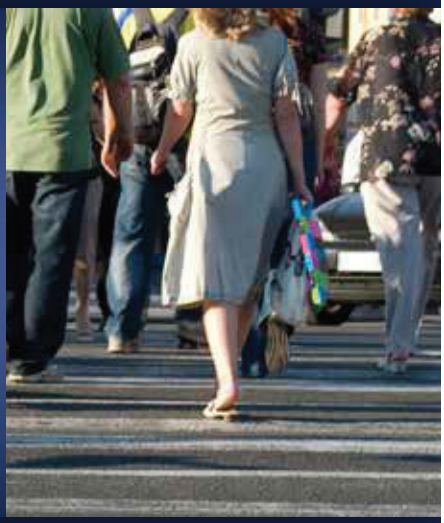
North Carolina
Pedestrian CrashTypes
2015 - 2019

Prepared for

The North Carolina Department of Transportation
Division of Bicycle and Pedestrian Transportation

THE UNIVERSITY OF NORTH CAROLINA
HIGHWAY SAFETY RESEARCH CENTER

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April 2021

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Introduction and Purpose

A total of 15,983 collisions between pedestrians and motor vehicles were reported in North Carolina over the five-year period of 2015 to 2019. A total of 1,083 crashes led to a pedestrian fatality with another 1,364 resulting in suspected serious injury. See the companion *North Carolina Pedestrian Crash Facts* report for a summary of pedestrian injuries and fatalities and related crash factors, including 10-year trends.

This report summarizes pedestrian-motor vehicle crash types that were developed for 2015-2019 for the entire State. For the data summarized in this report, UNC Highway Safety Research Center staff obtained copies of crash report forms submitted to NCDMV by law enforcement officers and reviewed diagrams, narrative summaries of the crash events, and other details in the reports. The study team used PBCAT version 2 software to code crash type, pedestrian position, and crash location variables for each pedestrian-motor vehicle crash, and also geo-coded the crash location. These data elements were combined with crash data elements already available from the State's crash database. The results of analyzing the crash group and other data elements are summarized in the tables, figures, and text in the following sections.

This report provides information about crash patterns observed across the State. Local agencies can use the information as a guide to analyze and understand their own specific crash issues and potential for different treatments to reduce these crash types. The information is for summary purposes only. Further safety analysis and risk assessment, diagnosis, and other procedures are necessary before implementing treatments at any location.

Background on Crash Typing

The information from the State crash report forms (DMV-349) and reported by public safety officials across the State is stored in electronic crash databases. Analysis of these data can provide information on *where* pedestrian-motor vehicle crashes occur (e.g., city street, two-lane roadway, intersection location, etc.), *when* they occur (e.g., time of day, day of week, etc.), and *to whom* they occur (e.g., age of victim, gender, level of impairment, etc.). However, the data contained in the crash database provides little information about the actual sequence of events leading to crashes between pedestrians and motor vehicles. The development of effective countermeasures to help prevent and reduce the severity of these crashes is limited by this lack of detail. To address this type of situation, the National Highway Traffic Safety Administration (NHTSA) developed a system of "typing" pedestrian and bicycle crashes. Each identified crash type is defined by a specific sequence of events, and each may have precipitating actions, predisposing factors, and characteristic populations and/or locations that can be targeted for interventions. The original pedestrian crash typology was developed and applied during the early 1970's (Snyder and Knoblauch 1971; Knoblauch 1977; Knoblauch, Moore and Schmitz 1978). Cross and Fisher (1977) later developed a similar typology for bicycle crashes. A Federal Highway Administration (FHWA) study in the 1990s contributed to the evolution of the current PBCAT typologies with a somewhat greater focus on roadway location elements (Hunter et al., 1996). Following the FHWA study, Harkey, Mekemson, Chen, and Krull (2000) created PBCAT that enabled both pedestrian and bicycle crash typing to be facilitated with a software application. Harkey, Tsai, Thomas, and Hunter updated this tool in 2006 in a project sponsored by the FHWA. The 2006 version of PBCAT (version 2) has been used to type crashes from 2007 – 2019.

For more information on PBCAT and crash typing, including detailed descriptions and images of typical crash scenarios, see the PBCAT webpage (https://www.pedbikeinfo.org/pbcat_us/). More resources are mentioned in the final section of this report and in the crash facts summary report.

Crash Events and Description

This report examines crash groups and the relationship of other variables to these groups. The following sections provide a summary of prevalent state-wide crash trends.

Crash Group

Table 1 lists the 16 crash groups generated by the coding of pedestrian crashes for each of the five years. The names are reasonably self-explanatory, but more details as to the meaning of each crash group, and the more specific crash types associated with each group, are available on the PBCAT software web page, in the manual that accompanies the software. For a complete description of crash-typing-related variables and other variables discussed in these summary reports, see the Bike and Pedestrian databooks provided by the Carolina Center for Health Informatics (https://cchi.web.unc.edu/data-sources-for-motor-vehicle-crash-injury-in-north-carolina/).

Unusual Circumstances is the most prevalent group over the study period. This includes crash types that are a blend of various specific circumstances such as vehicle loss of control or a pedestrian being struck in a secondary crash (following a vehicle into vehicle crash). These and other individually rather infrequent circumstances may require very targeted types of approaches to address.

The second most prevalent crash group over this period is *Crossing Roadway – Vehicle Not Turning.* These crashes involve a pedestrian crossing a roadway at either an *Intersection*, *Intersection-Related* or *Non-Intersection* location and being struck by a motor vehicle that was essentially going straight ahead. The third most common group are crashes that occur *Off Roadway,* which can include many specific types.

There is some year-to-year variability in the frequencies and proportions of each crash group, especially those with smaller numbers. Much of this variation is likely explained by chance, but some variation is potentially attributable to changes in behaviors, effects of roadway treatments, or enforcement measures. Also, numbers in some categories may vary somewhat year to year due to different interpretations of crash reports or different levels of information available.

