the success of VRU safety initiatives. Evaluating program delivery ensures that VRU safety programs effectively leverage regional partnerships and context-sensitive data to ensure safety efforts are aligned with local needs and priorities, leading to impactful VRU safety across the state. During consultations, MPOs and RPOs mentioned the benefits of right-sized safety programming as an important goal of VRU safety in their regions. Crash analysis extensive and widespread safety problems and high-risk locations across cities and regions. City-wide and context-specific safety programs lead to the development of more quality safety projects. Multidisciplinary approaches, such as integration of public health, enrich understanding of safety problems across a city or region.

OBJECTIVE: Identify new partners for city-wide and regional engagement with disadvantaged communities to inform safety strategies and projects.

APPROACH:

- Monitor PSIP large city pilot implementation in Wilmington and Fayetteville and mid-sized city implementation. Formalize large city pilot program and expand into additional large and mid-sized cities.
- Develop approaches for applying PSIP implementation in small cities and rural areas.
- Incorporate public health into vulnerable road user safety programming. Encourage further partnerships with statewide and local public health officials to understand needs of vulnerable road users in safety planning and studies.

PROJECTS

Project support is essential for VRU safety as it allows for a comprehensive evaluation of the effectiveness and impact of safety initiatives in project delivery in North Carolina. Conducting thorough reviews of projects can identify opportunities to incorporate systemic safety improvements, low-cost treatments, and additional areas for VRU safety measures, ensuring that resources are being used efficiently and effectively to deliver VRU safety benefits in NCDOT projects. MPOs and RPOs identified project support as an important partnership opportunity between local agencies and NCDOT to enhance VRU safety in their regions. Project support is crucial for continuously improving and refining VRU safety efforts.

OBJECTIVE: Develop safety projects that are responsive and risk-based.

APPROACH:

- Standardize pedestrian and bicyclist safety review in STIP project review and promote vulnerable road user safety improvements in local project reviews.
- Implement systemic safety improvements for vulnerable road user safety, prioritizing low-cost treatments.

EDUCATION

Education is an important component of a Safe System Approach and a successful statewide VRU safety program. Through training and education, NCDOT equips individuals, agencies, and partners with the knowledge and skills necessary to effectively implement VRU safety initiatives across the state. During consultations, MPOs and RPOs discussed the importance of educational resources about NCDOT safety programming, safety benefits, data, and safety project tools. By providing resources on VRU safety tools and programs, NCDOT can equip staff and partners to address VRU safety and reduce VRU serious injuries and fatalities.

OBJECTIVE: Provide training and increase opportunities for NCDOT and local agency partners to develop safety projects.

APPROACH:

- Develop toolkits for safety countermeasure selection and implementation that include established safety benefit measures and application guidance.
- Develop training resources for consultants and local staff to lead Road Safety Assessments for all road users.
- Develop and launch web-based tools and information about PSIP

IMPLEMENTATION

Implementation and performance assessment provide valuable insights into the effectiveness of safety measures and help identify areas for improvement. Stakeholders identified the need for new and maintained data that enables ongoing monitoring and evaluation of safety initiatives and ensures that NCDOT and partners are equipped with the information to achieve VRU safety outcomes. Performance assessment allows for the identification of areas for further research, as well as the measurement of progress and prioritization needs. The implementation strategy leads to informed decisions and evidence-based strategies to enhance VRU safety and reduce serious injuries and fatalities.

OBJECTIVE: Leverage data sources and methods to prioritize needs and assess performance of vulnerable road user safety.

APPROACH:

- Update and maintain Pedestrian and Bicycle Infrastructure Network (PBIN) as an inventory of existing conditions for safety improvements.
- Maintain data for pedestrian safety at signalized intersections. Incorporate safety improvement data into statewide traffic signal inventory.
- Conduct further research on interstates and expressways that experience disproportionate vulnerable road user crash frequencies to understand trends and inform safety implementation.
- Maintain and improve exposure and risk models. Review exposure and risk models for opportunities to enhance their effectiveness and responsiveness.

Endnotes/References

i. VRUs are defined as a pedestrian, bicyclist, other cyclist, person on personal conveyance, and pedestrians in a highway work zone. Full definition can be found in the FHWA Guidance.

ii. FHWA defines a Vulnerable Road User (VRU) as a nonmotorist with a fatality analysis reporting system (FARS) person attribute code for pedestrian, bicyclist, other cyclist, and person on personal conveyance or an injured person that is, or is equivalent to, a pedestrian or pedalcyclist. This includes highway workers on foot in a work zone. Please note that motorcyclists are not defined as VRUs for this program. [link FHWA memo]

iii. The KABCO injury scale definitions used to describe injury status of crashes in North Carolina can be found in the North Carolina DMV 349 Crash Report Instruction Manual.

iv. https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-10/VRU%20Safety%20Assessment%20Guidance%20FINAL_508.pdf

v. Data accessed on March 27, 2023.

vi. Definitions of injury categories A, B, and C changed May 27, 2016. (Previous changes have also been made prior to 2010.) These changes in definitions can affect the frequency distributions of injury categories. In practice, the changes in definitions may be phased in over a period of time across the state.

vii. Vehicle types were grouped into the following categories: Small (20, 21, 22, 23, 24, 27); Mid-size (1, 17), Large (2, 3, 4, 5), Bus/Truck (6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 25), Industrial (18, 19), Government (28, 29, 30, 31), Other (26); and Unknown (32).

viii. https://nhts.ornl.gov/briefs/PovertyBrief.pdf

Appendix

Appendix

Fatal (K) and Serious Injury (A) Crash Sample Key Findings

VRU Data Table Statistics 2016 – 2020

Pedestrian K/A Crashes in NC

K & A Crashes

K: Killed *- Deaths that occur within 12 months after the crash*

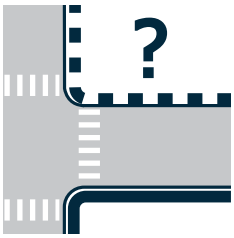
A: Suspected Serious Injury *- Disabling, serious enough to preventing the injured person from performing normal activities beyond one day after the collision.*

RURAL VS URBAN

56%

of K/A crashes occurred in urban areas

CONTEXT CHARACTERISTICS



66%

of K/A crashes occurred when no sidewalk was present.

54%

of K/A crashes occurred in commercial areas.

35%

occurring in suburban commercial contexts

Land use context

Downtown: *Urban core*

Suburban/Commercial/ Mix: *Residential area with commerce (bodega, strip mall).*

Residential: *Residential area with no commerce.*

Urban Commercial: *Commercial center within an area of high activity in town.*

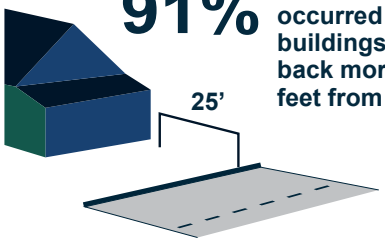
Rural/Suburban: *Rural highway with housing developments.*

Crashes in Proximity to Home Address

5miles

55%

Percent of crashes within distance of home address



91% **of K/A crashes occurred where buildings were set back more than 25 feet from the road.**

98%

of K/A crashes, there was no overhead lighting fixture present at the crash location.

Pedestrian level lighting

Pedestrian scaled street lighting is directed toward the sidewalk, positioned lower than roadway lighting (12 to 14 feet above the sidewalk)

DEMOGRAPHICS

9%

of pedestrian KA crashes occurred at a transit stop.

Of the KA crashes associated with transit stops, crashes were most likely to occur (65%) at stops with a sign only.

When analyzing transit stop presence at KA pedestrian crash sites, transit stops were tiered into 4 categories:

Shelter: *transit stop with shelter for waiting users*

No shelter: *transit stop with other facilities for users such as a bench, but no shelter*

Sign only: *transit stop with a sign but no other facilities for waiting users*

LRT: *light rail transit stop*

SPEED

54%

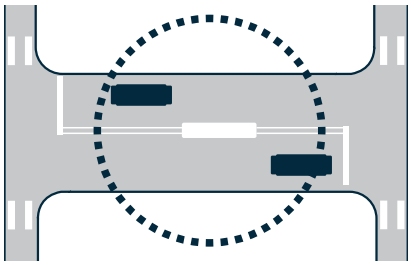
of K/A crashes occurred where the posted speed limit exceeds 35 mph.

Approximately half of all K/A crashes occurred when a vehicle was traveling at speeds equal to or greater than 40 mph

VRU Data Table Statistics 2016 – 2020

Pedestrian K/A Crashes in NC

INTERSECTIONS



75%

of K/A crashes occurred between intersections

56%

of K/A crashes occurred at intersections that where controlled by a traffic signal

Signalization

Intersection controlled by a traffic signal

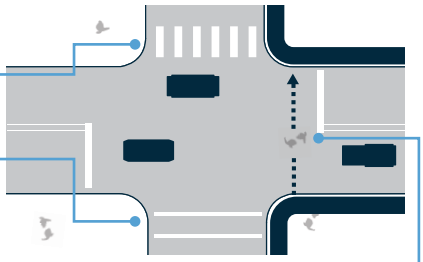
Marked crosswalks

Marked crosswalk – High Vis

A crosswalk with markings that give high visibility beyond the standard

Marked crosswalk – Standard

A crosswalk marked with two parallel lines or series of white blocks running across the street



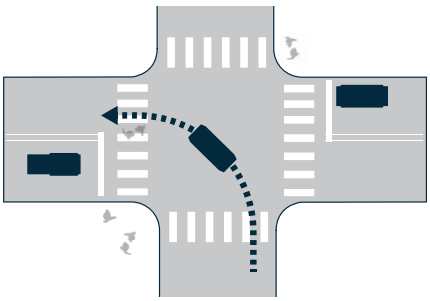
71%

of K/A crashes occurring at intersections were in unmarked crossings

Unmarked crosswalks

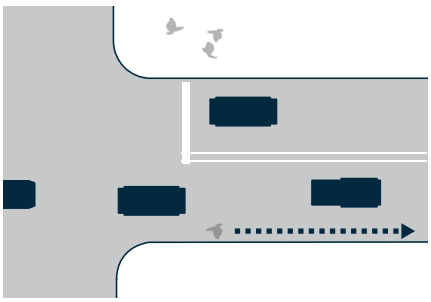
At an intersection with no traffic signals where pedestrians have the right of way

CRASH TYPE / OTHER



65%

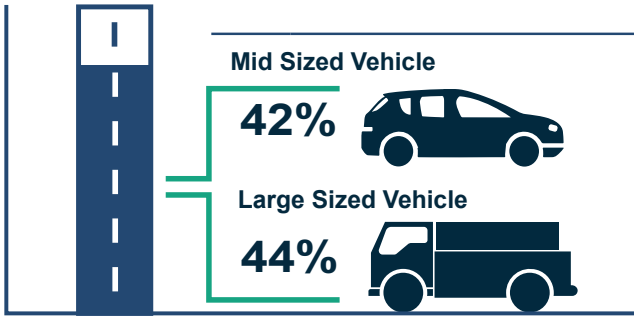
Of pedestrian K/A crashes involving a turning vehicle, involved a motorist turning left.



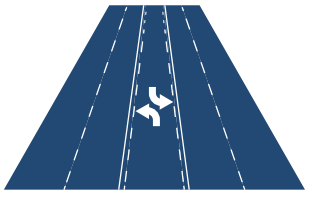
69%

Of K/A crashes involving pedestrians walking along the roadway were struck from behind while walking in the direction of traffic.

86% **of K&A crashes involved a mid or large size vehicles**



LANE NUMBER



50%

of pedestrian K/A crashes occurred on roads with 4 or more lanes

Appendix

Fatal (K) and Serious Injury (A) Crash Sample Methodology

NCDOT Vulnerable Road User Safety Assessment

KA Pedestrian Crash Sample Review Methodology

To take a deeper look at risk factors in fatal (K) and serious injury (A) pedestrian-involved crashes, the project team conducted an in-depth analysis of a sample of KA crashes. The purpose of this sample analysis was to assess and quantify crash data that are not recorded in more traditional crash summaries (FARS, PBCAT, etc.). This sample was created to be statistically proportionate with total crash numbers in urban and rural areas for both K and A severity crashes, and geographically distributed across the full state by NCDOT division. Figure 1 Crash Sampling Methodology shows a visual representation of how this sample was created. Table 1: Number of KA Crashes Reviewed by Division provides crash totals included in the sample review by Division. NCDOT published an online Storymap that presents key findings from this analysis: VRU Data Viewer.

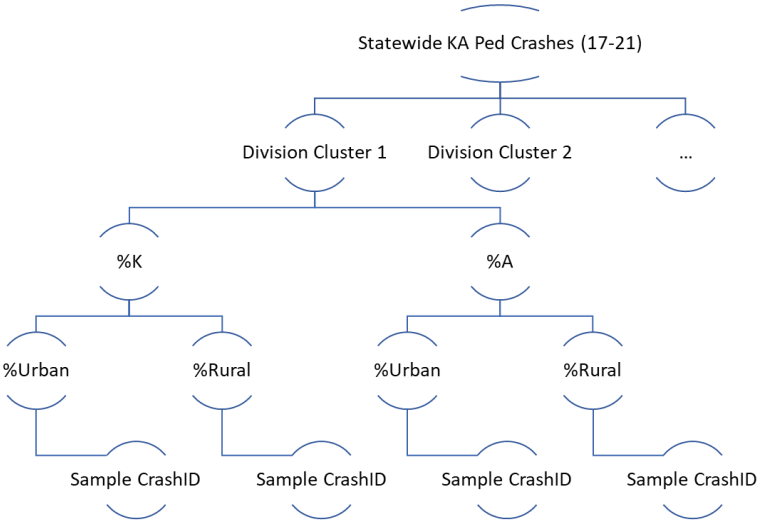


Figure 1 Crash Sampling Methodology

NCDOT Division	KA Crashes included in Sample
1	21
2	38
3	46
4	35
5	96
6	64
7	50
8	28
9	55
10	87
11	20

12	33
13	23
14	24
TOTAL	**620**

Table 1: Number of KA Crashes Reviewed by Division

For each crash reviewed, the team accessed the original crash report narrative and visually reviewed the location of the crash using digital imagery. For visual site assessment, reviewers used satellite imagery and street photography, as available, from as near to the date of the crash as possible. This assessment captured information about the site not typically included in crash reports, including the following:

- **presence of a sidewalk**
- **presence of a curb**
- **presence and type of transit facility (i.e. bus stop)**
- **presence and type of bicycle facility**
- **building setback**
- **land use context**
- **signal phasing**
- **presence and type of lighting**
- **operating and impact speed**
- **parking facilities**
- **distance from home address**
- **vehicle type**

Definitions for and summary percentages of each of these site characteristics are discussed further in the *KA Pedestrian Crash Sample Review - Summary of Findings*. Site characteristics include sub-types or categories. The team also tested statistical range and significance of these characteristics in the sample reviewed. The results of this analysis are summarized in the *KA Pedestrian Crash Sample Review - Statistical Analysis*.

For the crash report assessment, reviewers read the narrative of the crash report (and any associate reports) to identify "Other Crash Types" (*Flagged)* crash types. The first set of Flagged crash types included **Ability Difference, Unhoused Pedestrian, Mental Health,** and **Distracted.** These types attempt to capture information about the pedestrian and/or driver involved in the crash. The review criteria for these are listed below. These flagged crashes are noted in Table 2: Other Crash Type (Flagged): Person-Based Characteristics if they occurred more than once within the sample.

> **Ability Difference**: Crash report narrative that states that a pedestrian has an ability difference such as using a manual or motorized wheelchair, using a cane/crutch, or some level of blindness or deafness. This review includes witness statements and flags any mention or likelihood of an ability difference.

Unhoused: Crash report narrative that states that a pedestrian is homeless/unhoused, or has a blank address field or lists a home address as homeless/unhoused or a transitional housing facility (i.e. shelter, hotel, motel). Critically, this is not an assessment of whether the pedestrian involved is unhoused, but rather whether the crash report makes mention of this.

Mental Health: Crash report narrative mentions a pedestrian or driver under the influence of, or not on prescribed medications or associates any abnormal behavior from the pedestrian or driver to any sort of mental health concern. This is not an assessment of the mental health of the driver or pedestrian, but rather an assessment of whether the responding law enforcement officer or any witnesses note any mental health concerns.

Distracted: Crash report narrative mentions a pedestrian or a driver that was distracted by electronic devices, including phones, cameras, radios, navigation systems, computers, etc.

"Other Crash Type" (Person-Based)	**Count**	**% of Sample**
Ability Difference	12	1.94%
Unhoused	10	1.61%
Mental Health	16	2.58%
Distracted	13	2.1%

Table 2: Other Crash Type (Flagged): Person-Based Characteristics

The next set of Flagged crash types attempts to capture circumstantial elements of crashes that are familiar to many who work in pedestrian safety and emergency response are familiar with, but that have not previously been quantified or stratified in North Carolina. This effort to provide a data-informed background to these crash types helps to validate the existence of these types of crashes while also providing an informed basis for the frequency of these crash types. Once one of these crash types was identified in a crash report review, the reviewers stopped further review of the crash report and did not conduct a visual site assessment of the crash location. These types include **Suicide, Laying in Roadway, Good Neighbor, Work Zone, Violence/Assault, Eluding Arrest, Falling From Vehicle, Driveway/Backing,** and **Driver Leaves Roadway.** The review criteria for these are listed below.

Suicide: Crash report narrative specifically mentions a suicide attempt, based on witness statements, presence or a note, or other verifying factor.

Laying in roadway: Crash report narrative mentions pedestrian laying in the roadway, with no mention of suicide. Crash sketch reviewed for additional context.

Good neighbor: Crash report narrative and sketch mention/identify a pedestrian who was struck:

- After getting out of a vehicle that was previously struck
- After stopping to help a vehicle or other entity on the side of the roadway
- Attending to their own vehicle on the side of the roadway

Work Zone: Crash report narrative specifically mentions a crash occurring in a construction Work Zone

> *Work-Related*: Crashes that occur in non-official work zones, but are work-related, such as a tow truck operator, a delivery driver, a street maintenance or public works worker.

Violence/Assault: Crash report narrative mentions a fight/conflict between parties. This crash type includes conflict between a driver and passenger that results in a passenger exiting a moving vehicle, a pedestrian fleeing a vehicle, and an intentional vehicular assault.

Eluding arrest: Crash report narrative mentions a driver or pedestrian fleeing law enforcement resulting in a pedestrian being struck.

Falling from vehicle: Crash report narrative mentions a passenger falling from a moving vehicle (from an open door, the bed of a truck, etc.), or being on top of a vehicle that begins to move and strikes them.

Driveway/Backing: Crash report narrative mentions a pedestrian struck by a slow-moving backing vehicle, driverless vehicles (i.e. not in park) that roll and strike a pedestrian,

Driver leaves roadway: Crash report narrative mentions a vehicle striking a pedestrian outside of the right-of-way, beyond any pedestrian facility (i.e. in a building, yard, etc.)

Other flag: Crash report narrative review unveiled certain circumstances that did not fall into these categories, including joking/playing and dog pulling pedestrian into roadway. These total of "Other Crash Type" flags made up 16.65% (103 of 620) of the crash sample. The breakdown of each crash type is below. The **Good Neighbor** crash type was the highest frequency Flagged crash type, with 27 KA crashes, or 4.35% of the total crash sample. Flagged crashes represented Table 3: Other Crash Types (Flagged): Circumstantial were noted if they occurred more than once within the sample.

"Other Crash Type" (Circumstantial)	Count	% of Sample
Total	**103**	**16.61%**
Suicide	5	0.81%
Laying in Roadway	20	3.26%
Good Neighbor	27	4.35%
Work Zone	5	0.81%
Work Related	4	0.65%
Violence/Assault	8	1.29%
Eluding Arrest	2	0.32%
Falling from Vehicle	3	0.81%
Driveway/Backing	10	1.61%
Driver Leaves Roadway	13	2.10%
Other	6	0.97%

Table 3: Other Crash Types (Flagged): Circumstantial

Appendix

MPO/RPO Consultation Introduction and Survey Questions

MPO/RPO Consultation Introduction and Survey

NCDOT invites you to share insights about bicycle and pedestrian safety in your region. **Please complete this initial survey to help our team prepare for a meeting with your MPO or RPO**. The survey may be shared with local member agencies in your region, if desired. The second stage of consultation will include an online meeting with each MPO and RPO in the state. Meetings will last up to 90 minutes, and the team will review findings from data analysis and discuss strategies for identifying high-risk areas for pedestrians and bicyclists**.**

Survey Questions

- What questions do you have about the VRU Safety Assessment?
- Is your planning organization, or any local agencies in your region, currently performing or developing a comprehensive safety action plan or other type of bicycle/pedestrian safety plan? If yes, please describe more about the process, agencies involved, and timeline.
- Is your planning organization, or any local agencies in your region, intending to develop a comprehensive safety action plan in 2023? If yes, please describe more about the process, agencies involved, grants pursued, and timeline.
- Does your planning organization currently identify "high risk areas" for pedestrians and bicyclists? If yes, what analysis or process do you follow?
- Who from your planning organization should be involved in future discussions about the NC VRU Safety Assessment?
- If you have concerns or prefer not to be involved in future discussions, please explain here.

Appendix

MPO/RPO Consultation Presentation

NORTH CAROLINA
Department of Transportation

NCDOT Vulnerable Road User Safety Assessment: MPO and RPO Consultations

Traffic Safety Unit

March and April 2023

Connecting people, products and places safely and efficiently with customer focus, accountability and environmental sensitivity to enhance the economy and vitality of North Carolina

Agenda

- Introductions
- What is the Vulnerable Road User Safety Assessment?
- Overview of NCDOT Pedestrian Safety Improvement Program (PSIP)
- MPO and RPO Role in Improving Pedestrian and Bicycle Safety
- Review Story Map of KA Pedestrian Crash Sample
- Discuss Next Steps

What is the Vulnerable Road User Safety Assessment?

New FHWA requirement for all states per Infrastructure Investment and Jobs Act (IIJA) [23 U.S.C. 148(l). (23 U.S.C. 148(a)(16))]

- "Vulnerable Road Users" defined as:
  - Pedestrian (including "highway worker on foot in a work zone")
  - Bicyclist (including any person using a device fitting definition of bicycle)
  - Person on personal conveyance

Requirements:

- Conduct a quantitative data analysis of VRU fatal and serious injury crashes to determine "high-risk areas."
  - Includes location, roadway functional classification, design speed, speed limit, and time of day
  - Considers the demographics of the locations of fatalities and serious injuries, including race, ethnicity, income, and age
- Complete by November 15, 2023, include as part of SHSP
- Update every 5 years

NC Approach to VRU Safety Assessment

1 Fatal (K) and Serious injury (a) ped crash review

- Sample of KA ped crashes (appx 500)
- Dashboard of key metrics
- Summary statistics
- Unusual circumstance crash review ("flags")

2 Bike + ped crashes for causal factor Analysis

- Bike and Ped Crashes, focus on KA, 2012-2021, by:
  - Roadway Characteristics
  - Socioeconomic and Demographic Characteristics
  - Context and Multimodal Characteristics
  - Temporal / Seasonal Characteristics
- Online summary of statistics, Statewide and per MPO / RPO

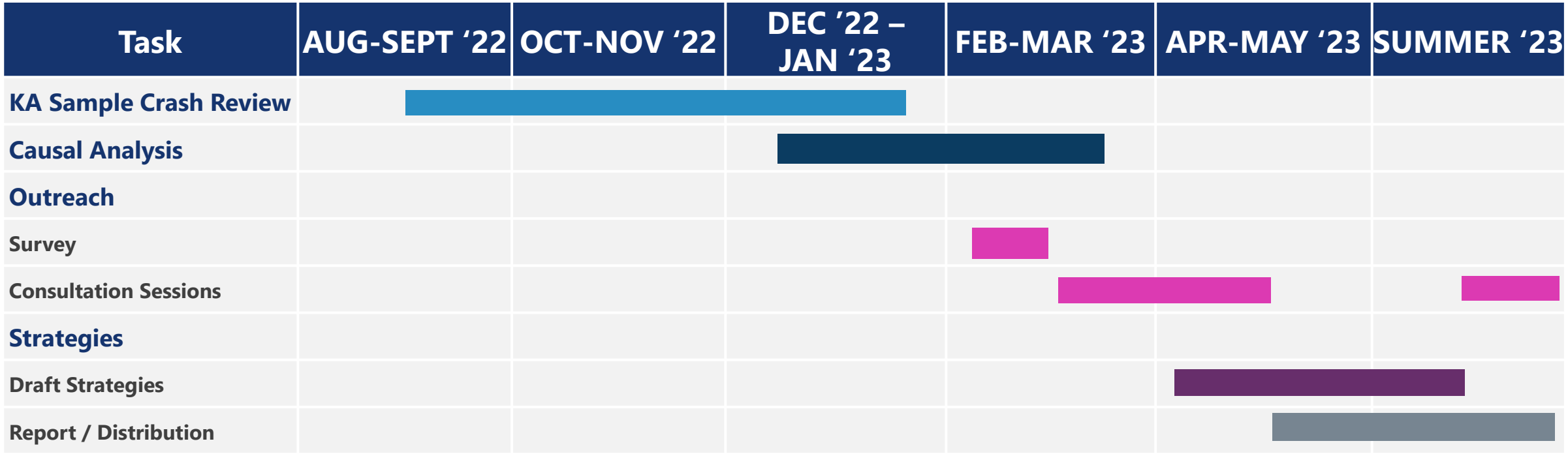
3 Consultation

- Initial Survey
- Outreach Sessions with all MPOs and RPOs
- Additional outreach to external stakeholders
- Coordination with other NCDOT divisions

4 Strategies

- Inclusion of ideas and strategies from consultation sessions
- Summary of current NCDOT strategies and programs (i.e. HSIP/PSIP, SHSP strategies)
- Consideration of Safe System Approach

Schedule


Task
AUG-SEPT '22
OCT-NOV '22
DEC '22 – JAN '23
FEB-MAR '23
APR-MAY '23
SUMMER '23
KA Sample Crash Review
Causal Analysis
Outreach
Survey
Consultation Sessions
Strategies
Draft Strategies
Report / Distribution

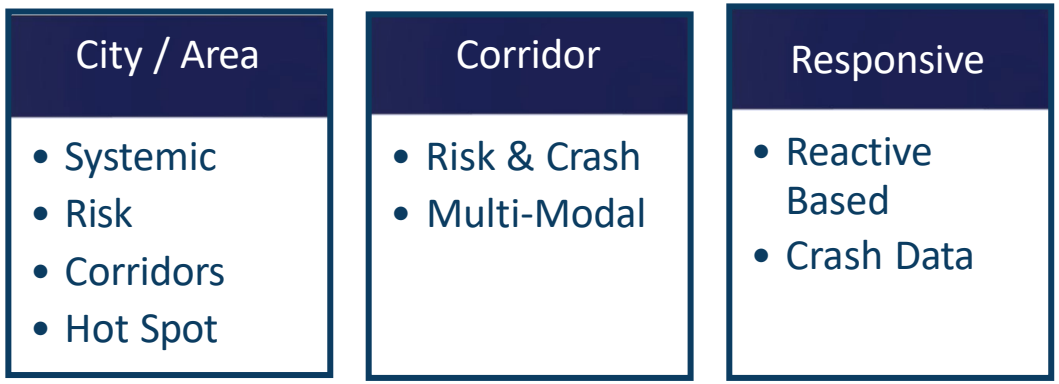
What questions do you have about the NC Vulnerable Road User Safety Assessment?

