

# APPENDIX E - Intersection Safety Action Plan

## Introduction

*Intersection Safety* is one of nine emphasis areas of the North Carolina Strategic Highway Safety Plan. This emphasis area includes all crashes occurring at the intersection of two or more roads.

## State of the Problem

Intersection crashes comprised 23 percent of all crashes and 19 percent of all fatalities in 2012 on North Carolina roadways. Table E-1 offers a basic summary of intersection-related crashes by severity on North Carolina's highways from 2004 – 2013. Also included are the number of injuries and fatalities resulting from intersection crashes. Injuries are classified into four levels of severity, defined as:

- **Fatal** – Crash-related injuries result in a death within twelve months of the crash.
- **Type A Injury** – Crash-related injuries serious enough to prevent normal activity for at least one day such as a massive loss of blood, broken bones, etc.
- **Type B Injury** – Crash-related injuries that are not fatal or Type A, but are evident at the scene such as bruises, swelling, limping, etc.
- **Type C Injury** – There is no visible injury but there are complaints of pain or has been momentarily unconsciousness.

Table E-1 shows intersection crash trends in North Carolina from 2004 – 2013. The total crashes figures include crashes that did not result in injury or fatality.

There has been a steady decline in intersection crashes over the last decade, consistent with a decline in all crashes statewide. However, the

percent of all crashes that are intersection crashes has remained consistent over the ten-year period. The number of fatalities and injuries has also declined, with serious injuries reduced by more than half in the last ten years.

There are many challenges to reducing intersection crashes and the fatalities and serious injuries that result. Notable challenges include:

- Determining the best use of resources in an area that has countermeasures of widely varying costs and effectiveness.
- Determining the right combination of system-wide countermeasures versus site-specific applications.
- Selecting appropriate treatments at rural intersections, where there are often less frequent but more severe collisions.

In 2011, as part of the Focused Approach to Safety, the Federal Highway Administration (FHWA) worked with the North Carolina Department of Transportation (NCDOT) to address intersection crashes through data analyses and the development of a straw man intersection safety implement plan. This plan provided insight for several efforts in North Carolina. Additionally, North Carolina has undertaken several related successful efforts in the last few years that have likely contributed to the reductions evident in Table E-1.

Notable efforts include the following successes:

- The North Carolina Highway Safety Improvement Program (HSIP) has been very successful in identifying hazardous intersections, performing field investigations, and developing safety recommendations to reduce intersection crashes.

**Table E-1:** North Carolina Intersection Crash Trends (2004 – 2013).

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<b>Total Intersection Crashes</b>	59,431	56,866	55,296	56,023	52,815	50,829	49,616	49,244	49,723	50,059
<b>Fatal Crashes</b>	278	261	262	289	250	224	236	201	231	225
<b>A Injury Crashes</b>	748	687	672	597	533	436	379	456	391	387
<b>B Injury Crashes</b>	6,212	5,891	5,607	5,681	5,208	4,864	4,776	4,678	4,671	4,481
<b>C Injury Crashes</b>	18,187	16,881	16,528	16,547	15,642	15,186	14,516	14,255	14,592	14,404
<b>Fatalities</b>	312	280	287	319	269	237	253	208	241	243
<b>A Injuries</b>	964	904	865	788	660	535	495	572	473	471
<b>B Injuries</b>	9,063	8,480	8,064	8,024	7,295	6,810	6,599	6,527	6,441	6,102
<b>C Injuries</b>	33,736	31,134	30,588	30,514	28,845	28,305	27,037	26,054	26,678	25,879

- The Complete Streets policy has been successful and ensures that all modes of transportation are considered.
- Modern intersection designs—such as roundabouts, superstreets, and median channelization—have been successfully installed throughout the State.
- North Carolina has successfully incorporated systemic treatments such as pedestrian countdown heads, signal lenses size, and flashing yellow arrows at signalized intersections.

Although these successful efforts have had a positive impact on intersection crashes, additional actions are needed to continue to improve intersection safety.

## Emphasis Area Goal

In 2013, there were 243 fatalities and 471 serious injuries at intersections. The goal for this

emphasis area is to reduce fatalities and serious injuries at intersections.

## Strategies and Supporting Actions

The following strategies are needed to achieve the goals of the Intersection Safety emphasis area. Listed below each strategy are several recommended actions to support it, as well as one or more North Carolina agencies identified as having a potentially significant role in its implementation and the current status of the action.

### Strategy 1

#### Improve visibility of intersections by providing enhanced signs and pavement markings.

There are many cases in which intersections are not readily visible to approaching drivers, particularly at rural, unsignalized locations. The

visibility of intersections and the ability of approaching drivers to perceive them and respond appropriately can be enhanced by signing and delineation.

## *Supporting Actions*

1. Conduct an evaluation of intersections that are candidates for systematic, low-cost signage, and delineation improvements.

Field check sites to determine quality and appropriateness of existing signs and pavement markings; verify that minimum signing needs are met; identify unnecessary signs or sight distance obstructions to remove. Improvements may include additional signs, advance signs, post reflectors, sign replacement, and pavement markings.

*Potential Implementing Agencies:* NCDOT  
*Status:* Needed

2. Research high-visibility crosswalk markings to determine whether a higher prevalence of their use dilutes their effectiveness, and refine guidelines on suggested or required locations for their installation.

*Potential Implementing Agencies:* NCDOT, ITRE  
*Status:* Needed

## **Strategy 2**

### **Reduce the frequency and severity of intersection crashes through traffic control enhancements.**

Traditional two-way stop-controlled and signalized intersections comprise the overwhelming majority of intersection types in North Carolina. Unconventional intersection

designs (e.g., roundabout and superstreet) often experience fewer and less severe crashes due to a reduction in conflict points at the intersection. In addition, all-way stop-controlled intersections have been effectively used at some locations in the State to reduce severe crashes.