Table 1 NC pedestrian crash group by year, 2015-2019[1]

Crash group	2015	2016	2017	2018	2019	Total
Unusual Circumstances	479	548	464	560	525	2,576
	15.7%[1]	17.2%	14.9%	16.5%	16.3%	16.1%[2]
Crossing Roadway – Vehicle Not Turning	456	465	421	504	468	2,314
	14.9%	14.6%	13.5%	14.9%	14.5%	14.5%
Off Roadway	379	407	425	497	477	2,185
	12.4%	12.8%	13.6%	14.7%	14.8%	13.7%
Walking Along Roadway	421	414	412	475	399	2,121
	13.8%	13.0%	13.2%	14.0%	12.4%	13.3%
Crossing Roadway – Vehicle Turning	397	383	452	422	433	2,087
	13.0%	12.0%	14.5%	12.4%	13.4%	13.1%
Backing Vehicle	321	360	333	320	320	1,654
	10.5%	11.3%	10.7%	9.4%	9.9%	10.3%
Dash / Dart-Out	256	254	200	212	222	1,144
	8.4%	8.0%	6.4%	6.3%	6.9%	7.2%
Pedestrian in Roadway – Circumstances Unknown	96	123	158	154	138	669
	3.1%	3.9%	5.1%	4.5%	4.3%	4.2%
Working or Playing in Roadway	40	61	72	65	57	295
	1.3%	1.9%	2.3%	1.9%	1.8%	1.8%
Crossing Driveway or Alley	67	62	35	57	57	278
	2.2%	1.9%	1.1%	1.7%	1.8%	1.7%
Other / Unknown – Insufficient Details	65	47	40	32	34	218
	2.1%	1.5%	1.3%	0.9%	1.1%	1.4%
Multiple Threat / Trapped	32	22	34	28	42	158
	1.0%	0.7%	1.1%	0.8%	1.3%	1.0%
Unique Midblock	17	16	29	26	22	110
	0.6%	0.5%	0.9%	0.8%	0.7%	0.7%
Bus-Related	14	18	21	19	15	87
	0.5%	0.6%	0.7%	0.6%	0.5%	0.5%
Crossing Expressway	13	10	18	14	14	69
	0.4%	0.3%	0.6%	0.4%	0.4%	0.4%
Waiting to Cross	1	2	5	5	5	18
	0.0%	0.1%	0.2%	0.1%	0.2%	0.1%
Total	3,054	3,192	3,119	3,390	3,228	15,983
	19.1%[3]	20.0%	19.5%	21.2%	20.2%	

[1] The format for this and subsequent tables, unless otherwise noted:

[1] = Row percent of yearly (column) total

[2] = Row total percent of total

[3] = Column total percent of total

[4] = Total in each table is based on cases with no missing data for that variable

The remaining analyses focuses on those crashes that occurred on the roadway system and excludes those where the crash location was indicated to be 'non-roadway' or was unknown (4,704 crashes). It is important for local agencies to consider parking lot, driveway design, and lighting issues with respect to non-roadway crashes. (Non-roadway crashes are included in the statewide pedestrian and bicyclist spatial crash data mentioned at the end of this report.) However, the remainder of this report describes crashes that occurred on trafficways that are under the purview of state and local transportation system providers.

Crash Group and Severity

An average of 19 percent of all trafficway crashes resulted in fatal or suspected serious injury (Table 2). Along with being the most prevalent crash group for all severities, *Crossing Roadway – Vehicle Not Turning* was also most highly represented among crashes resulting in fatal or suspected serious injury with 29 percent of severe crashes being in this group. Other crash groups that are over-represented among severe crashes compared to all severities include *Waking Along Roadway*, *Pedestrian in Roadway – Circumstances Unknown* (this group includes Standing in Roadway and Lying in Roadway crash types) and *Crossing Expressway.*

Table 2 Crash group and pedestrian injury severity for on-trafficway crashes

Crash Group	Fatal and Suspected Serious Injury	% of Fatal and Suspected Serious Injury	Other / Unknown Injury	Total On Trafficway	% of Total On Trafficway
Crossing Roadway - Vehicle Not Turning	626	28.8%	1,688	2,314	20.5%
Walking Along Roadway	474	21.8%	1,647	2,121	18.8%
Crossing Roadway - Vehicle Turning	86	4.0%	2,001	2,087	18.5%
Unusual Circumstances	301	13.8%	1,203	1,504	13.3%
Dash / Dart-Out	238	10.9%	906	1,144	10.1%
Pedestrian in Roadway - Circumstances Unknown	256	11.8%	413	669	5.9%
Working or Playing in Roadway	30	1.4%	265	295	2.6%
Crossing Driveway or Alley	7	0.3%	271	278	2.5%
Backing Vehicle	12	0.6%	207	219	1.9%
Other / Unknown - Insufficient Details	47	2.2%	159	206	1.8%
Multiple Threat / Trapped	17	0.8%	141	158	1.4%
Unique Midblock	15	0.7%	95	110	1.0%
Bus-Related	14	0.6%	73	87	0.8%
Crossing Expressway	50	2.3%	19	69	0.6%
Waiting to Cross	2	0.1%	16	18	0.2%
Total	2,175		9,104	11,279	

Trafficway Location

Whether a crash occurs at an *Intersection* or *Non-Intersection* location is also associated with pedestrian injury severity. Overall, 57 percent of crashes involved pedestrians struck at *Non-Intersection* locations, but among those where pedestrians were killed or received disabling injuries, the proportion was close to 75 percent (Table 3). (*Intersection-Related* indicates a crash that occurred within 50 feet of an intersection.) A *Non-Intersection* crash could involve a pedestrian crossing or in the roadway at a midblock location, or a pedestrian struck at a driveway not controlled by a signal. Pedestrians may be less anticipated by motorists when crossing at a location not associated with an intersection, there may be no crosswalk markings or other facilities or lighting enhancements, and motorists may not be slowing in anticipation of turns or stopping for traffic controls. Nighttime, as shown in the crash facts report, can multiply these issues.

Table 3 Crash location and pedestrian injury status - trafficway crashes

Crash Location	Fatal and Suspected Serious Injury	Suspected Minor, Possible, No, and Unknown Injury	Total
Intersection	341	3,026	3,367
	15.7%	33.2%	29.9%
Intersection-Related	207	1,246	1,453
	9.5%	13.7%	12.9%
Non-Intersection	1,627	4,832	6,459
	74.8%	53.1%	57.3%
Total	2,175	9,104	11,279
	19.3%	80.7%	

A higher percentage of urban crashes occurred at or near intersections (Table 4). A majority of rural crashes occurred at non-intersection locations. As mentioned in the Pedestrian Crash Facts summary, whether crashes occurred in a rural or urban location also is correlated with injury outcomes, with outcomes tending to be more severe in rural areas. The blend of these factors, along with the less frequent presence of roadway lighting, and higher speed limits, likely contributes to the higher rate of more serious injuries when pedestrians are struck in rural areas.

