Analysis of Speeds and Crashes in North Carolina Interstate Work Zones

Final Draft Report

March 18, 2025

Prepared for

North Carolina Department of Transportation (NCDOT)

Submitted by

VHB

Table of Contents

List of Tables

List of Figures

Acronyms

AADT	Annual Average Daily Traffic
AWZSE	Automated Work Zone Speed Enforcement
BLRT	Blue Light Radar Trailer
CFR	Code of Federal Regulations
CLCD	Connected Lane Closure Devices
CSL	Changeable Speed Limit
CMS	Changeable Message Sign
DSFS	Dynamic Speed Feedback Sign
DSL	Digital Speed Limit
FHWA	Federal Highway Administration
HAWKS	Helping All Work Zones Keep Safe
HCS	Highway Capacity Software
IIHS	Insurance Institute for Highway Safety
ICM	Integrated Corridor Management
ISP	Illinois State Police
MUTCD	Manual on Uniform Traffic Control Devices
NCDOT	North Carolina Department of Transportation
NCHRP	National Cooperative Highway Research Program
NCSHP	North Carolina State Highway Patrol
PCMS	Portable Changeable Message Sign
PI	Public Information (as part of TMP)
SFWL	Sequential Flashing Warning Lights
SPE	Speed-Radar Photo Enforcement
SSC	Speed Safety Camera
STOC	State Traffic Operations Center
TMP	Transportation Management Plan

TO	Transportation Operations (as part of TMP)
TTC	Temporary Traffic Control
VDOT	Virginia Department of Transportation
VSL	Variable Speed Limit
WB	Westbound
EB	Eastbound
NB	Northbound
SB	Southbound
WZ	Work Zone

Executive Summary

The North Carolina Department of Transportation (NCDOT) implements practices to enhance work zone safety and mobility, including managing speeds in work zones. NCDOT's approach to setting work zone speed limits follows national practices and is consistent across the State. It considers the type of construction activity and the safety of workers and the traveling public. Recently, the construction industry expressed concerns about vehicles speeding in work zones. In response to those concerns, this report documents a review of vehicle speeds and crashes from six construction work zones in North Carolina. The six locations involved major Interstate reconstruction projects in six counties (Buncombe, Mecklenburg, Orange, Robeson, Cumberland, and Wake).

The collected speed data show that vehicle operating speeds are consistently above work zone speed limits, often by considerable amounts. Two of the six work zones had static speed limit signs. For one of the two, 90 percent of vehicles traveling in the work zone were speeding. Four of the six work zones had variable speed limits, in that the speed limit was set (generally, 55 to 70 MPH) at the location depending on what was happening in the work zone. Approximately half of the drivers exceeded the upper end of the speed limit range (e.g., 70 mph). Maximum observed speeds in the work zones exceeded 100 mph.

Crashes at these six work zone locations were also reviewed. The total number of crashes increased by 26 percent in the work zone compared to the time before the construction started. For fatal and serious injury crashes, the increase was much greater. Those crashes nearly doubled (87 percent increase) with the work zone.

This report provides detailed information on the speeds and crashes in these six work zones. It also includes information on speed and safety management strategies implemented by NCDOT. It concludes with strategies used by other State DOTs, including decoy radar, variable speed limits, changeable speed limit signs, dynamic speed feedback signs, temporary transverse rumble strips, portable changeable message signs (including with police lights), and speed safety cameras.

Chapter 1. Introduction

This report documents an analysis of speed and crash data from six construction work zones on Interstate highways in North Carolina. The report is organized into the following sections:

Chapter 1 synthesizes relevant background information, including North Carolina Department of Transportation (NCDOT) work zone speed limit setting practices, other speed and safety management strategies implemented by NCDOT, and the motivation for analyzing speed and crash data in a sample of Interstate work zones.

Chapter 2 describes data collection, analysis, and key takeaways from observing speed and crash data in six Interstate work zones.

Chapter 3 identifies speed and safety management strategies used in other states.

Chapter 4 provides a summary and conclusions.

Background

A work zone is an area along a highway or street "with construction, maintenance, or utility work activities" (23 CFR Part 630 Subpart J, 2004). These work activities are critical to maintaining and upgrading North Carolina's infrastructure in support of the continued growth throughout the state. North Carolina's highway and street network serves local and regional trips that drive the economic, employment, and recreational activities of the state now and into the future.

Depending on the type of work activity, work zones can last hours, days, months, or years. Planning, designing, and operating work zones involves addressing multiple needs and objectives:

- Serve movement of facility users safely, efficiently, and reliably.
- Provide adequate space for construction, maintenance, or utility activities; access for workers and equipment; and safe working conditions.
- Address broader context and community-specific needs and objectives, such as business and property access, recreation, ecological and environmental health, and other objectives that will vary by location.

A transportation management plan (TMP) identifies work zone design and operations strategies for addressing these types of needs and objectives. The TMP for significant projects consists of a Temporary Traffic Control (TTC) Plan, as well as Transportation Operations (TO) and Public Information (PI) components (23 CFR Part 630 Subpart J, 2004). For individual projects or classes of projects that are not significant, the TMP may consist of only a TTC plan.

The TTC plan provides the approach for facilitating road users through a work zone. The TTC plan generally consists of traffic control devices and other roadway and roadside design elements in work zones. These elements may be a mix of permanent and temporary features. Reduced cross sections, increased curvature, and other temporary design and traffic control features may be present. The Manual on Uniform Traffic Control Devices (MUTCD) includes

requirements and other supporting information for traffic control devices, including TTC devices in Part 6 of the MUTCD. NCDOT has adopted the MUTCD basic principles and guidelines for the design, application, installation, and maintenance of traffic control devices. NCDOT uses the MUTCD as a minimum requirement and, in most cases, requires the NCDOT Standard Specifications for Roads and Structures and the NCDOT Roadway Standard Drawings as the plan standard.

NCDOT publishes a *Transportation Management Plans Design Manual* to serve as a TTC plan design resource for Transportation Management Plan designers. The Manual is also intended to foster uniformity and consistency in TTC plans statewide. The Manual is not intended to replace the MUTCD, but rather, to customize its principles to meet the specific requirements and conditions of the State of North Carolina.

Work Zone Speed Limit Setting

The NCDOT work zone speed limit practices are consistent with guidance in the MUTCD. The principles and requirements of the work zone speed limit setting practices and applications in Chapter 8 of NCDOT's *Transportation Management Plans Design Manual* are intended to promote objectivity, consistency, and transparency for both the construction industry and the traveling public. The general MUTCD principle guiding NCDOT's work zone speed limit setting practices is that lowering the regulatory speed limit should be avoided as much as practical because drivers will reduce their speeds only if they clearly perceive a need to do so. When implemented, reduced speed limits are used only in the specific portion of the work zone where special conditions or restrictive features are present. Typical speed limit reductions are 10 mph below the existing posted speed limit. In 70 mph speed zones, a maximum of 15 mph speed reduction may be used. NCDOT's guidance strongly recommends that no speed limits below 55 mph be posted on fully controlled access facilities.

NCDOT implements two types of work zone speed limit reductions:

1. Work Zone Variable Speed Limit
2. Work Zone Speed Limit

Regardless of the approach, speed limit reductions require a speed ordinance signed by the State Traffic Engineer for the reduced speed to be legally enforced. NCDOT uses advanced warnings to make the motorist aware of the speed reduction.

Work Zone Variable Speed Limit

A Work Zone Variable Speed Limit is one that temporarily reduces the existing speed limit for shorter-term activities in work zones. It is implemented using portable devices such as portable changeable message signs and portable signs. Per NCDOT's *Transportation Management Plans Design Manual,* this method can only be applied at locations where the existing speed limit is 65 mph or greater and for a maximum of 30 days. In addition to these two qualifying characteristics, the Manual also specifies additional warrants that the work zone must meet before using the Work Zone Variable Speed Limit.

If the conditions warrant a longer than 30-day period, the Work Zone Speed Limit discussed in the next section is used. The Work Zone Variable Speed Limits are only posted when and where the traffic controls necessitate a slower speed. The Work Zone Variable Speed Limit is intended to provide workers an environment with fewer potential high-speed encroachments into their work space and to help motorists safely navigate the temporary traffic controls in place. Only the specific portion of the work zone where conditions or restrictive features are present receives consideration for the Work Zone Variable Speed Limit reduction.

