

# NCDOT Traffic Safety Unit Programs



## All Way Stop Control

All-way stop control (AWSC) is a countermeasure that can be used to help alleviate crash problems at intersections with a pattern of high severity frontal impact crashes, and in many cases the treatment can be quick and easy to implement. Two-way stop control works well at thousands of intersections across North Carolina and is appropriate for many lower volume intersections; however, where there is a demonstrated safety problem and a pattern of crashes at an intersection, AWSC should be considered.

### Benefits

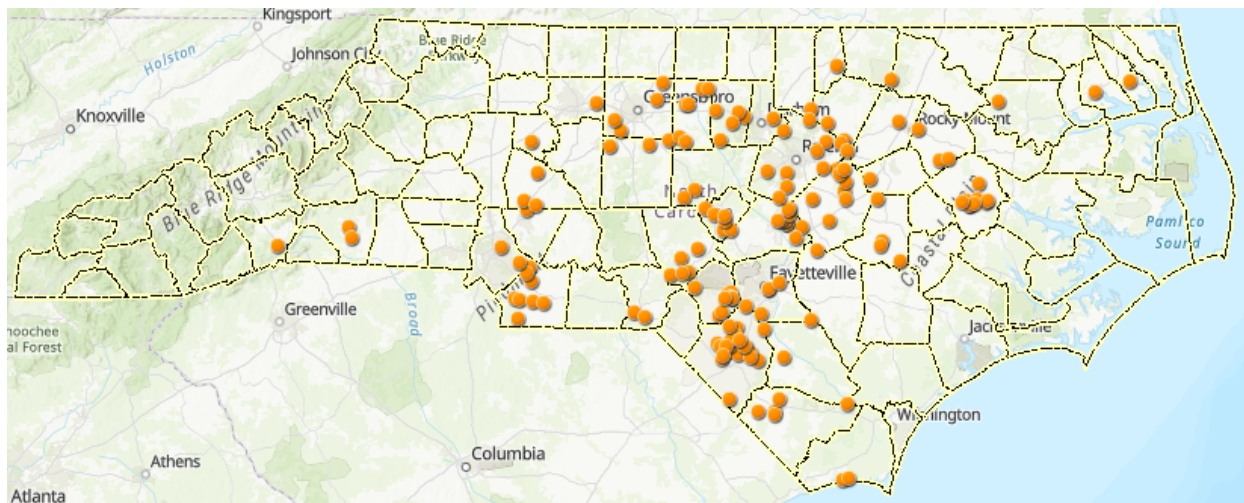
AWSC is a proven treatment to address safety concerns. AWSC is relatively low cost and can operate effectively under a variety of conditions.

- ❖ **Median Cost is roughly \$20,000** looking at over 80 AWSC projects funded in the last 5 years.
- ❖ **Benefit to Cost is 83:1** looking at 36 AWSC projects at four-leg intersections evaluated with before & after crash data. In those projects, there were 26 Fatal & Serious Injury Crashes reported before and *NONE* after.

### Spot Safety Treatments

Support for AWSC projects as a safety treatment continues to grow across the State. As of 2019, over 150 AWSC conversions have been funded as safety projects across 11 Divisions in North Carolina. There has been a pronounced increase in projects for funding years 2016 – 2019.

### Statewide AWSC Spot Safety Treatments



## Safety Study Findings

NCDOT completed a safety study of over 50 intersections in North Carolina converted from two-way stop control to AWSC. The study includes a diverse group of four-leg intersections converted to AWSC in urban, suburban, and rural areas. Intersections with a range of volumes and approach speeds are included. The study is comprised of locations both with and without overhead and/or sign mounted flashing beacons. The overall results from all study locations indicate a:

**68% Reduction in Total Crashes**  
**77% Reduction in Fatal and Injury Crashes**  
**75% Reduction in Frontal Impact Crashes**

***There appears to be an even greater crash reduction at higher speed (45-55 mph) AWSC sites.***

## Volume Thresholds

The conversion to AWSC is consistently effective at reducing crashes for a range of intersection volumes. Sites with volumes below the minimum Manual on Uniform Traffic Control Devices (MUTCD) thresholds have performed well in NC. The Safest Feasible Intersection Design (SaFID) Chart produced by Dr. Joe Hummer provides volume thresholds for the optimal intersection control. In volume ranges where AWSC is the SaFID and a crash pattern is present, AWSC should be considered.