Table 4 Pedestrian crashes by rural/urban and trafficway location

Crash Location	Rural	Urban	Total
Intersection	317	3,050	3,367
	10.7%	36.6%	29.9%
Intersection-Related	227	1,226	1,453
	7.7%	14.7%	12.9%
Non-Intersection	2,408	4,051	6,459
	81.6%	48.6%	57.3%
Total	2,952	8,327	11,279
	26.2%	73.8%	

Not surprisingly, *Crossing Roadway – Vehicle Turning* is the crash group that accounts for over half of all *Intersection* crashes (Table 5). *Crossing Roadway – Vehicle Not Turning* is the most prevalent *Intersection-Related* crash group at around 26 percent, and *Walking Along Roadway* is the most common crash group that occurred at *Non-Intersection* locations (27 percent). *Dash / Dart-Out* crashes are over-represented in *Intersection-Related* locations (over 14 percent) compared with their overall prevalence (around 10 percent). The *Unusual Circumstances* and *Pedestrian in Roadway – Circumstances Unknown* groups are over-represented among *Non-Intersection* crashes.

Table 5 Crash group and crash location - trafficway crashes

Crash Group	Intersection	Intersection-Related	Non-Intersection	Total
Crossing Roadway – Vehicle Not Turning	654	373	1,287	2,314
	19.4%	25.7%	19.9%	20.5%
Walking Along Roadway	113	234	1,774	2,121
	3.4%	16.1%	27.5%	18.8%
Crossing Roadway – Vehicle Turning	1,721	186	180	2,087
	51.1%	12.8%	2.8%	18.5%
Unusual Circumstances	265	197	1,042	1,504
	7.9%	13.6%	16.1%	13.3%
Dash / Dart-Out	227	211	706	1,144
	6.7%	14.5%	10.9%	10.1%
Pedestrian in Roadway – Circumstances Unknown	94	84	491	669
	2.8%	5.8%	7.6%	5.9%
Working or Playing in Roadway	65	41	189	295
	1.9%	2.8%	2.9%	2.6%
Crossing Driveway or Alley	13	11	254	278
	0.4%	0.8%	3.9%	2.5%
Backing Vehicle	24	31	164	219
	0.7%	2.1%	2.5%	1.9%
Other / Unknown – Insufficient Details	91	19	96	206
	2.7%	1.3%	1.5%	1.8%
Multiple Threat / Trapped	58	24	76	158
	1.7%	1.7%	1.2%	1.4%
Unique Midblock	6	14	90	110
	0.2%	1.0%	1.4%	1.0%
Bus-Related	26	25	36	87
	0.8%	1.7%	0.6%	0.8%
Crossing Expressway	0	0	69	69
	0.0%	0.0%	1.1%	0.6%
Waiting to Cross	10	3	5	18
	0.3%	0.2%	0.1%	0.2%
Total	3,367	1,453	6,459	11,279
	29.9%	12.9%	57.3%	

Pedestrian Position

The injury severity trends of different types of crashes are affected by a combination of factors including where these crashes typically occur. For example, pedestrians overall were most often indicated to be using a regular *Travel Lane* when struck (62 percent of crashes) (Table 6). An even higher percentage (79 percent) of crashes with fatal or serious injury included pedestrians in a regular *Travel Lane*, not in a crosswalk area, or other facility type when struck. By contrast, crashes occurring in a *Crosswalk Area* (around 19 percent of all crashes) are less likely to be severe (6 percent).

Table 6 Position of pedestrian when struck and pedestrian injury status - roadway crashes

Pedestrian Position when Struck	Fatal and Suspected Serious Injury	Suspected Minor, Possible, No, and Unknown Injury	Total
Travel Lane	1,727	5,290	7,017
	79.4%	58.1%	62.2%
Crosswalk Area	140	1,991	2,131
	6.4%	21.9%	18.9%
Intersection Proper	36	146	182
	1.7%	1.6%	1.6%
Paved Shoulder / Bike Lane / Parking Lane	87	356	443
	4.0%	3.9%	3.9%
Sidewalk / Shared Use Path / Driveway Crossing	27	404	431
	1.2%	4.4%	3.8%
Unpaved Right-of-Way	94	515	609
	4.3%	5.7%	5.4%
Other / Unknown	64	402	466
	2.9%	4.4%	4.1%
Total	2,175	9,104	11,279
	19.3%	80.7%	

Pedestrian Crossing Roadway - Vehicle Not Turning Crashes

This section focuses additional attention on the most frequent trafficway crash group, *Pedestrian Crossing Roadway - Vehicle Not Turning*, which accounted for 2,314 crashes from 2015-2019, and also resulted in the most fatalities and suspected serious injuries. Figure 1 illustrates this crash group at an intersection crosswalk. These crashes can also occur at *Non-Intersection* locations, which are less likely to have a crosswalk, and where injuries tend to be more severe.

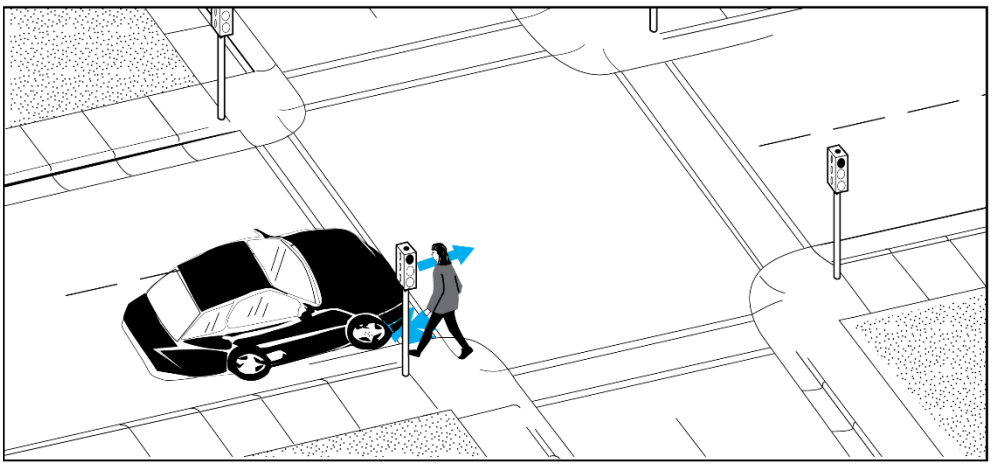

Figure 1 An example of a *Crossing Roadway - Vehicle Not Turning* crash

The following characteristics were noted for *Pedestrian Crossing Roadway – Vehicle Not Turning* crashes:

- 81 percent occurred in urban areas.
- 56 percent occurred at *Non-Intersection* locations.
- 21 percent occurred under *Dark – Roadway Not Lighted* (similar percentage as all crashes) and 39 percent under *Dark – Lighted Roadway* conditions (compared with 25 percent of all crashes).
- 60 percent occurred on *Two-way, Not Divided* roads.
- 56 percent occurred on roads with 35 mph or lower speed limits.
- 62 percent occurred on roads with *No Traffic Control Present* and 20 percent occurred at a *Stop and Go Signal.*

Crossing Roadway – Vehicle Not Turning crashes are more likely to occur in urban areas compared with pedestrian crashes overall (Figure 2).