Work Zone Speed Limit

The Work Zone Speed Limit uses speed limit signs to reduce speed due to a longer-term impact on a larger project. NCDOT uses this approach where significant changes in lane geometry may have occurred, lane widths may have been significantly reduced, and/or where shoulders may have been significantly reduced or eliminated. The Work Zone Speed Limit is specifically targeted at improving motorist safety due to work zone conditions on Interstates and other freeways. A work zone must meet all the following warrants to be considered for the Work Zone Speed Limit approach:

1. Existing Speed Limit is 65 mph or greater.
2. Speed reduction applies to an area one mile in length or greater.
3. Work zone is of longer duration (greater than 30 days) where there are continuous obstacles (present 24 hours a day) which may create difficult navigation for the motorists. Some of these include long-term median cross-overs, continuous lane closures, on-site detours, narrowed lanes, non-usable shoulders, and/or sharp roadway curvature, among others.

In addition to these three qualifying characteristics, the NCDOT *Transportation Management Plans Design Manual* includes different combinations of warrants that the work zone must also meet.

Other Work Zone Speed and Safety Management Practices

In addition to establishing work zone speed limits, NCDOT implements additional speed and safety management strategies to enhance safety for workers and the traveling public. These strategies are typically documented in NCDOT's bi-annual *Work Zone Safety & Mobility Process Review* reports, where NCDOT assesses the effectiveness of its current practices in managing work zone impacts and determines where improvements can be made. The reports, dating back to 2015, are published and publicly available on NCDOT's work zone manuals, guidelines, and reports website. The reports cover a wide range of strategies, activities, and collaborations aimed at making continual improvements in work zone safety and mobility. The following paragraphs are a selection of these strategies relevant to increasing public awareness of work activities and work zone speed limits.

Helping All Work Zones Keep Safe (HAWKS). HAWKS is a joint initiative between NCDOT and the North Carolina State Highway Patrol (NCSHP) to utilize off-duty law enforcement officers to monitor and patrol work zones. This initiative provides dedicated enforcement in a

specific work zone to improve safety and mobility. NCDOT prioritizes the work zones for HAWKS using crash rates, existing congestion, average speeds, and roadway tier classification (statewide, regional, sub-regional) as the scoring criteria. Projects with higher scores are selected for the program and notifications are sent to the Resident Engineer and the NCSHP Office for staffing and scheduling assignments.

Blue Light Radar Trailers. The Blue Light Radar Trailers (BLRTs) are portable trailers equipped with changeable message signs (CMS), traffic radars, and blue strobe lights. The BLRTs are deployed in work zones to assist with speed compliance and visibility for lane and road closures with the aim of improving safety for construction workers and motorists. Speed thresholds, which vary based on the work zone speed limit, can be set on each BLRT to trigger specific responses. For slight speeding, the CMS displays a warning message alone. Significant speeding activates both the blue strobe lights and an enhanced message with the goal to affect driver behavior at that location.

Digital Speed Limit Signs. Digital speed limit signs (DSL) are regulatory speed limit signs with LED displays for the speed limit numbers. They display the speed limit brightly and clearly to motorists during night and day. The speed limit is changed remotely by NCDOT personnel depending on the operating conditions. Digital speed limit signs completely take the place of existing stationary speed limit signs for the duration of the work in that area.

Sequential Flashing Warning Lights and Digital Speed Limit Signs during Nighttime Work Operations. NCDOT continues to perform construction work at night to limit the number of motorists exposed to work zone conditions. Sequential Flashing Warning Lights (SFWL) and Digital Speed Limit Signs are now standard practice for nighttime construction operations. In its 2023 *Work Zone Safety & Mobility Process Review* report, NCDOT reported overwhelmingly positive feedback from the construction industry and its regional traffic partners on the Sequential Flashing warning lights.

Dynamic Zipper Merge. Dynamic Zipper Merge Systems automatically detect traffic conditions, namely slow/stopped traffic, and change the messages on portable changeable message signs to warn drivers before they reach the back of the traffic queue. In addition, when congested conditions are present, the Dynamic Zipper Merge Systems encourage motorists to use all open lanes up to the merge point and then take turns to merge into a single lane. Once congested conditions are no longer present, the system reverts back to standard lane closure messaging. NCDOT has been using Dynamic Zipper Merge systems at selected locations since 2019. The Dynamic Zipper Merge system does not work for every work zone. The system functions best for highways with travel lane reductions that will last for several months.

Smart Work Zones. Smart and connected technology has been implemented in an increasing number of projects throughout North Carolina. Traveler information systems in Smart Work Zones use a combination of sensors and message boards to notify drivers of traffic conditions in the work zone. Typical messages are, for example, “Travel Times Normal”, “Delays Exceed xx minutes”, or “Major Delays – Follow [Alternate Route]”.

Connected Lane Closure Devices. Connected lane closure devices (CLCD) were introduced on projects in 2018. They are essentially small GPS transmitters attached to or adjacent to the merge taper flashing arrow board and attached to or adjacent to the last traffic control device in the lane closure. These devices transmit their location to navigational companies and the NCDOT Statewide Transportation Operations Center (STOC). The goal is to allow motorists to see active lane closure information in any navigational software they are using.

Integrated Corridor Management (ICM). NCDOT implements integrated corridor management (ICM) along major corridors with significant construction projects. ICM improves the performance of a corridor by leveraging the capacity of the major facility under construction as well as parallel facilities. ICM takes an active management approach by monitoring the corridor and dynamically implementing actions and providing services in response to conditions and incidents. ICM results in improved traveler information, shorter incident response and clearance times, and increased coordination and communication between first responders, law enforcement, municipal and state transportation officials, and the public.

Motivation for Work Zone Speed and Crash Analysis in this Report

NCDOT implements systematic processes to continually enhance its work zone safety and mobility policies, processes, and practices. This includes an objective approach for establishing work zone speed limits that are consistent with MUTCD principles and promote consistency and transparency for both the construction industry and the traveling public. It also includes the use of additional speed and safety management strategies to enhance safety for workers and the traveling public. Despite these practices, the construction industry has reported concerns with work zone speeds in North Carolina's work zones. Such work zone speeding concerns have also been common in recent years in other states across the U.S. Using a sample of vehicle probe data, NCDOT noted speeds higher than the posted speed limit in Interstate work zones. In addition, North Carolina crash data show an increase in fatal and suspected serious injury work zone crashes on Interstates coming out of the COVID-19 pandemic (see Figure 1). National trends in overall traffic fatalities have seen similar increasing numbers, with some analyses showing higher proportions of speeding-related fatalities than pre-pandemic levels, especially during nighttime hours (1). With these observations, NCDOT undertook a data collection and analysis effort to more fully and objectively characterize operating speeds and safety performance in North Carolina Interstate highway work zones.

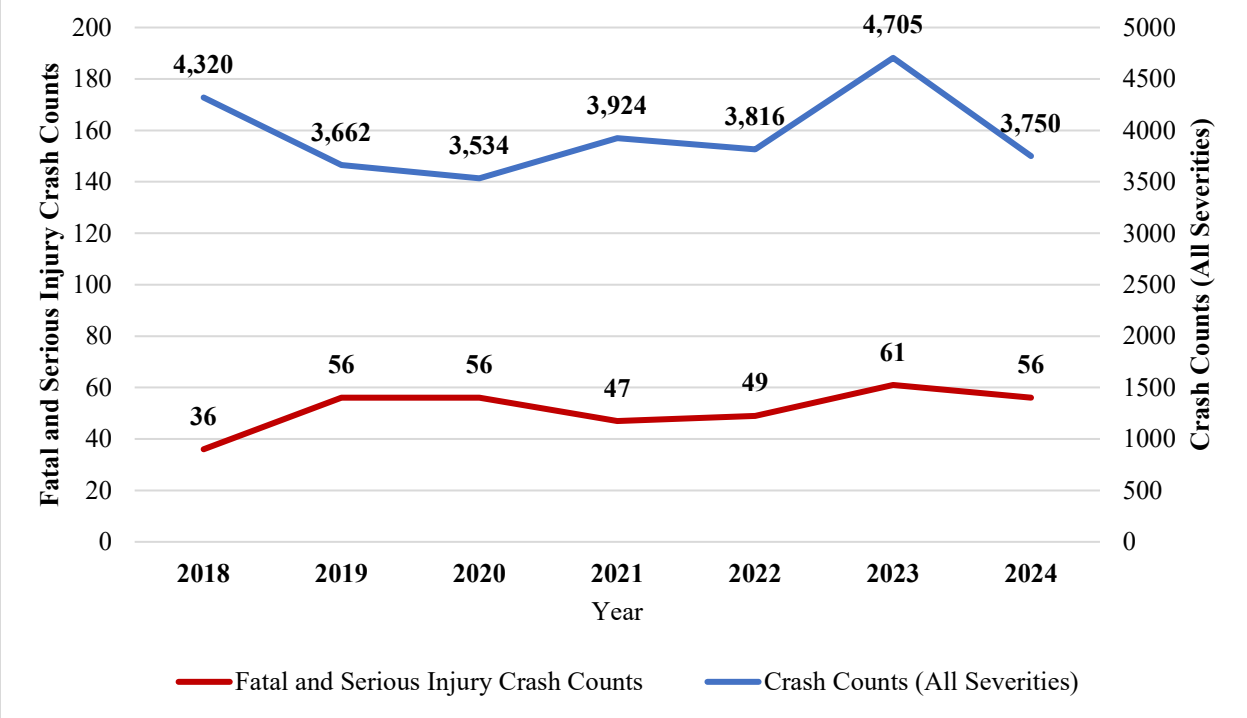

Figure 1 Statewide Interstate Work Zone Crashes of All Severities and Fatal and Serious Injury Crashes in North Carolina, 2018-2024 (through December 18, 2024)