NCDOT Pedestrian Safety Improvement Program

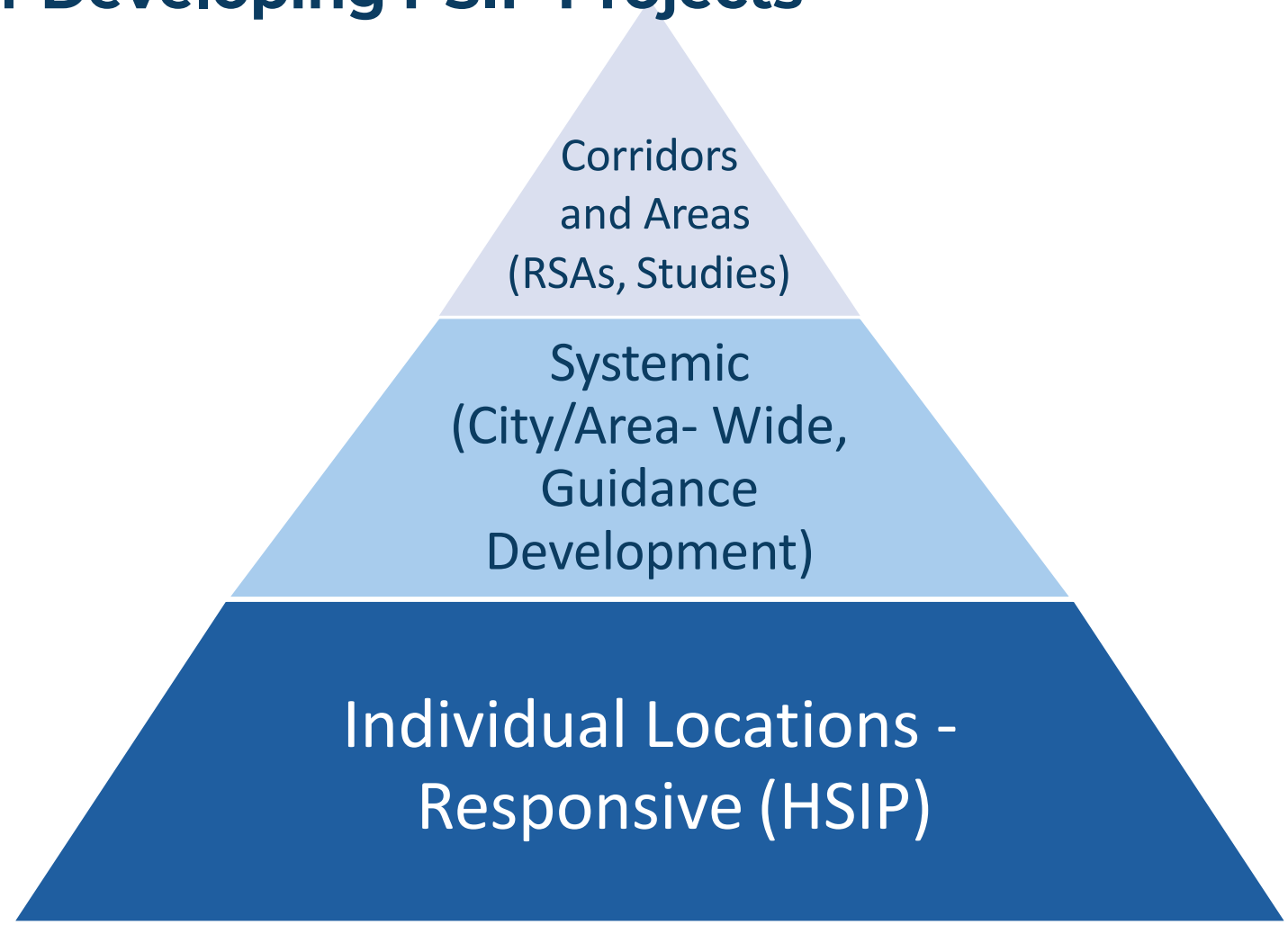
NC Highway Safety Improvement Program

Pedestrian Safety Improvement Program

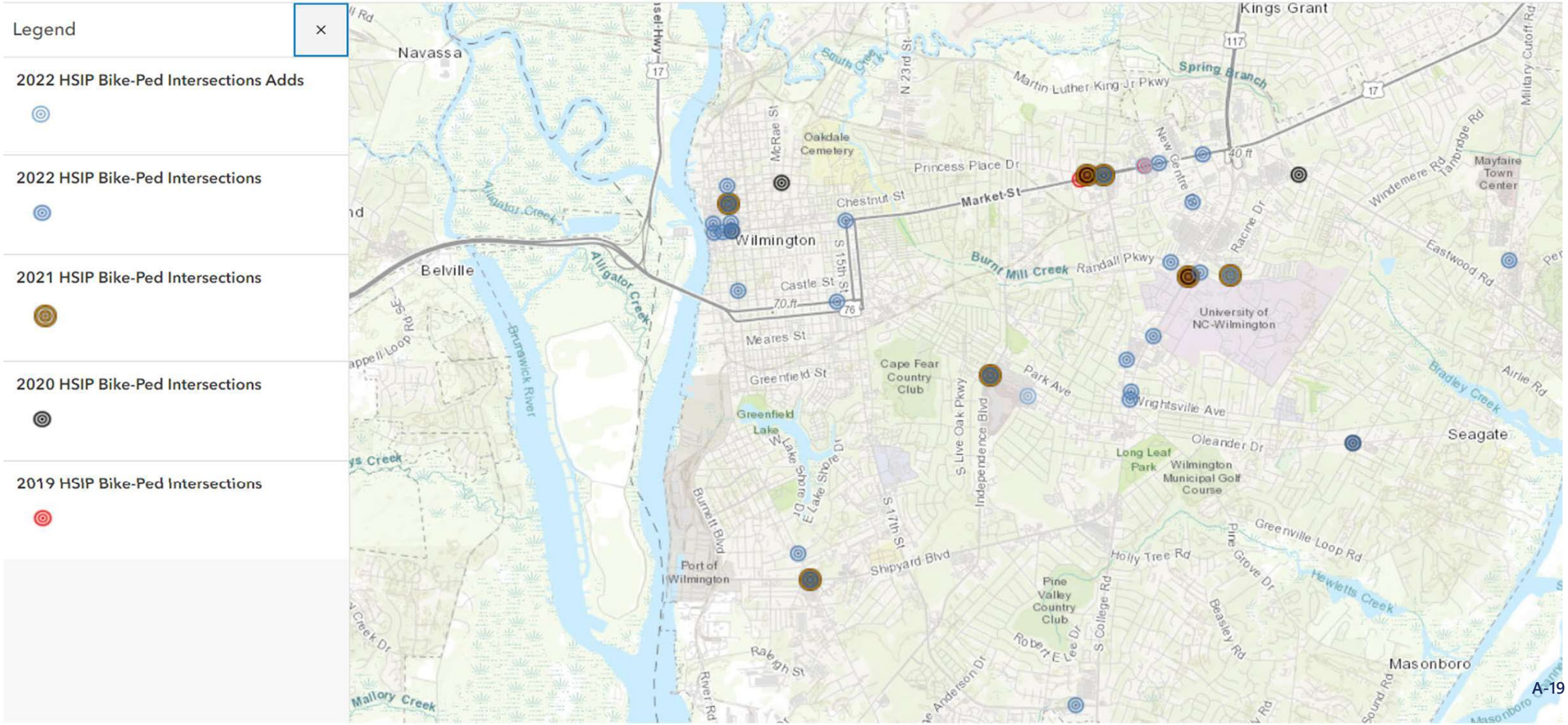
The PSIP is a **comprehensive and data-driven framework** for prioritizing locations for investigating pedestrian safety improvements, and by leveraging multiple data sources and analysis methods. PSIP is supported through **ongoing** HSIP review; proactive safety improvements; coordination with STIP and local capital projects; and integration with local policies, plans and processes.



Strategies for Developing PSIP Projects



HSIP Locations Map



Risk-Based Analysis

Network Screening / Systemic Analysis

+

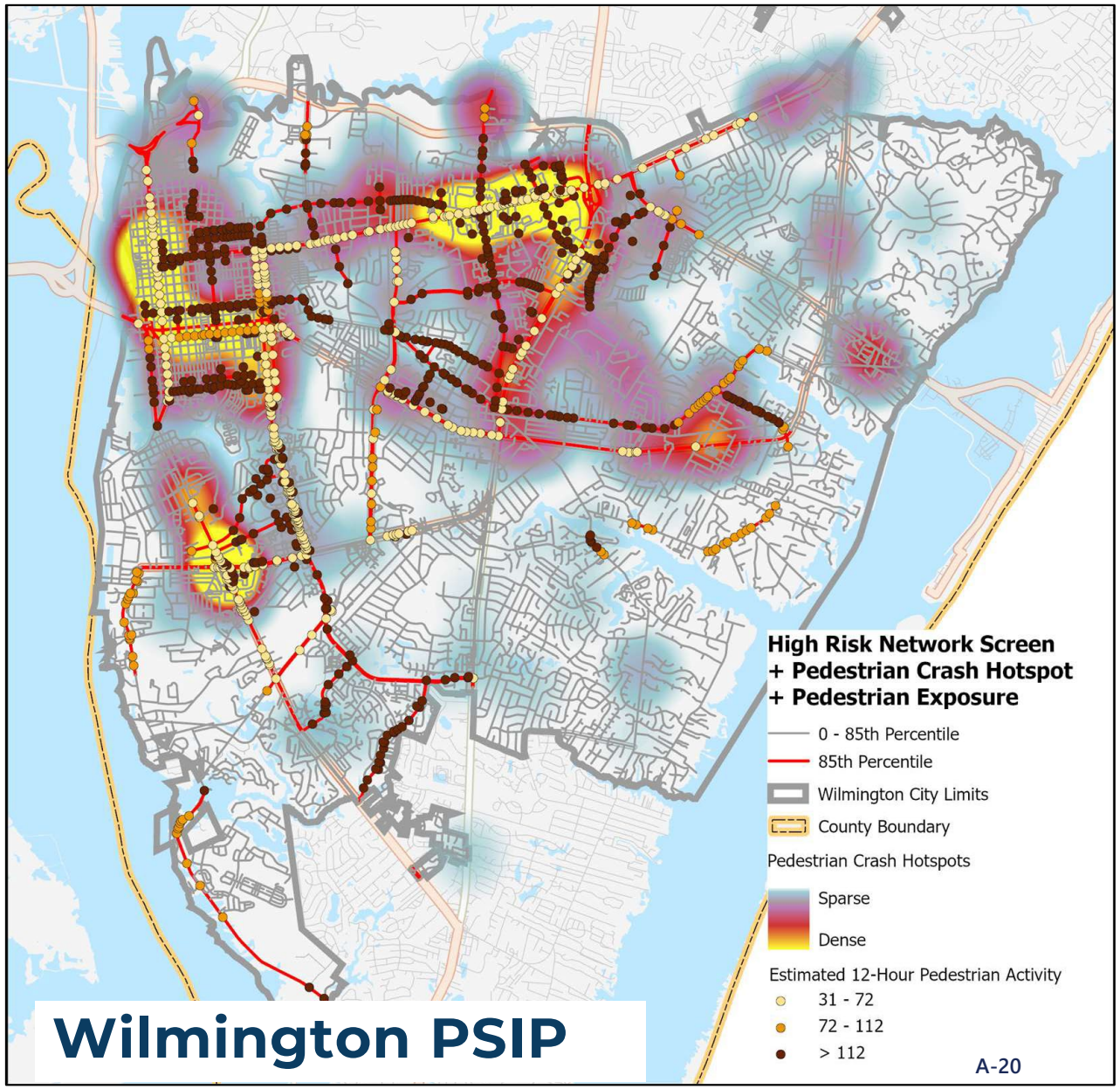
Historical Crashes

+

Pedestrian Exposure/Activity

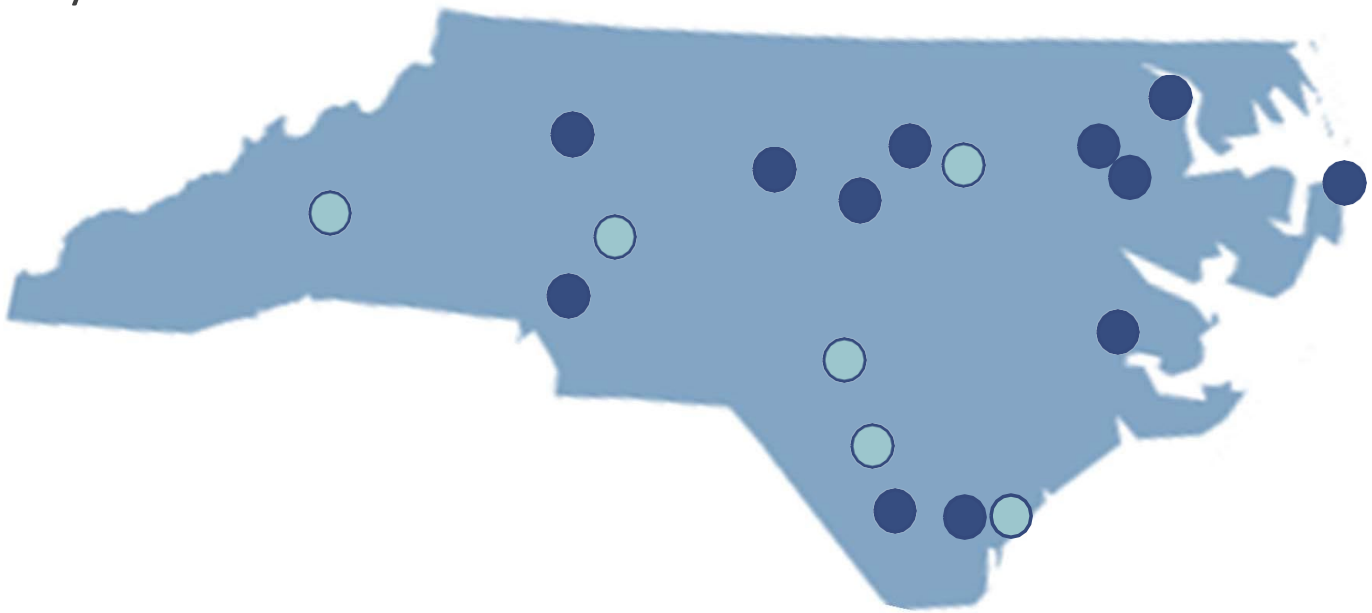
+

Socioeconomic/Equity Factors



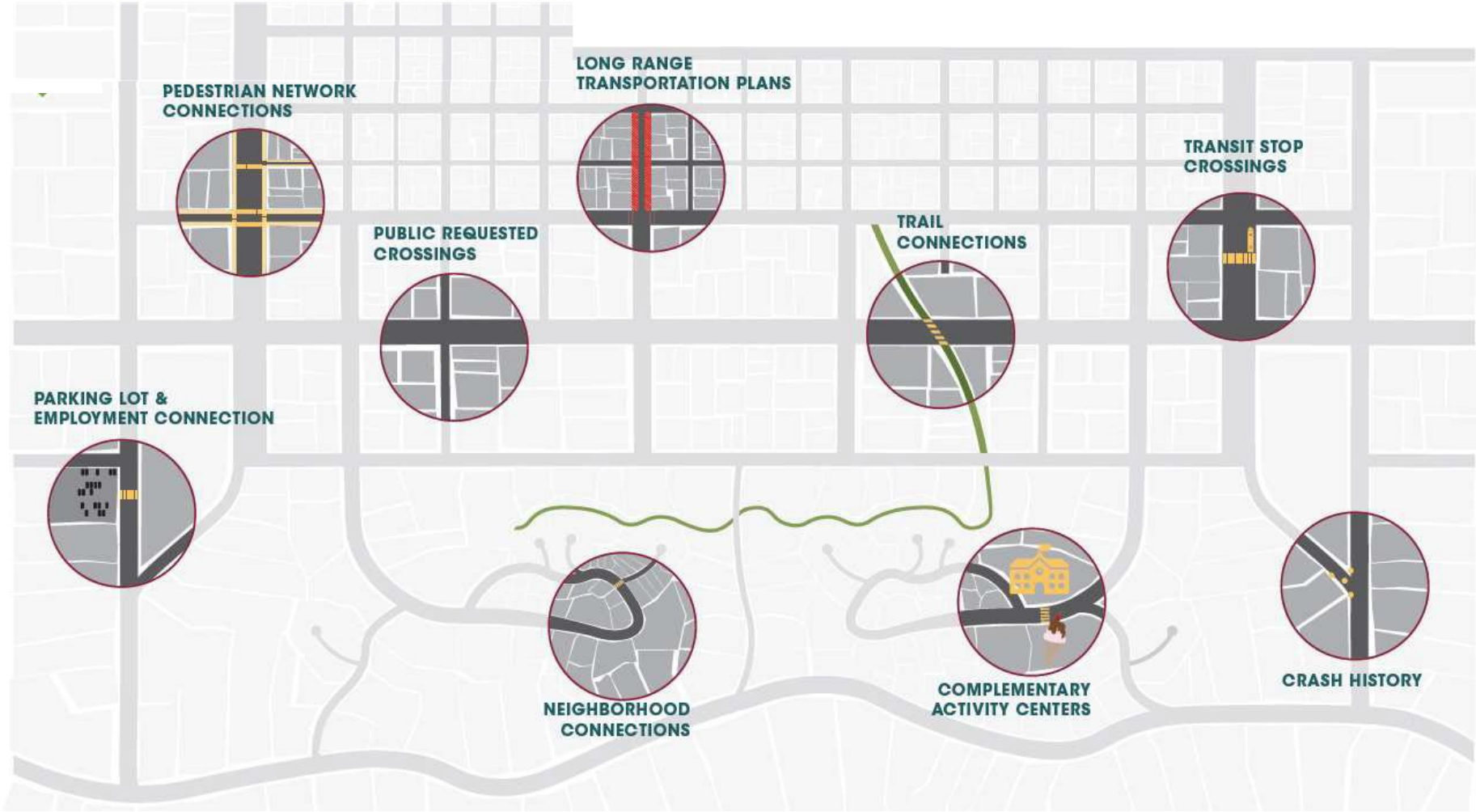
Pedestrian Safety Studies

- Corridor Studies
- Mid-sized and Large City Studies



Field Reviews and Road Safety Audits (RSAs)

Plan and Data Review

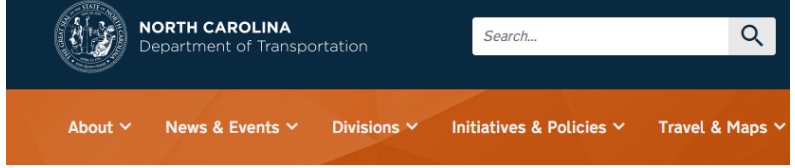


What questions do you have about the PSIP?

Which strategies have you used in planning for pedestrian and bicycle safety?

What is a Comprehensive Safety Action Plan?

- ❑ Goals and Metrics (all modes)
- ❑ Implementation Committee or Workgroup
- ❑ Safety Analysis
  - ❑ Focus on Fatal and Serious Injury crashes
  - ❑ Contributing and Risk Factors
  - ❑ Network Screening or Systemic Analysis
- ❑ Engagement and Equity Considerations
- ❑ Policy and Procedures
- ❑ Strategy Development
  - ❑ Project Development
  - ❑ Prioritization
- ❑ Reporting and Tracking



Safe Streets for All Grant Program

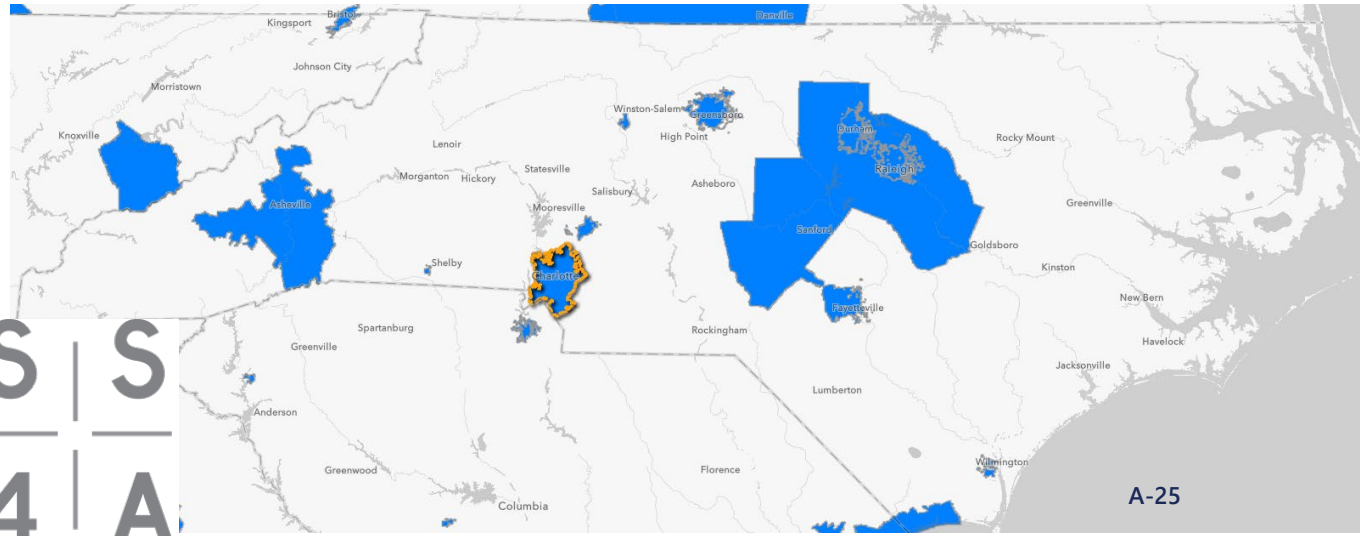
The U.S. Department of Transportation's Safe Streets for All Grant Program provides funding to local governments and metropolitan planning organizations, or MPOs, to develop safety action plans and to carry out projects identified in those plans.

USDOT's goal is aligned with Vision Zero, a collaborative partnership (which includes the N.C. Department of Transportation) that works to eliminate fatal and serious injuries caused by crashes on all roadways.

Using data and technical support provided by NCDOT, local agencies are better prepared when ncies can request a rant program also ay safety problems.

lina that apply for a plan grant—a

https://www.ncdot.gov/initiatives-policies/safety/traffic-safety/Pages/safe-streets-grant-program.aspx



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Survey Results and Questions

What are the requirements or expectations for MPOs and RPOs, as part of VRU?

How will the VRU Safety Assessment influence design or funding for NCDOT projects?

What training, guidance or resources are needed to assist with safety planning?

What tools or data do you need or use to plan for pedestrian and bicyclist safety?

Other questions?

What questions do you have about developing a comprehensive safety action plan for your region?

What are some examples of pedestrian and bicycle safety problems in your region?

Next Steps

1 Fatal (K) and Serious injury (a) Ped Crash Review

- Sample of KA ped crashes (appx 500)
- Dashboard of key metrics
- Summary statistics
- Unusual circumstance crash review ("flags")

2 Bike + Ped Crashes for Causal Factor Analysis

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Thank you!

Appendix

Statewide Quantitative Analysis Report

NORTH CAROLINA
Department of Transportation

NC VRU MPO-RPO Crash Analysis Report

Statewide

April 2023

Connecting people, products and places safely and efficiently with customer focus, accountability and environmental sensitivity to enhance the economy and vitality of North Carolina

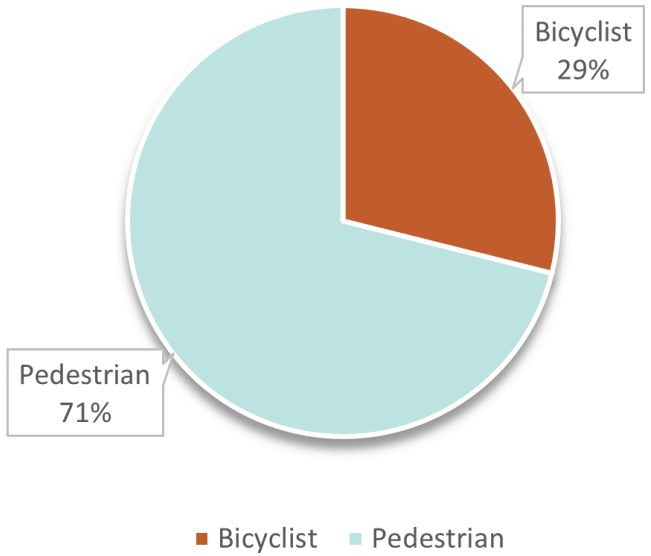
Introduction to the Report

This report summarizes all reported bicycle and pedestrian crashes in North Carolina over a 10-year period.

The crashes analyzed occurred between January 1st, 2012 and December 31st, 2021.

- In that 10-year period, there were 31,024 total crashes. 22,057 were pedestrian crashes and 8,927 were bicycle crashes.
- Find more information here:
  - NCDOT Pedestrian and Bicyclist Crash Dashboard
  - NCDOT VRU Data Viewer

Bicyclist vs. Pedestrian Crashes



Definitions

What is a Vulnerable Road User (VRU)?

- FHWA defines a VRU as a nonmotorist with a fatality analysis reporting system (FARS) person attribute code for pedestrian, bicyclist, other cyclist, and person on personal conveyance or an injured person that is, or is equivalent to, a pedestrian or pedalcyclist. This includes highway workers on foot in a work zone. Please note that motorcyclists are not defined as VRUs.

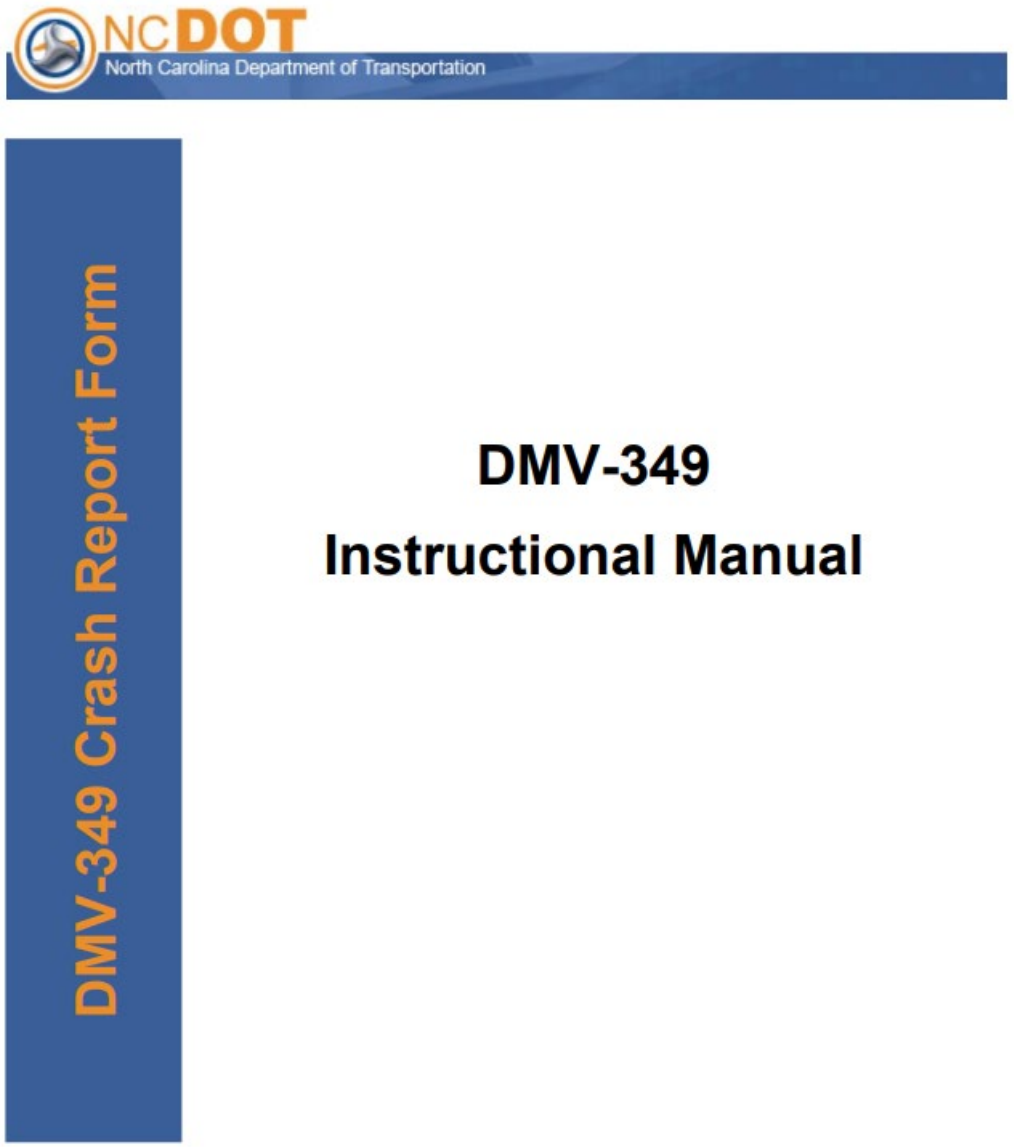
  Source: FHWA Vulnerable Road User Safety Assessment Guidance Memorandum (2022)

- All VRU nonmotorist categories described as a VRU by the FHWA are captured as a bicycle or pedestrian crashes by NCDOT.
- For the purpose of this analysis, all bicycle and pedestrian crashes have been combined unless specified otherwise.
- The project team has analyzed VRU crashes in two groups:
  - All crashes (all KABCO injury classifications)
  - Fatality and serious Injury crashes (K & A injury classifications)
  - Crash data definitions pulled from the North Carolina DMV 349 Crash Report Instruction Manual

*due to rounding to the nearest percentage point, some bar charts may not total 100%

Data Sources

- The data used in this analysis is NCDOT bicyclist and pedestrian crash geodata. It includes police-reported bicycle-motor vehicle and pedestrian-motor vehicle collisions that have been coded and geolocated. Data and data dictionary can be accessed on the NCDOT GIS portal.
- Terms and definitions were drawn from the North Carolina Crash Report Instruction Manual, which is published by NCDOT's Division of Motor Vehicles.
- Regional demographic data is from the US Census 5-Year American Community Survey (ACS), 2017-2021.
- Roadway mileage values were calculated using the NCDOT Route Arc Characteristics feature class.

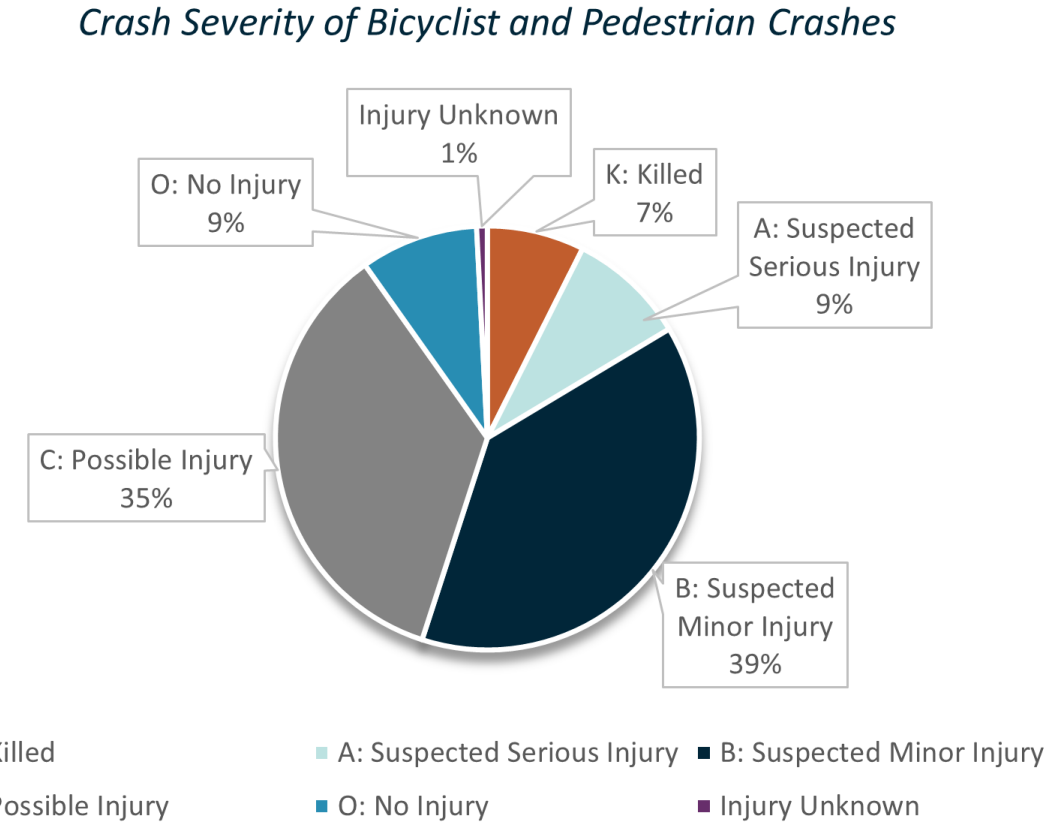


Injury Classification

KABCO Scale

The KABCO Injury Classification Scale was established by FHWA and is used to classify crash injuries in North Carolina.

