



FACT SHEET

North Carolina Department of Transportation Collecting and Using Data from Manual Flagging Operations

SMARTER WORK ZONES TECHNOLOGY APPLICATION STRATEGIES

Smarter Work Zones Technology Applications involve deployment of intelligent transportation systems (ITS) for dynamic management of work zone traffic impacts to improve motorist and worker safety and mitigate work zone-related congestion.

This fact sheet focuses on the North Carolina Department of Transportation (NCDOT) use of technology applications to collect data at manual flagging operations for mobility performance measurement of projects on its Statewide Rural Surfacing/Resurfacing program.

Background

The Work Zone Safety and Mobility Rule¹ requires operational data collection to better manage resulting safety and mobility impacts in work zones. Many technologies are available for work zone data collection, and recent innovations have made data collection easier and less expensive. Temporary data collection technologies such as side-fire radar, side-fire microwave radar sensor, and k-band radar Doppler can be used in the field, over the duration of a work zone, to support a variety of applications, including queue warning systems, traveler information, and performance measurement. NCDOT provides an example of employing k-band radar Doppler to collect data to monitor mobility and adjust operations for better work zone management.

Work Zone Mobility Assessment

The NCDOT saw an opportunity to assess mobility in rural work zones using k-band Doppler devices that were originally supplied for a USDOT-sponsored research project. In 2009, at the conclusion of the project, the devices were turned over to the NCDOT. Today, NCDOT uses seven of these devices to evaluate performance criteria for manual flagging operations for its Statewide Rural Surfacing/Resurfacing program.

NCDOT partners with a traffic control company to collect and assess data coming from the devices. A memorandum of understanding between the traffic control contractor and NCDOT outlines responsibilities of both parties. In those contracts, a flat rate for labor is specified and the traffic control contractor charges based on time worked. Because there are more resurfacing projects than pairs of data collection devices, specific sites are selected by the contractor and approved by NCDOT for deployment. The sites are approved by NCDOT before the contractor



Figure 1: Manual flagging operations on low-volume two-lane roadways can have negative mobility impacts. (Source: FHWA)

deploys data collection devices. In most cases, the traffic control contractor provides the flagging services. In other cases, when the construction contractor provides flagging services, coordination between contractors is expected.

At flagger stations in single-lane work zones, the performance measure of wait time is used. This particular performance measure was selected by NCDOT because it is a value that equates to driver experience. Wait time is a value that is understood by the general public and elected officials, and is less likely to produce skepticism from non-traffic experts who are not familiar with other measures of mobility.

A single device is placed at each manual flagging station. While devices are generally capable of providing speed and volume information, they are used to detect when vehicles are waiting in this application. At the conclusion of the project, the contractor removes the devices and assists NCDOT in processing the collected data. For every 15-minute period during active construction, a score is assigned depending on the total amount of time vehicles are waiting at the flagger station. The categorization system is displayed in Table 1.

¹ 23 CFR 630, Subpart J available at: http://www.ops.fhwa.dot.gov/wz/docs/wz_final_rule.pdf

Table 1: Average Wait Time Categorization used by NCDOT

Wait time	Mobility Score
<5 minutes	1
5-10 minutes	2
10-15 minutes	3
>15 minutes	4

A daily score is devised by averaging the scores from all 15-minute periods when work zone operations are active, and a project's overall mobility performance rating is determined by averaging the daily scores on days where work zone operations are active. The duration of a project can range anywhere from one to thirty days. Table 2 indicates the relationship between the daily and project average scores and overall performance rating.

Table 2: NCDOT Develops Average Daily and Project Mobility Score for Work Zones

Daily/Project Average Mobility Score	Mobility Performance Rating
1.0	Excellent
1.1-2.0	Expected
2.1-3.0	Below Expected
> 3.1	Poor

At the conclusion of a project, NCDOT looks at instances of poor mobility to get an indication of the events that may have resulted in a low mobility rating. While mobility issues are rare for planned events on low-volume roads, they do happen and could be the result of a paver breaking down, a plant breaking down, or that there are at times few incentives for the contractor to maintain a certain level of mobility. However, this can typically be prevented in future work zones by utilizing lane closure restrictions in the contract and providing incentives/disincentives for maintaining/restricting mobility.

Because the decision to close a lane is made at the NCDOT division level, mobility performance can be assessed for each division to indicate areas where improvements in traffic control can be made. Furthermore, having a measure of mobility provides a good starting point for a conversation between NCDOT and divisions regarding division-level decisions that will improve mobility in work zones. If decreasing mobility is noted, the NCDOT could take several actions to rectify the issue on future projects:

- Assess traffic volumes to determine whether lane closure restrictions are warranted
- Change duration of closure and/or type of work
- Perform site visits to ascertain if proper flagging techniques are being used, and that traffic alternates every five minutes, as recommended
- Investigate if automated flaggers or portable traffic signals could better serve operations.

Expanding Work Zone Data Collection

NCDOT has plans to expand their work zone data collection program. NCDOT tracks mobility performance project-by-project and once enough data is collected, develops a statewide mobility rating for rural work zones. The state plans to continue using k-band radar Doppler devices to assess wait time on rural flagging projects and eventually leverage third-party data sources to devise mobility performance measures on more heavily-traveled routes. One concern is the ability to devise a robust system that processes large volumes of data and provides an output that can be easily understood and acted upon. Posting mobility data to a dashboard in real-time is another vision the state has for managing its work zone operations.

Once enough data is collected, North Carolina wants to be able to predict the number of 15-minute periods where poor mobility is expected on a planned project, given its time of operation and expected traffic volumes. Such a system could provide support for restricting lane closures during certain times of the day for a particular planned work zone.

Additional resources on SWZ technology application strategies can be found at: https://www.workzonesafety.org/swz/technology_application

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