Chapter 2. Evaluation of Speed and Crash Data in Six Interstate Work Zones

This chapter describes the collection and analysis of speed and crash data from six active work zones on Interstates across North Carolina. The study locations span six counties (Buncombe, Mecklenburg, Orange, Robeson, Cumberland, and Wake) and involve major Interstate reconstruction projects. Figure 2 displays the locations of the work zones. The six work zones included in the analysis were chosen based on the following factors:

- Long-term projects with significant roadway modifications.
- High-speed, high-volume corridors.
- Locations covering different regions to form a representative analysis.

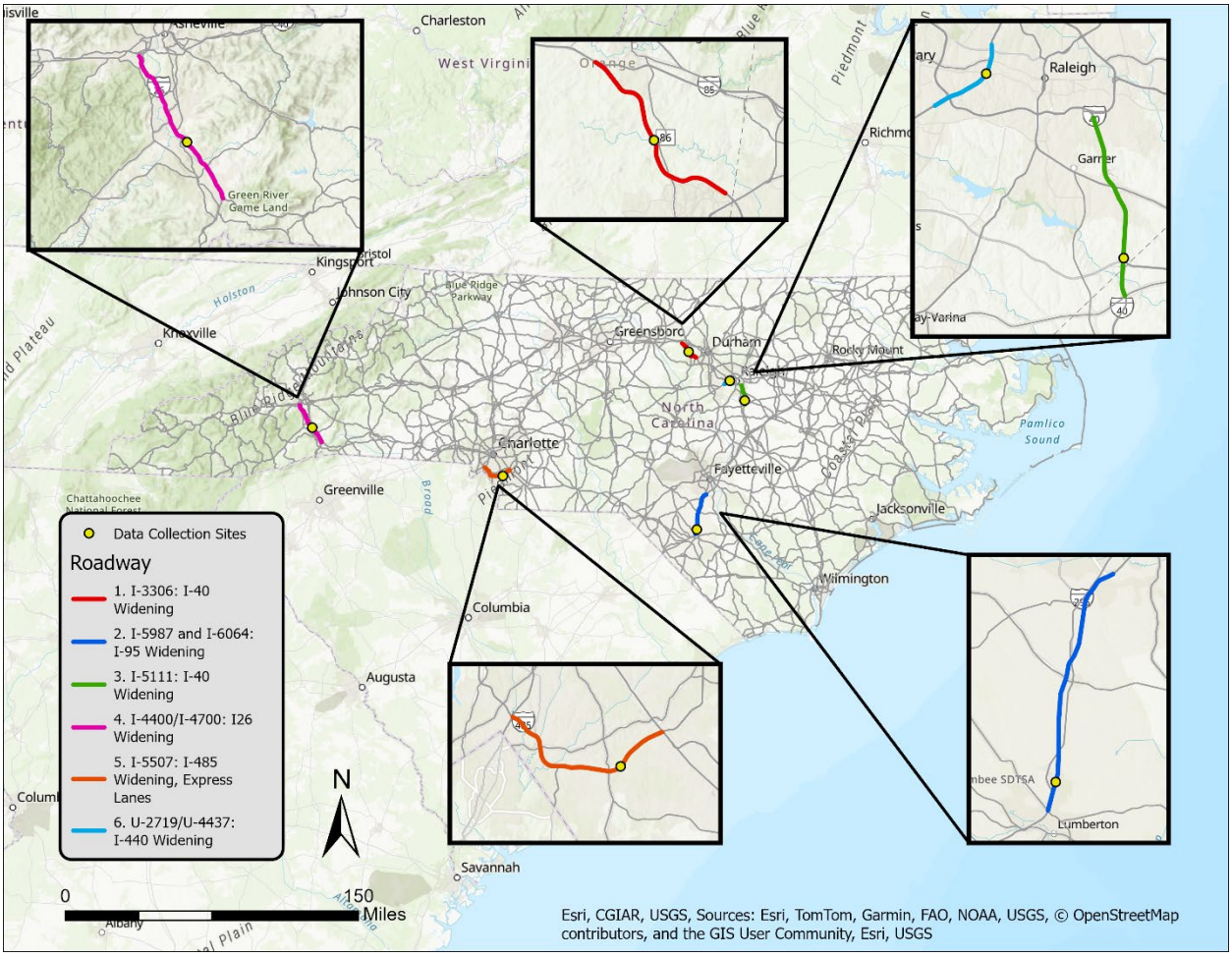

Figure 2 Work Zone Study Area

Specific details on work activities for each work zone are summarized in the following paragraphs:

- **WZ1: I-3306[1] – I-40 Widening in Orange County:** This project involves widening an 11.4-mile stretch of I-40 from four to six lanes, extending from the interchange with I-85 in Orange County to the Durham County line. The scope includes modifications to interchanges, notably at the I-40 and NC 86 junction. The primary objectives are to alleviate peak-hour congestion, achieve a Level of Service D or better in the design year of 2040, and improve traffic continuity between the existing eight-lane section at the beginning of the project segment and the six-lane section at the end of the project segment. As of August 1, 2024, the status of work activity includes operational concrete batch plants, ongoing concrete pavement work in the median, completion of most drainage installations, and active bridge work over Old NC 86 and Millhouse Road.[2]
- **WZ2: I-5987 and I-6064 – I-95 Widening in Robeson County:** NCDOT is widening approximately 18.7 miles of I-95 from south of U.S. 301 (Exit 22) in Robeson County to north of State Road 1732 (Parkton Tobermory Road) in Cumberland County. This project is to expand the current four-lane highway to eight lanes by adding two additional travel lanes in each direction. The primary goal is to enhance traffic flow and reduce congestion, accommodating anticipated increases in traffic volumes projected for 2040. The project work includes reconfiguring interchanges, replacing overpass bridges, and raising bridge crossings over streams to mitigate future flooding risks. Much of the construction is occurring within the existing NCDOT right of way.[3]
- **WZ3: I-5111 – I-40 Widening in Wake County:** This project will enhance traffic flow along a 13-mile segment of I-40, stretching from Raleigh to Cornwallis Road in Clayton. This corridor is a crucial route for Wake and Johnston counties, linking the region to I-95 and providing access to coastal destinations. In 2015, the roadway saw approximately 35.6 million vehicles, leading to significant congestion and delays, particularly during morning and evening peak hours. With traffic on this route expected to increase by 65% by 2040, congestion was projected to worsen, especially around the I-40/NC 42 interchange, an area experiencing rapid residential and commercial expansion. The widening project, by adding two lanes in each direction, is designed to reduce congestion, enhance roadway safety, and improve traffic conditions to support both current demands and future growth in this high-traffic corridor.[4]
- **WZ4: I-4400/I-4700 – I-26 Widening in Henderson and Buncombe Counties:** The I-26 widening project spans 16.9 miles from US 64 in Hendersonville to Brevard Road in Asheville, aiming to increase roadway capacity, improve safety, and reduce congestion. Divided into two sections, I-4400 (9.1 miles) extends from US 64 to NC 280, while I-4700 (7.8 miles) continues from NC 280 to the I-40/I-240 interchange. The project involves widening I-26 to three lanes in each direction between US 25 and the I-26/US 25 (Asheville Highway) interchange and widening it to four lanes in each direction from the

[1] Refers to Transportation Improvement Program (TIP) project number
[2] WZ1: I-3306A: I-40 Widening - Orange County - PublicInput
[3] WZ2: I-5987: I-95 Widening - Robeson & Cumberland Counties - PublicInput
[4] WZ3: NCDOT: I-40 Widening - Southeast Raleigh to Clayton

US 25 (Asheville Highway) to the I-40/I-240 interchange. Construction began in fall 2019. The project also includes widening lanes, upgrading bridges, improving drainage, and rehabilitating deteriorating road surfaces. Once complete, these improvements will enhance high-speed regional travel, providing a more efficient and reliable interstate corridor.[5]