- 16% of crashes were classified as K: Killed or A: Suspected Serious Injury
- 39% of crashes were classified as B: Suspected Minor Injury.
- 35% of crashes were classified as C: Possible Injury.

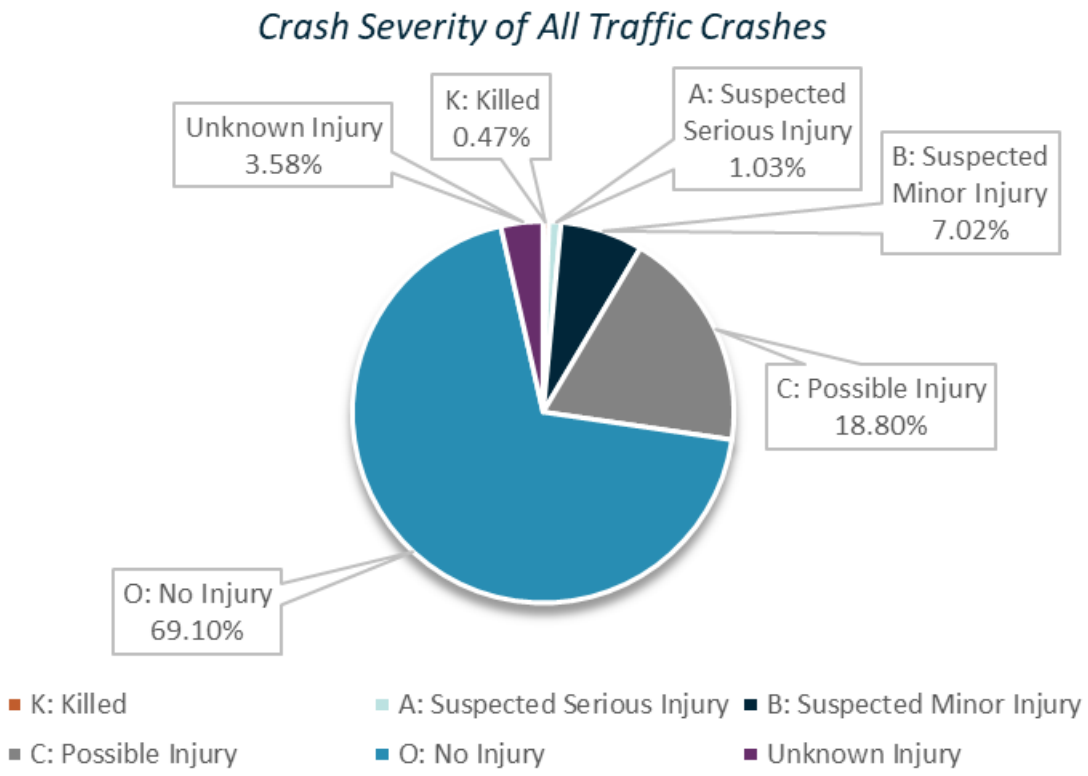


Source: North Carolina DMV 349 Crash Report Instruction Manual

Injury Classification: All Crashes

All traffic crashes compared with bicycle and pedestrian crashes (all injuries, 2012 – 2021)

- 16% of bicyclist and pedestrian crashes resulted in fatality (K) or serious injury (A).
- 1.5% of all vehicle crashes resulted in fatalities (K) and serious injury (A) for the same time period.
- Bicyclist and pedestrian crashes were 1% of all traffic crashes (all injuries).
- Bicyclists and pedestrians comprised more than 17% of all traffic fatalities (K) in the state.
- Bicyclists and pedestrians comprised 27% of all traffic fatalities (K) and serious injury (A) crashes.



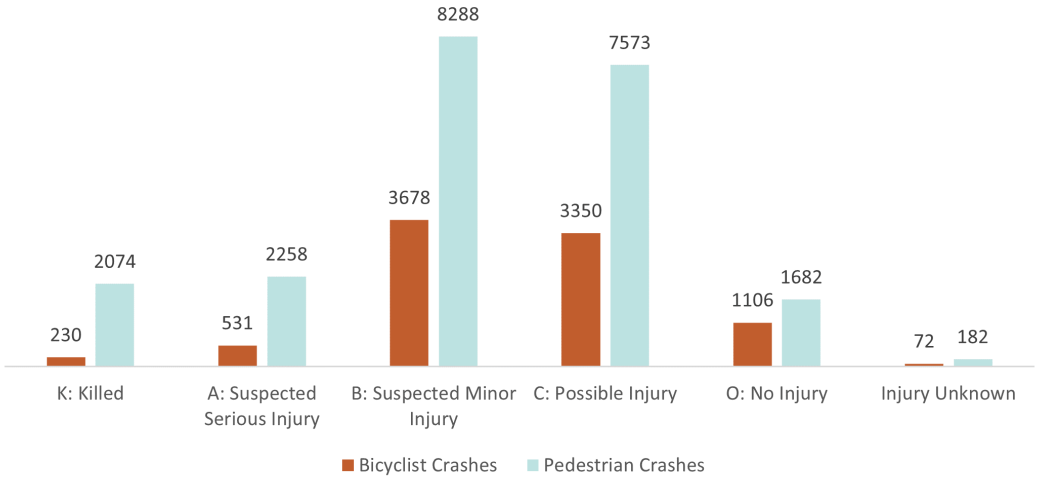
Source: North Carolina DMV 349 Crash Report Instruction Manual

Injury Classification Continued

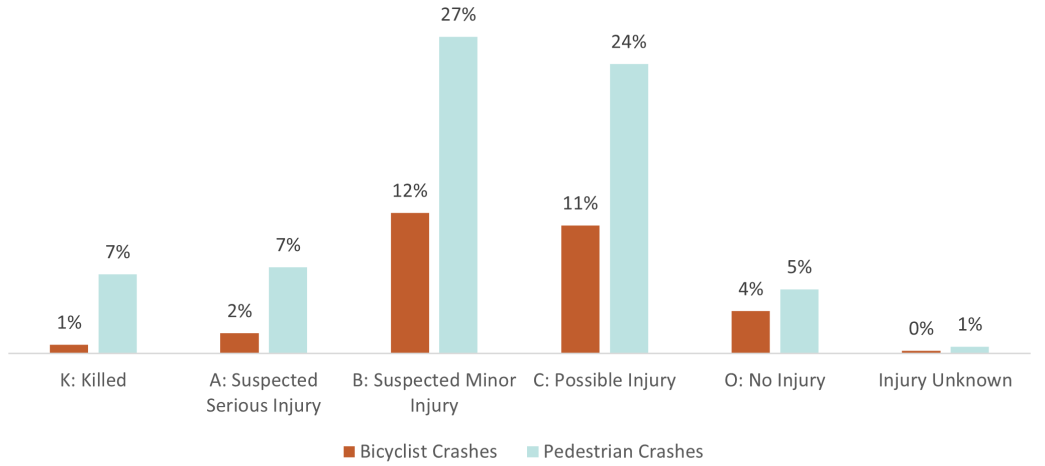
Bicycle and Pedestrian Crashes

- 4,332 pedestrians were killed (K) or seriously injured (A).
  - Pedestrian KA crashes represent 14% of all bicyclist and pedestrian crashes.
- 761 bicyclists were killed (K) or seriously injured (A).
  - Bicyclist KA crashes represent 3% of all bicyclist and pedestrian crashes.

Bicyclist and Pedestrian Crash Severity (Count)



Bicyclist and Pedestrian Crash Severity (Percentage)



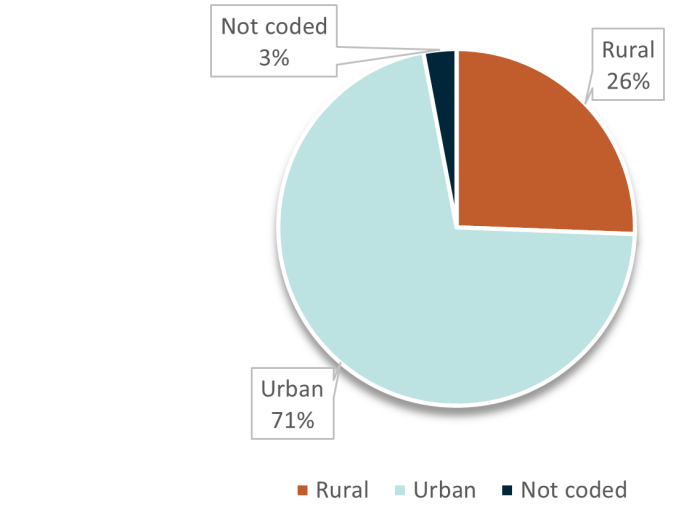
Context Characteristics

Urban vs. Rural Areas

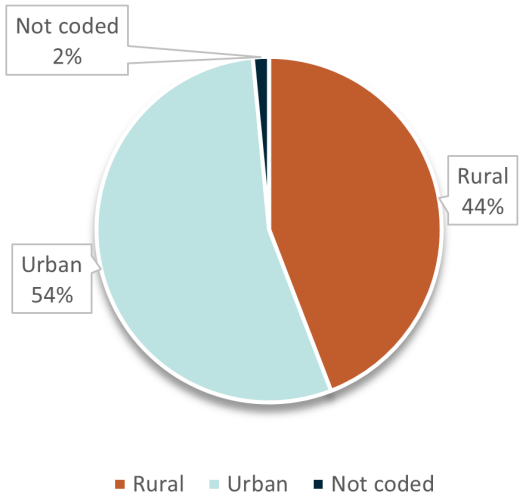
Crashes are classified as “urban” if the crash occurred within municipal boundaries.

- 71% of all bicycle and pedestrian crashes occurred in urban areas.
- 54% of KA crashes occurred in urban areas.

Urban vs. Rural for Bicyclist and Pedestrian Crashes (All Severities)



Urban vs. Rural for Bicyclist and Pedestrian Crashes (KA)



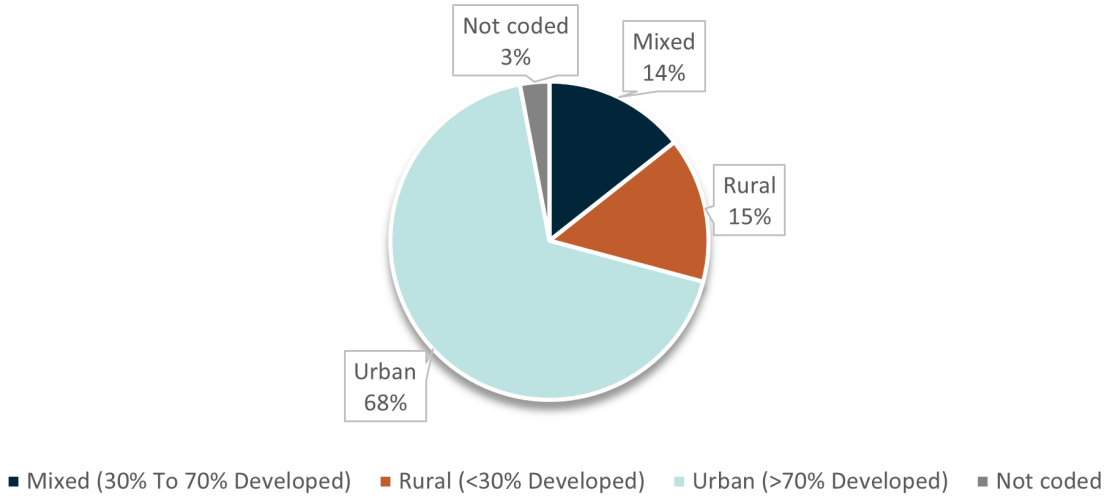
Development Level

Areas were classified according to their level of development based on the following criteria:

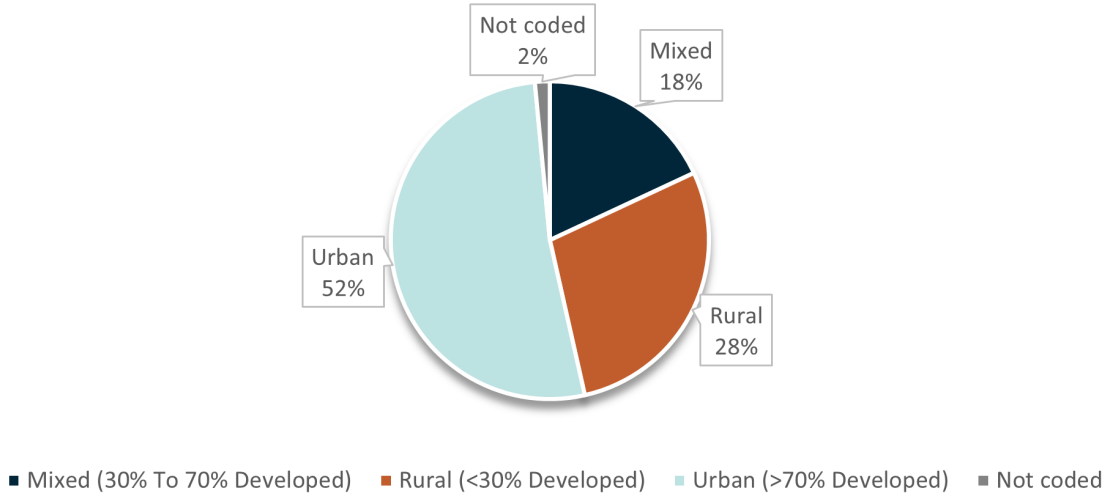
- Urban: More than 70% developed
- Mixed: Between 30% and 70% developed
- Rural: Less than 30% developed

- 68% of all bicyclist and pedestrian crashes occurred in urban areas.
- 52% of KA crashes occurred in urban areas.

Development Context for Bicyclist and Pedestrian Crashes (All Severities)



Development Context for Bicyclist and Pedestrian Crashes (KA)



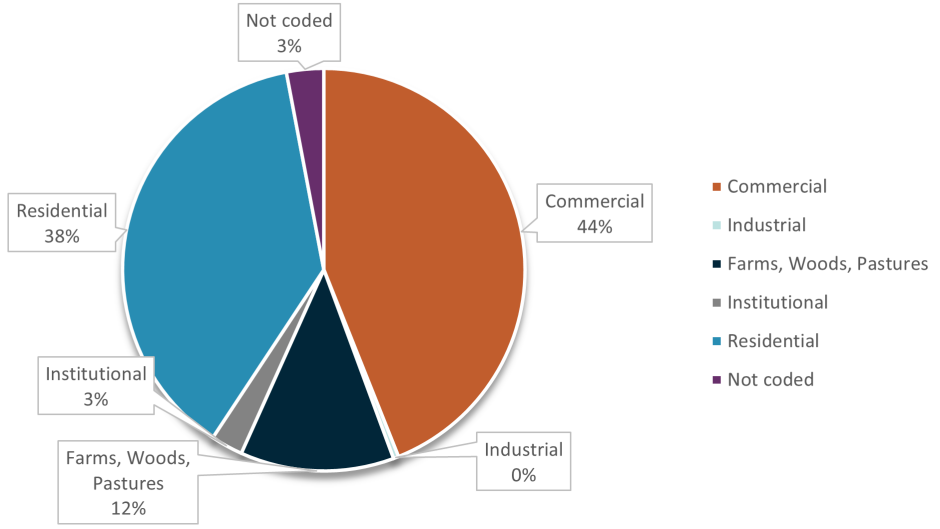
Land Use Context

Land use context, or the predominant type of development in the area in which the collision occurred, is divided into the following categories:

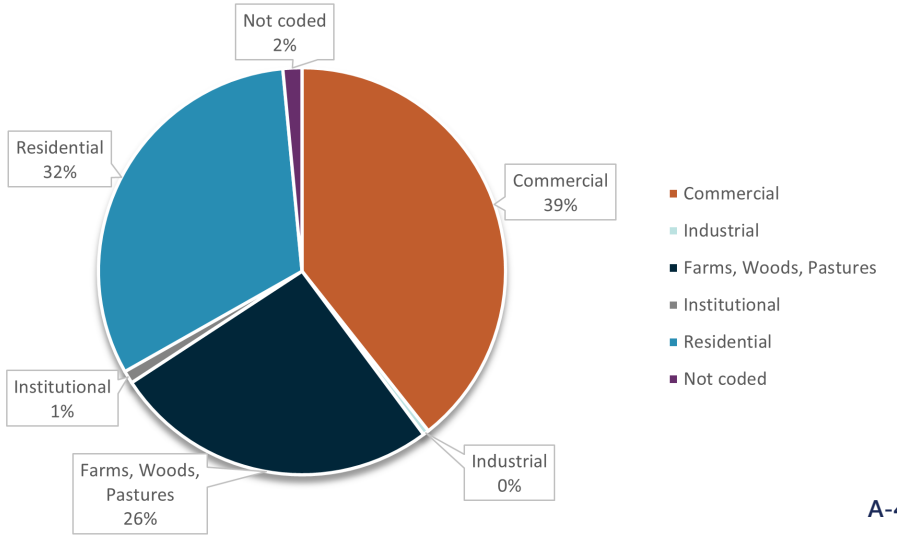
- Farms, woods, pastures
- Residential
- Commercial
- Institutional
- Industrial

- 38% of all bicyclist and pedestrian crashes occurred in residential areas, and 32% of KA crashes occurred in residential areas.
- 44% of all bicyclist and pedestrian crashes occurred in commercial areas, and 39% of KA crashes occurred in commercial areas.

Land Use Context for Bicyclist and Pedestrian Crashes (All Severities)



Land Use Context for Bicyclist and Pedestrian Crashes (KA)



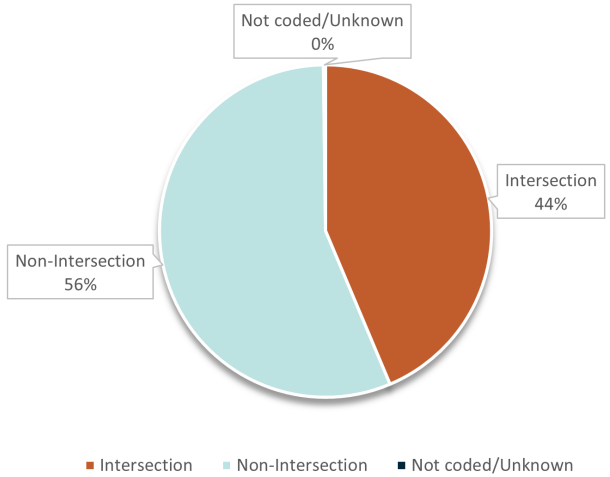
Intersection vs. Non-Intersection

Bicyclist and Pedestrian Crashes

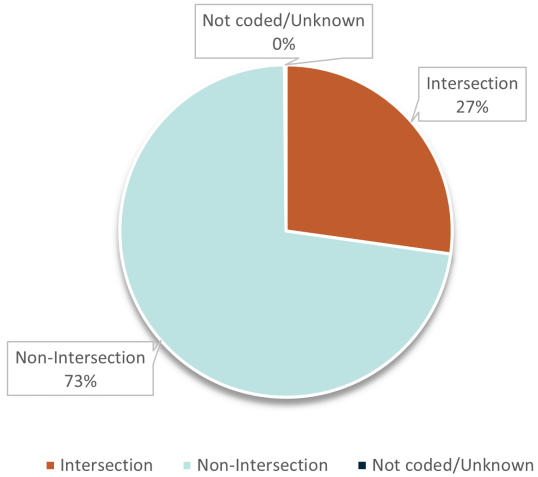
An intersection crash is defined as a crash that occurred at or related to an at-grade junction of two or more roads or within 50 feet of the edge line or curb of the crossing street.

- 44% of all bicyclist and pedestrian crashes occurred at an intersection.
- 27% of KA crashes occurred at an intersection.
- 73% of KA crashes occurred outside of an intersection.

Intersection vs. Non-Intersection Bicyclist and Pedestrian Crashes (All Severities)



Intersection vs. Non-Intersection Bicyclist and Pedestrian Crashes (KA)



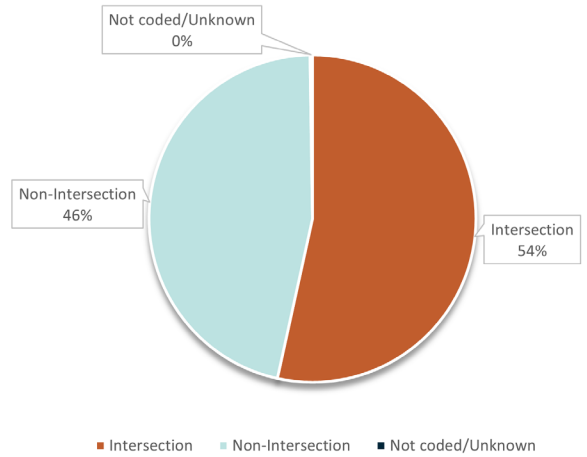
Intersection vs. Non-Intersection

Urban Bicyclist and Pedestrian Crashes

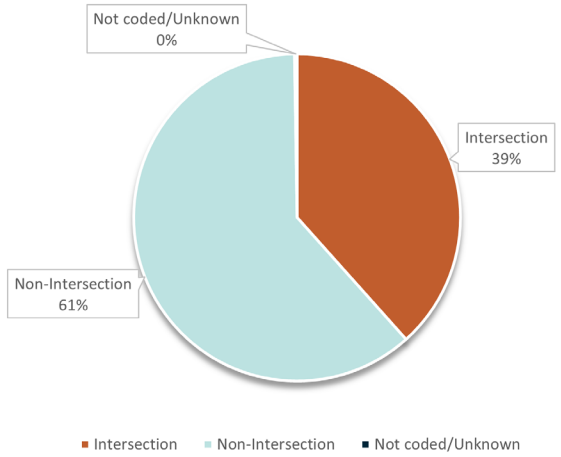
As previously stated, crashes are classified as "urban" if the crash occurred within municipal boundaries.

- 54% of all urban bicyclist and pedestrian crashes occurred at an intersection.
- 39% of urban KA crashes occurred at an intersection.
- 61% of urban KA crashes occurred outside of an intersection.

Intersection vs. Non-Intersection for Urban Bicyclist and Pedestrian Crashes (All Severities)



Intersection vs. Non-Intersection for Urban Bicyclist and Pedestrian Crashes (KA)



** The development context of 928 crashes was not coded/unknown (3% of all crashes).*

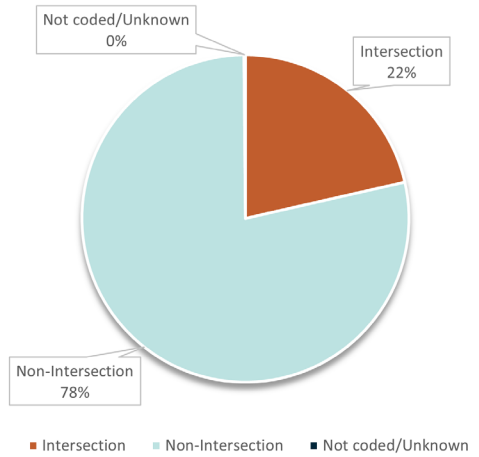
Intersection vs. Non-Intersection

Rural Bicyclist and Pedestrian Crashes

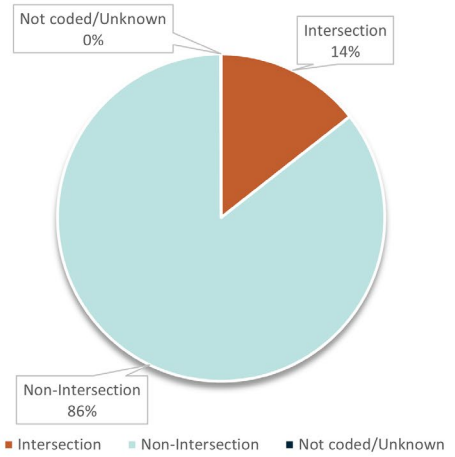
Crashes are classified as “rural” if the crash occurred outside of municipal boundaries.

- 78% of all rural bicyclist and pedestrian crashes occurred outside of an intersection.
- 86% of rural KA crashes occurred outside of an intersection.

Intersection vs. Non-Intersection for Rural Bicyclist and Pedestrian Crashes (All Severities)



Intersection vs. Non-Intersection for Rural Bicyclist and Pedestrian Crashes (KA)



** The development context of 928 crashes was not coded/unknown (3% of all crashes).*

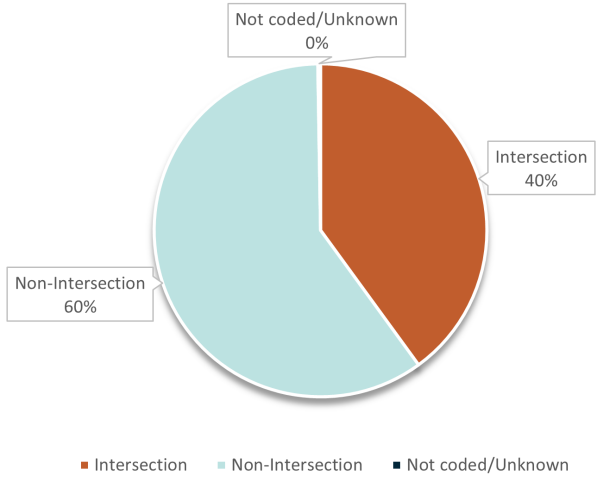
Intersection vs. Non-Intersection

Pedestrian Crashes

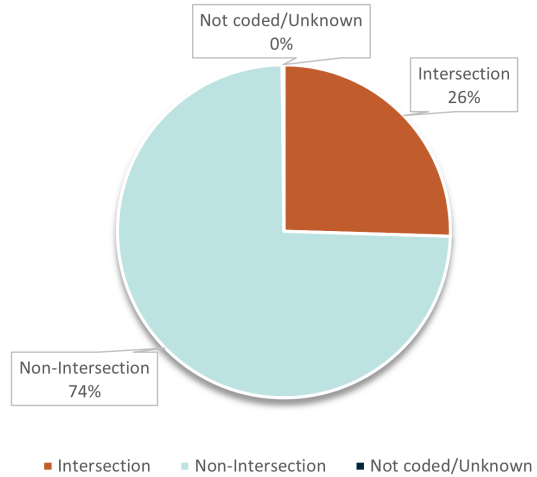
To better understand crash trends statewide, the percentage of crashes occurring at or outside of intersections are shown separately for pedestrians and bicyclists:

- 40% of all pedestrian crashes occurred at an intersection.
- 26% of KA pedestrian crashes occurred at an intersection.

Intersection vs. Non-Intersection Pedestrian Crashes (All Severities)



Intersection vs. Non-Intersection Pedestrian Crashes (KA)

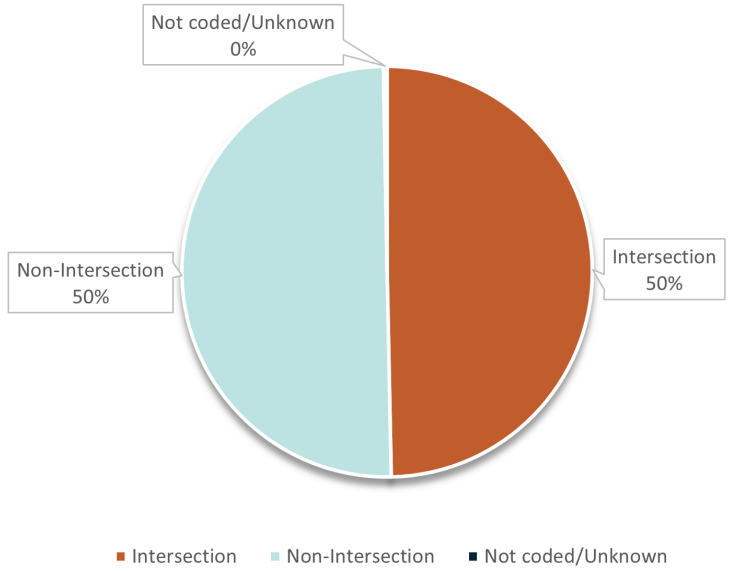


Intersection vs. Non-Intersection

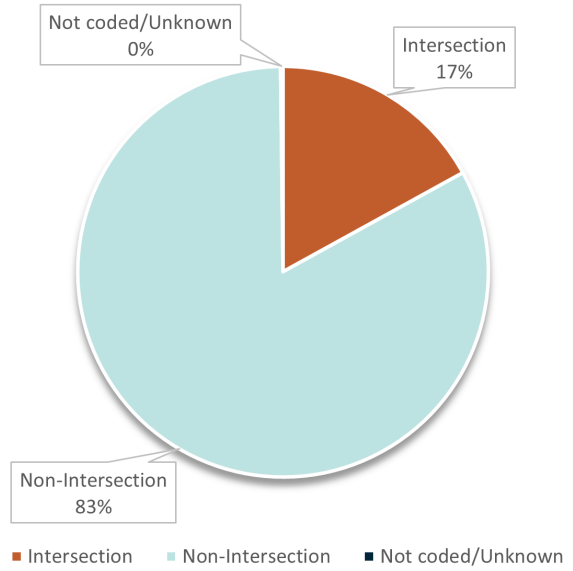
Urban and Rural Pedestrian Crashes

- 50% of all urban pedestrian crashes occurred at an intersection.
- 17% of all rural pedestrian crashes occurred at an intersection.
- 83% of all rural pedestrian crashes occurred outside of an intersection.