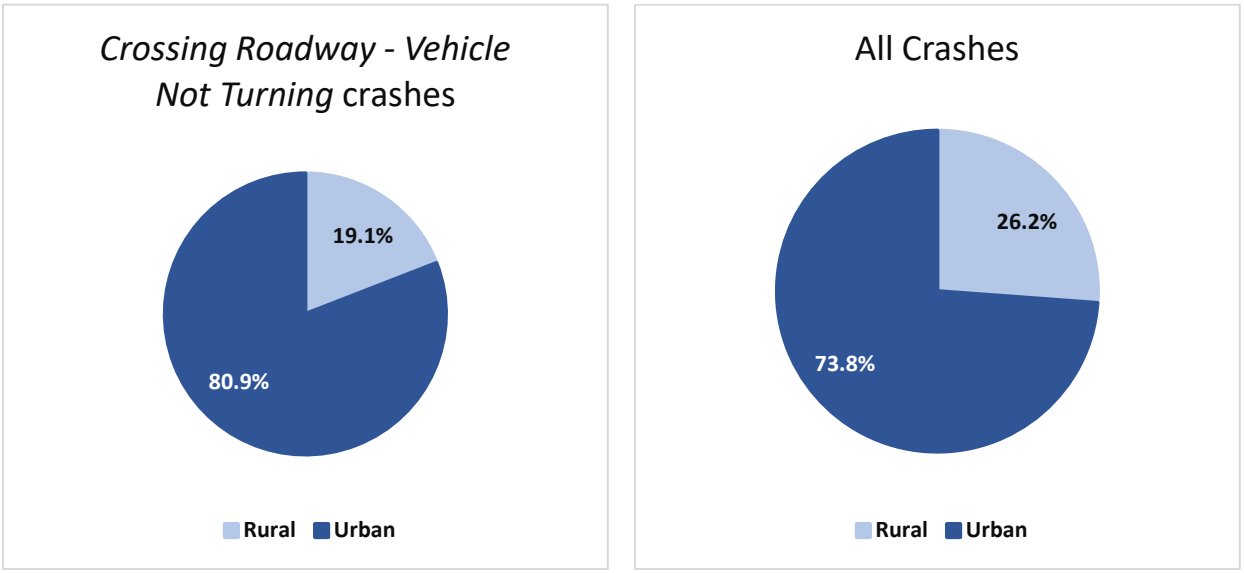

Figure 2 Percent rural/urban for *Crossing Roadway - Vehicle Not Turning* compared with all crashes

Potential Countermeasures

Countermeasures for these crashes should aim to provide safe locations and times for pedestrians to cross roadways, separated from conflicts with motor vehicles (such as through traffic control signals or pedestrian hybrid beacons), especially on higher speed, higher volume, and multilane roads (Thomas et al. 2018; Blackburn et al. 2017). Medians or median islands and crossings can provide refuge areas for pedestrians crossing multi-lane roads including for roads with a center, two-way, left turn lane. Lighting enhancements, especially at crossing locations used by pedestrians at night, are important for enhancing pedestrian conspicuity. Where designated crosswalks are appropriate, advance stop-yield bars and high visibility crosswalks can aid conspicuity and visibility between pedestrians and drivers, especially important on multi-lane roads (Thomas et al. and Blackburn et al. 2017). Measures should aim to minimize the chance of harm by providing sufficient crossing opportunities, encourage safer speeds, and provide appropriate levels of separation for the road type, speed and volume of traffic present, especially since motorists do not always yield even if they observe pedestrians. Additional countermeasures resources are mentioned at the end of this report.

Crossing Roadway – Vehicle Not Turning Crash Tree

To take a closer look at the combinations of factors most associated with a pedestrian who was crossing the roadway being struck by a straight through motorist, the analysts developed a crash tree that identifies hierarchical combinations of several of the most prevalent crash factors that were also associated with higher rates of severe injuries (Figure 3). Because speed limits, roadway designs, lighting and a number of other factors vary for rural and urban locations, we first subdivided by rural/urban location. Although a higher percentage of rural crashes led to fatal (indicated by K in the crash tree) and suspected serious (A) injuries at 44 percent compared to urban areas with 23 percent, the frequency is much higher in urban areas, and thus, a plurality of more severe crashes also occurred in urban areas.

The pedestrian was most often not in a crosswalk or within an intersection, but rather crossing the roadway in a regular travel lane when struck. In addition, there was most often no specific traffic control associated with these crashes. (The presence of a double-yellow line, a form of traffic control that restricts passing does not provide any control of crossing-related conflicts and was included with the 'No Traffic Control' group.) The 'No Control' group accounted for 62 percent of all severity urban crashes (5,150/8,327) and 67 percent of all fatal and suspected serious injury crashes of this type in urban areas (291/433). Beyond that, roads with higher speed limits (40 or more mph) were associated with a much higher rate of severe injuries. The combination of pedestrian being struck in an urban setting, while crossing in a travel lane with no specific traffic controls on higher speed limit roads captured 25 percent of all of these crashes (461/1,871), but 37 percent (162/433) of fatal and disabling injury crashes in urban locations. A majority of these (415/461) were 40 – 45 MPH roads. Finally, among this set of crashes, roads with 5 through lanes (typically two-way, center turn lane designs) accounted for a significant percentage: while only 7 percent of all severity crashes, these road types in conjunction with the other factors, were associated with 14 percent of fatal and disabling types in urban settings.