- **WZ5: I-5507 – I-485 Widening and Express Lanes in Mecklenburg County:** The I-485 Express Lanes project aims to improve traffic flow and enhance travel time reliability by adding one express lane in each direction along I-485 between I-77 and US 74 (Independence Boulevard). Additionally, the project includes the construction of one new general-purpose lane in each direction between Rea Road and Providence Road to further accommodate increasing traffic volumes. As part of a larger network of express lanes in southern Mecklenburg County, this project integrates with other transportation improvements to provide drivers with more efficient and predictable travel options.[6]
- **WZ6: U-2719/U-4437 – I-440 Widening in Wake County:** The I-440 widening project between just south of Walnut Street in Cary and north of Wade Avenue in Raleigh is being undertaken to reduce congestion, improve access, and enhance traffic flow by widening the existing four-lane section to six lanes (three in each direction). This segment currently acts as a bottleneck, as it narrows between wider six-lane sections at both ends, creating frequent traffic slowdowns that were expected to worsen over time. Originally built in the 1960s, this portion of I-440 required major rehabilitation, as it contained substandard design features such as poor sight lines, narrow shoulders and medians, and short acceleration/deceleration lanes. The project also includes pavement and bridge replacements and interchange upgrades to meet modern roadway standards.[7]

Table 1 provides an overview of the six work zones where NCDOT and its supporting contractors collected and analyzed speed and crash data in this study. The information in Table 1 includes project details, locations, mile markers, work zone start dates, speed limits, lane configurations, AADT, and the work zone strategies from Chapter 1 that were in place.

[5] WZ4: NCDOT: I-26 Widening
[6] WZ5: NCDOT: I-485 Express Lanes
[7] WZ6: NCDOT: I-440 & Blue Ridge Road Improvements

Table 1 Work Zone Details

No	Project & Roadway	County	Mile Marker	Length (miles)	Begin Work Zone Impact	Speed Limit (mph)	Lanes in WZ	AADT	WZ Strategies in Place *
WZ1	I-3306: I-40 Widening	Orange County	259-270	11.66	October 2021	55-65	2	68,500	HAWKS, SFWL, DSL, ICM, CLCD, BLRT
WZ2	I-5987 and I-6064: I-95 Widening	Robeson County	13-41	28.29	November 2021 (I-6064), November 2022 (I-5987)	55-70	2	60,000	HAWKS, SFWL, DSL, ICM, CLCD, BLRT
WZ3	I-5111: I-40 Widening	Wake County	300-313	12.51	December 2018	70	4	101,000	HAWKS, SFWL, ICM
WZ4	I-4400/I-4700: I-26 Widening	Multiple Counties	31-54	23.77	October 2019	55-65	2	62,500	HAWKS, SFWL, DSL, ICM, CLCD, BLRT
WZ5	I-5507: I-485 Widening, Express Lanes	Mecklenburg County	57-67	16.56	Summer 2019	55-70	2	84,500	HAWKS, SFWL, DSL, BLRT
WZ6	U-2719/U-4437: I-440 Widening	Wake County	99 & 5	5.43	October 2018	55	2	85,000	HAWKS, SFWL

Note: WZ3 and WZ6 have static work zone speed limits. The others have work zone variable speed limits.

*Helping All Work Zones Keep Safe (HAWKS), Sequential Flashing Warning Lights (SFWL), Digital Speed Limit (DSL) Signs, Connected Lane Closure Devices (CLCD), Integrated Corridor Management (ICM), and Blue Light Radar Trailer (BLRT).

Speed Data Collection and Analysis

This section describes the approach to speed data collection and the prevailing work zone conditions during data collection.

Data Collection Method

One of NCDOT's data collection contractors collected speed data in each work zone using Houston Radar SpeedLane detectors. This radar technology captures speed on a per-vehicle basis. The radar units are deployed on the side of the roadway on existing permanent structures such as sign posts, sign gantry support structures, or utility poles, depending on what is available. The orientation of the radar is perpendicular to traffic and can detect vehicles by-lane. The units use a dual-beam side-fire radar system to accurately measure the speeds of vehicles in individual lanes by timing how long it takes for each vehicle to travel between the two beams. The technology works from either side of the road and is connected to solar panels that allow it to run for multiple days when the weather is clear.

The units are programmed on-site with the help of the Houston Radar software. Further refinement can be made by the installer using manual lane adjustments for fine-tuning vehicle detections until all vehicles across the different lanes are registered. The installation is complete once the technician has confirmed that each lane is registering vehicles and speeds as they pass by the unit.

Speed Data Collection Period

Speed data were collected at the six work zones over designated periods to capture vehicle speeds under different traffic and operational conditions. The specific data collection windows were as follows:

- WZ1: January 28, 2025, from 12:00 AM to 11:59 PM
- WZ2: January 28, 2025, 7:45 PM to January 29, 2025, 7:44 PM
- WZ3: January 30, 2025, from 12:00 AM to 11:59 PM
- WZ4: January 28, 2025, from 12:00 AM to 11:59 PM
- WZ5: January 30, 2025, from 12:00 AM to 11:59 PM
- WZ6: February 4, 2025, 2:00 PM to February 5, 2025, 1:59 PM

Work Zone Conditions During Data Collection

During the speed data collection period, various work zone conditions were observed, including lane closures, full closures, and active incidents, which may have influenced vehicle speeds. Below is a summary of work zone conditions at each site:

- WZ1: A vehicle crash occurred eastbound downstream of the count location on January 28, 2025, from 6:42 AM to 7:10 AM.
- WZ2: A moving lane closure occurred westbound between mile markers 17-27 on January 28, 2025, from 3:30 PM to 4:30 PM, potentially influencing vehicle speeds
- WZ3: No reported incidents or closures during the data collection period.

- WZ4: Lane closure eastbound (EB) downstream of the count location on January 28, 2025, from 7:30 PM to 12:00 AM. Full closure westbound (WB) from January 28, 2025, at 8:00 PM to January 29, 2025, at 3:30 AM.
- WZ5: No reported incidents or closures during the data collection period.
- WZ6: Full closure eastbound (SB) upstream of the count location on February 5, 2025, from midnight to 5:00 AM.

Speed Data Analysis

This section provides a summary of vehicle speeds for the six work zones at the speed data collection locations discussed in the previous section in both travel directions (e.g., NB and SB/EB and WB). The reported metrics include average speed, 85th percentile speed, 95th percentile speed, and 99th percentile speed:

- **Average speed, mph:** The mean speed of all vehicles observed in the dataset. It is calculated by summing the speeds of all vehicles and dividing by the total number of vehicles. This value gives an overall sense of how fast an average vehicle is moving in a work zone.
- **85th percentile speed, mph:** The speed at or below which 85% of all observed vehicles are traveling. It is commonly used when comparing operating speeds to speed limits.
- **95th percentile speed, mph:** The speed at or below which 95% of all observed vehicles are traveling. This metric is useful for identifying higher-end speeding behavior.
- **99th percentile speed, mph:** The speed at or below which 99% of all observed vehicles are traveling. It represents the extreme high-end speeds within the dataset and is often used to assess the most aggressive speeding behavior.

The analysis results also report the percentage of vehicles going above the work zone speed limits as well as the percentages of vehicles exceeding the work zone speed limits by 5, 10, 15, and 20 mph or more. For the work zones with variable speed limits, records of when speed limits changed because of construction activity do not exist. Therefore, the percentages of vehicles traveling higher than the speed limit are estimated in relation to both the lower end of the variable speed limit range and the upper end of the variable speed limit range. Table 2 presents a summary of speed measures and percentages across each work zone. Figure 6, Figure 7, Figure 8, Figure 9, Figure 10, and Figure 11 in Appendix A: Speed Summary by Work Zone present the speed distributions by lane and by travel direction in work zones 1 through 6, respectively. Appendix A: Speed Summary by Work Zone also provides additional tabular speed statistics for each site analyzed.