Intersection vs. Non-Intersection for Urban Pedestrian Crashes (All Severities)



Intersection vs. Non-Intersection for Rural Pedestrian Crashes (All Severities)



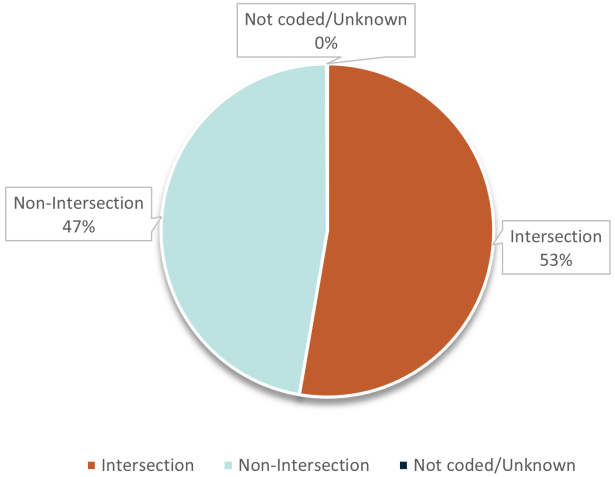
Intersection vs. Non-Intersection

Bicyclist Crashes

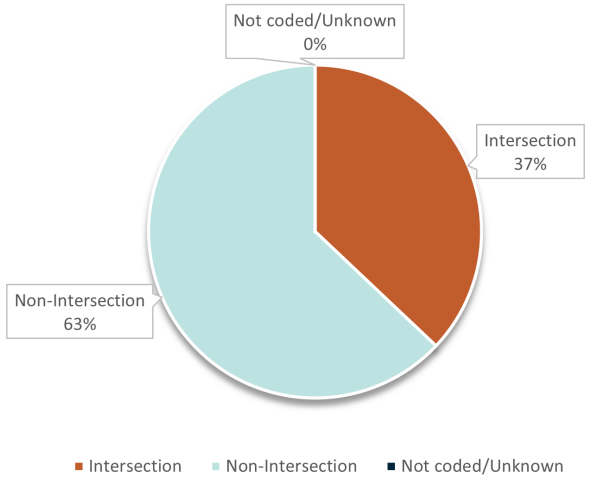
To better understand crash trends statewide, the percentage of crashes occurring at or outside of intersections are shown separately for pedestrians and bicyclists:

- 53% of all bicyclist crashes occurred at an intersection.
- 37% of KA bicyclist crashes occurred outside of an intersection.

Intersection vs. Non-Intersection Bicyclist Crashes (All Severities)



Intersection vs. Non-Intersection Bicyclist Crashes (KA)

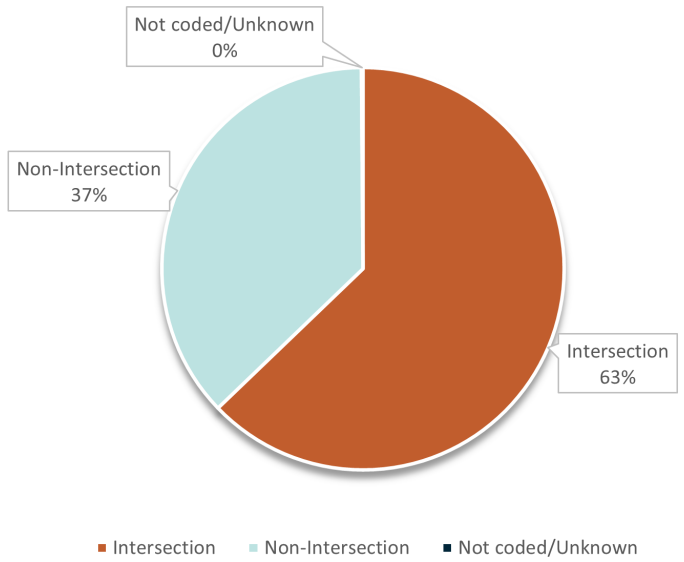


Intersection vs. Non-Intersection

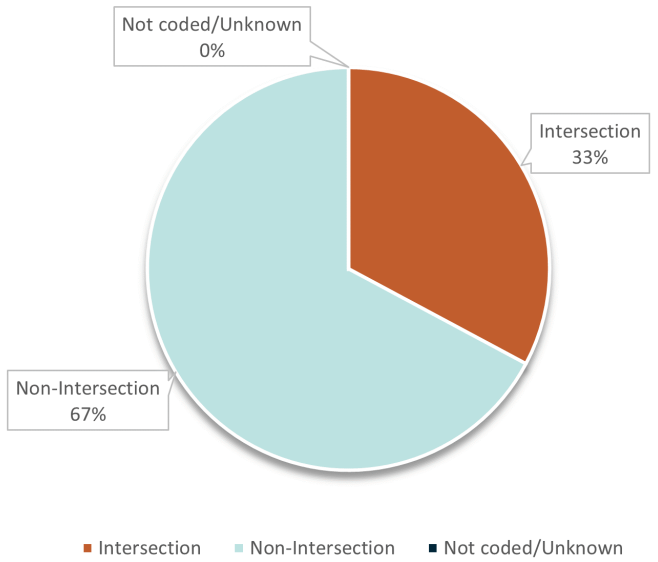
Urban and Rural Bicyclist Crashes

- 63% of all urban pedestrian crashes occurred at an intersection.
- 33% of all rural pedestrian crashes occurred at an intersection.
- 67% of all rural pedestrian crashes occurred outside of an intersection.

Intersection vs. Non-Intersection for Urban Bicyclist Crashes (All Severities)



Intersection vs. Non-Intersection for Rural Bicyclist Crashes (All Severities)



Roadway Characteristics & Speed

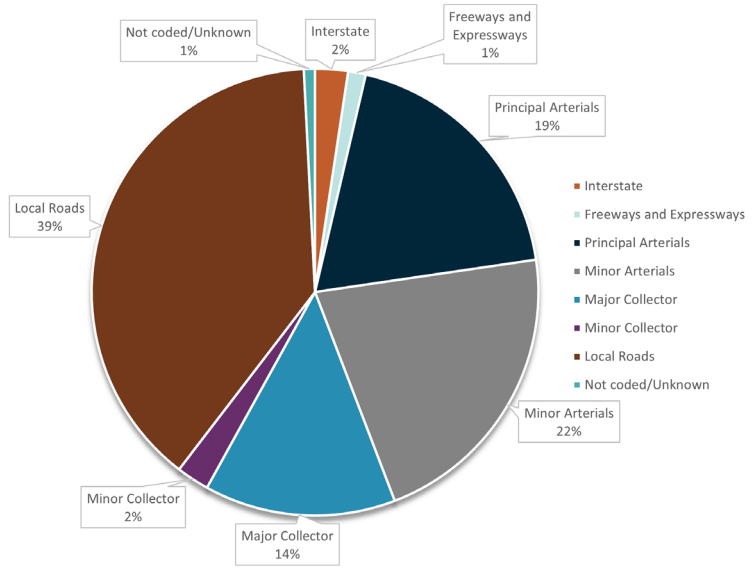
Functional Classification

Roads were categorized into 7 classes based off the functional classification system.

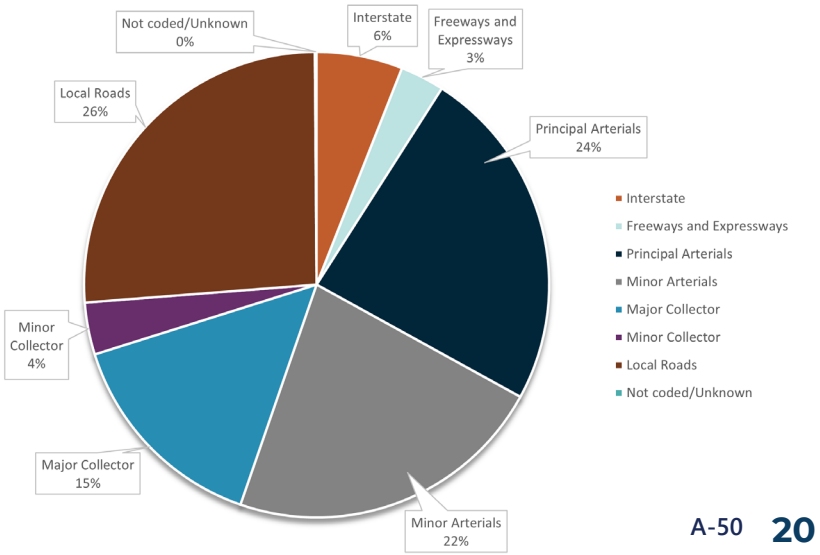
- Class 1: Interstate
- Class 2: Other Freeways and Expressways
- Class 3: Other Principal Arterial
- Class 4: Minor Arterial
- Class 5: Major Collector
- Class 6: Minor Collector
- Class 7: Local

- 39% of all bicyclist and pedestrian crashes occurred on a local road.
- 26% of KA crashes occurred on a local road.
- 22% of all bicyclist and pedestrian crashes occurred on a minor arterial road.
- 22% of KA crashes occurred on a minor arterial road.

Functional Classification for Bicyclist and Pedestrian Crashes (All Severities)



Functional Classification for Bicyclist and Pedestrian Crashes (KA)



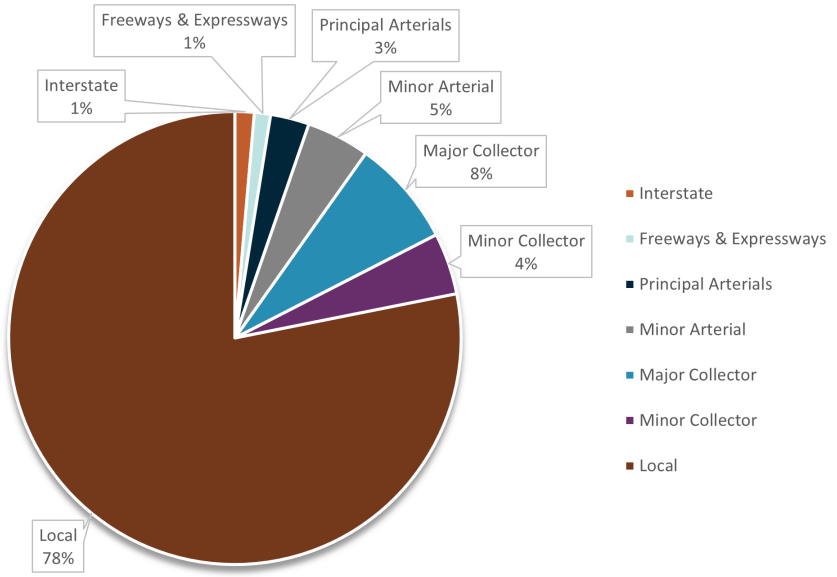
Functional Classification

Comparing the percent of crashes occurring on roads with different functional classifications to the total road mileage with the same classification in the region can give us an idea of the types of roads that present a higher crash risk for bicyclists and pedestrians.

In North Carolina, crashes are more likely to occur on roads with higher functional classifications, which typically have higher speeds, higher traffic volumes, and more travel lanes.

- 8% of all road miles are principal or minor arterials but 41% of all bicyclist and pedestrian crashes and 46% of KA crashes occur on arterials.
- 78% of all road miles are local roads but 39% of all bicyclist and pedestrian crashes and 26% of KA crashes occur on local roads.

Percent Road Mileage by Functional Classification

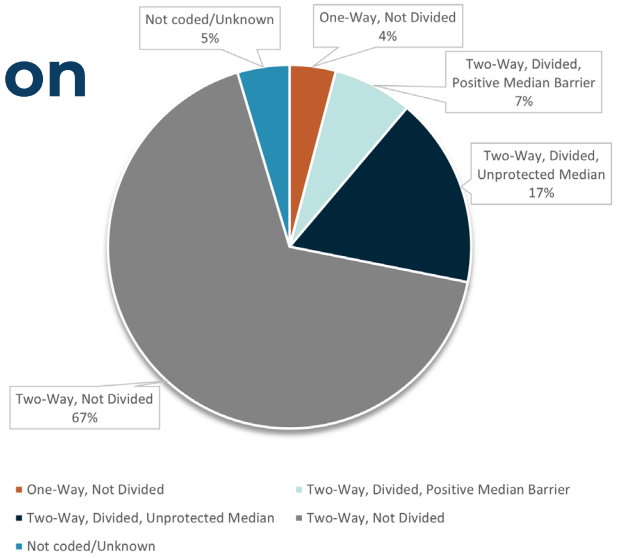


Presence of Median – Roadway Configuration

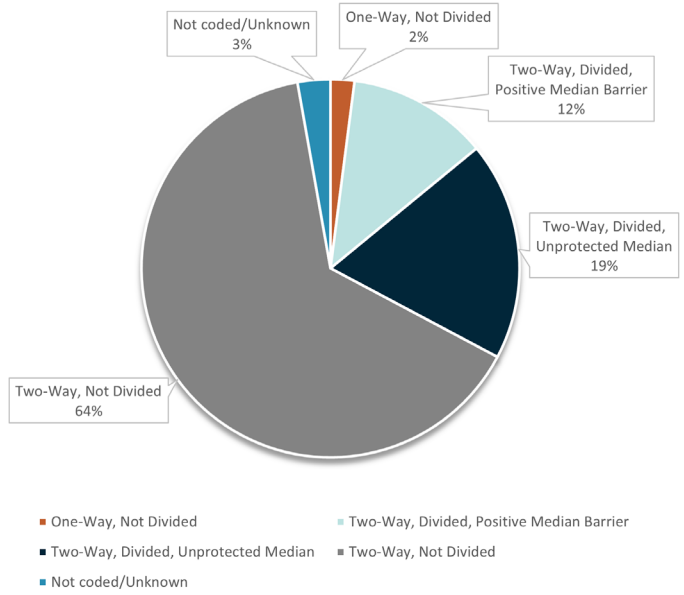
Road configuration indicates if and where a roadway is divided. It also identifies if the roadway serves one or two-way traffic. For a roadway to be classified as divided, a median must be present.

- 67% of all bicyclist and pedestrian crashes occurred on two-way roads without road division.
- 64% of KA crashes occurred on two-way roads without road division.
- 17% of all bicyclist and pedestrian crashes occurred on two-way roads divided by an unprotected median.
- 19% of all KA crashes occurred on two-way roads divided by an unprotected median.

Roadway Configuration for Bicyclist and Pedestrian Crashes (All Severities)



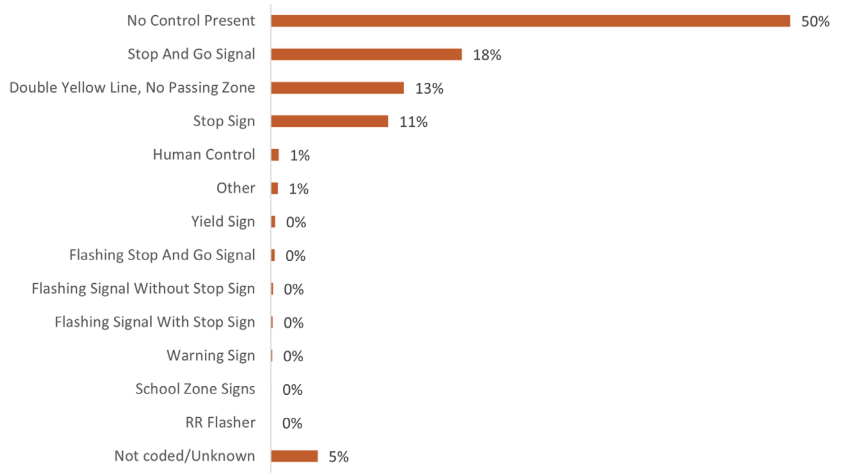
Roadway Configuration for Bicyclist and Pedestrian Crashes (KA)



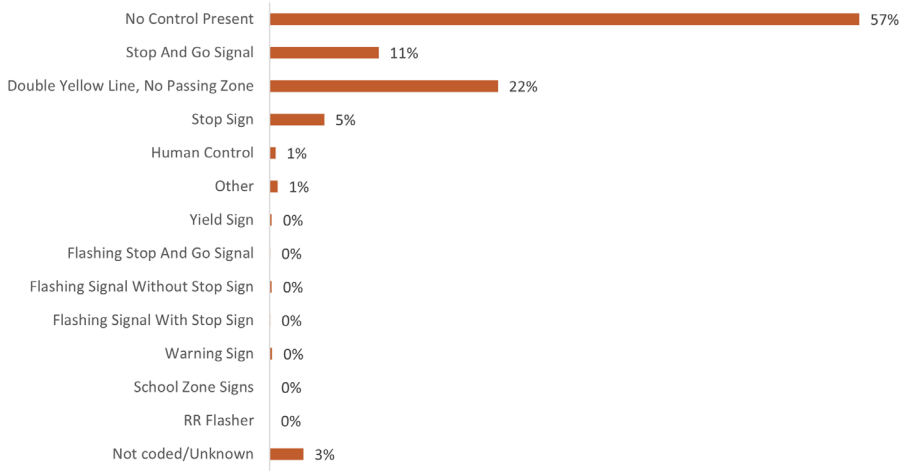
Presence of a Traffic Control Device

- 50% of all bicyclist and pedestrian crashes occurred on roads where no traffic control was present.
- 57% of KA crashes occurred on roads where no traffic control was present.
- 18% of all bicyclist and pedestrian crashes occurred where there was a stop and go signal (traffic signal).
- 22% of KA crashes occurred where there was a double yellow line and no passing zone.

Traffic Controls for Bicyclist and Pedestrian Crashes (All Severities)



Traffic Controls for Bicyclist and Pedestrian Crashes (KA)



Number of Travel Lanes

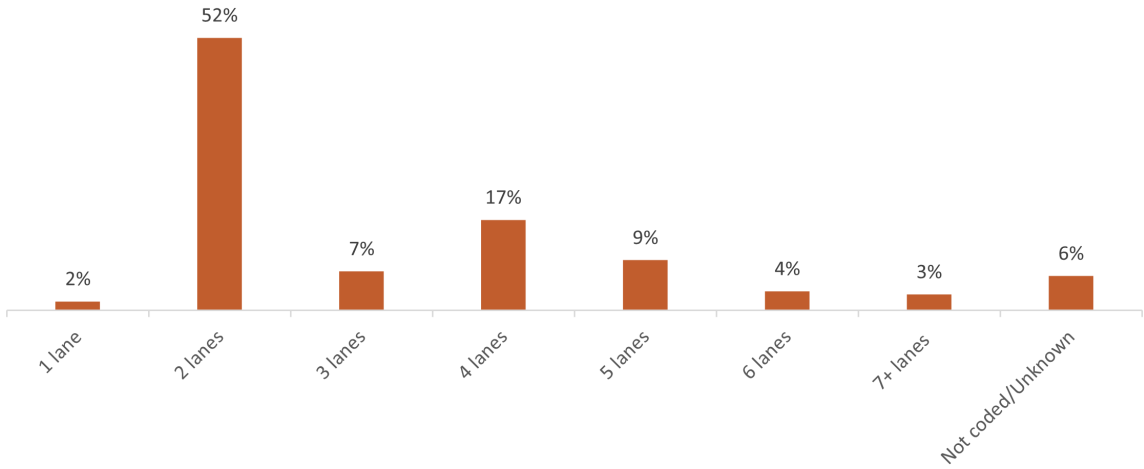
- 52% of all bicyclist and pedestrian crashes occurred on roads with 2 lanes.
- 47% of KA crashes occurred on roads with 2 lanes.
- 24% of all crashes occurred on roads with 3-4 lanes.
- 26% of KA crashes occurred on roads with 3-4 lanes.
- 16% of all bicyclist and pedestrian crashes occurred on roads with 5 or more lanes.
- 21% of all KA crashes occurred on roads with 5 or more lanes.

Travel Lane Miles – All System Roads (Centerline)

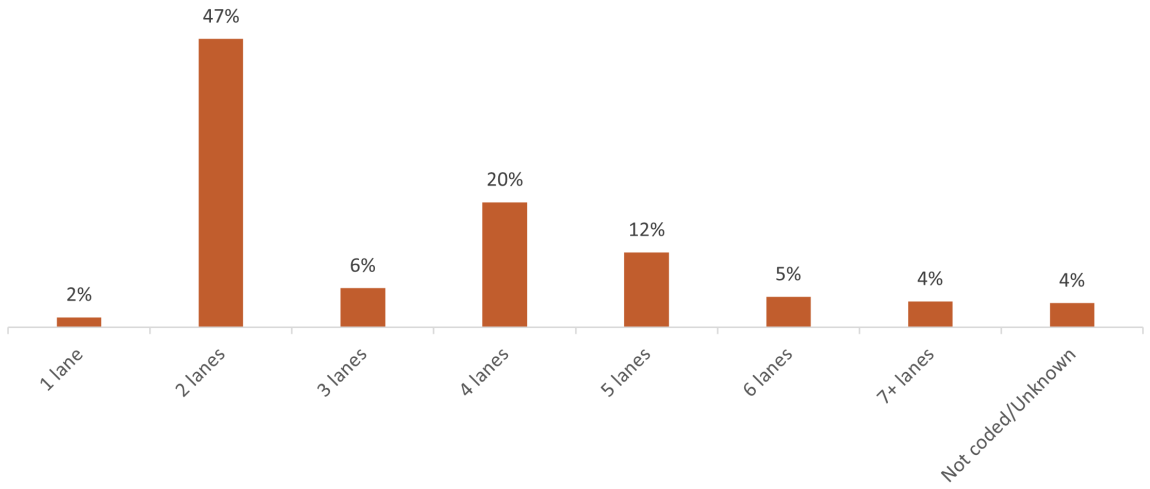
	1 - 2 Lanes	3 - 4 Lanes	5+ Lanes	Unknown*
All System Miles	71%	3.5%	0.5%	25%

*Unknown may reflect local (non-NCDOT) system roads without known attributes.

Number of Travel Lanes for Bicyclist and Pedestrian Crashes (All Severities)



Number of Travel Lanes for Bicyclist and Pedestrian Crashes (KA)



Posted Speed Limit

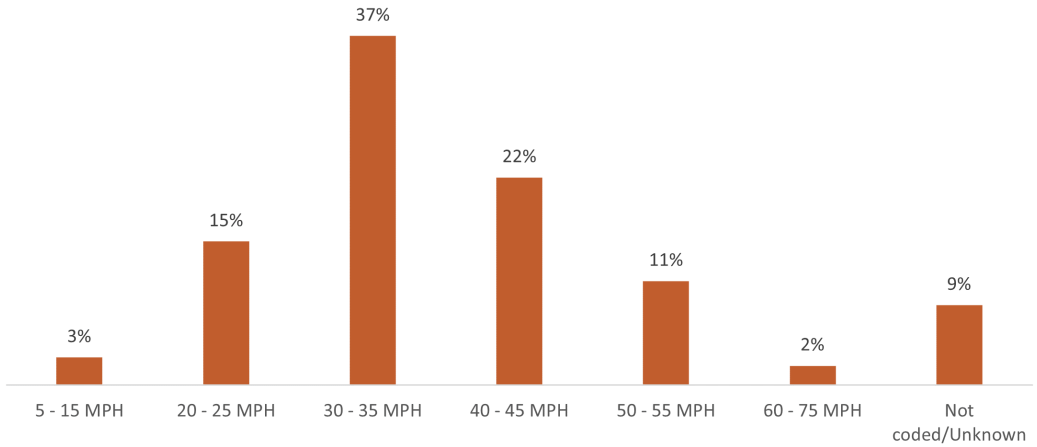
- 37% of all bicyclist and pedestrian crashes occurred where the posted speed limit was between 30 and 35 mph.
- 26% of KA crashes occurred where the posted speed limit was between 30 and 35 mph.
- 22% of all bicyclist and pedestrian crashes occurred where the posted speed limit was 40 or 45 mph.
- 30% of KA crashes occurred where the posted speed limit was 40 or 45 mph.
- 25% of KA crashes occurred where the posted speed limit was 50 or 55 mph.

Speed Limits – All System Roads

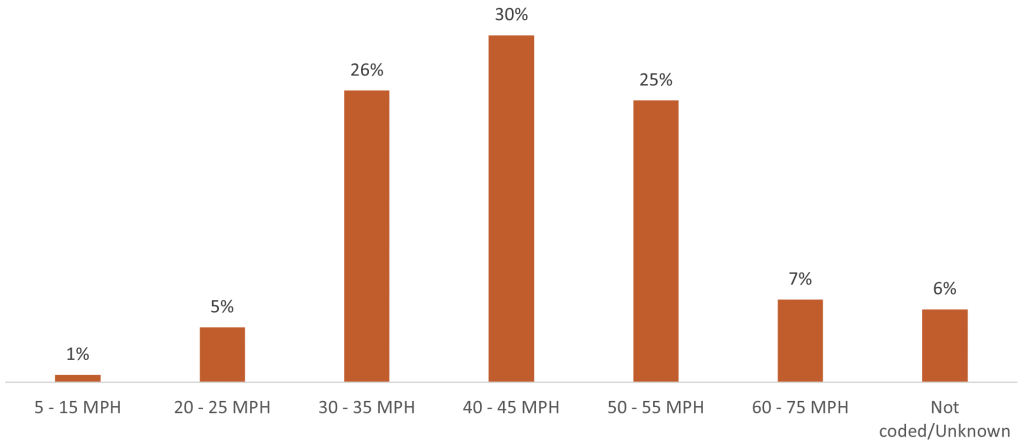
	< 30 mph	30 – 35 mph	40 - 45 mph	50 – 55 mph	60+ mph	Unknown*
Speed Limit	5%	12%	14%	64%	3%	2%

*Unknown may reflect local (non-NCDOT) system roads without known attributes.

Speed Limit for Bicyclist and Pedestrian Crashes (All Severities)



Speed Limit for Bicyclist and Pedestrian Crashes (KA)



Demographic Characteristics

Demographics

This section contains three types of demographic breakdown for North Carolina.

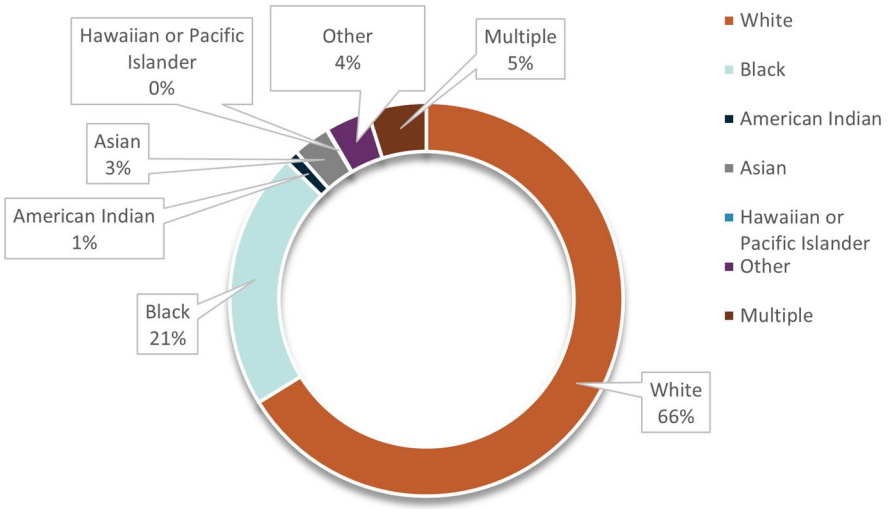
1. Demographic breakdowns for the entire state based on the US Census 5-Year American Community Survey (ACS), 2017-2021 for:
    - Race
    - Ethnicity
    - Sex
    - Age
    - Limited English speaking households
    - Poverty
    - Vehicle availability
2. Demographics of bicyclists and pedestrians involved in crashes as reported on the DMV-349 Crash Report.
3. A comparison of the demographics of the Census block groups where crashes occurred to demographics for the state to identify disparities in communities where crashes occur.

Race and Ethnicity

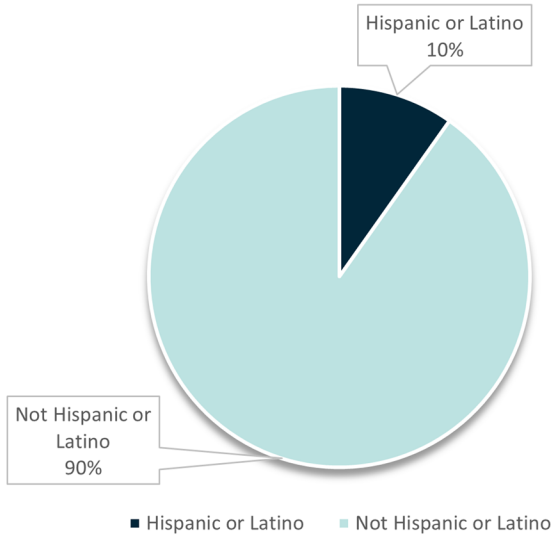
NC Demographics

- 21% of the population is Black and 66% of the population is White.
- 34% of the population is non-White.
- 10% of the population is Hispanic or Latino.

