

# GREAT-NC

## Bicycle and Pedestrian Facility Crossing Safety Analysis

PREPARED BY

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## Urban v Rural Crashes

In North Carolina, between 2012 and 2021, rural bicyclist and pedestrian crashes were more likely to result in a fatality or serious injury than urban crashes. As shown in Figure 1, 26% of all-injury pedestrian and bicyclist crashes occurred in rural contexts, while 44% of fatal and serious injury pedestrian and bicyclist crashes occurred in rural contexts.<sup>1</sup> The share of crashes that occur in urban areas decreases as severity increases, while the share of crashes in rural areas increases as severity increases. This indicates that a crash in a rural area is more likely to result in a serious injury or fatality than a crash in an urban area. According to the most recent census data, 44% of North Carolina residents live in rural areas. This indicates that crashes at all injury levels are under-represented in rural areas, but fatal and serious injury bicyclist and pedestrian crashes are more consistent with population breakdowns.

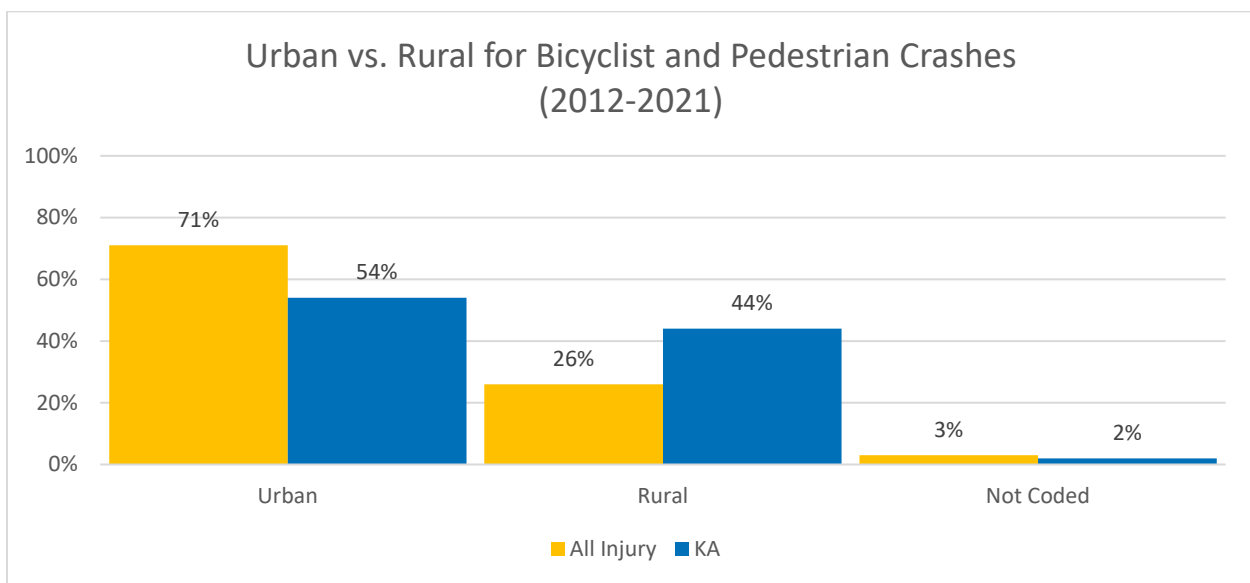


Figure 1

## Separated Facilities

In this same timeframe, 77% of fatal and serious injury pedestrian crashes occurred in the travel lane, compared to 2% occurring while a pedestrian was in a sidewalk or shared-use path. This is particularly pronounced in rural areas, where there is less likelihood of a separated facility (such as sidewalk or

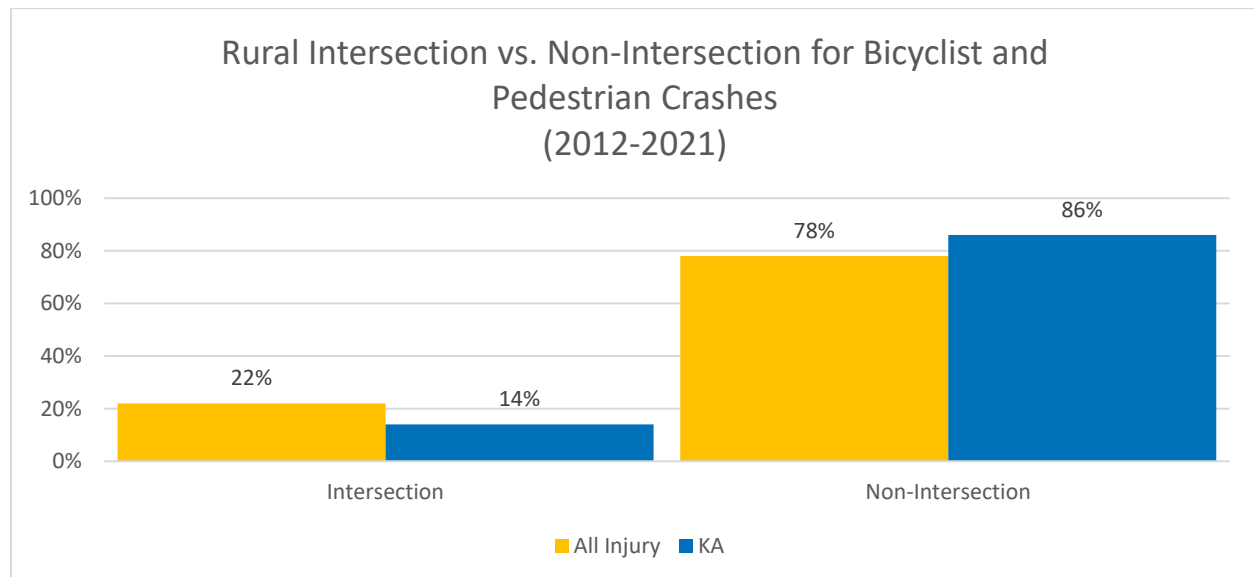
<sup>1</sup> North Carolina aggregates and geo-locates crash reports in the Pedestrian and Bicyclist Crast Analysis Tool (PBCAT). PBCAT uses municipal boundaries as the definition of urban crashes, with "rural" crashes occurring outside of municipal boundaries.