Table 2 Summary of Speed Measures and Speed Limit Non-Compliance in Work Zones

Measures	WZ1		WZ2		WZ3		WZ4		WZ5		WZ6	
	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	NB	SB
Sample Size	29,741	33,905	18,974	21,945	42,130	38,839	25,457	27,040	43,611	45,363	33,596	33,116
Work Zone Speed Limit, mph	55-65	55-65	55-70	55-70	70	70	55-65	55-65	55-70	55-70	55	55
Average Speed, mph	67.0	66.8	68.5	66.2	72.5	72.2	65.9	64.3	59.5	65.3	62.8	57.3
Standard Deviation	7.8	9.1	8.7	7.2	9.4	8.3	7.2	7.5	15.6	8.3	7.5	14.5
85th Percentiles Speed, mph	73	73	74	73	84	81	72	72	72	73	71	71
95th Percentiles Speed, mph	75	75	85	77	86	86	77	74	79	77	73	73
99th Percentile Speed, mph	86	86	88.3	86	88	89	83	82	81	85	85	81
Maximum Speed, mph	106	106	106	98	106	106	99	99	97	102	101	102
Standard Deviation	7.8	9.1	8.7	7.2	9.4	8.3	7.2	7.5	15.6	8.3	7.5	14.5
Over WZ Lower Speed Limit (%)	95.1	95.1	96.5	95.6	88.0	71.8	96.8	92.8	74.9	90.9	89.6	74.1
5 mph Over WZ Lower Speed Limit (%)	83.1	85.4	87.5	79.4	69.2	29.2	86.2	72	66	72.7	62.2	51.5
10 mph Over WZ Lower Speed Limit (%)	64.2	66.4	68.3	55.3	40.8	18.2	55.5	47.3	45.4	52.4	36.9	30.1
15 mph Over WZ Lower Speed Limit (%)	46.8	46.8	49.9	36.7	16.7	7.2	32.6	27.1	35.3	37.3	19.2	16.4
20 mph Over WZ Lower Speed Limit (%)	6.2	5.9	13.3	6.5	5.3	0.7	7.3	4.5	8.4	6.8	3.4	2.2
Over WZ Upper Speed Limit (%)	64.2	66.4	49.9	36.7	--	--	55.5	47.3	35.3	37.3	--	--
5 mph Over WZ Upper Speed Limit (%)	46.8	46.8	13.3	6.5	--	--	32.6	27.1	8.4	6.8	--	--
10 mph Over WZ Upper Speed Limit (%)	6.2	5.9	9.5	4.3	--	--	7.3	4.5	4.2	3.9	--	--
15 mph Over WZ Upper Speed Limit (%)	3.6	3.4	6.1	2.2	--	--	2.9	1.8	0.2	1.6	--	--
20 mph Over WZ Upper Speed Limit (%)	1.9	2.0	0.6	0.1	--	--	0.6	0.5	0.1	0	--	--

Note: WZ3 and WZ6 have static work zone speed limits. The others have work zone variable speed limits. For the work zones with variable speed limits, Table 2 refers to the lower and upper work zone speed limits. Since WZ3 and WZ6 are static, the percentages of drivers exceeding the speed limit are provided in the lower work zone speed limit rows of the table and are not repeated in the upper speed limit rows.

Key Observations and Takeaways

The analysis of vehicle speeds across the six work zones (WZ1–WZ6) reveals high work zone operating speeds and significant trends in work zone speed limit non-compliance. Below are the key takeaways:

- Approximately 72-90% of drivers exceeded the work zone speed limit in the two work zones that had static speed limits.
    - WZ3 had a speed limit of 70 mph, but saw average speeds of 72-73 mph, 85th percentile speeds of 81-84 mph, 95th percentile speeds of 86 mph, 99th percentile speeds of 88-89 mph, and maximum speeds of 106 mph. More than 5 percent of drivers in the WB direction of WZ3 exceeded the speed limit by more than 20 mph.
    - WZ6 had a speed limit of 55 mph, but saw average speeds of 57-63 mph, 85th percentile speeds of 71 mph, 95th percentile speeds of 73 mph, 99th percentile speeds of 81-85 mph, and maximum speeds of 101-102 mph.
- In the four work zones with work zone variable speed limits, more than 90% of drivers were operating above the lower end of the work zone speed limit in all but one location. Between 35-66% of drivers exceeded the work zone upper speed limit.
    - In these same four work zones, the 85th percentile speeds were above the lower end of the work zone speed limit by 17-19 mph and exceeded the work zone upper speed limit by 2-8 mph. The maximum speeds were 98-106 mph.
- The fastest one percent of drivers (99th percentile) traveled at speeds above 81 to 89 mph. The maximum speeds ranged from 97 to 106 mph.

Crash Data Analysis

This section presents the results of an analysis of crash data in the same six work zones. The goal was to observe differences in the number of crashes before and during the work zone. Crash data were collected from 2018 to December 18, 2024, providing a multi-year perspective on work zone crash trends. This analysis focuses on the six work zones, using work zone locations and work zone start dates to evaluate crash occurrences within each designated work zone. This results in a total of 98.2 miles of work zones for this analysis. As the work zone start dates differ, crashes in both before and during periods have been annualized for comparison purposes.

The analysis results are presented for different groupings of crash severity. Crash severity is defined by the most serious injury sustained by anyone involved in the crash using the following categories:

- Fatal
- Serious injury
- Minor injury
- Possible injury
- No apparent injury

The crash data analysis results refer to several severity groupings:

- Fatal and serious injury: crash severity is either fatal or serious injury
- Fatal, serious, and minor injury: crash severity is either fatal, serious injury, or minor injury
- Fatal serious, minor, and possible injury: crash severity is either fatal, serious injury, minor injury, or possible injury
- Total (all severities)

Crashes by severity across all six work zones

An analysis of crash data across all six work zones reveals a significant increase in crashes during the work zone period compared to the before work zone conditions, as presented in Figure 3.

- Across all severity levels, the total number of crashes per year increased during work zone activity by 26% from an average of 3,608.5 crashes per year before the work zones to 4,533.9 crashes per year during the work zones. This increase is larger when looking at more serious crash types:
    - Annual average numbers of fatal, serious injury, minor injury, and possible injury crashes increased by 23%.
    - Annual average numbers of fatal, serious injury, and minor injury crashes increased by 51%.
    - Annual average numbers of fatal and serious injury crashes increased by 87%.

Crashes by severity for each work zone

The analysis of fatal and serious injury crashes and crashes of all severities for each individual work zone is presented in Figure 4. Key takeaways from this analysis are presented below.

- The annual average number of fatal and serious injury crashes increased at each of the six work zones during the work zone period.
    - The highest increase was in WZ3, where fatal and serious injury crashes increased by 927% from 1.1 to 11.3 fatal and serious injury crashes per year.
    - WZ4 showed a 141% increase from 3.4 to 8.2 fatal and serious injury crashes per year.
    - WZ1 experienced a 129% increase from 2.1 to 4.8 fatal and serious injury crashes per year.
    - WZ6 rose from 0 to 3.1 fatal and serious injury crashes per year.
    - WZ2 and WZ5 saw smaller increases in fatal and serious injury crashes, with WZ2 increasing 7% (from 8.8 to 9.4 fatal and serious injury crashes per year) and WZ5 increasing 4% (from 9.9 to 10.4 fatal and serious injury crashes per year).
- The annual average number of total crashes (all severities) mostly increased compared to pre work zone crashes at each of the six work zones. WZ1 experienced the largest percentage increase of 126.6%, from 269.0 to 609.4 crashes per year. WZ2 and WZ3 each experienced a 39% increase from 417.2 to 578.4 crashes per year and 588.2 to 818.4 crashes per year, respectively. WZ4 experienced a 29% increase from 845.9 to 1,087.0 crashes per year, the highest annual crash frequency for any of the work zones.