State Demographics: Race



State Demographics: Ethnicity

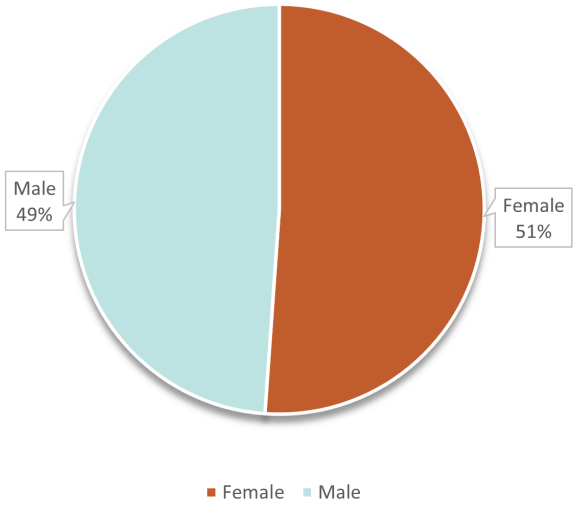


Sex

NC Demographics

- 51% of the population is female.
- 49% of the population is male.

State Demographics: Sex

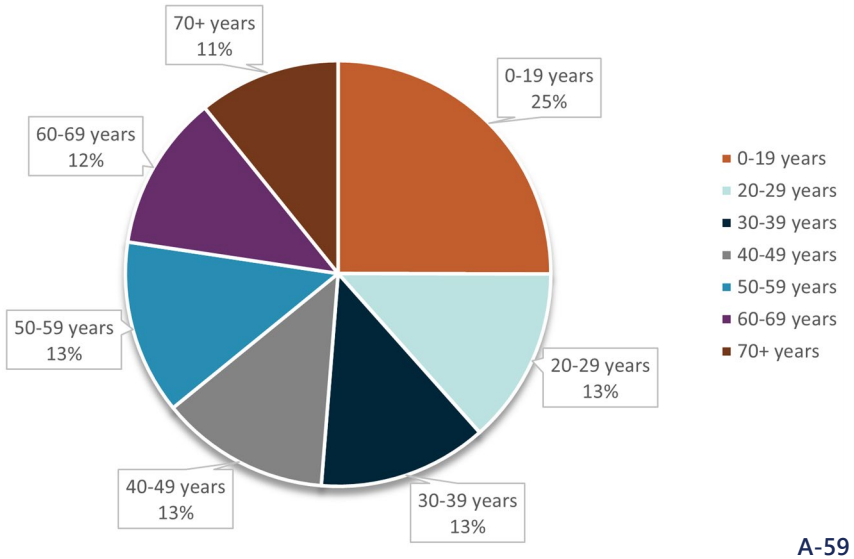


Age

NC Demographics

- 25% of the population is under the age of 20.
- 23% of the population is over the age of 60.

State Demographics: Age



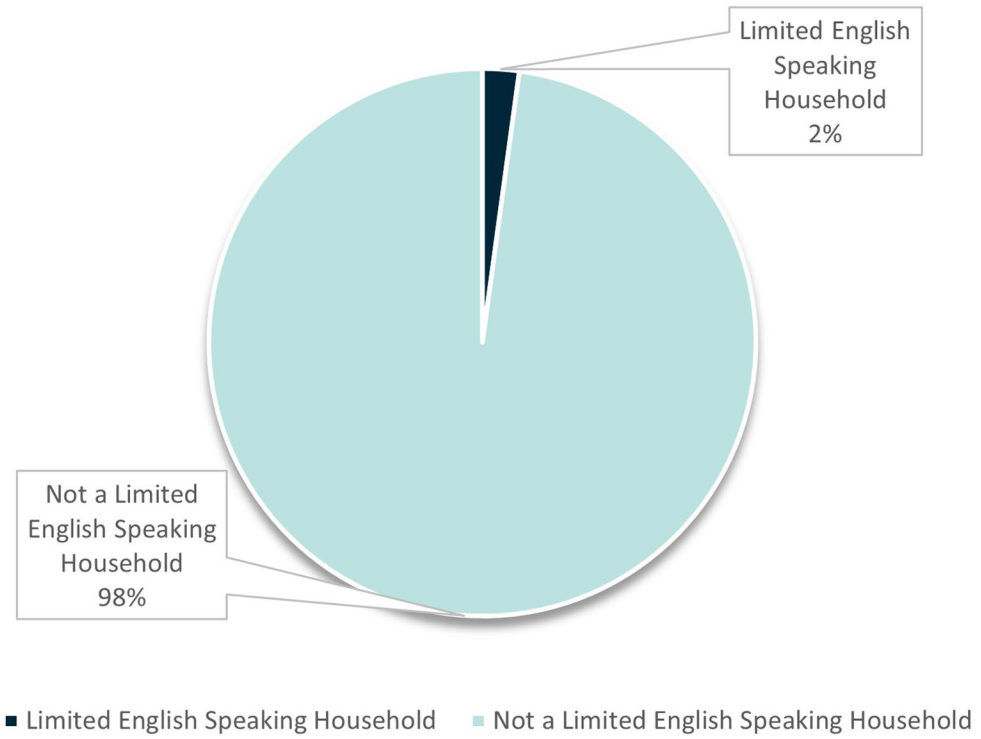
Language

NC Demographics

Limited English speaking households are those with household members over the age of five that speak English less than very well.

- 2% of households are limited English speaking.

State Demographics:
Limited English Speaking Households

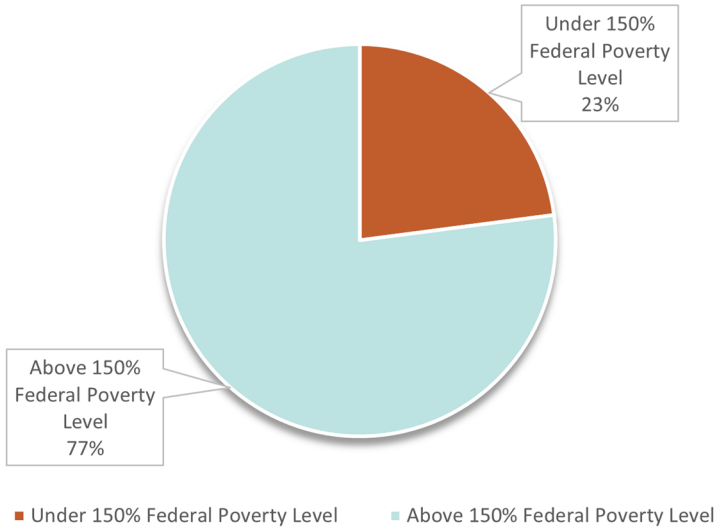


Poverty

NC Demographics

- 23% of households in the are under 150% of the Federal poverty level.

State Demographics: Poverty Status

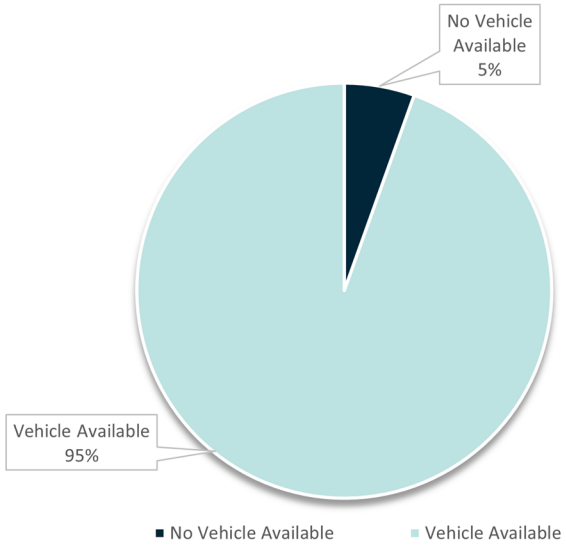


Vehicle Ownership

NC Demographics

- 5% of households in the have no vehicle available for use.

State Demographics: Vehicle Available

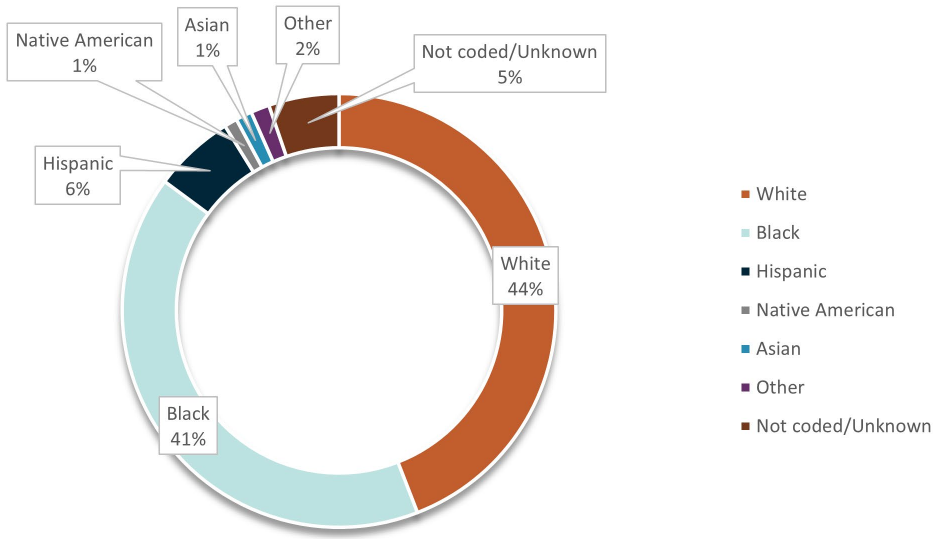


Race & Ethnicity

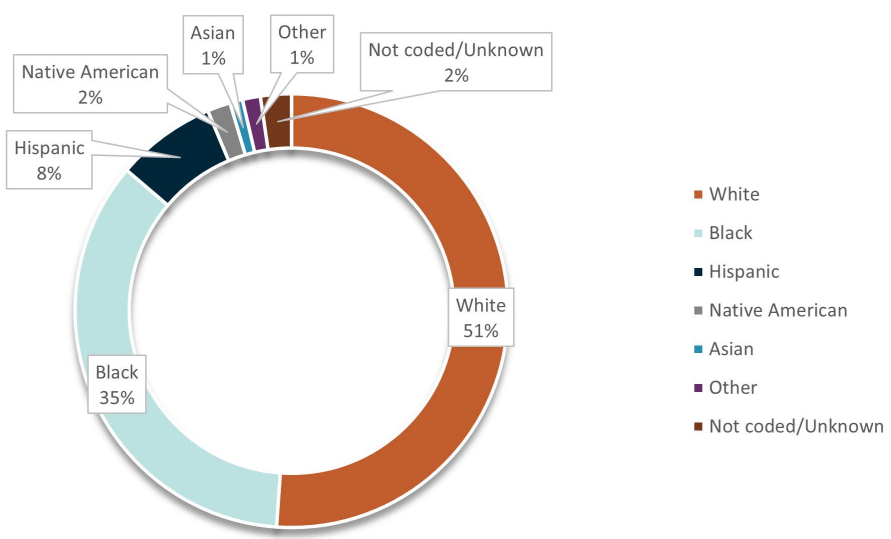
Pedestrians

- 44% of all pedestrian crashes involved a White pedestrian.
- 41% of all pedestrian crashes involved a Black pedestrian
- 51% of KA pedestrian crashes involved a White pedestrian.
- 35% of KA pedestrian crashes involved a Black pedestrian.

Race or Ethnicity of Pedestrian in Pedestrian Crashes (All Severities)



Race or Ethnicity of Pedestrian in Pedestrian Crashes (KA)

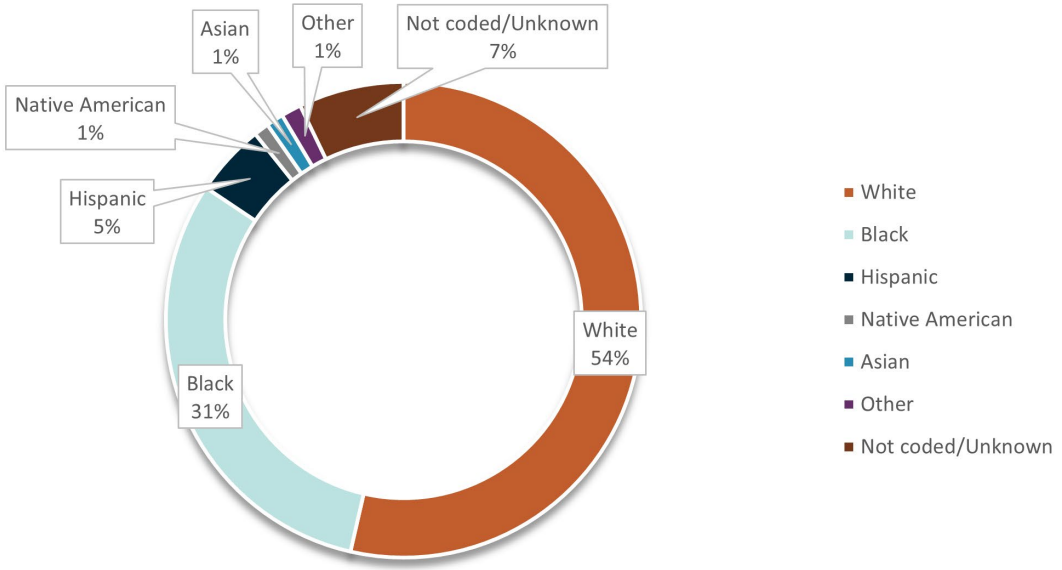


Race & Ethnicity

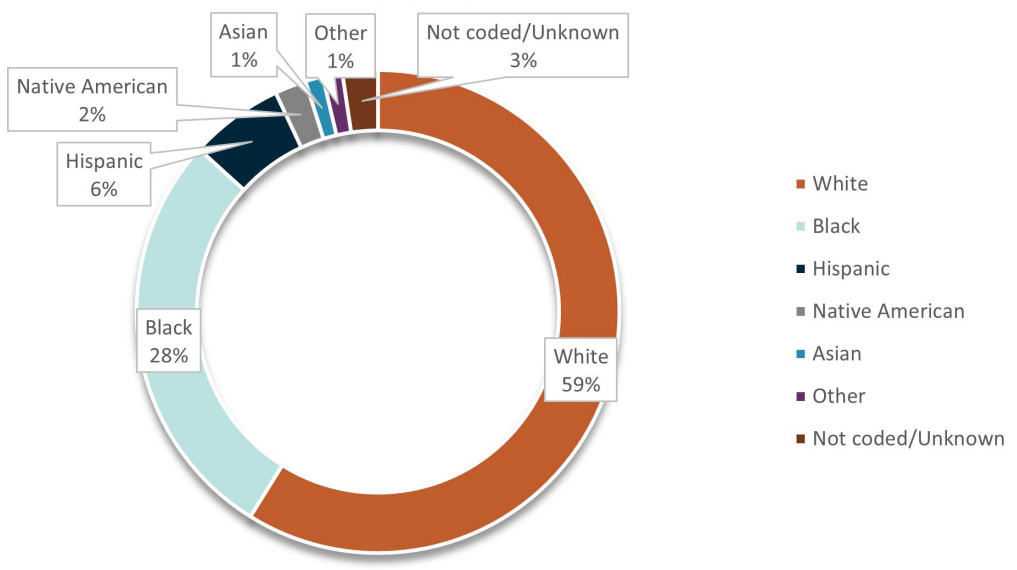
Bicyclists

- 54% of all bicyclist crashes involved a White bicyclist.
- 31% of all bicyclist involved a Black bicyclist.
- 59% of KA bicyclist crashes involved a White bicyclist.
- 28% of KA bicyclist crashes involved a Black bicyclist.

Race or Ethnicity of Bicyclist in Bicyclist Crashes (All Severities)



Race or Ethnicity of Bicyclist in Bicyclist Crashes (KA)

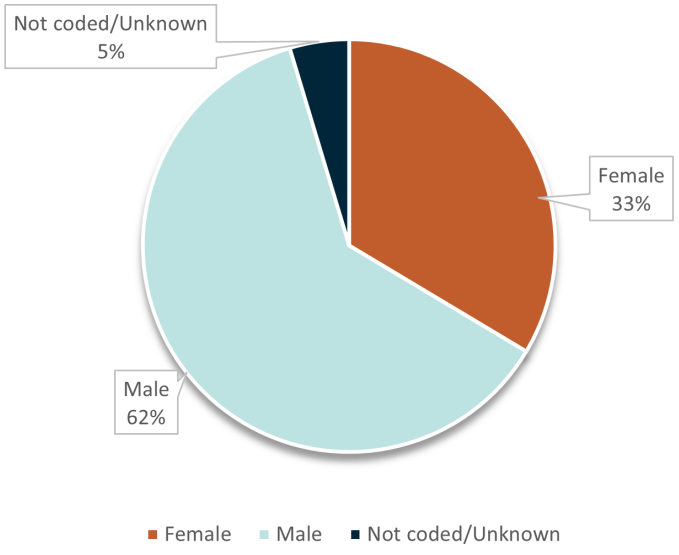


Sex

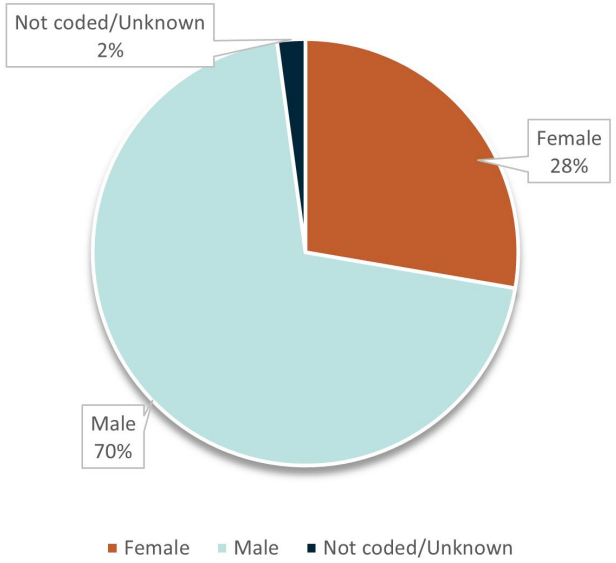
Pedestrians

- 62% of all pedestrian crashes involved a male pedestrian.
- 70% of KA pedestrian crashes involved a male pedestrian.

Sex of Pedestrian in Pedestrian Crashes (All Severities)



Sex of Pedestrian in Pedestrian Crashes (KA)

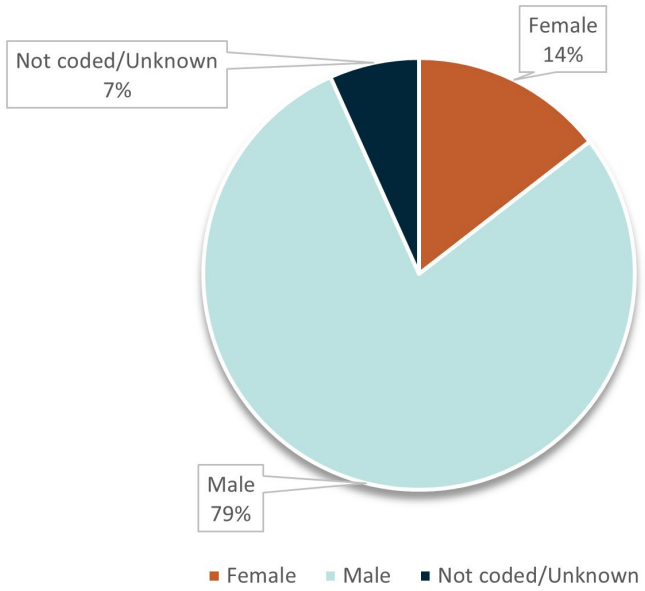


Sex

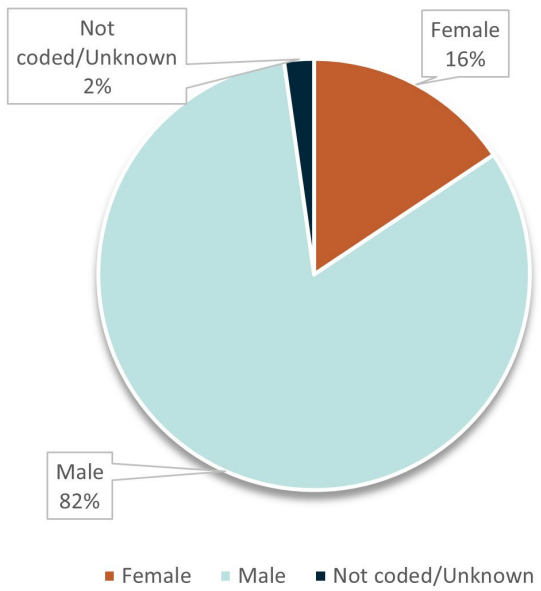
Bicyclists

- 79% of all bicyclist crashes involved a male bicyclist.
- 82% of KA bicyclist crashes involved a male bicyclist.

Sex of Bicyclist in Bicyclist Crashes (All Severities)



Sex of Bicyclist in Bicyclist Crashes (KA)

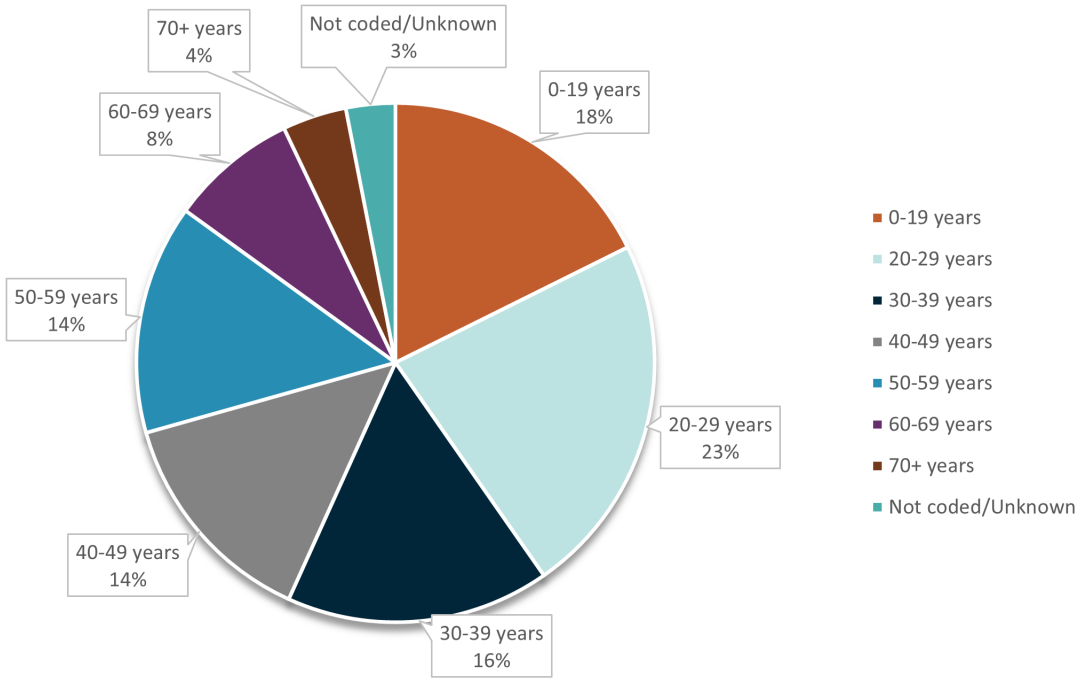


Age

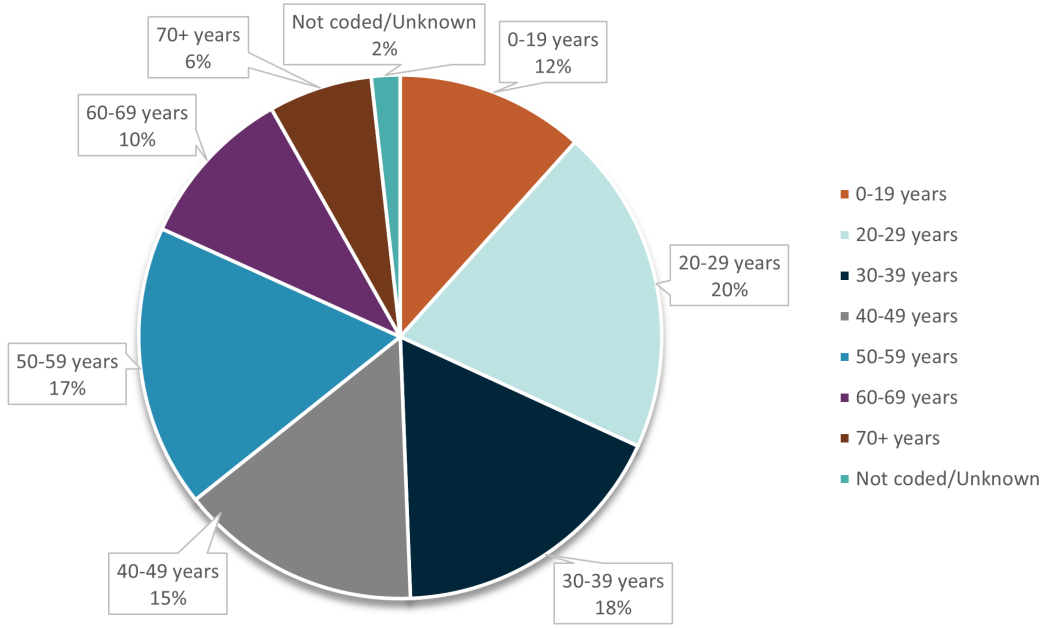
Pedestrians

- 23% of pedestrians involved in pedestrian crashes were between 20 and 29 years old, and 18% were between 0 and 19 years old.
- 20% of pedestrians in KA pedestrian crashes were between ages 20 and 29.

Age of Pedestrian in Pedestrian Crashes (All Severities)



Age of Pedestrian in Pedestrian Crashes (KA)

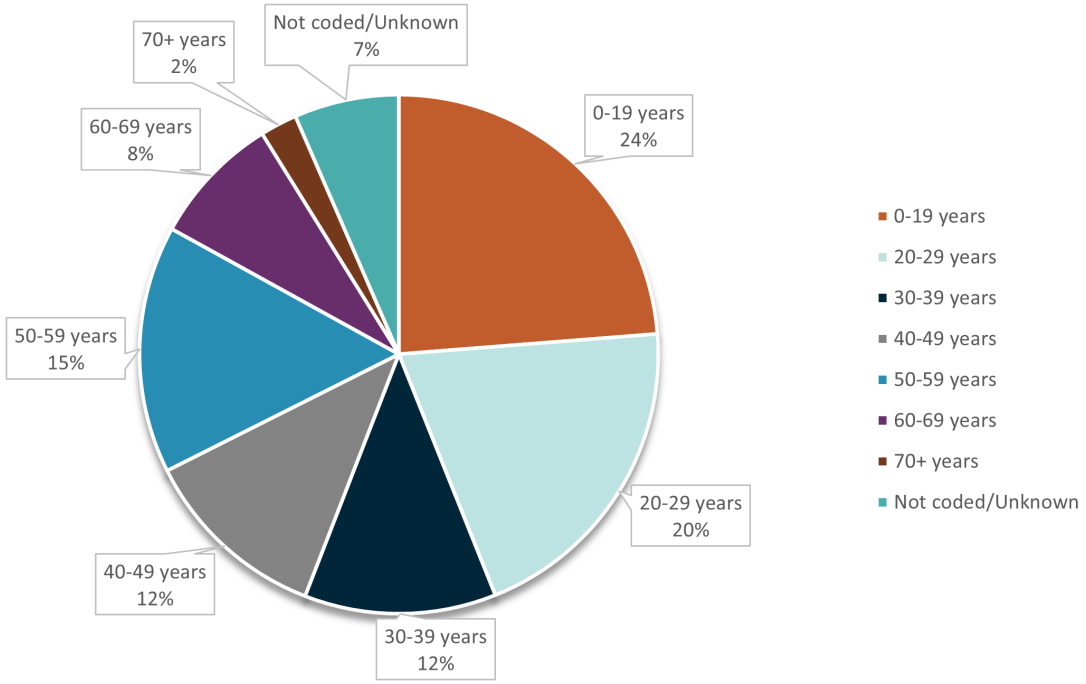


Age

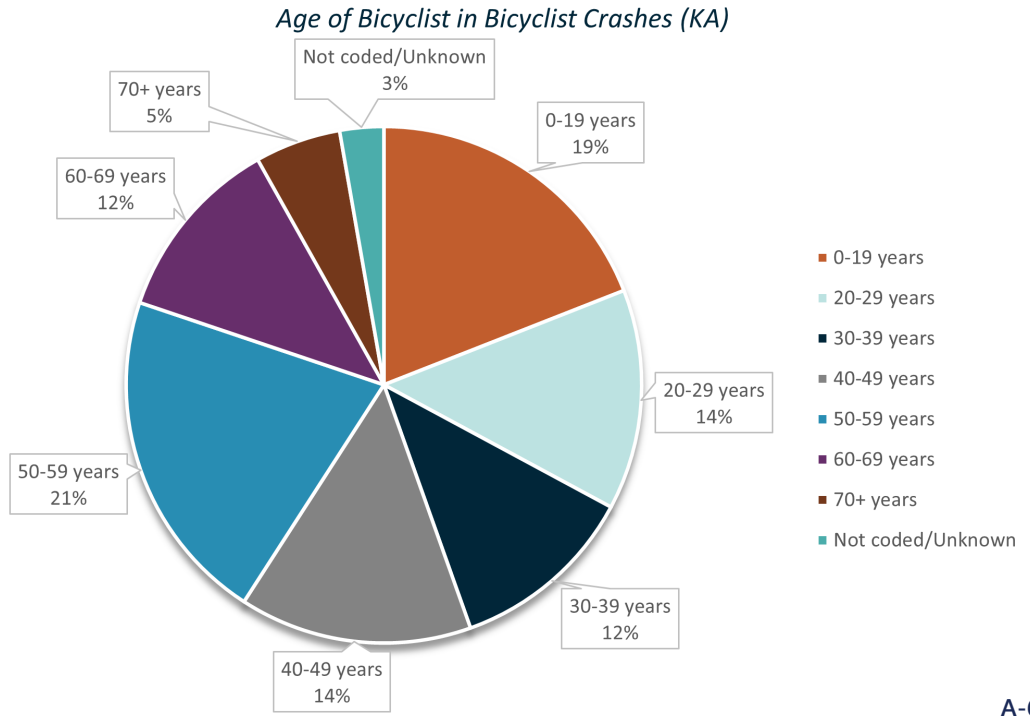
Bicyclists

- 24% of bicyclists involved in a bicyclist crash were between the ages of 0 and 19.
- 21% of bicyclists involved in a KA bicyclist crash were between the ages of 50 and 59.