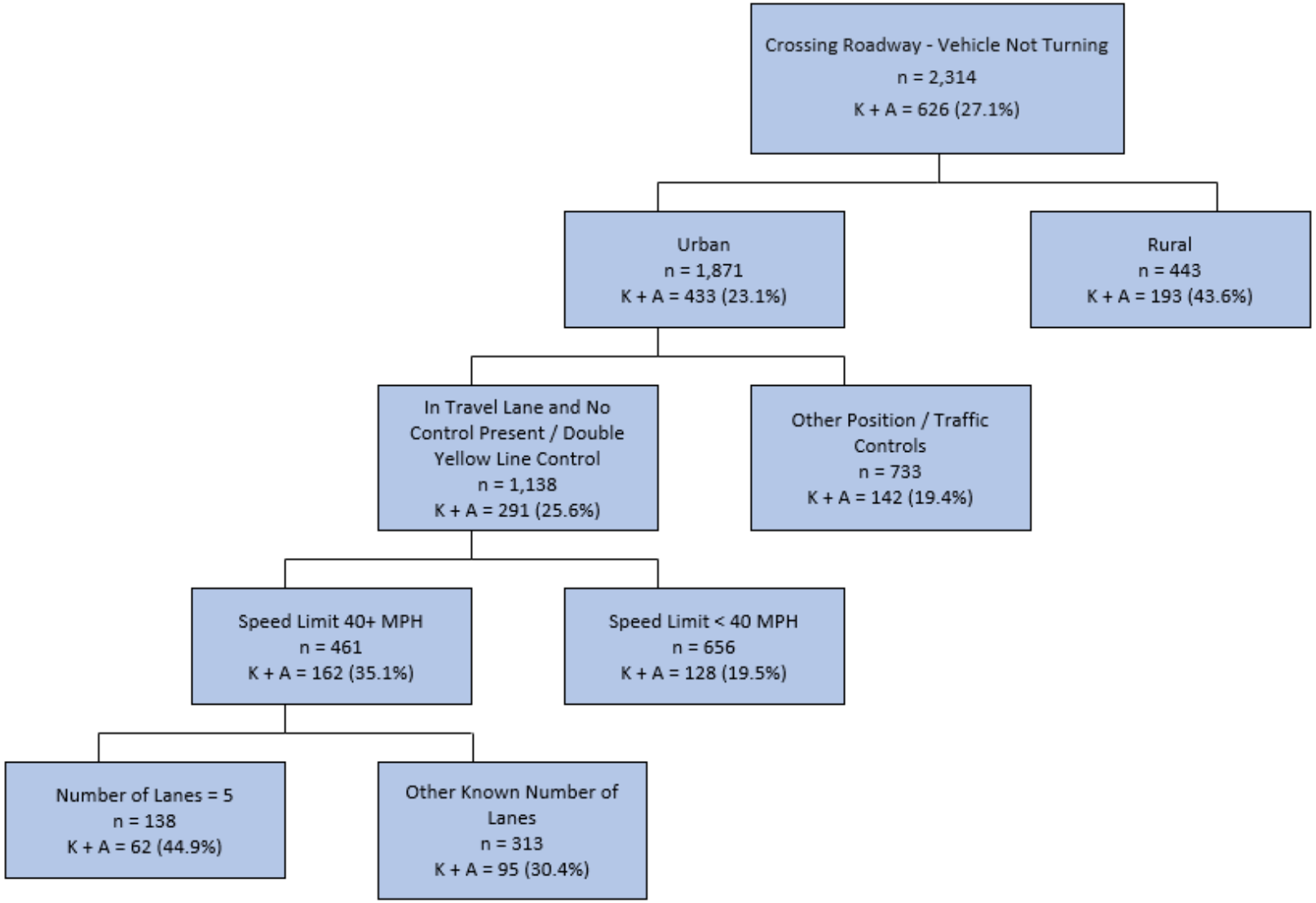

Figure 3 Tree Diagram of prevalent factors associated with *Crossing Roadway - Vehicle Not Turning* types of crashes

The frequency and rates per population of *Crossing Roadway – Vehicle Not Turning* crashes in counties across the state were examined and compared with distributions of all pedestrian crashes. These data and maps are presented and discussed in the Appendix and show that while the most populous counties tended to have the highest counts of both total pedestrian crashes and *Crossing Roadway - Vehicle Not Turning* crashes, a few had higher proportions of this type. Additionally, when examined by population-based rates, several rural counties appear in the lists as having experienced relatively high rates of total pedestrian crashes or this focus type of crash. The jurisdictions in these counties may consider further investigation of the conditions and locations of these crashes and potential treatments.

While there may be some errors in reporting of these factors in crash data, similar associations have been reported for pedestrian crashes and injury severities in other studies (Thomas et al. 2018). These factors could potentially be used to proactively identify locations for further assessment, especially in conjunction with land uses/destinations, transit, and other measures that are associated with pedestrian activity.

Additional Resources

NC pedestrian and bicycle crash data are available in GIS format for local agencies and their partners to explore (https://www.arcgis.com/home/item.html?id=b4fcdc266d054a1ca075b60715f88aef) or to download for more in-depth analysis.

In order to develop countermeasures for particular locations, crash data and other data specific to those locations should be examined. Diagnosis of the specific problems and treatments should include professional site visits during different times of day and night, and collection of data and input from the community. This process may be done through a formal interdisciplinary road safety audit, which is an ideal way to gather insights on the safety issues on a particular road or area. For more information on analyzing and diagnosing safety problems and identifying potential treatments, see the following resources:

- *North Carolina Pedestrian and Bicycle Road Safety Assessment Guide* (Thomas et al. 2018) – Available at: https://connect.ncdot.gov/projects/research/RNAProjDocs/RSA_Guide_FINAL.pdf
- *Pedestrian and Bicyclist Road Safety Audit (RSA) Guide* (Goughnour, et al. 2020) – Available at: (https://safety.fhwa.dot.gov/ped_bike/tools_solve/docs/fhwasa20042.pdf)
- FHWA's *Guidance to Improve Pedestrian and Bicyclist Safety at Intersections* (Sanders, et al., 2020) – Available at: - https://www.nap.edu/catalog/25808/guidance-to-improve-pedestrian-and-bicyclist-safety-at-intersections and other NCHRP reports.
- PEDSAFE interactive tool and website (Zegeer et al., 2013), developed for the U.S. Department of Transportation, Federal Highway Administration – Available at: http://www.pedbikesafe.org/PEDSAFE/index.cfm
- FHWA resources at Safe Transportation for Every Pedestrian (STEP), webpages: https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/step2.cfm
- *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations* (Blackburn, Zegeer & Brookshire, 2017) – Available at: https://safety.fhwa.dot.gov/ped_bike/step/docs/STEP_Guide_for_Improving_Ped_Safety_at_Unsig_Loc_3-2018_07_17-508compliant.pdf

- *North Carolina Pedestrian Crossing Guidance* (Schroeder, O'Brien & Findley, 2015) – Available at: https://connect.ncdot.gov/resources/safety/Teppl/TEPPL%20All%20Documents%20Library/Pedestrian_Crossing_Guidance.pdf and the associated flow chart for help determining appropriate treatments

For designing facilities, several resources include:

- North Carolina Department of Transportation's Complete Streets webpage – Available at: https://www.ncdot.gov/divisions/bike-ped/Pages/complete-streets.aspx
- *AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities* – Available from https://store.transportation.org/Item/CollectionDetail?ID=131
- *NACTO Urban Street Design Guide* – Available from *https://nacto.org/publication/urban-street-design-guide/*

Resources to help agencies improve interactions and safe behaviors among road users include:

- *Advancing Pedestrian and Bicyclist Safety: A Primer for Highway Safety Professionals* (Brookshire et al., 2016) – Available from NHTSA's website: https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/812258-peds_bike_primer.pdf
- Watch for Me - NC webpage – Available at: https://www.watchformenc.org/
- NHTSA's *Countermeasures That Work*, which is updated frequently with information on effective behavior change programs.