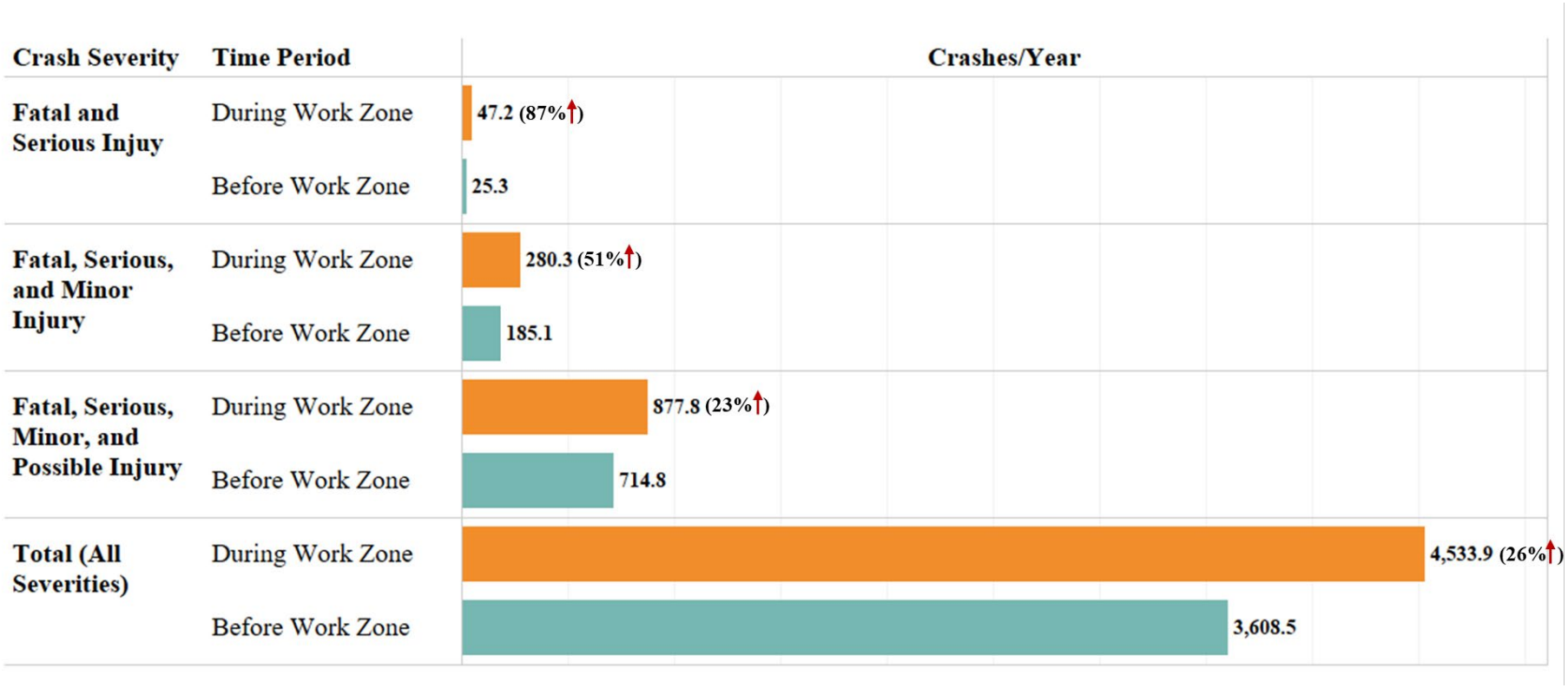

Figure 3 Average Annual Work Zone Crashes (crashes per year) by Severity Across Six Work Zones

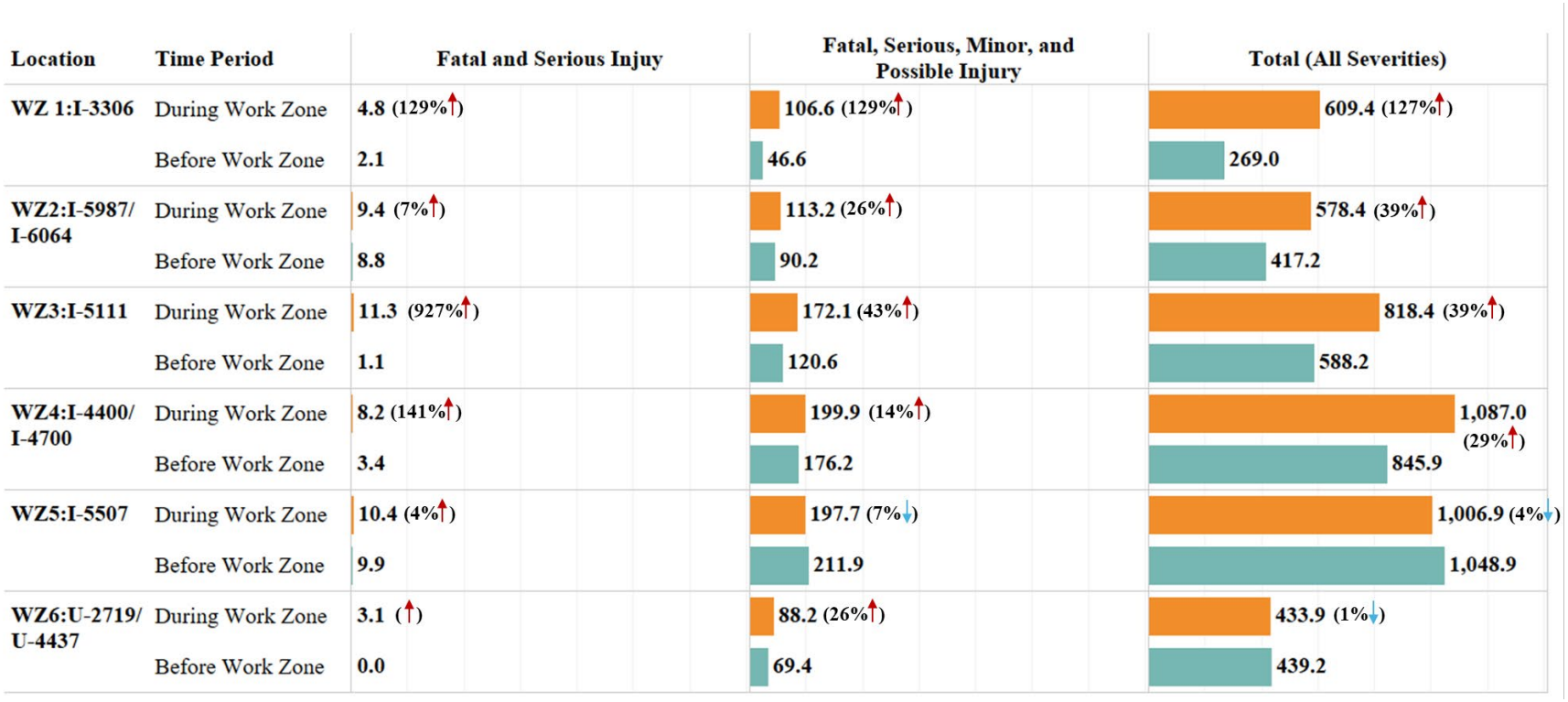

Figure 4 Average Annual Work Zone Crashes (crashes/year) by Individual Work Zone

Chapter 3. Review of Speed Management Strategies in Work Zones

The purpose of this final chapter is to identify types of speed management strategies used by other State DOTs in work zones. NCHRP Synthesis 482: Work Zone Speed Management (*2*), contains a detailed synthesis of work zone practices used by State DOTs and was the primary resource informing this chapter. For some strategies, the information is augmented with recent information from FHWA, State DOT websites, or similar. The chapter concludes with a summary of the state experience implementing speed safety cameras. Since the chapter is a review and synthesis of other State DOT practices, it directly adopts terminology from the associated resources. The chapter does not necessarily reflect NCDOT terminology and practices, which were described in Chapter 1.

Decoy Radar

Decoy or "drone" radar systems are unattended units that emit radar signals to mimic police radar enforcement. These cost-effective units can be mounted on various roadside objects such as signs, guardrails, and vehicles. The primary goal is to prompt drivers with radar detectors to reduce their speed, mistaking the decoy signal for active police enforcement. Decoy radar is particularly effective in targeting speeding vehicles equipped with radar detectors. NCHRP Synthesis 482 (*2*) reported that South Carolina, Maryland, and Texas use this strategy.

The South Carolina Department of Transportation (SCDOT) implemented decoy radar units in various work zones throughout the state and has observed a noticeable reduction in speeds. A 2007 study of the installations found a 2 mph reduction in mean speeds for the entire traffic stream and 5 to 8 mph for those with radar detectors (*3*). Similarly, the Virginia Department of Transportation (VDOT) used sixteen units of drone radar statewide. They observed that the devices were only minimally effective, requiring frequent recharging and repositioning to prevent drivers learning of their use and no longer being affected. Coordination with Virginia State Police helped maintain uncertainty about police presence, achieving a modest 2-3 mph speed reduction (*4*). The Maryland Department of Transportation State Highway Administration (MDOT SHA) uses drone radar units to simulate the presence of law enforcement, which they report can effectively influence motorists to reduce their speed. They recommend using two concealed drone radar units simultaneously within the work zone to obscure their source from motorists, thereby maintaining the radar's effectiveness (*5*).

Variable Speed Limits

FHWA identifies variable speed limits (VSL) as a proven safety countermeasure and work zones are one of the applications for their use (*6*). VSL uses information on the roadway, including traffic volumes and weather conditions, to dynamically determine an appropriate speed limit which is displayed to a driver on a dynamic sign. FHWA reports up to a 34% reduction in total crashes and a 51% percent reduction in fatal and injury crashes. FHWA notes that this strategy is particularly effective on urban and rural freeways and higher-speed arterials

with posted speed limits greater than 40 mph. This strategy is included in NCHRP Synthesis 482 (*2*), which identifies several states that use this strategy, including Virginia, Michigan, Minnesota, and Missouri. The report notes that they are particularly useful in work zones.

Changeable Speed Limit Signs

Changeable speed limit (CSL) signs are dynamic traffic control devices that can display different speed limits based on criteria or a specified condition such as the presence of workers in a work zone, as opposed to VSL, which responds dynamically to real-time conditions. This strategy is included in NCHRP Synthesis 482 (*2*) which identifies several states that use this strategy, including Virginia, Minnesota, Missouri, and the Wyoming-Utah border.