Age of Bicyclist in Bicyclist Crashes (All Severities)



Age of Bicyclist in Bicyclist Crashes (KA)



Overrepresentation by Census Block Group

The demographics of the locations (i.e., Census block groups) where bicyclist and pedestrian crashes occurred in the state were compared to the demographics of the state as a whole to identify disparities in communities where crashes have taken place in the last ten years.

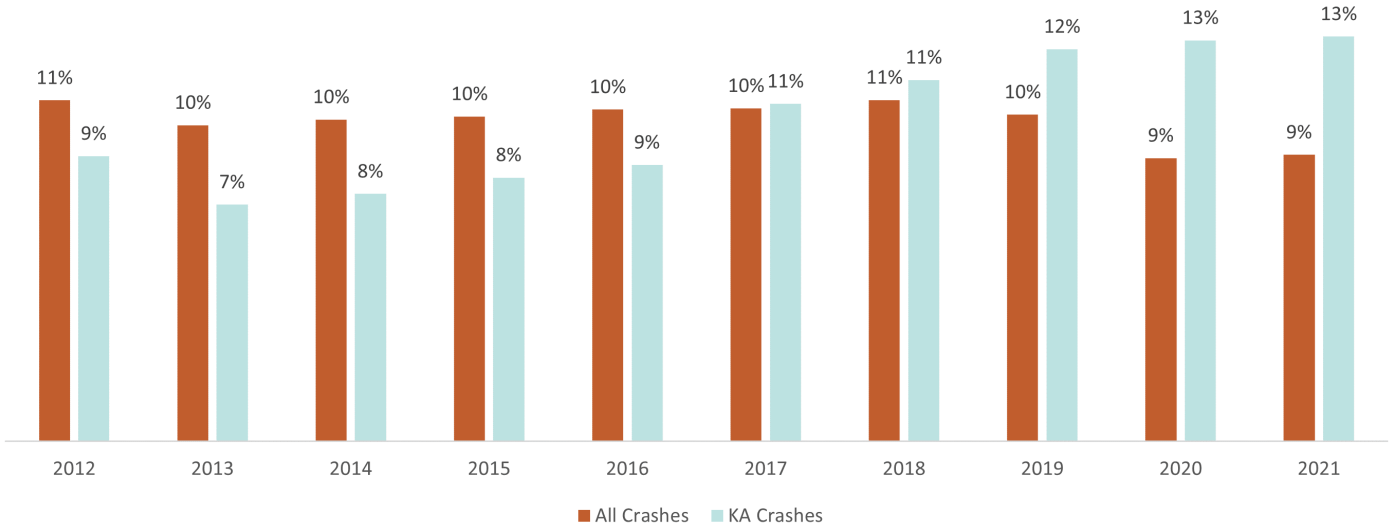
- 54% of all bicyclist and pedestrian crashes and 52% of KA crashes occurred in census block groups where the Black population is greater than the state average.
- 60% of all bicycle and pedestrian crashes and 57% of KA crashes occurred in census block groups where the non-White population is greater than the state average.
- 51% of KA crashes occurred in census block groups where population under 20 years old is greater than the state average.
- 66% of all bicyclist and pedestrian crashes and 66% of KA crashes occurred in census block groups where the percent of households under 150% of the Federal poverty level is greater than the state average.
- 51% of all bicyclist and pedestrian crashes occurred in census block groups where the percent of households no vehicle available is greater than the state average.

Time & Weather

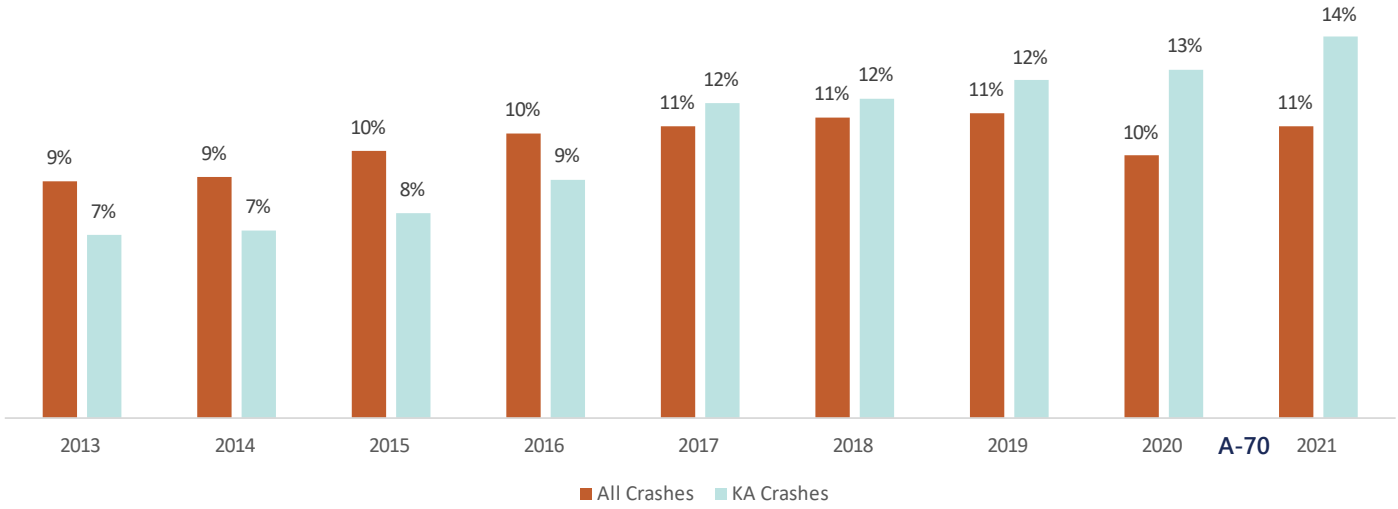
Year

- The highest percentage of bicycle and pedestrian crashes (all injuries) occurred in 2012 and 2018.
- The highest percentage of KA crashes, for bicycle / pedestrian and traffic crashes, occurred in 2020 and 2021.

Bicyclist and Pedestrian Crashes by Year (All Severities vs. KA)



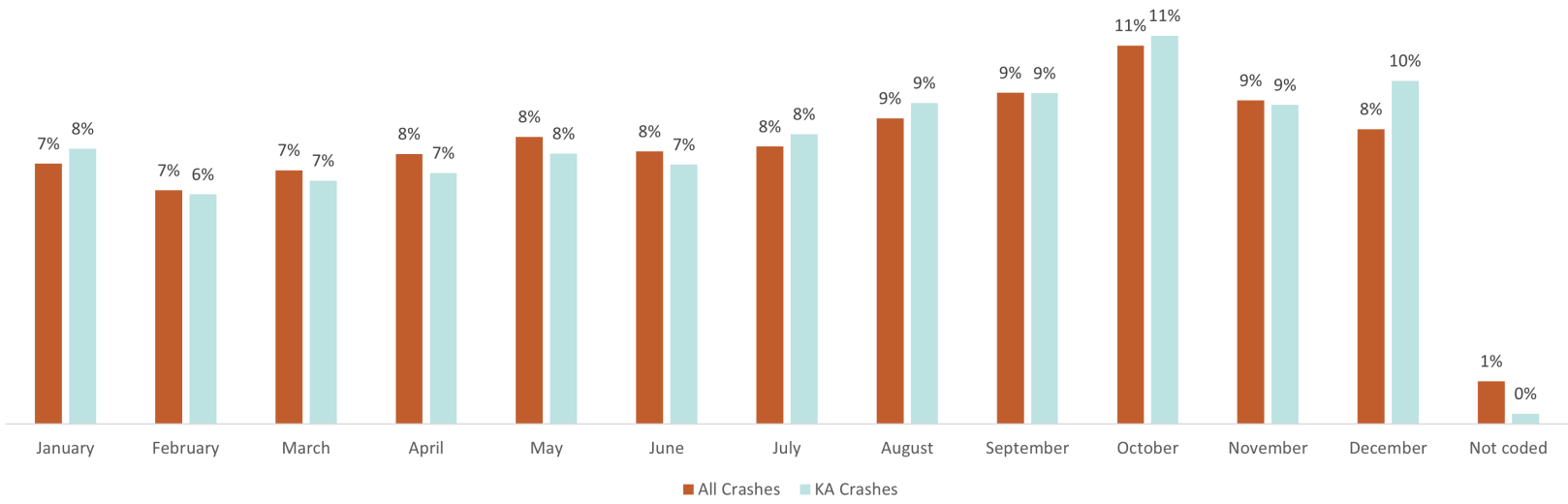
All Traffic Crashes by Year (All Severities vs. KA)



Month

- 11% of all bicyclist and pedestrian crashes occurred in October.
- 11% of KA crashes also occurred in October.

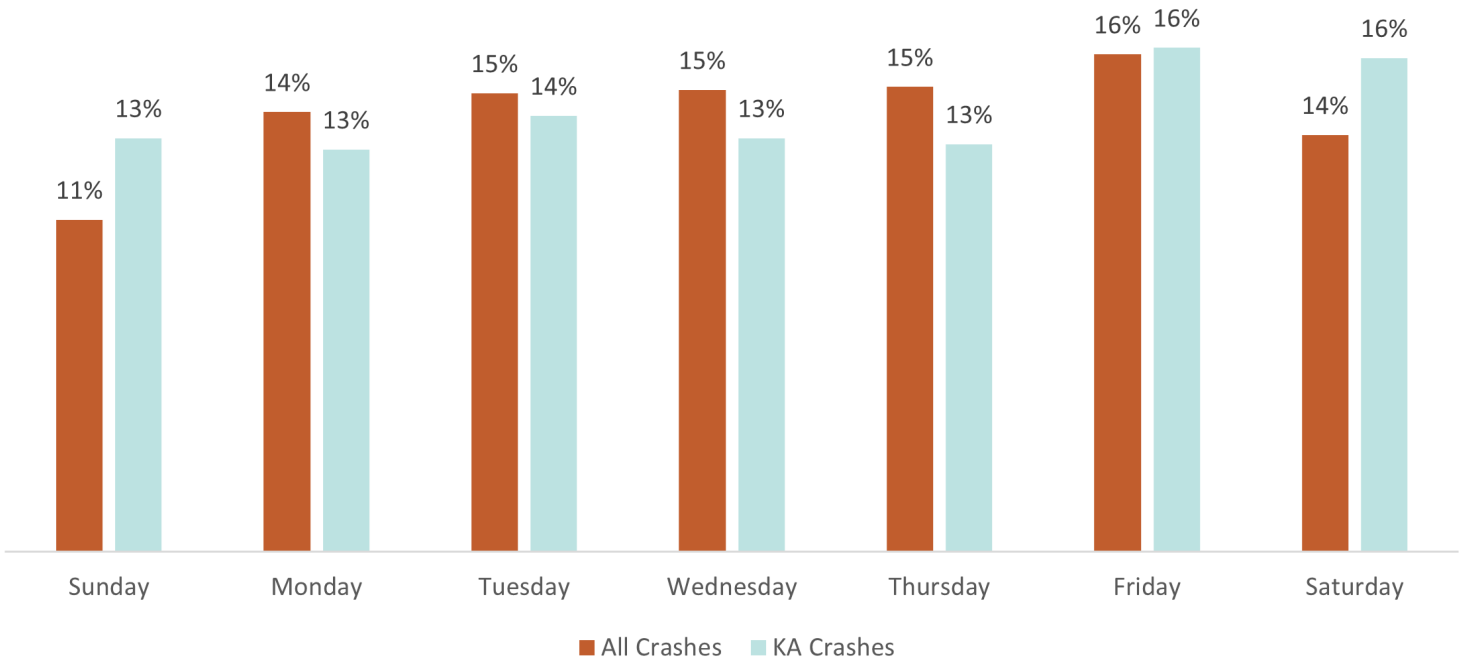
Bicyclist and Pedestrian Crashes by Month (All Severities vs. KA)



Day of the Week

- For all bicyclist and pedestrian crashes, collisions most often occurred on Friday, representing 16% of all crashes occurring during the week.
- For KA crashes, collisions most often occurred on Friday and Saturday, with each day representing 16% of all KA crashes occurring during the week.

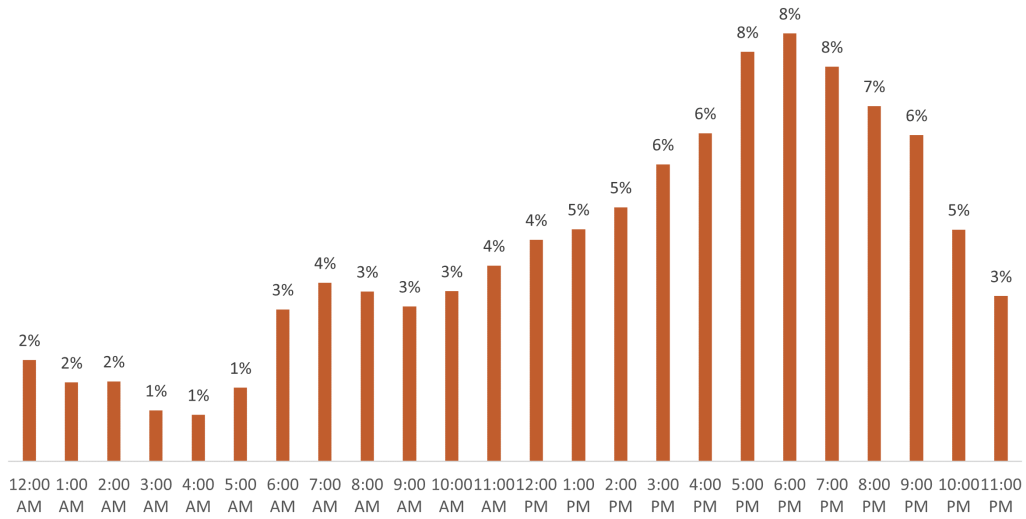
Bicyclist and Pedestrian Crashes by Day of the Week (All Severities vs. KA)



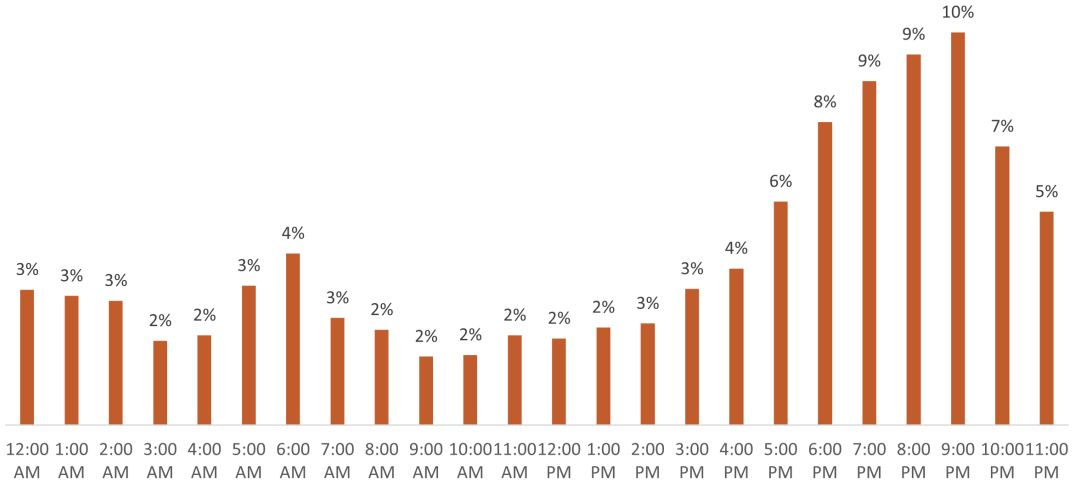
Hour

- Bicyclist and pedestrian crashes of all severities most often occurred between 5 PM and 8 PM (24%).
- KA crashes most often occurred between 7 PM and 10 PM (28%).

Time for Bicyclist and Pedestrian Crashes (All Severities)



Time for Bicyclist and Pedestrian Crashes (KA)

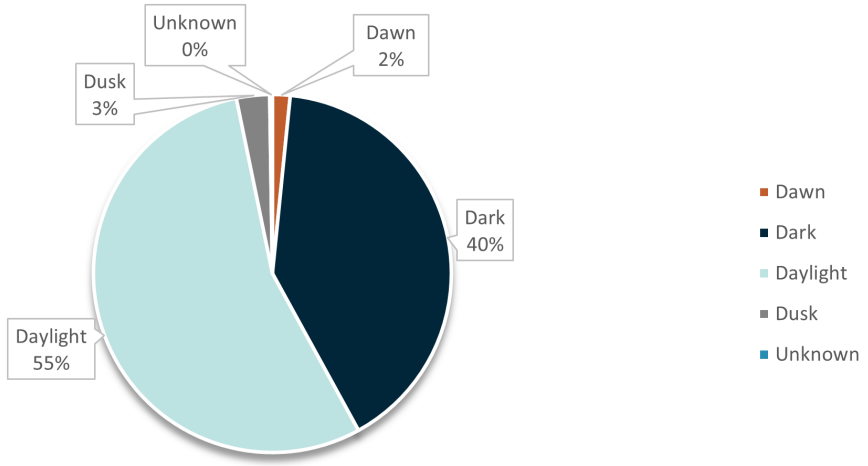


Time of Day

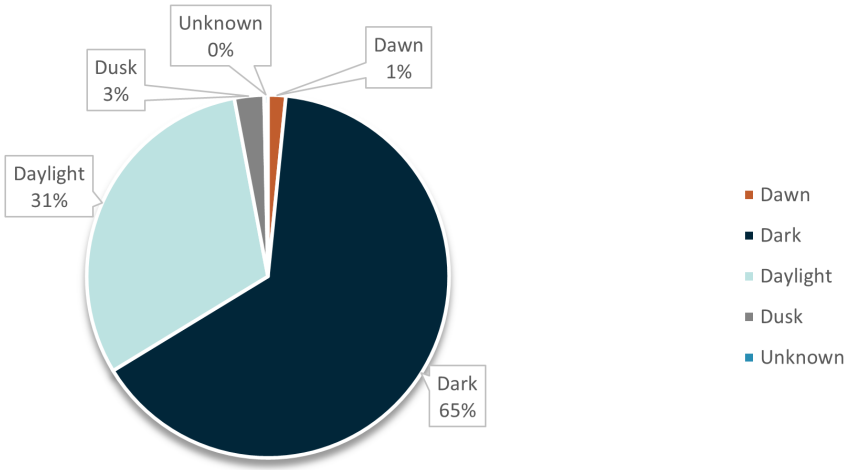
Light conditions were determined by the type of light that existed at the time of the crash. Extremely cloudy conditions may be classified as dawn (or dusk) if the ambient light conditions are similar.

- 55% of all bicyclist and pedestrian crashes occurred during daylight conditions.
- 65% of KA crashes occurred during dark conditions.

Time of Day for Bicyclist and Pedestrian Crashes (All Severities)



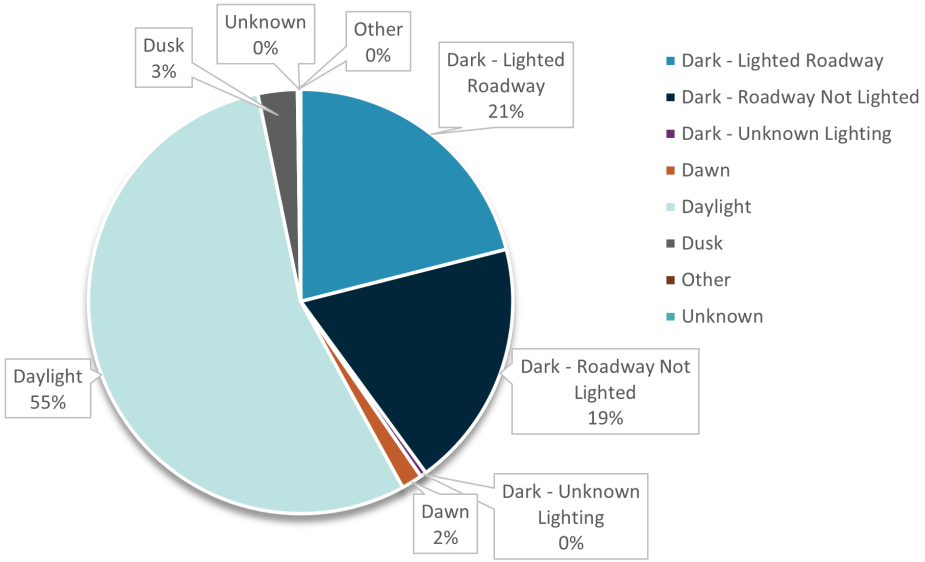
Time of Day for Bicyclist and Pedestrian Crashes (KA)



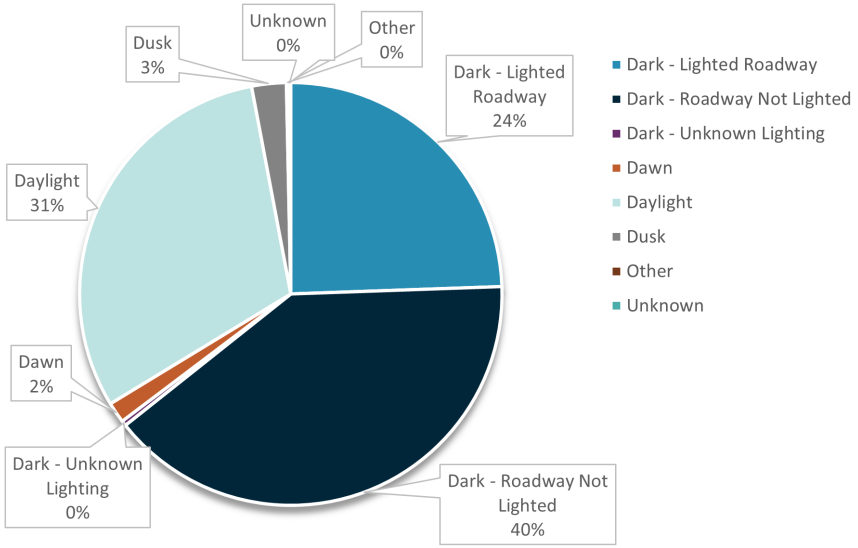
Light Conditions

- 55% of all crashes occurred in daylight conditions.
- 40% of KA crashes occurred in dark conditions on roadways that were not lit.

Light Conditions for Bicyclist and Pedestrian Crashes (All Severities)



Light Conditions for Bicyclist and Pedestrian Crashes (KA)



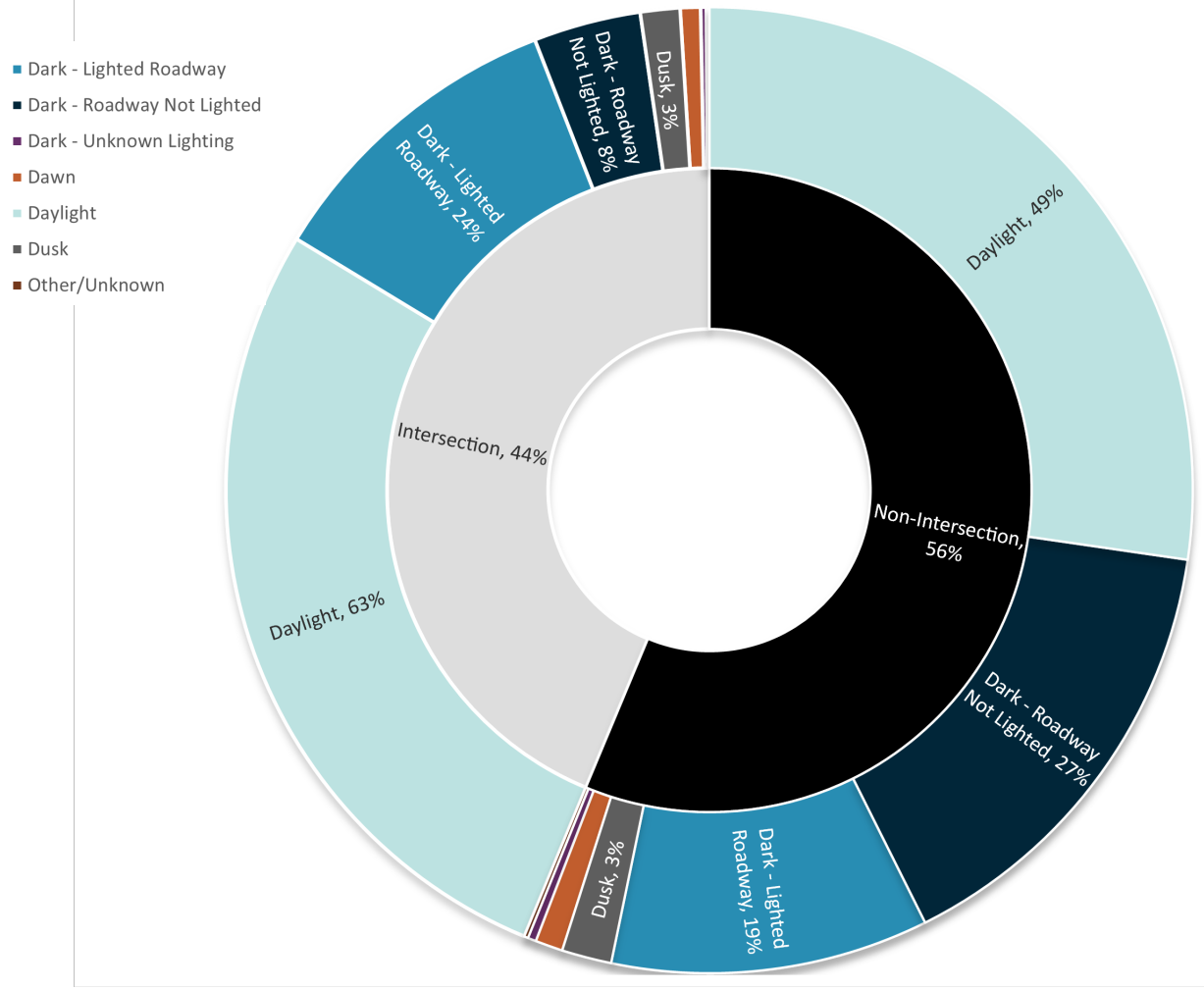
Light Conditions

Intersection vs. Non-Intersection

As previously stated, an intersection crash is defined as a crash that occurred at or related to an at-grade junction of two or more roads or within 50 feet of the edge line or curb of the crossing street.

- 24% of all bicyclist and pedestrian crashes that occurred at intersections occurred in dark conditions on lighted roadways.
- 19% of all bicyclist and pedestrian crashes that occurred outside of an intersection occurred in daylight conditions.
- 8% of all bicyclist and pedestrian crashes that occurred at intersections occurred in dark conditions on roadways that were not lit.
- 27% of all bicyclist and pedestrian crashes that occurred outside of an intersection occurred in dark conditions on roadways that were not lit.