[https://connect.ncdot.gov/resources/safety/Teppi/TEPPL%20All%20Documents%20Library/C60\\_SaFID%20Chart.pdf](https://connect.ncdot.gov/resources/safety/Teppi/TEPPL%20All%20Documents%20Library/C60_SaFID%20Chart.pdf)

- ❖ When considering INJURY crashes, AWSC is the safest feasible intersection design for 2-lane at 2-lane intersections where: Major street AADT is under 5,000 vehicles per day & Minor street AADT is under 5,000 vehicles per day.
- ❖ When considering ALL crashes, AWSC is the safest feasible intersection design for 2-lane at 2-lane intersections where: Major street AADT is under 7,500 vehicles per day & Minor street AADT is under 7,500 vehicles per day.

***Under lower volume conditions, AWSC does not pose a threat to operations.***

### General rules of thumb regarding volumes:

- ❖ When the AADT on both roadways is 4,000 vehicles/day or less, the intersection is expected to operate at an acceptable level of service without the need for additional capacity analysis.
- ❖ When the AADT of either roadway is between 4,000 to 7,500 vehicles/day, or in unique situations with strong peak hours or directional volume, further capacity analysis may be warranted to verify operation and to know the scale of the expected delay.
- ❖ The upper limit for AWSC operations is when both roadways have AADT of 7,500 vehicles per day assuming typical conditions. Above these limits, the likely safest feasible intersection design is a single lane roundabout based on the SaFID chart.
- ❖ Turning movement counts may be needed at higher volume thresholds; however, Congestion Management Unit (CMU) may estimate these volumes from adjacent AADTs. Capacity analysis of AWSC is quick and easy, and CMU can assist with speedy turnarounds on requests.

## Unbalanced Volumes

The 2009 MUTCD states “Multi-way stop control is used where the volume of traffic on the intersecting roads is approximately equal.” The guidance in this section of the MUTCD has only seen minor changes since 1971, when the FHWA began administering the manual. More recent research does not suggest approach volumes must be nearly equal for AWSC to be effective.

NCHRP 03-109 created proposed MUTCD criteria for determining appropriate traffic control at unsignalized intersections. The criteria were developed to be considered for inclusion in the next version of the MUTCD Sections 2B.04 to 2B.10. In the AWSC criteria, **all language pertaining to unbalanced volumes was removed**. The research results have been provided to the National Committee on Uniform Traffic Control Devices for their consideration.

Using current AWSC safety projects in North Carolina, half of the intersections have volumes that are considered unbalanced (with the minor road volume making up less than 40% of the total intersection volume), demonstrating AWS can be applied and work in unbalanced conditions.

## Primary Route Performance

AWSC can be installed on primary routes without violating driver expectations or creating safety concerns. AWSC has been implemented at over 40 intersections with primary routes. AWSC has been used effectively on primary routes as an interim treatment and as a long-term safety solution.

### Case Study: NC 39 at NC 97 in Wake County (GPS 35.833490, -78.269698)

AWSC has been in place since 2007. The Spot Safety Project Evaluation (*web link below*) shows an 83% reduction in total crashes from 23 to 4, and a dramatic reduction in the frontal impact crash pattern.



<https://connect.ncdot.gov/resources/safety/Safety%20Evaluation%20Completed%20Projects/SS-05-06-211%20Web.pdf>

Images Source: Google Maps

## Trucks

Presence of trucks should not be a reason to exclude AWS as a safety treatment. Locations with a high truck percentage may need a closer inspection; however, AWSC does not appear to pose a problem for trucks based on crash data.

Trucks represent 2% of vehicles involved in crashes at AWSC intersections based on a review of crash data from over 30 intersections.

Based on the 2018 NC Traffic Crash Facts, trucks represent 3% of vehicles involved in crashes at the statewide level.



NCDOT has never received negative feedback from the Oversize/Overweight trucking industry on AWSC intersections.

Images Source: Google Maps (NC 11/42 at NC 308 in Bertie Co.)

## Other Considerations

- ❖ The decision to install AWSC should be based on an engineering study.
- ❖ Where roundabouts, mini-roundabouts, or traffic control signals are justified, AWSC may be used as an interim measure that is installed quickly to control traffic while arrangements are being made for the installation of the long-term traffic control.
- ❖ The safety of AWSC at four leg intersections is well demonstrated. There is likely great potential for three leg intersections; however, limited safety data is currently available.
- ❖ At intersections where the major road turns left or right, AWSC can provide both a safety and operational benefit.
- ❖ In urban locations the impacts of pedestrians on AWSC operation need to be considered. In locations with heavy pedestrian volumes there may be conflicts between pedestrians and motor vehicles and operations may degrade. However, presumably slower approach speeds and considerable eye contact among users may mean AWSC is a safer option than some other forms of traffic control. Additional study may be needed if pedestrian volumes are high.

AWSC in Images

AWSC has been installed under a variety of conditions, including those with skew, with crosswalks, within proximity to schools, with three legs, with unusual configurations, and with slip lanes.