The Minnesota DOT (MnDOT) uses electronic Workers Present Speed Limit signs, a CSL, as one of the tools in their Intelligent Work Zone Toolbox. When workers are present in an active work zone, the signs present a lowered speed limit. MnDOT provides guidelines for the use of these signs and other speed limit considerations in street and highway work zones in their booklet, Speed Limits in Work Zones Guidelines (*7*). Their experiences and guidelines may be helpful for other agencies interested in implementing this strategy.

Dynamic Speed Feedback Signs

Dynamic Speed Feedback Signs (DSFS) are traffic control devices that consist of a static regulatory or advisory speed limit sign paired with a digital display that shows the speed of the nearest approaching vehicle. By providing real-time feedback on the vehicle's speed, DSFS encourages drivers to slow down and comply with the posted speed limits, thereby improving safety for both workers and motorists. These systems typically use radar technology to detect vehicle speeds and can be mounted on trailers for easy installation and portability, or as fixed units. Additionally, the digital display may highlight excessive speeds in red or flashing amber digits to capture drivers' attention more effectively. NCHRP Synthesis 482 *(1)* reported that Illinois and Wisconsin use this strategy. A study in Michigan work zones reported its effectiveness in reducing approaching vehicles' speed and recommended its placement at or near the location of the greatest speed reduction (i.e., active work area, work zone entry point) (*8*).

Temporary Transverse Rumble Strips

Temporary transverse rumble strips are rumble strips placed in the lane perpendicular to the direction of traffic and are intended to alert drivers to upcoming changes in road conditions (i.e., a work zone) and prompt them to reduce their speed. The strips create vibrations and audible warnings to capture the driver's attention. The American Traffic Safety Services Association (ATSSA) reports that they can have a significant reduction in vehicle speeds, citing an evaluation in California that found an average reduction of 8 mph (*9*). This strategy is used in Maryland in combination with a warning sign for approaching road users (*10*). ATSSA also reports that the Texas Department of Transportation incorporated temporary rumble strips as standard practice in work zone safety protocols. Texas mandates the use of temporary portable rumble strips for one-way flagging operations on two-lane roads with speed limits of 70 mph or

less (*9*). A 2022 study by the Missouri Department of Transportation (MoDOT) found that temporary rumble strips can lead to lower vehicle speeds, crash reduction, and high benefit-cost ratios (*11*). Worker exposure during installation and removal of temporary rumble strips can be a significant impediment to their use.

Portable Changeable Message Signs (PCMS)

A portable changeable message sign (PCMS) is a traffic control device that is capable of displaying a variety of messages to inform motorists of driving conditions. A PCMS can be trailer-mounted and portable for temporary use in a work zone. They can be used for speed reduction or advance notice of a lane closure. When used for speed reduction, radar-activated versions of these signs detect the speed of approaching vehicles and display custom anti-speeding messages when a vehicle exceeds a preset threshold. Common messages include warnings like "you are speeding, slow down," "high speed, slow down," "reduce speed in work zone," and "excessive speed, slow down." Studies of PCMS in Kansas (*12*), South Carolina (*13*), and Arizona (*2*) all found modest work zone speed reductions.

Maryland has successfully implemented PCMS with vehicle-activated speed messages (for example, Baltimore Beltway (I-695)). While PCMS with speed display may be used on all types of highways and work zones in Maryland, either in rural or urban environments, PCMS deployment is recommended for rural and urban multi-lane divided high-speed roadways (*11*).

Portable Changeable Message Signs with "Police Lights"

This strategy uses a PCMS trailer but is equipped with flashing blue lights and radar speed data collection. The flashing lights are activated when a speed threshold is exceeded to provide a warning to drivers. In 2011, a series of small-scale field tests were conducted in moderate-volume freeway maintenance work zones near Stockton, California. The work zone had a lane closure. NCHRP Synthesis 482 (*2*) reports that the light-augmented PCMS found a speed reduction of 3 to 7 mph more than the lane closure alone.

Speed Safety Cameras[8] in Work Zones

The Insurance Institute for Highway Safety (IIHS) reports that communities using speed safety cameras have grown from around 150 in 2013 to over 200 in 2023 (*14*). Several States (Arizona, Colorado, Connecticut, Delaware, Illinois, Indiana, Maryland, Michigan, New Mexico, Oregon, Pennsylvania, Texas, Washington D.C., West Virginia, and Virginia) have legislations that allow the use of speed safety cameras in work zones as part of their speed reduction programs, although not all those States have active programs. Figure 5 presents the active work zone programs as of August 2024 (*15*).

[8] Speed safety camera (SSC) enforcement (previously referred to as automated speed enforcement cameras) is a technological system that can be used to enforce speed limits as part of a broader speed enforcement program. SSC enforcement is not intended to replace traditional speed management strategies but can be used as a supplement to other speed management techniques. In reviewing practices from other states, the descriptions direct adopt terminology from that state.

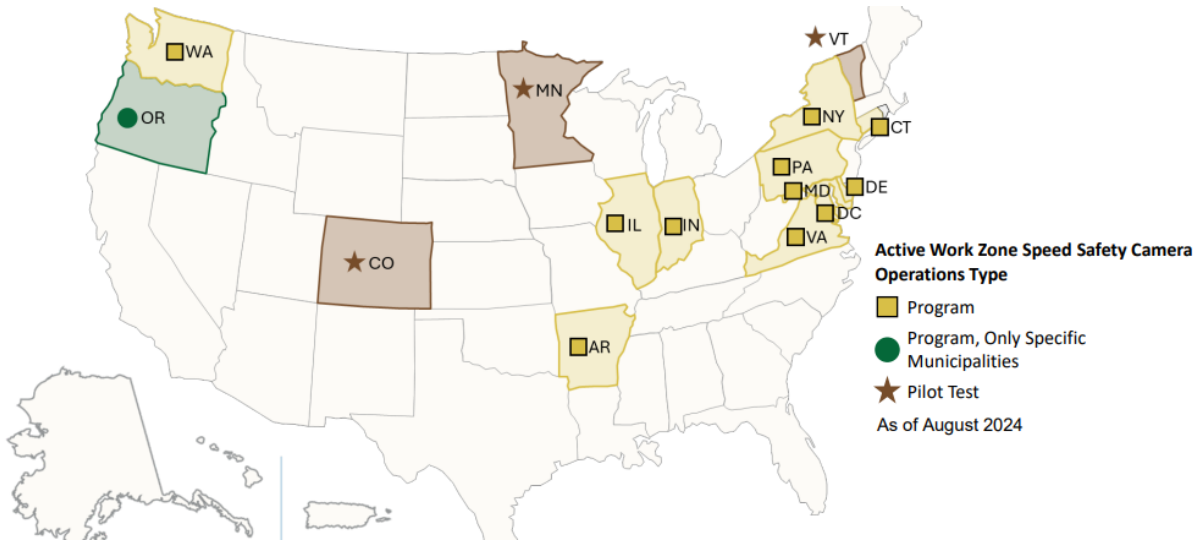

Figure 5 Active Work Zone Speed Safety Camera Program in the USA (as of August 2024)

Table 9 presents an overview of the States presented in Figure 1 for program structure and operation (*16*). Notably, most of the existing programs started as pilots, require that a worker is present during the SSC operation, and are based on civil penalties (i.e., the citation is issued to the owner of the vehicle and is an administrative penalty). In most States, the State DOT leads the program, but this is often in close coordination with the State Police. Additionally, most of the programs limit the use of the SSCs to higher speed roadways. Many of the States in Figure 1 are in the very early stages of their program and are still learning and shaping their programs.

Three active programs – Pennsylvania, Virginia, and Illinois – are summarized in detail here.

Illinois Department of Transportation

The Illinois Vehicle Code allows for automated speed enforcement by the Illinois Department of Transportation (IDOT) and Illinois State Police (ISP) in work zones and in safety zones by the Chicago DOT. IDOT reports that speeding and distracted driving are the leading causes of crashes in work zones and that the law allowing automated enforcement was enabled to assist IDOT and ISP in reducing the number and severity of crashes related to speeding in work zones (*17*). Photo citations can only be issued when workers are present.

In 2004, Illinois passed the Automated Traffic Control Systems in Highway Construction or Maintenance Zones Act, authorizing speed-radar photo enforcement (SPE) in work zones on highways (*18*). This was the first State to authorize automated enforcement on the Interstate Highway System. The program started with two self-contained vans that provided vehicles advancing with a speed feedback sign of their speed in advance of the van. A second speed measurement was taken 150 feet after the van and was used to determine if a citation was issued. This allowed drivers the opportunity to reduce their speeds in response to the speed feedback sign.