Crash Location and Light Conditions for Bicyclist and Pedestrian Crashes (All Severities)



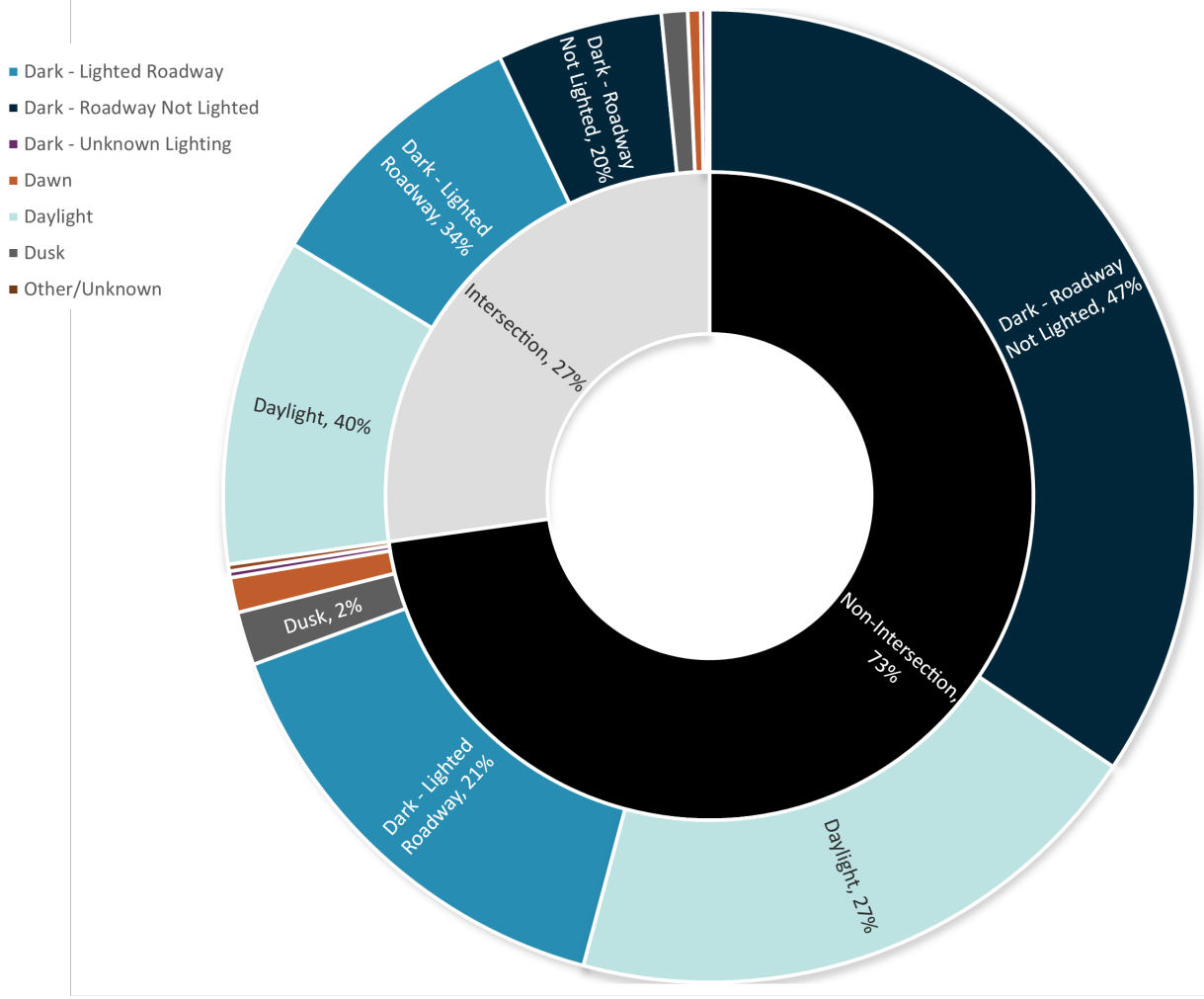
** The crash location of 65 of crashes was not coded/unknown (0.2% of all crashes).*

Light Conditions

Intersection vs. Non-Intersection

- 20% of KA bicyclist and pedestrian crashes that occurred at intersections occurred in dark conditions on roadways that were not lit.
- 47% of KA bicyclist and pedestrian crashes that occurred outside of an intersection occurred in dark conditions on roadways that were not lit.
- 34% of KA bicyclist and pedestrian crashes that occurred at intersections occurred in dark conditions on lighted roadways.
- 21% of KA bicyclist and pedestrian crashes that occurred outside of an intersection occurred in dark conditions on lighted roadways.

Crash Location and Light Conditions for Bicyclist and Pedestrian Crashes (KA)

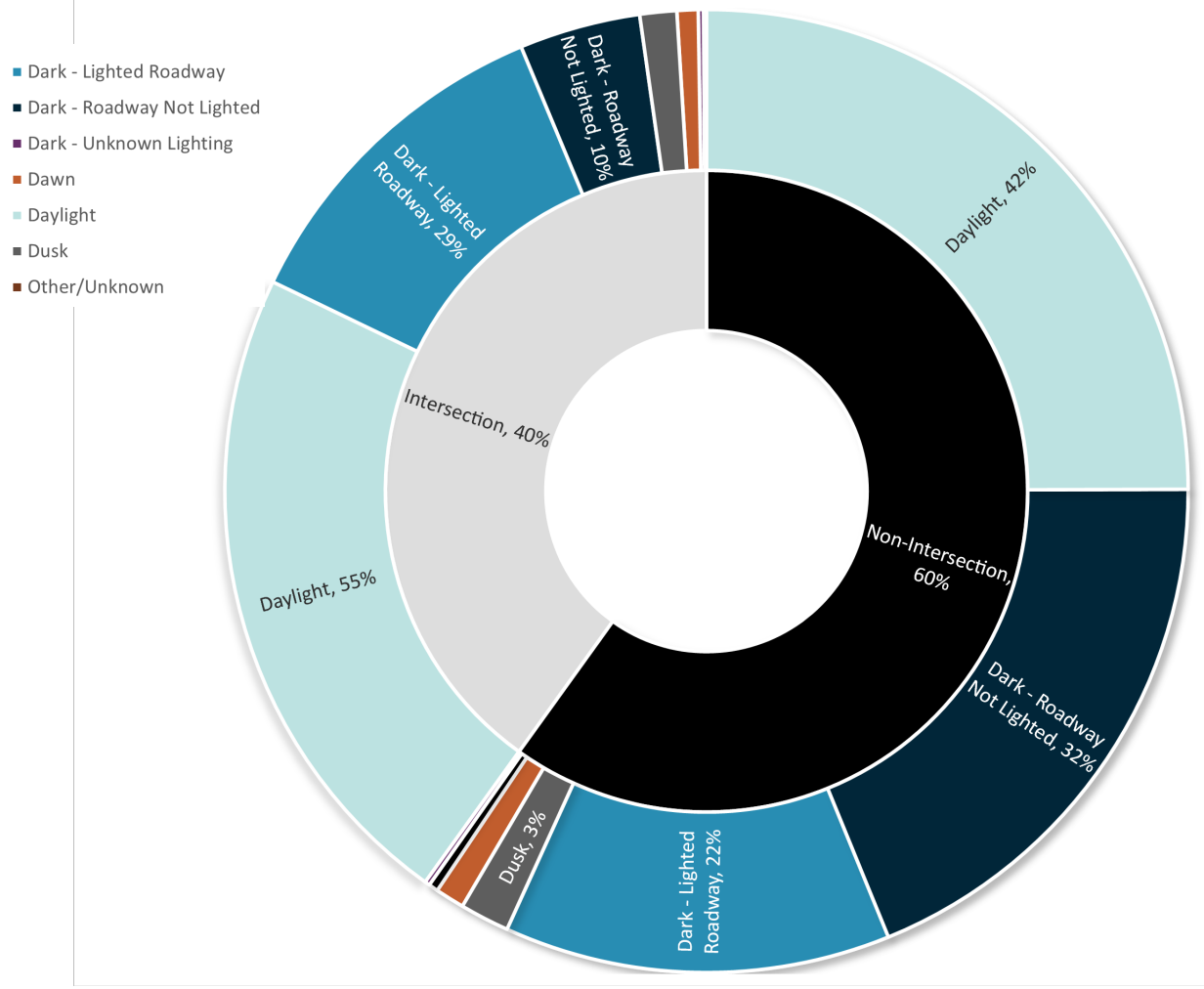


Light Conditions

Pedestrian Intersection vs. Non-Intersection

- 29% of all pedestrian crashes that occurred at intersections occurred in dark conditions on lighted roadways.
- 22% of all pedestrian crashes that occurred outside of an intersection occurred in dark conditions on lighted roadways.
- 10% of all pedestrian crashes that occurred at intersections occurred in dark conditions on roadways that were not lit.
- 32% of all pedestrian crashes that occurred outside of an intersection occurred in dark conditions on roadways that were not lit.

Crash Location and Light Conditions for Pedestrian Crashes (All Severities)

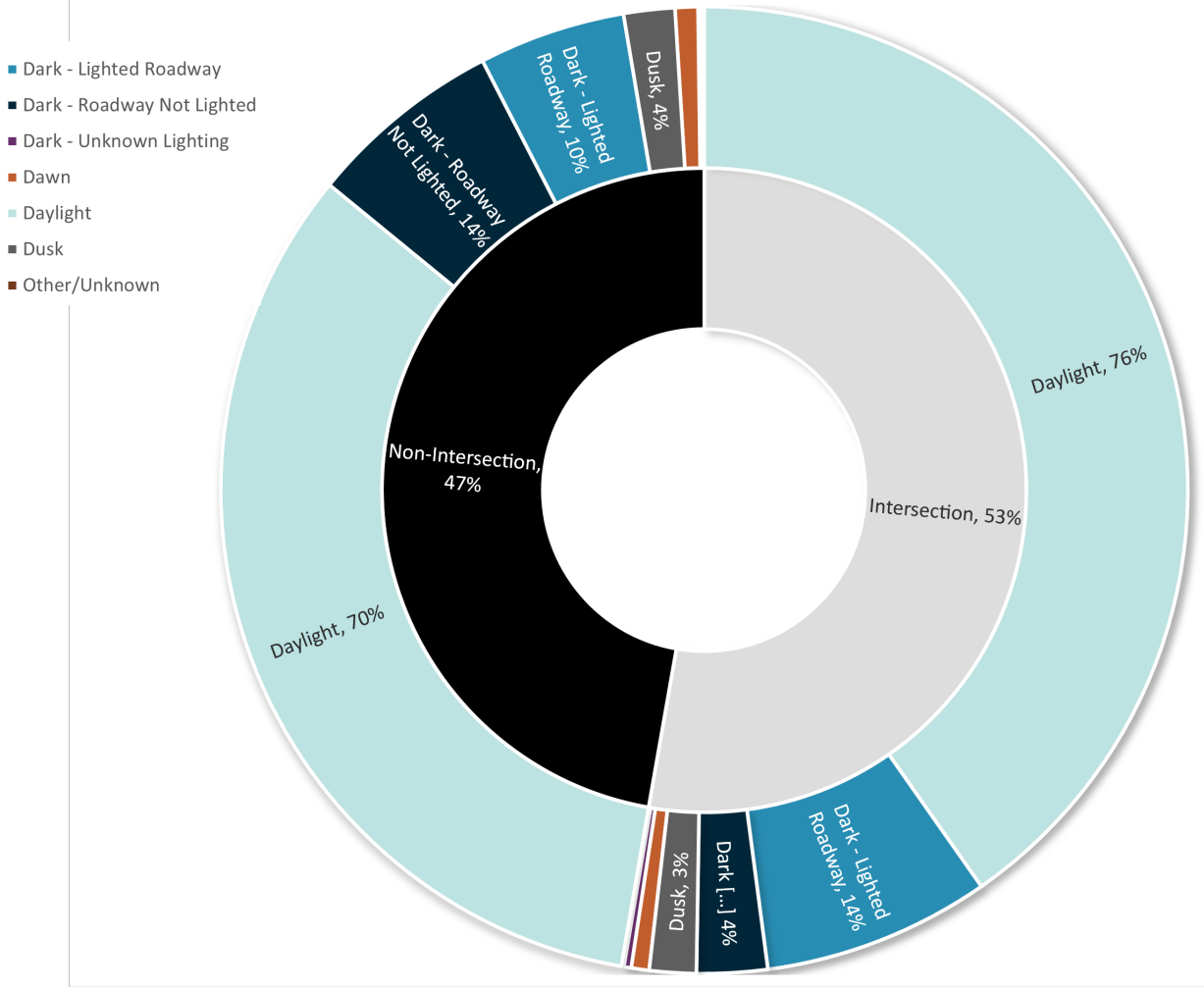


Light Conditions

Bicyclist Intersection vs. Non-Intersection

- 14% of all bicyclist crashes that occurred at intersections occurred in dark conditions on lighted roadways.
- 10% of all bicyclist crashes that occurred outside of an intersection occurred in dark conditions on lighted roadways.
- 4% of all bicyclist crashes that occurred at intersections occurred in dark conditions on roadways that were not lit.
- 14% of all bicyclist crashes that occurred outside of an intersection occurred in dark conditions on roadways that were not lit.

Crash Location and Light Conditions for Bicyclist Crashes (All Severities)

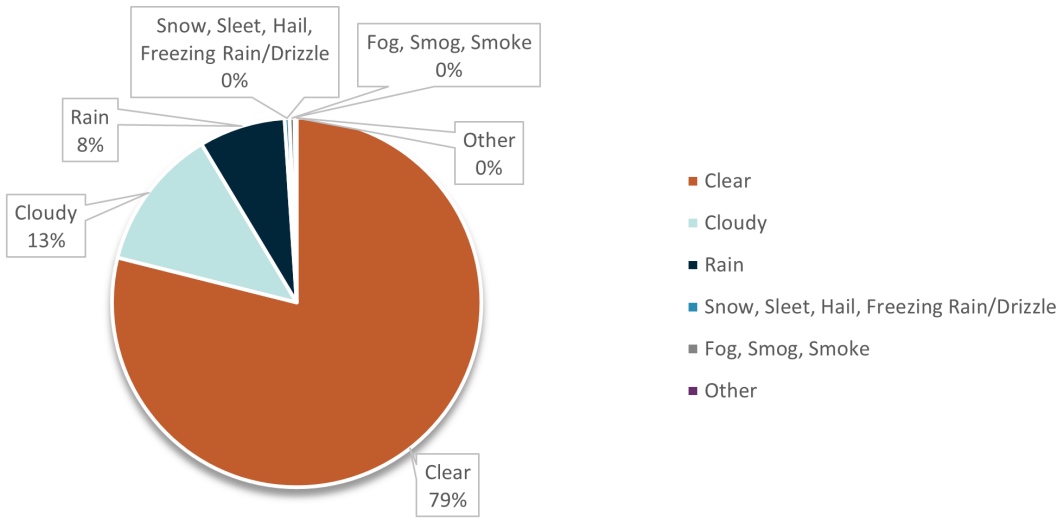


Weather Conditions

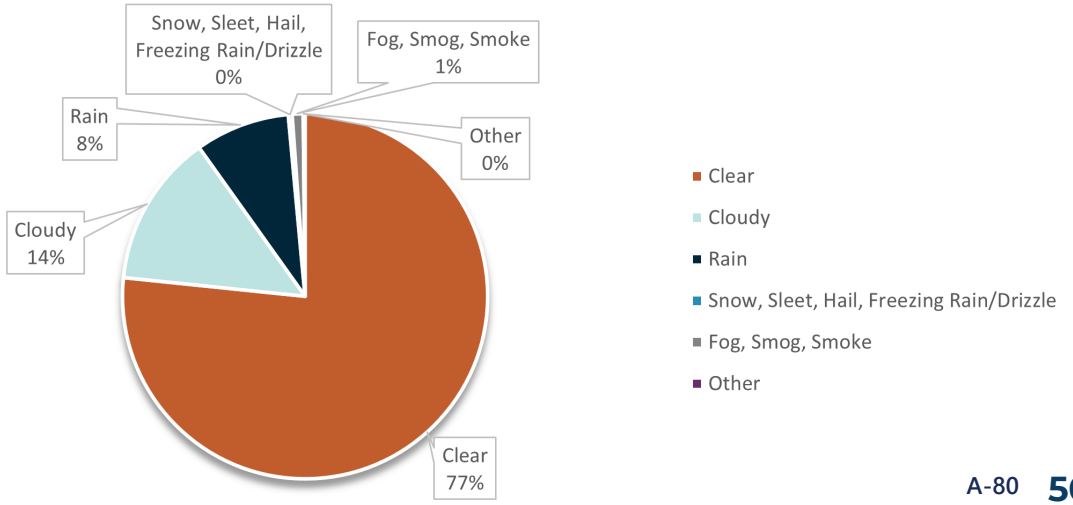
Weather conditions are defined as general atmospheric conditions present at the time of the crash.

- 79% of all bicyclist and pedestrian crashes occurred during clear weather conditions.
- 77% of KA crashes occurred during clear weather conditions.
- 13% of all bicyclist and pedestrian crashes occurred during cloudy conditions.
- 14% of KA crashes occurred during cloudy conditions.

Weather Conditions for Bicyclist and Pedestrian Crashes (All Severities)



Weather Conditions for Bicyclist and Pedestrian Crashes (KA)

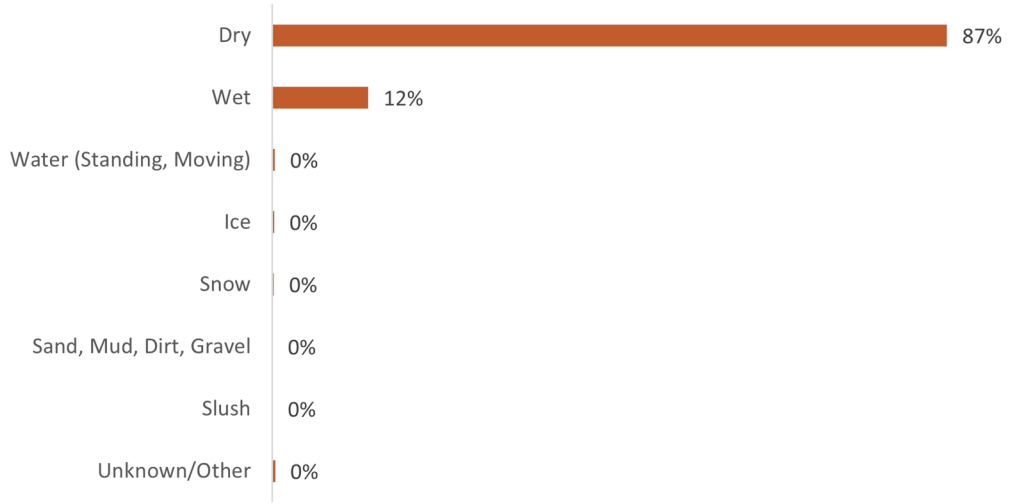


Road Conditions

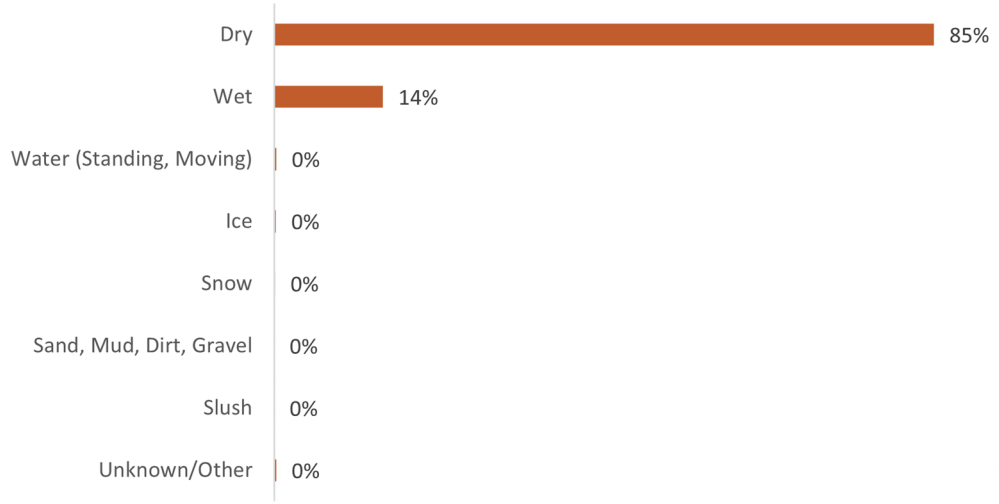
Road condition describes the roadway surface conditions at the time and place of the crash.

- 87% of all bicyclist and pedestrian crashes occurred on dry roadway surfaces.
- 85% of KA crashes occurred on dry roadway surfaces.
- 12% of all bicyclist and pedestrian crashes occurred on wet roadway surfaces.
- 14% of KA crashes occurred on wet roadway surfaces.

Road Condition for Bicyclist and Pedestrian Crashes (All Severities)



Road Condition for Bicyclist and Pedestrian Crashes (KA)

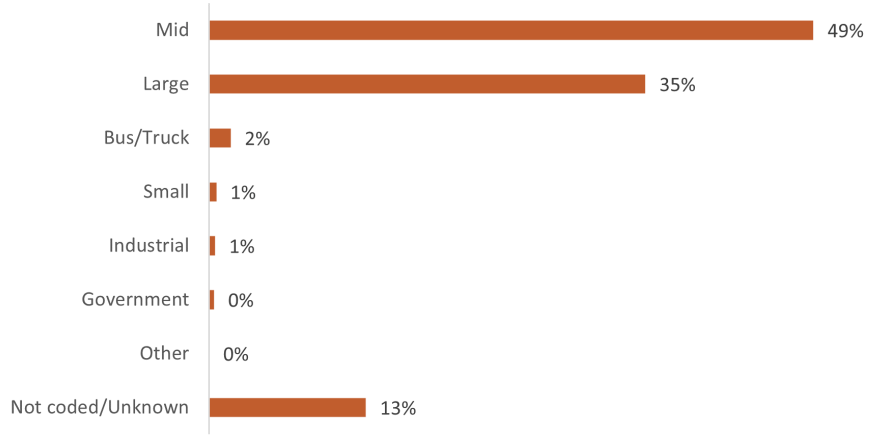


Crash Type & Other Factors

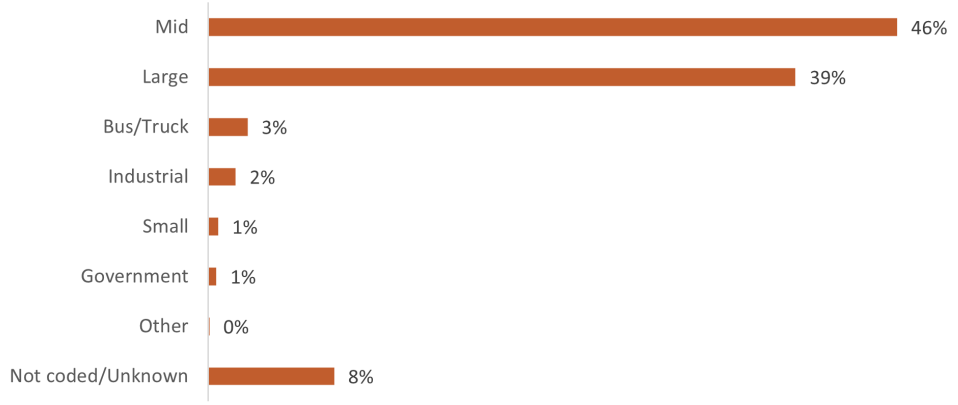
Vehicle Type

- Vehicle type describes the kind of vehicle that was involved in the collision with a bicyclist or pedestrian. Vehicle types were classified as:
  - Small: motorcycles, mopeds, motor scooters or motor bikes, pedal cycles, pedestrians, all-terrain vehicles.
  - Mid: passenger cars, taxicabs.
  - Large: pickups, light trucks (mini-van, panel), sport utility vehicles, vans.
  - Bus/Truck: all buses, single unit trucks, truck/trailers, tractor/semi-trailers, tractor/doubles, unknown heavy trucks, motor homes, recreational vehicles.
  - Industrial: farm equipment, farm tractors.
  - Government: firetrucks, EMS vehicles, ambulances, military, police.
  - Other: other vehicle not listed above.
- 84% of all bicyclist and pedestrian crashes involved a mid or large size vehicle (49% and 35% respectively).
- 85% of KA crashes involved a mid and large size vehicle (46% and 39% respectively).

Vehicle Type for Bicyclist and Pedestrian Crashes (All Severities)



Vehicle Type for Bicyclist and Pedestrian Crashes (KA)

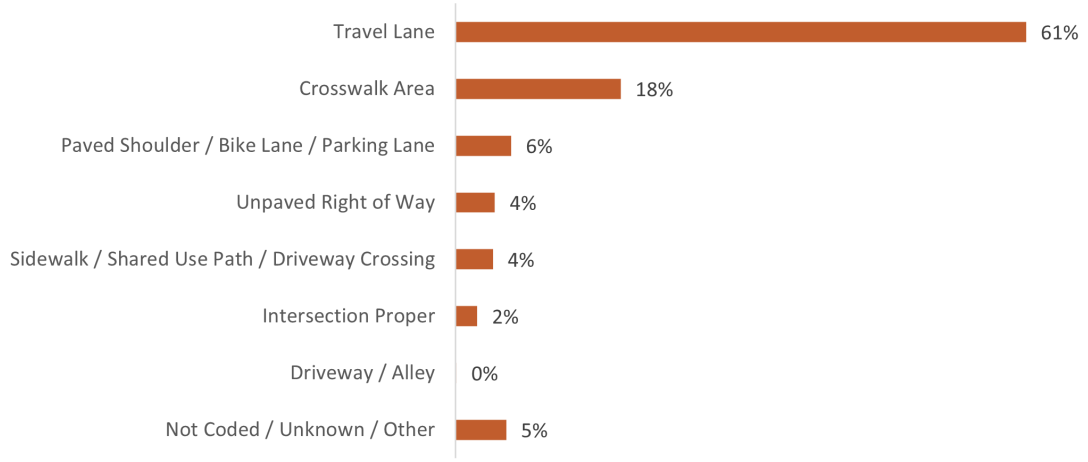


Pedestrian Position

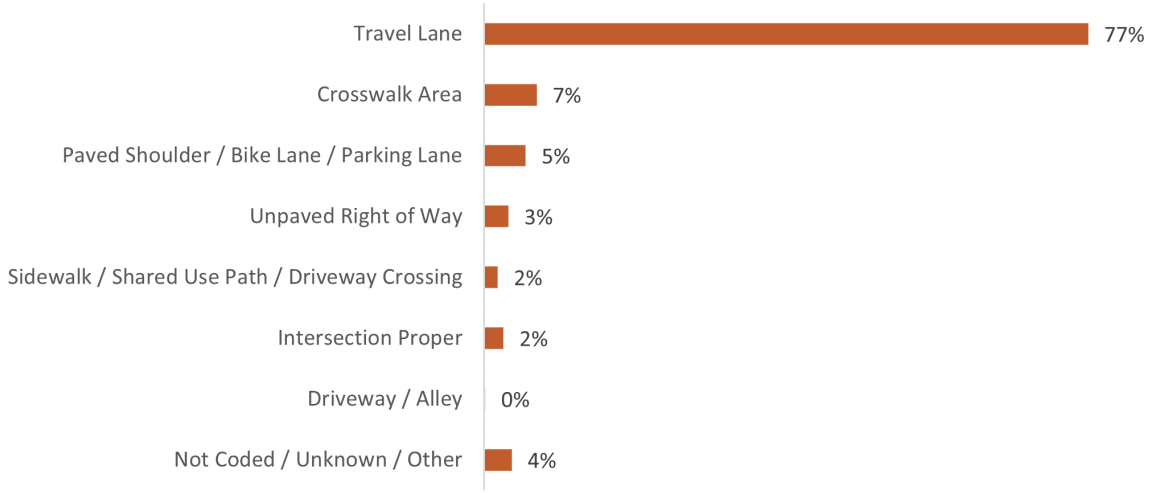
Pedestrian Crashes

- In 61% of all pedestrian crashes, the pedestrian was in the travel lane.
- In 77% of KA pedestrian crashes, the pedestrian was in the travel lane.

Pedestrian Position for Pedestrian Crashes (All Severities)



Pedestrian Position for Pedestrian Crashes (KA)



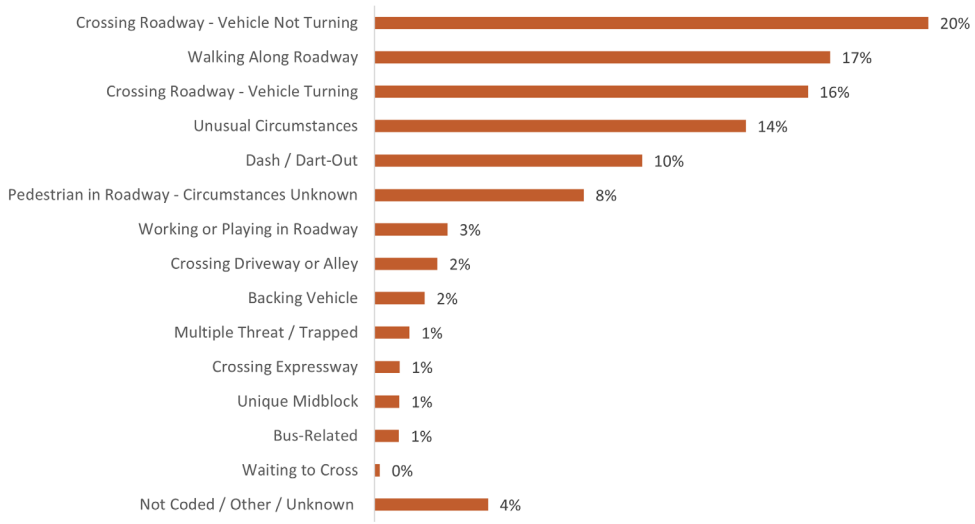
Crash Group

Pedestrian Crashes

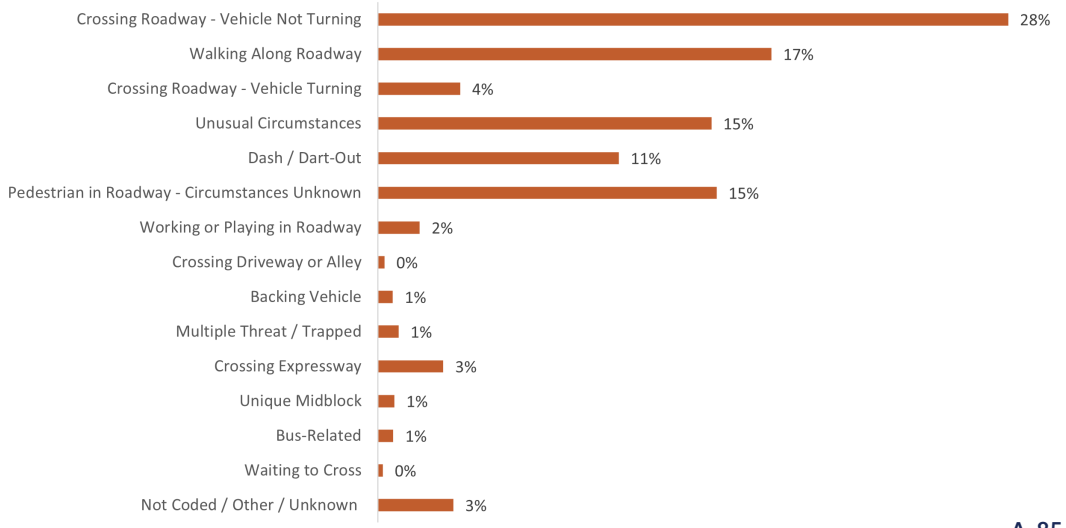
Crash Group describes the circumstances of the crash.