For assistance with safety planning and assessment see *How to Develop a Pedestrian and Bicycle Safety Action Plan* (Gelinne et al., 2017) – Available at: https://safety.fhwa.dot.gov/ped_bike/ped_focus/docs/fhwasa17050.pdf

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Appendix: Pedestrian-Motor Vehicle Crashes by County

The following North Carolina tables and maps illustrate the total number of pedestrian-motor vehicle crashes by county (including non-trafficway crashes) and the standard deviation of the average annual rate per 10,000 residents for all crashes. The total number of *Crossing Roadway – Vehicle Not Turning* crashes and their average annual rate per 10,000 residents are also illustrated in tables and maps following.

More populous, urbanized counties have the highest total numbers of crashes (Table 7). The same counties appear in the top 10 for *Crossing Roadway – Vehicle Not Turning* crashes as well (Table 8), although not in exactly the same rank order (Table 8). Additionally, among the top 10 counties for frequency of *Crossing Roadway - Vehicle Not Turning* types of crashes, several have a high proportion of all pedestrian crashes that are these types. These include Cumberland and New Hanover counties, followed by Durham county. See Figure 4 and Figure 6 to illustrate these relationships for all counties. Figure 8 provide a map of all counties with county name labels for reference.

Table 7 Top 10 NC Counties for pedestrian crashes

County	Total Pedestrian Crashes
Mecklenburg	2,915
Wake	1,794
Guilford	1,194
Durham	869
Forsyth	707
Cumberland	696
New Hanover	497
Buncombe	482
Gaston	354
Pitt	324

Table 8 Top 10 counties for *Crossing Roadway - Vehicle Not Turning* crashes

County	*Pedestrian Crossing - Motorist Not Turning* Crashes	Proportion of Total Crashes in County
Mecklenburg	455	15.6%
Wake	231	12.9%
Guilford	172	14.4%
Durham	152	18.1%
Cumberland	146	21.0%
New Hanover	101	20.3%
Forsyth	84	11.9%
Buncombe	80	16.6%
Gaston	58	16.4%
Pitt	57	17.6%

When adjusted for population, the top 10 highest-ranking counties are more varied (Table 9 and Table 10). Durham County has the highest average annual rate per 10,000 residents for any county in the State with 5.7 per 10,000 for all crashes as well as having the highest rate for *Crossing Roadway – Vehicle Not Turning* crashes with 1.0 per 10,000. More rural counties have a high adjusted rate as well, with Halifax County appearing in both the top overall crash counties as well as the top counties for *Crossing Roadway – Vehicle Not Turning* crashes. Other more rural counties also appear in one or the other list. See Figure 5 and Figure 7 to illustrate where each county stands in terms of relative crash rates per population.

Table 9 Counties with standard deviation > 1.5 for all crashes

County	Average Annual Rate per 10,000 Residents	Standard Deviation
Durham	5.7	> 2.5
Mecklenburg	5.4	> 2.5
Guilford	4.5	> 1.5
New Hanover	4.3	> 1.5
Cumberland	4.2	> 1.5
Scotland	4.0	> 1.5
Vance	3.9	> 1.5
Dare	3.9	> 1.5
Forsyth	3.8	> 1.5
Buncombe	3.7	> 1.5

Table 10 Counties with standard deviation > 1.5 for *Crossing Roadway - Vehicle Not Turning* crashes

County	Average Annual Rate per 10,000 Residents	Standard Deviation
Durham	1.0	> 2.5
Cumberland	0.9	> 2.5
New Hanover	0.9	> 2.5
Mecklenburg	0.8	> 2.5
Washington	0.8	> 2.5
Vance	0.8	> 1.5
Scotland	0.7	> 1.5
Lenoir	0.7	> 1.5
Guilford	0.6	> 1.5
Pitt	0.6	> 1.5