separated bikeways) than in urban areas. Of the crashes that occurred in a travel lane, 48% involved a pedestrian crossing or attempting to cross the roadway between intersections (midblock crossings).

In 17% of all-injury and 17% of fatal and serious injury pedestrian crashes, the pedestrian was walking along the roadway. This is the second highest crash circumstance for pedestrians in this time period, after crossing the roadway. The most common crash circumstance for bicyclists in this time period was a motorist overtaking a bicyclist from behind. One fifth of all bicyclist crashes and 37% of fatal and serious injury bicyclist crashes involved a bicyclist being overtaken by a vehicle.

## Intersection v Non-Intersection

In North Carolina, the majority of pedestrian and bicyclist crashes occur outside of an intersection. This is even more pronounced in rural areas, where there are often longer distances between intersections and fewer land usages that generate pedestrian crossing activity. Figure 2 shows this disparity between intersection and non-intersection crashes in rural locations.



**Figure 2**

Additionally, the presence of a sidewalk shifts this risk slightly in rural contexts. Where no sidewalk is present, 89% of rural fatal and serious injury pedestrian crashes occurred at non-intersection locations, according to a sample of fatal and serious injury pedestrian crashes in North Carolina. Where a sidewalk is present, this decreases to 47% of fatal and serious injury pedestrian crashes occurring at non-intersection locations.<sup>2</sup>

<sup>2</sup> [NCDOT VRU KA Crash Sample](#)

## GREAT-NC

Crash data indicates that creating a separated network and safe crossing locations is paramount to the safety of bicycle and pedestrian facilities such as the ones proposed in GREAT-NC. Creating a separated network improves the safety of users moving along the facility, and safe crossings improves access to the network and residential and commercial areas along the network. The distance between crossing locations is an important safety consideration for pedestrian or bicyclist networks. Land use context is one factor that impacts the need for crossing locations. In urban or dense areas, pedestrian and bicyclist crossing activity is expected to be highest and distance between crossings should be the shortest. Commercial land use in urban, suburban or rural locations is a common indicator of pedestrian and bicyclist activity generators. Rural locations without commercial land use have less demand for shorter distances between crossings. GREAT-NC considers the relationship between land use, activity generators, and distance between crossings in the implementation and design of a safe bicycle and pedestrian network. Distance between crossings will range from < 300 ft in dense or high activity areas to >2,000 ft in rural areas with no residential or commercial land use. Another factor that impacts the distance between crossings is the presence of transit. Pedestrian and bicyclist facilities that align with transit routes should have safe crossing opportunities within 100 feet of each transit stop. Ideally, transit stops will align with intersections that have safety enhancements, or mid-block crossings.

The following matrix shows safety considerations that GREAT-NC is using to create a safe network of rural pedestrian and bicyclist facilities. The matrix shows a set of crossing safety countermeasures, and the situations under which they will be considered at signalized and unsignalized crossings in GREAT-NC. The baseline countermeasures are safety features that will be prioritized at all crossings, signalized or unsignalized. GREAT-NC crossings in urban-like contexts are likely to evaluate the applications of countermeasures such as bike signals, pedestrian recall, or right turn on red restrictions, while the more rural crossings will consider countermeasures like visibility enhancements. This matrix of countermeasures is not comprehensive, and some crossings in GREAT-NC may require unique approaches that apply context-sensitive safety improvements. These will be evaluated on a case-by-case basis in the design of crossings and applied to maximize SUP user safety.