- In 20% of all pedestrian crashes, the collision occurred while the pedestrian was crossing the roadway and the vehicle was not turning.
- In 28% of KA pedestrian crashes, the pedestrian was crossing the roadway and the vehicle was not turning.
  - *More details about the "Crossing Roadway – Vehicle Not Turning" crash group in following slide.*
- In 17% of all pedestrian crashes, the pedestrian was walking along the roadway.
- In 17% of KA pedestrian crashes, the pedestrian was walking along the roadway.
  - *More details about the "Walking Along the Roadway" crash group in the following next slide.*

Crash Group for Pedestrian Crashes (All Severities)



Crash Group for Pedestrian Crashes (KA)



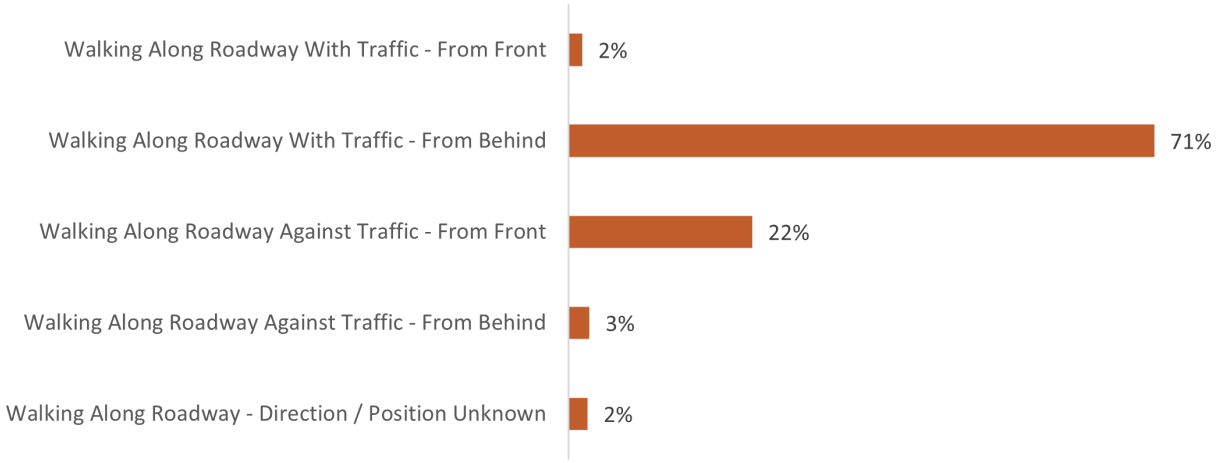
Walking Along the Roadway

Pedestrian Crashes

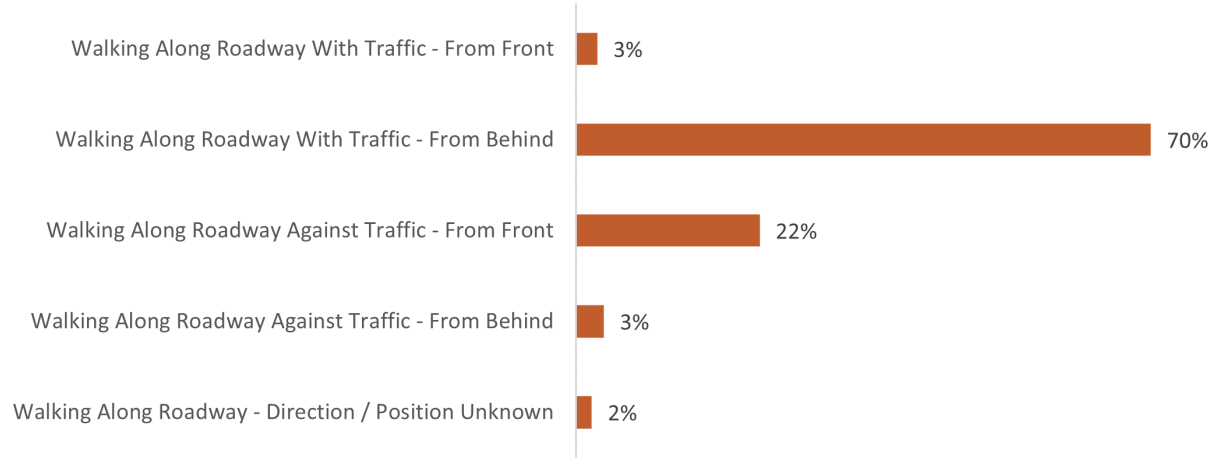
The crash group “Walking Along the Roadway” can be broken down into several crash types that provide more detail about the circumstances of the crash.

- In all crashes where pedestrians were hit while walking along the roadway, 71% of pedestrians were walking with the flow of traffic and struck from behind.
- In KA crashes where pedestrians were hit while walking along the roadway, 70% of pedestrians were walking with the flow of traffic and struck from behind.

Walking Along the Roadway for Pedestrian Crashes (All Severities)



Walking Along the Roadway for Pedestrian Crashes (KA)

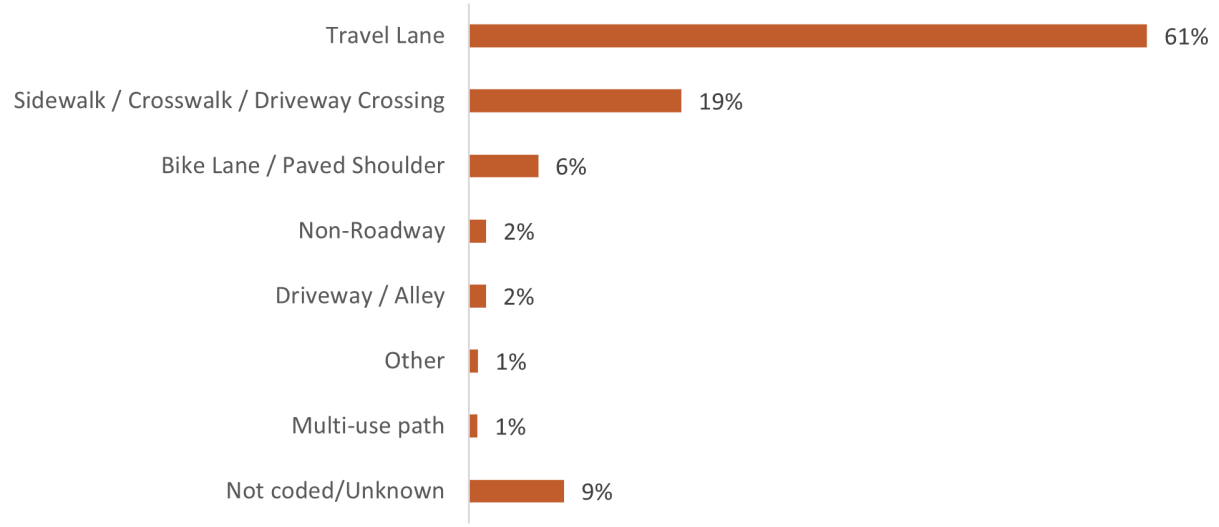


Bicyclist Position

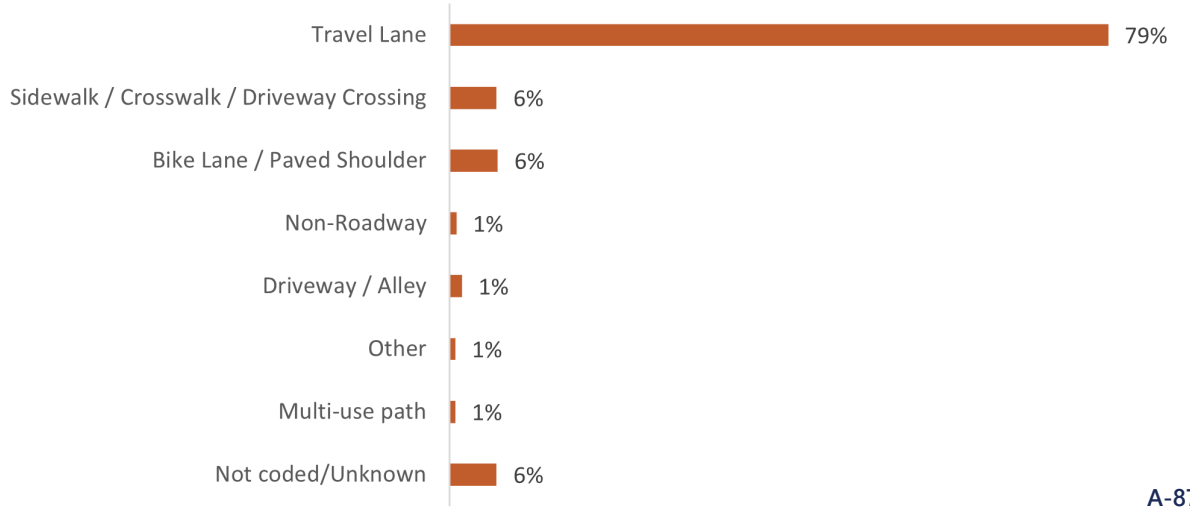
Bicycle Crashes

- In 61% of all bicyclist crashes, the bicyclist was in the travel lane.
- In 79% of KA bicyclist crashes, the bicyclist was in the travel lane.

Bicyclist Position in Bicyclist Crashes (All Severities)



Bicyclist Position in Bicyclist Crashes (KA)



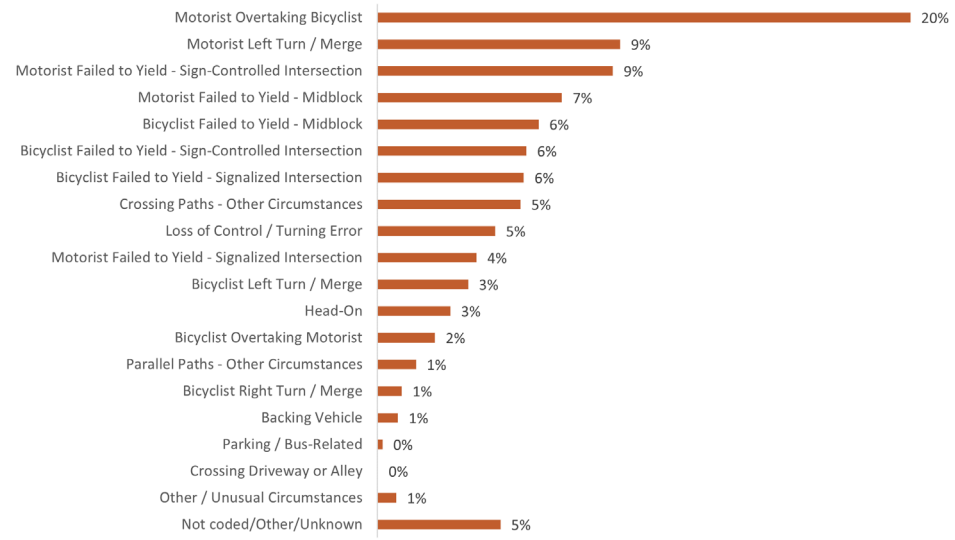
Crash Group

Bicycle Crashes

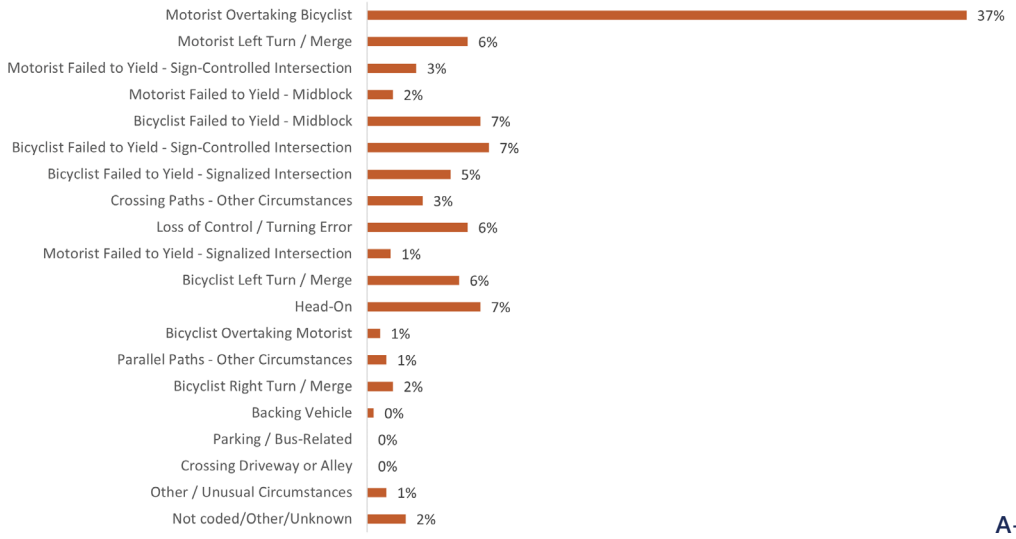
Crash Group describes the circumstances of the crash.

- In 20% of all bicyclist crashes, the collision occurred as a result of the motorist overtaking the bicyclist (bicyclist swerved, the motorist misjudged space, the bicyclist was undetected by the motorist, etc.).
- In 37% of KA bicyclist crashes, the collision occurred as a result of the motorist overtaking the bicyclist (bicyclist swerved, the motorist misjudged space, the bicyclist was undetected by the motorist, etc.).

Crash Group for Bicyclist Crashes (All Severities)



Crash Group for Bicyclist Crashes (KA)



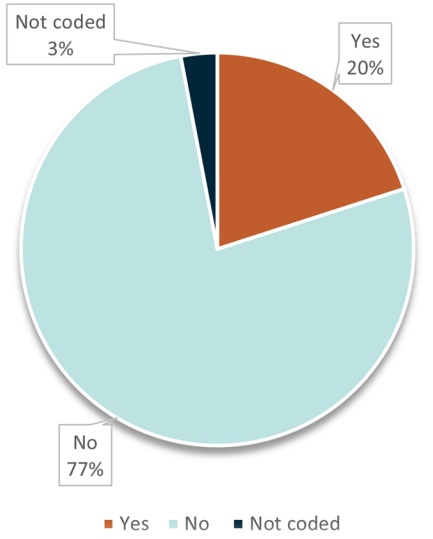
Hit and Run

In cases where a vehicle involved in the crash leaves the scene, it is classified as a hit and run.

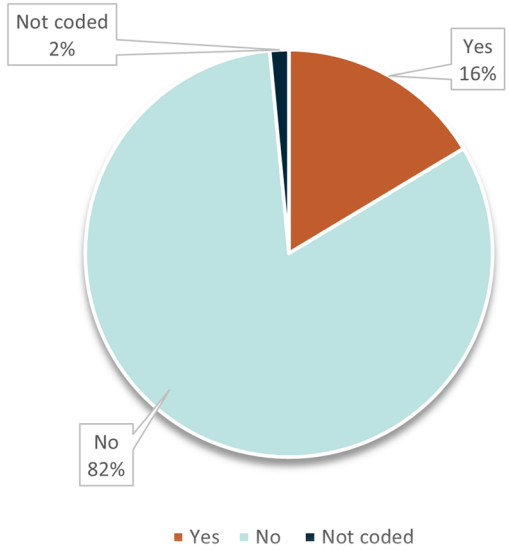
- 20% of all bicyclist and pedestrian crashes were a hit and run.
  - 10% of all traffic crashes were hit and run.*
- 16% of KA crashes were a hit and run.
  - 4% of KA (all traffic) crashes were hit and run.*

* Based on NCDOT crash data for all traffic crashes between 2012 – 2021.

Hit and Run for Bicyclist and Pedestrian Crashes (All Severities)



Hit and Run for Bicyclist and Pedestrian Crashes (KA)



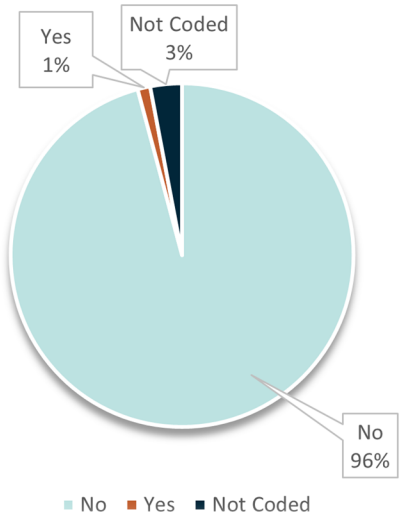
Work Zone

Work Zone crashes are defined as crashes that occurred in or near a construction work area, maintenance work area, utility work area, or other road work area.

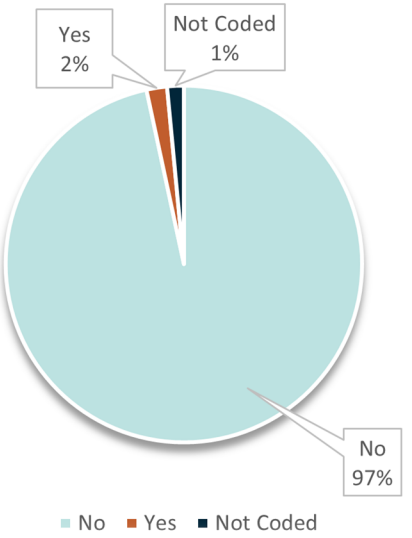
- 1% of all bicyclist and pedestrian crashes occurred in a work zone.
  - 2% of all traffic crashes occurred in a work zone.
- 2% of KA crashes occurred in a work zone.
  - 2% of KA (all traffic) crashes occurred in a work zone.

* Based on NCDOT crash data for all traffic crashes between 2012 – 2021.

Work Zone for Bicyclist and Pedestrian Crashes (All Severities)



Work Zone for Bicyclist and Pedestrian Crashes (KA)

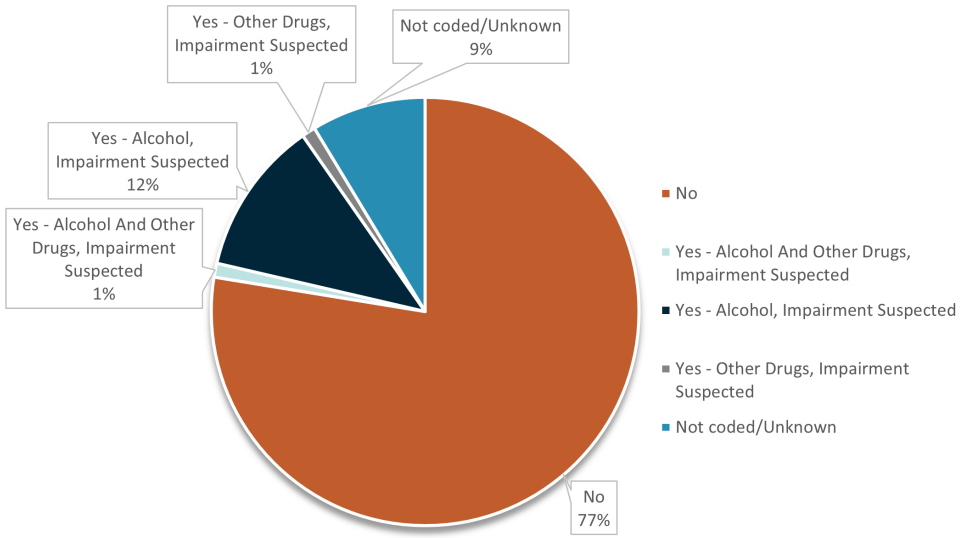


Pedestrian Impairment

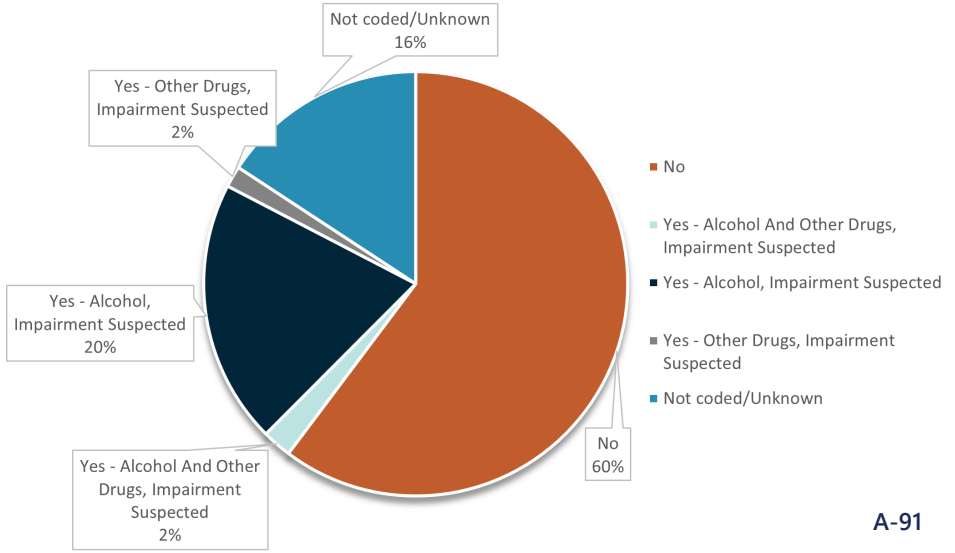
Pedestrian Crashes

- In 77% of all pedestrian crashes, the pedestrian was not impaired.
- In 60% of KA pedestrian crashes, the pedestrian was not impaired.
- In 12% of all pedestrian crashes, the pedestrian was suspected to be under the influence of alcohol.
- In 20% of KA pedestrian crashes, the pedestrian was suspected to be under the influence of alcohol.

Pedestrian Impairment for Pedestrian Crashes (All Severities)



Pedestrian Impairment for Pedestrian Crashes (KA)

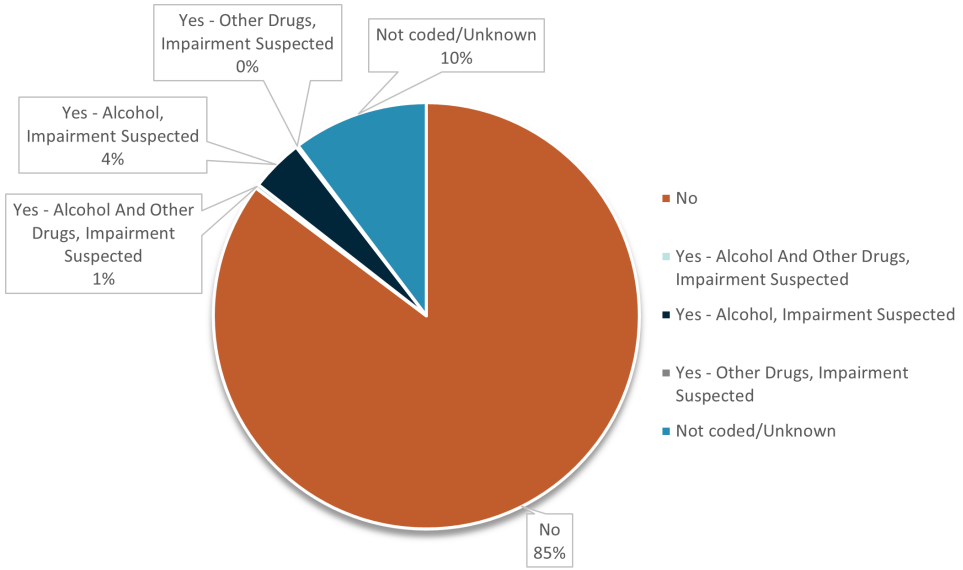


Bicyclist Impairment

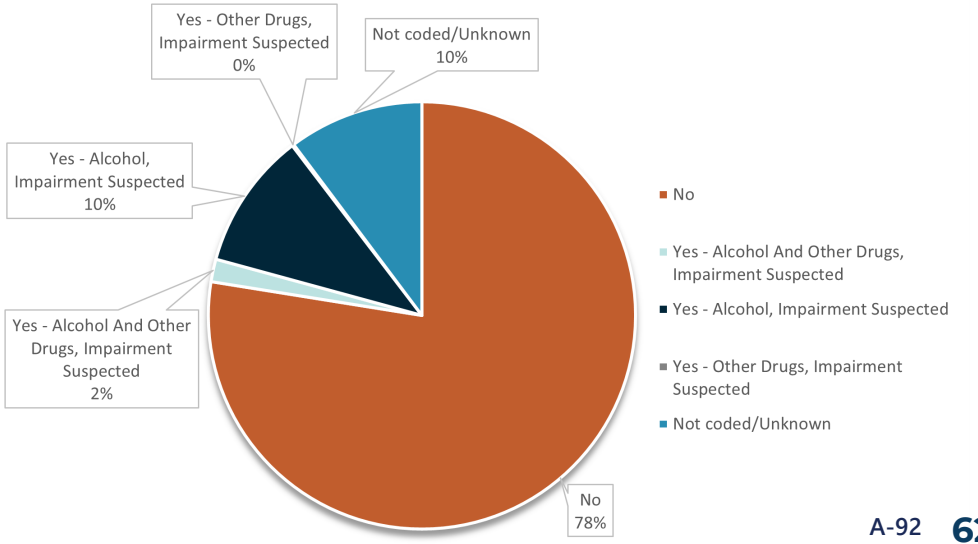
Bicyclist Crashes

- In 85% of all bicyclist crashes, the bicyclist was not impaired.
- In 78% of KA bicyclist crashes, the bicyclist was not impaired.
- In 4% of all bicyclist crashes, the bicyclist was suspected to be under the influence of alcohol.
- In 10% of KA bicyclist crashes, the bicyclist was suspected to be under the influence of alcohol.

Bicyclist Impairment for Bicyclist Crashes (All Severities)

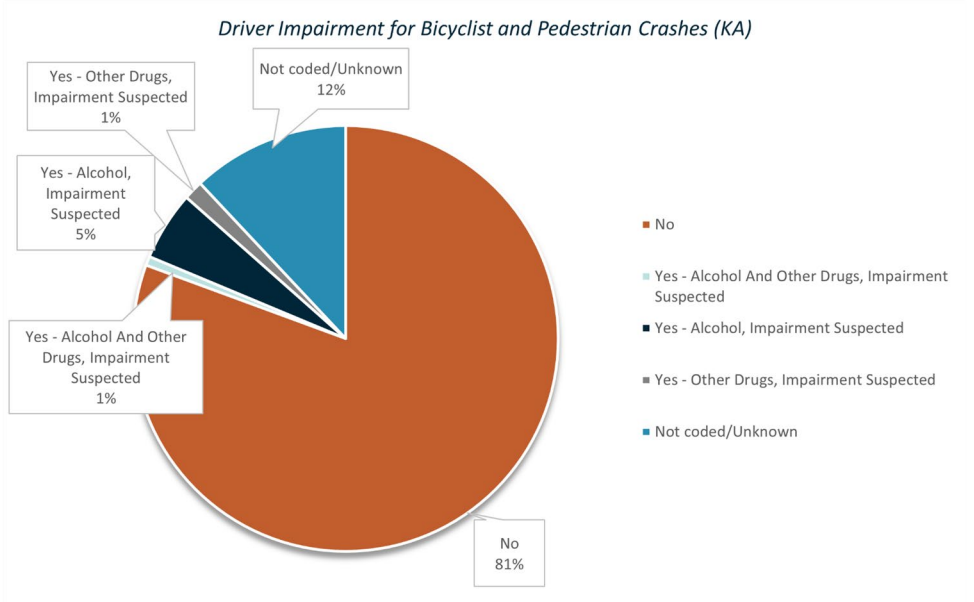


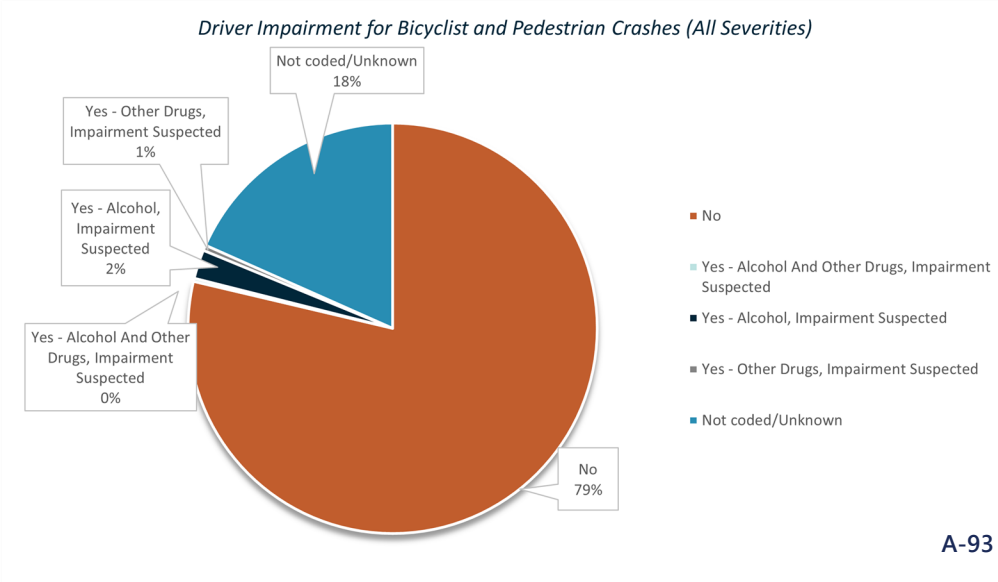
Bicyclist Impairment for Bicyclist Crashes (KA)



Driver Impairment

- In 81% of all bicyclist and pedestrian crashes, the vehicle driver was not impaired.
- In 79% of KA crashes, the vehicle driver was not impaired.
- In 5% of all bicyclist and pedestrian crashes, the vehicle driver was suspected to be under the influence of alcohol.
- In 2% of KA crashes, the vehicle driver was suspected to be under the influence of alcohol.





Appendix

Contact Information

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Thank you!