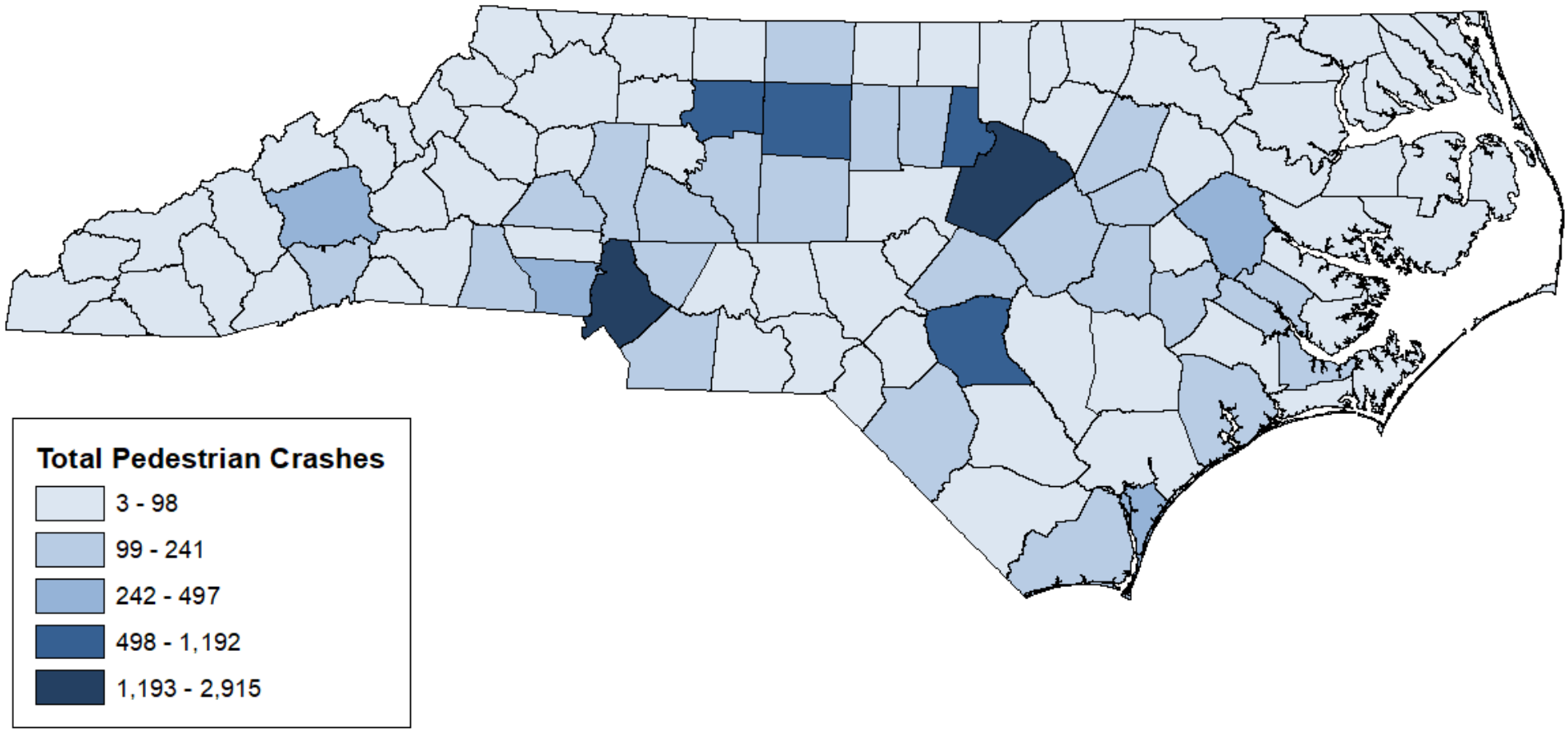

Figure 4 Total pedestrian crash frequencies by NC County

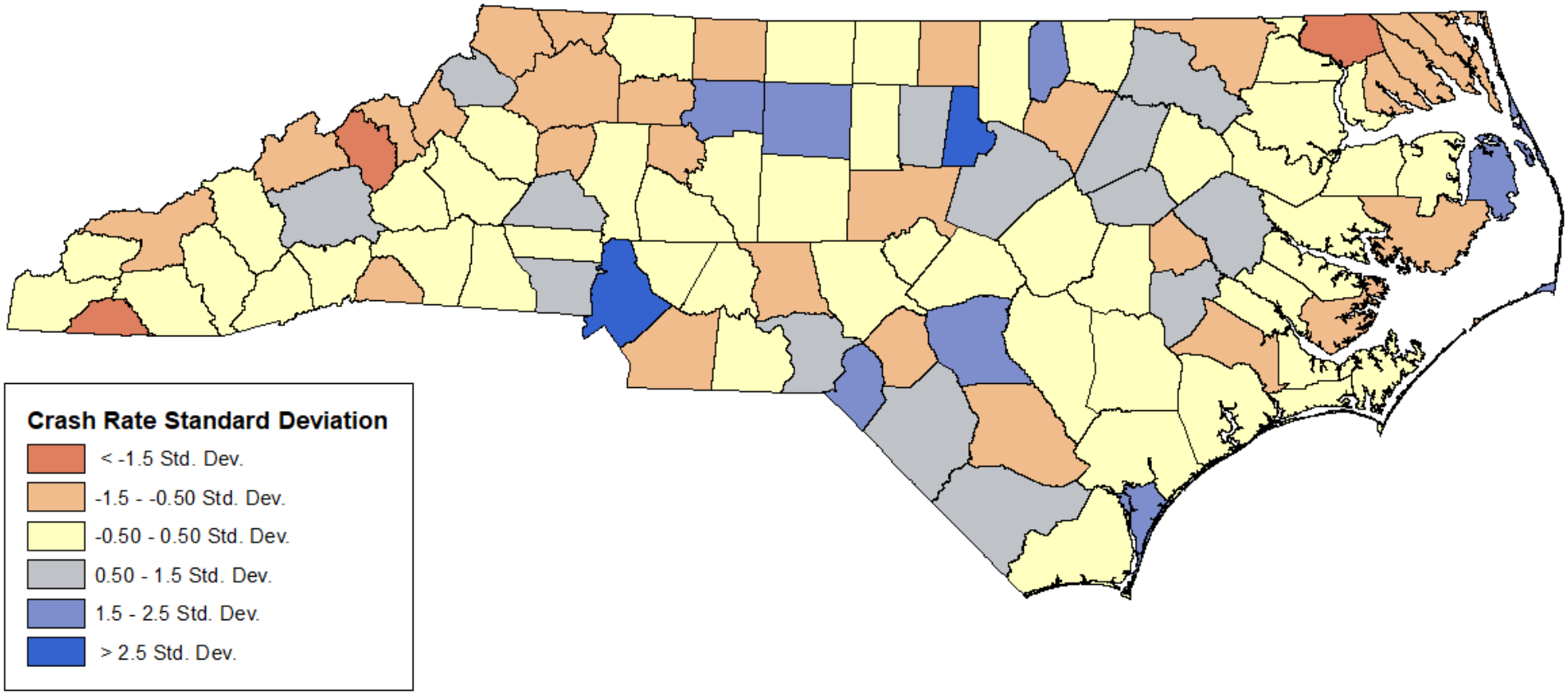

Figure 5 Standard deviation of average annual rate of total pedestrian crashes per 10,000 residents