Countermeasure	Application	
	Signalized Crossing	Unsignalized Crossing
High Visibility Crosswalk	Baseline	Baseline
Warning Signs	Baseline	Baseline
ADA Compliant	Baseline	Baseline
Adequate Lighting	Baseline	Baseline
Perpendicular to Roadway	Baseline	Baseline
Grade Separation	High vehicle and shared use path user activity levels	High Speeds (35+MPH) Multilane High Volumes
Refuge Island	High Speeds (35+MPH) Multilane High Volumes	High Speeds (35+MPH), Multilane Rural, two-lane High Volumes
Rectangular Rapid-Flashing Beacons (RRFB)	N/A	Low Volume, Multilane
Review for Signalization of Pedestrian Hybrid Beacon (PHB)	N/A	High Speeds (35+MPH) Multilane High Volumes
Enhanced Visibility (Signage, Markings)	Poor Visibility Vegetation Low Yield Rates	Poor Visibility Vegetation
Protected Left Turn Phase	High Speeds (>35MPH), Multilane High Volumes Dual Left Turns	N/A
Leading Pedestrian Interval (LPI)	Heavy Right Turn Volume Turning Movement Conflict Long Crossing Distance	N/A
Right Turn on Red (RTOR) Restrictions	Low Yield Rates Poor Visibility	N/A
Reduced Corner Radii	Heavy Right Turn Volume Turning Movement Conflict Long Crossing Distance	N/A
Pedestrian Recall	High Pedestrian Activity Levels	N/A
Bicyclist Signal	High Bicyclist Activity Levels	N/A

## GREAT-NC Crossing Analysis

This crossing analysis identifies three main safety considerations for the shared use path and sidewalk segments in GREAT-NC:

1. **Main alignment ADT > 6K:** All of the shared use path and sidewalk segments in GREAT-NC follow NCDOT roadway alignments. Any road with an Average Daily Travel (ADT) greater than 6,000 fits a minimum threshold for enhanced bicyclist/pedestrian crossing safety improvements. This includes any proposed midblock crossings, neighborhood connections, and signalized and unsignalized intersections.
2. **Signalized crossings:** Signalized crossings should follow the safety applications described in the previous table. Signalized crossings on roads with ADT >6K should be considered for enhanced safety applications.
3. **High crossroad ADT/Potential new signals:** This analysis looks at the ADT of crossroad/minor intersection approaches along the shared use path and sidewalk segments in GREAT-NC. Where ADT data is available (State System Primary or Secondary Routes), a 6K threshold was used again. Crossroads with ADT >6K are recommended for signalization consideration. Crossroads with high ADTs but below 6K are recommended for potential signalization evaluation (including alternate signals such as Pedestrian Hybrid Beacons). Intersections with potential high pedestrian demand despite low ADT (i.e. school crossings) are recommended for signalization consideration.

ID	GTSP Network Segment	Main Alignment ADT >6K	Signalized Crossings	High Crossroad ADT / Potential New Signals
1	13D (Marion N Main Sidepath)	<ul style="list-style-type: none"> <li>• Full segment</li> </ul>	<ul style="list-style-type: none"> <li>• 6</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>
2	13I	<ul style="list-style-type: none"> <li>• Rutherford Rd and NC 226 east of Marion</li> </ul>	<ul style="list-style-type: none"> <li>• 5</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>
3	Lawndale TC	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• 0</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>
4	11J	<ul style="list-style-type: none"> <li>• Full segment</li> </ul>	<ul style="list-style-type: none"> <li>• 2</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>
5	Lumberton Lp	<ul style="list-style-type: none"> <li>• Segment on Roberts</li> <li>• Segment on Pine from Roberts to Elizabethtown</li> <li>• Segment on 2nd</li> </ul>	<ul style="list-style-type: none"> <li>• 7</li> </ul>	<ul style="list-style-type: none"> <li>• Potential at 2nd and Chestnutt</li> </ul>
6	5B	<ul style="list-style-type: none"> <li>• US-15 in DT Oxford</li> </ul>	<ul style="list-style-type: none"> <li>• 13</li> </ul>	<ul style="list-style-type: none"> <li>• Signalize D St at Central Ave</li> </ul>
7	4G	<ul style="list-style-type: none"> <li>• Smithfield to 95 Jct</li> <li>• Keen Rd</li> <li>• N Wall in DT Benson to S terminus</li> </ul>	<ul style="list-style-type: none"> <li>• 13</li> </ul>	<ul style="list-style-type: none"> <li>• Signalize Keen at Boyette</li> <li>• Signalize N Wall at Federal</li> </ul>
8	5D	<ul style="list-style-type: none"> <li>• Short segment in DT Warrenton</li> </ul>	<ul style="list-style-type: none"> <li>• 7</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>
9	3F	<ul style="list-style-type: none"> <li>• Full segment excl. Southport</li> </ul>	<ul style="list-style-type: none"> <li>• 19</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>
10	3E	<ul style="list-style-type: none"> <li>• DT Leland to S terminus</li> </ul>	<ul style="list-style-type: none"> <li>• 7</li> </ul>	<ul style="list-style-type: none"> <li>• Signalize by school</li> </ul>
11	2F	<ul style="list-style-type: none"> <li>• Western segment in Gville</li> <li>• East of 587 Jct</li> </ul>	<ul style="list-style-type: none"> <li>• 11</li> </ul>	<ul style="list-style-type: none"> <li>• Signalize Old Pactous/264</li> </ul>
12	2E	<ul style="list-style-type: none"> <li>• Full segment</li> </ul>	<ul style="list-style-type: none"> <li>• 7</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>