## *Supporting Actions*

1. Consider the conversion from traditional two-way stop control to all-way stop intersections as a low-cost means of reducing crash severity.

Review volume warrants for all-way stop installation, and ensure that they are appropriate.

*Potential Implementing Agencies:* NCDOT  
*Status:* Needed

2. Consider the installation or conversion of intersections to roundabouts.

*Potential Implementing Agencies:* NCDOT  
*Status:* Underway

3. Increase use of access management techniques to reduce conflict points at intersections.

Intersection treatments include the use of a raised median to restrict movements, superstreet designs, and driveway consolidation.

*Potential Implementing Agencies:* NCDOT  
*Status:* Underway

4. Investigate the use of actuated No Turn on Red signs, Pedestrian Hybrid Beacons (PHBs), or Rectangular Rapid Flashing Beacons (RRFBs) at intersections or other pedestrian crossings to improve driver yielding rates.

*Potential Implementing Agencies:* NCDOT  
*Status:* Needed

## Strategy 3

### **Enhance safety at signalized intersection through the use of proven safety countermeasures.**

North Carolina has successfully upgraded and enhanced equipment at signalized intersections over the years. Continued applications of measures designed to improve signal head visibility and conspicuity, compliance with the signal, and yielding compliance (including to pedestrians) are encouraged.

#### *Supporting Actions*

1. Investigate opportunities to install signal technology improvements, such as leading pedestrian intervals. Flashing yellow arrows, pedestrian countdown heads, and 12" signal lenses are being installed regularly. Increased use of back plates and dynamic red extension technology are measures that can be expanded within the State.

*Potential Implementing Agencies:* NCDOT

*Status:* Underway

## Strategy 4

### **Support and enhance driver education and awareness programs.**

Targeted public information and education campaigns increase awareness of the safety issues at intersections.

#### *Supporting Actions*

1. Update driver education curriculum to include information on flashing yellow arrows and other newer traffic control devices or intersection treatments (e.g., RRFBs, PHBs, roundabouts).

Incorporate additional bicycle and pedestrian information into the driver education curriculum, with particular emphasis on yielding to pedestrians at crosswalks.

*Potential Implementing Agencies:* NCDOT, NCDPI

*Status:* Planned

2. Consider implementation of a graduated transportation education curriculum that focuses on pedestrian and bicycle safety for children ("Let's Go NC!") and then transitions to vehicular safety for teenagers.

*Potential Implementing Agencies:* NCDOT, NCDPI

*Status:* Needed

## Working Group Members

The working group for this emphasis area includes the following representatives from nine agencies committed to achieving the goals of this Action Plan:

- Greg Brew, North Carolina Department of Transportation
- Julian Council, North Carolina Department of Transportation
- Andie Cozzarelli, North Carolina Department of Transportation
- Haywood Daughtry, North Carolina Department of Transportation
- Reginald Flythe, North Carolina Department of Public Instruction
- Bucky Galloway, North Carolina Department of Transportation
- Frank Hackney, Governor's Highway Safety Program
- David Harkey, UNC Highway Safety Research Center

- Denny Hoadley, AARP
- Terry Hopkins, North Carolina Department of Transportation
- Tim Inglis, 3M
- Ron King, North Carolina Department of Transportation
- Dan Lang, Ennis-Flint
- Brian Mayhew, North Carolina Department of Transportation
- Brian Murphy, North Carolina Department of Transportation
- Barak Myers, Eastern Band of Cherokee Indians
- Sarah O'Brien, NCSU Institute for Transportation Research and Education
- Chris Oliver, North Carolina Department of Transportation
- Shawn Troy, North Carolina Department of Transportation
- Robert Willcox, Eastern Band of Cherokee Indians
- FHWA, North Carolina Intersection Safety Implementation Plan: Data Analysis and Straw Man Outline, March, 2011.
- North Carolina Department of Transportation Crash Data Tool and Reports. <http://bit.ly/1u2vHeu>
- North Carolina Department of Transportation Complete Streets Policy. <http://bit.ly/1n5k3tx>
- NHTSA's Countermeasures that Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices. <http://bit.ly/1AbynCV>
- Pedestrian and Bicycle Countermeasure Selection System. <http://bit.ly/1AMQ2Ur>
- Crash Modification Factors Clearinghouse. <http://bit.ly/1wVVK2x>
- Watch for Me NC. <http://bit.ly/1tywPok>
- Let's-Go NC! - Pedestrian and Bicycle Safety Curriculum. <http://bit.ly/1y8EZXE>
- National Association of City Transportation Officials Urban Street Design Guide (<http://bit.ly/1AMR4Qj>) and Urban Bikeway Design Guide (<http://bit.ly/1gPhKHi>).
- American Association of State Highway and Transportation Officials (AASHTO) bicycle and pedestrian design guides
- Institute of Transportation Engineers Designing Urban Walkable Thoroughfares

## Supporting Material

The following are considered valuable resources to the implementation of the Intersection Safety Emphasis Area Action Plan:

- FHWA, Intersection Safety Implementation Plan Process. <http://1.usa.gov/14ScssN>
- FHWA, Proven Safety Countermeasures. <http://1.usa.gov/1HvhEBv>
- FHWA, Intersection Safety Needs Identification Report. <http://1.usa.gov/1BXZ42g>
- FHWA, National Agenda For Intersection Safety. <http://1.usa.gov/1Acj25h>
- FHWA, Intersection Safety. <http://1.usa.gov/1BXZ5TS>