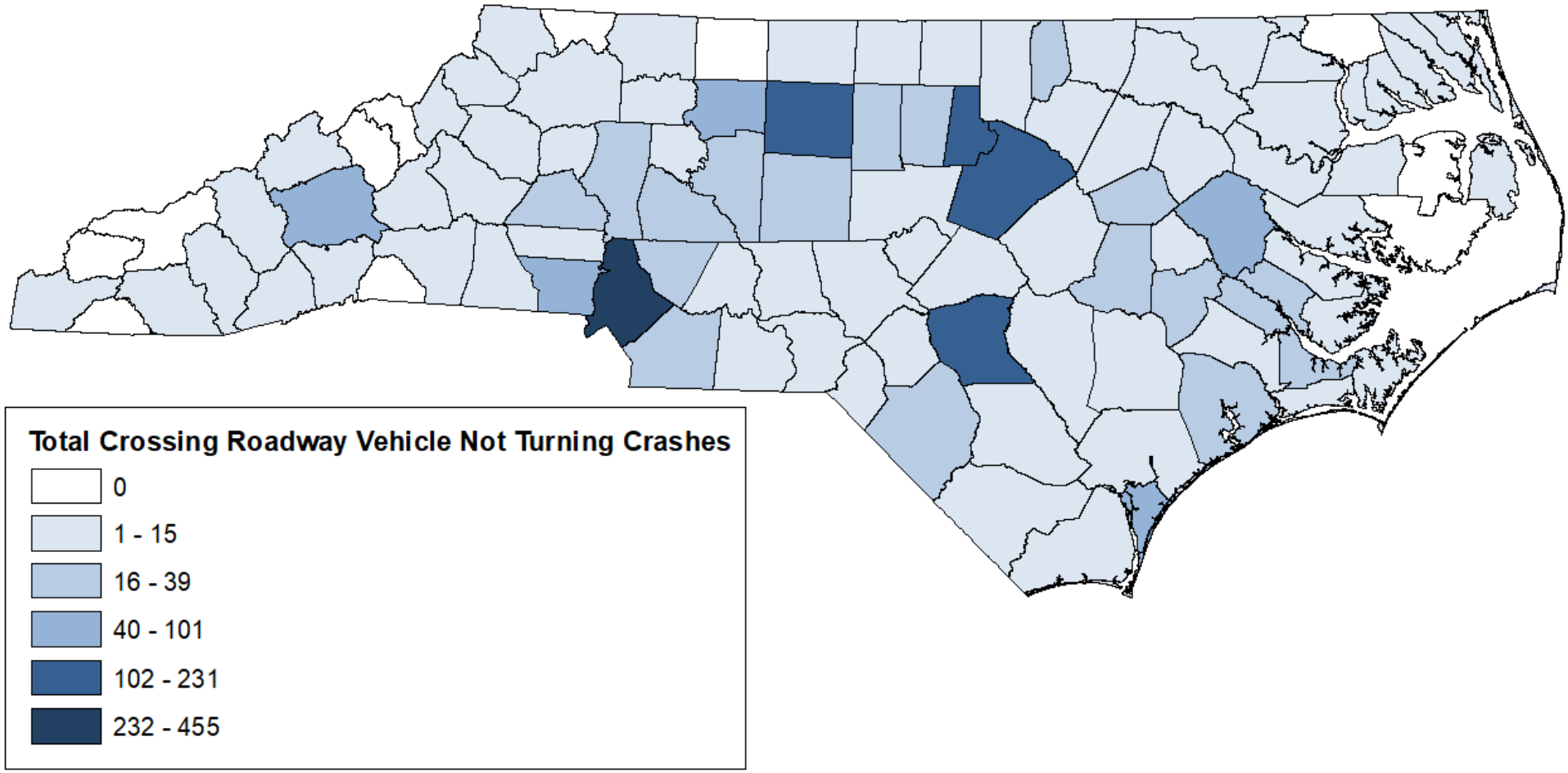

Figure 6 *Crossing Roadway - Vehicle Not Turning* crash frequencies by County

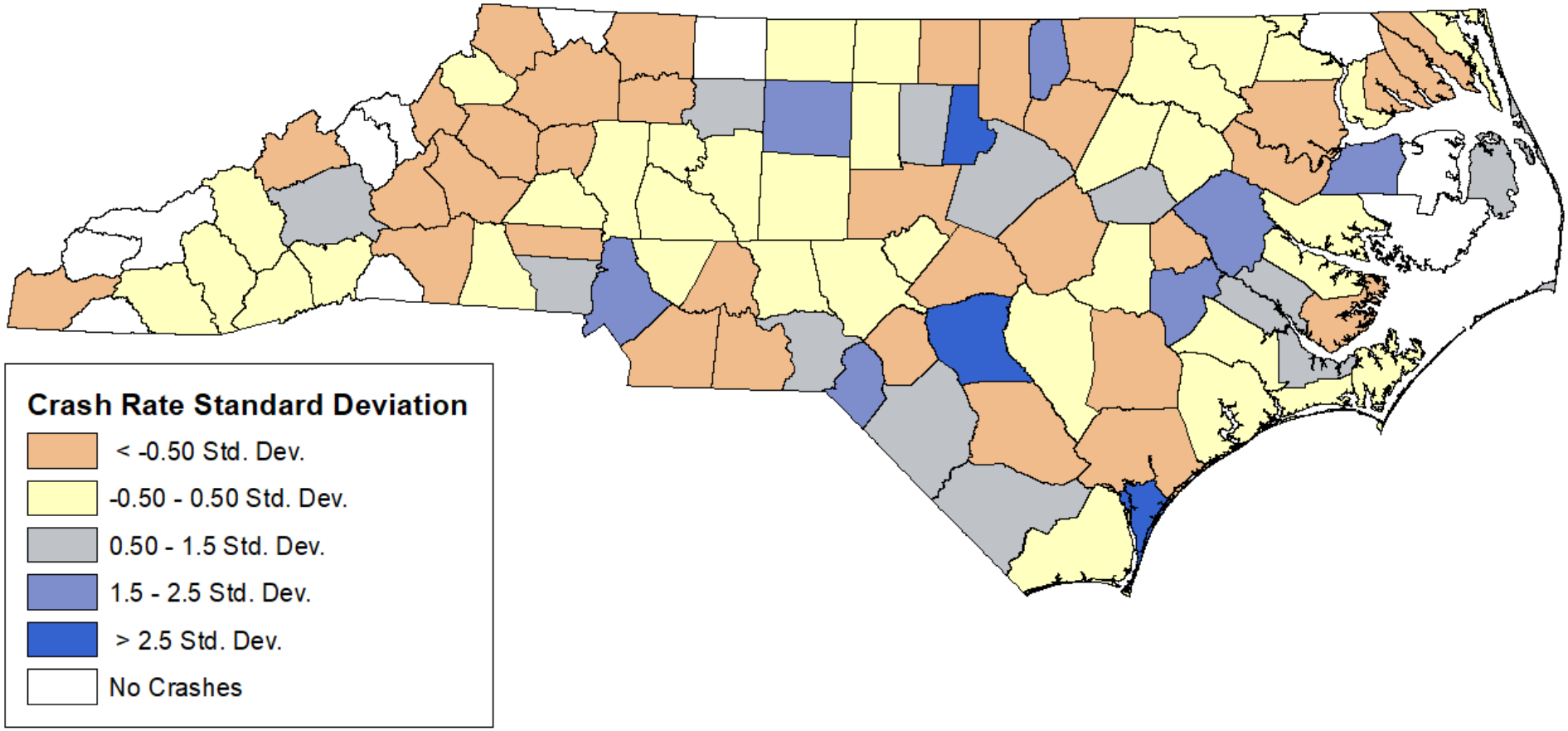

Figure 7 Standard deviation for *Crossing Roadway - Vehicle Not Turning* crashes per 10,000 residents

Figure 8 Map of NC Counties with County names