The University of Illinois at Urbana-Champaign evaluated the SPEs in two Interstate work zones and compared speed reductions to traditional enforcement approaches in 2006 and 2007. The evaluation found that the SPE significantly reduced car and truck speeds by 3 to 8 mph in the work zones and resulted in a large reduction in speeding free-flowing vehicles (*18*). The Research Advisory Committee of the American Association of State Highway and Transportation Officials (AASHTO) recognized "Speed Photo Enforcement in Illinois Work Zones" as a high-value research project at the regional level.

Pennsylvania Department of Transportation

Pennsylvania's program, Automated Work Zone Speed Enforcement (AWZSE), is a joint effort of the Pennsylvania Department of Transportation (PennDOT), the Pennsylvania Turnpike Commission (PA Turnpike) and the Pennsylvania State Police (PSP) through an Interagency Agreement. The program, originally called Automated Work Zone Speed Enforcement (AWZSE), was established in 2019 as a pilot program with a five-year sunset date to 2024. In 2023, the sunset date was removed, and a permanent program was established in 2024, renamed Work Zone Speed Safety Camera (WZSSC) program. The program is for use on select PennDOT-operated and all Commission-operated highways in active work zones (that is, workers must be present), including both short and long-term work zones and both construction and maintenance activities. The program uses 17 mobile enforcement units with ten generally available for PennDOT roadways and seven for Commission roadways. The program's annual report documents reductions in speeding, excessive speeding, crashes, and fatalities in work zones. The report also notes that the program is a complement to existing speed enforcement by the State Police. Interestingly, the program evaluation found that travel speeds adjacent to barrier protected work zones (as opposed to work zones channelized with barrels or similar) have been the most challenging to gain speed limit compliance (*19*).

Commonwealth of Virginia

Virginia passed enabling legislation in 2020 that allows speed monitoring devices in highway work zones. They are also allowed for use in school crossing zones and high-risk segments. The Virginia code allows the State or local police to conduct the enforcement (*20*). The State police are working on setting up a statewide speed monitoring contract. The State police will lead overseeing the procurement and the contract, but they have included the Virginia Department of Transportation (VDOT) in the procurement process and have VDOT represented on the selection panel.

VDOT has a memorandum of understanding with the State police that delineates the responsibilities of each agency (*21*). The State police are leading procurement and once the contract is awarded, they will monitor the vendor and lead the citation process.

Currently, several municipalities in Virginia use speed cameras with two municipalities, Suffolk and Harrisonburg, using the cameras in work zones. Harrisonburg uses the cameras at a work zone at the interchange of Interstate 81 and East Market Street (Exit 247). The work zone is signed for 25 mph. The Harrisonburg Public Works Department and the Harrisonburg Police Department partner to lead the program. This has caused some debate about whether the local police can use the system on the interstate, although this installation is not on the interstate.

The City of Suffolk uses speed cameras for school zones and work zones. They have contracted with a vendor to install and maintain the technology and the Suffolk Police Department is responsible for the citation process. The program information notes that the cameras will be moved to different work zones throughout the City. Currently, they are in use on Route 58 as part of the Holland Road Widening Project.

Other Insights into SSC

NCHRP Synthesis 482: Work Zone Speed Management (*2*), contains a detailed synthesis of work zone practices. The report was published in 2015 and included a chapter on the use of automated work zone speed enforcement. Two methods are addressed, single-point and point-to-point, with the former basing citations on a vehicle's instantaneous speed recorded at one location in a work zone and the latter on a vehicle's speed that is estimated based on their travel time between two points. Notably, the report references the point-to-point method is well suited for work zones because it requires drivers to comply with the speed limit throughout the work zone. The point-to-point method also benefits work zone capacity by reducing abrupt speed changes near a camera. The report also notes that European experiences indicated that crash rates and fatalities can be dramatically reduced with the comprehensive use of automated enforcement.

Chapter 4. Summary and Conclusions

NCDOT uses systematic processes to continually enhance its work zone safety and mobility policies, processes, and practices. This includes an objective approach for establishing work zone speed limits that follows MUTCD principles and promotes consistency and transparency for both the construction industry and the traveling public. NCDOT implements additional speed and safety management strategies to enhance safety for workers and the traveling public. Despite these activities, the construction industry has reported concerns with work zone speeds in North Carolina's work zones. In addition, North Carolina crash data show an increase in fatal and suspected serious injury work zone crashes on Interstates coming out of the COVID-19 pandemic (Figure 1). National trends in overall traffic fatalities have seen similar increasing numbers, with some analyses showing higher proportions of speeding-related fatalities than pre-pandemic levels, especially during nighttime hours (1).

NCDOT undertook a data collection and analysis effort to objectively characterize operating speeds and safety performance in North Carolina Interstate highway work zones. Data collection occurred in six work zones on Interstates across the state. The study locations spanned multiple counties and involved major Interstate reconstruction projects.

The speed data show operating speeds consistently above work zone speed limits, often by considerable amounts. Approximately 72-90% of drivers exceeded the speed limit in the two work zones that had static speed limits. In the four work zones with work zone variable speed limits, more than 90% of drivers exceeded the work zone lower speed limit in all but one location. Between 35-66% of drivers exceeded the work zone upper speed limit. The fastest one percent of drivers (99th percentile) traveled at speeds above 81 to 89 mph. Maximum speeds across the six work zones ranged from 97 to 106 mph, exceeding speed limits by more than 30 mph in several cases.

The analysis of crash data revealed that the average annual number of fatal and serious injury crashes from before to during the work zones increased by 87% across all six work zones. The highest increase was in WZ3, where fatal and serious injury crashes increased by 927% from 1.1 to 11.3 crashes per year.

Chapter 3 synthesized speed and safety management strategies used by other State DOTs, including decoy radar, variable speed limits, changeable speed limit signs, dynamic speed feedback signs, temporary transverse rumble strips, portable changeable message signs (including with police lights), and speed safety cameras. The Insurance Institute for Highway Safety (IIHS) reports that communities using speed safety cameras have grown from around 150 in 2013 to over 200 in 2023 (*14*). Several States (Arizona, Colorado, Connecticut, Delaware, Illinois, Indiana, Maryland, Michigan, New Mexico, Oregon, Pennsylvania, Texas, Washington D.C., West Virginia, and Virginia) have legislations that allow the use of speed safety cameras in work zones as part of their speed reduction and safety improvement programs. Chapter 3 highlighted the key attributes of existing state work zone speed safety camera programs and provided additional detail on three active programs – Pennsylvania, Virginia, and Illinois.

References

1. AAA Foundation for Traffic Safety. Traffic Safety Impact of the COVID-19 Pandemic: Fatal Crashes in 2020–2022 - AAA Foundation for Traffic Safety. 2024.
2. Shaw, J., M. Chitturi, W. Bremer, and D. Noyce. *NCHRP Synthesis 482: Work Zone Speed Management*. 2015.
3. Eckenrode, R. T., W. A. Sarasua, J. H. Mattox III, J. H. Ogle, and M. Chowdhury. Revisiting the Use of Drone Radar to Reduce Speed in Work Zones: South Carolina's Experience. *Transportation research record*, Vol. 2015, No. 1, 2007, pp. 19–27.
4. Use of Drone Radar, Safety Intrusion Alarms, and CB Wizard in Work Zones. *National Work Zone Safety Information Clearinghouse*. https://workzonesafety.org/practice/use-of-drone-radar-safety-intrusion-alarms-and-cb-wizard-in-work-zones/. Accessed Feb. 17, 2025.
5. Maryland Department of Transportation. *Use of Drone Radar in Work Zones*. Federal Highway Administration, 2005.
6. FHWA. Variable Speed Limits. https://highways.dot.gov/safety/proven-safety-countermeasures/variable-speed-limits. Accessed Feb. 17, 2025.
7. MnDOT. *Work Zone Speed Limits*. Office of Traffic Engineering, Minnesota Department of Transportation (MnDOT), Minnesota, 2023.
8. Mahmud, M. S., H. Jashami, M. Usamah Megat Johari, N. Gupta, A. Bamney, T. J. Gates, and P. Savolainen. Effects of Speed Feedback Trailer Positioning and Police Enforcement on Vehicular Speeds in Freeway Work Zone Lane Closures. *Transportation Research Record: Journal of the Transportation Research Board*, Vol. 2678, No. 9, 2024.
9. American Traffic Safety Services Association's Work Zone Safety. Wake Up! Using Temporary Rumble Strips in Work Zones to Improve Driver Alertness. *Work Zone Safety Information Clearinghouse*. https://workzonesafety.org/training/podcast-12-wake-up-using-temporary-rumble-strips-in-work-zones-to-improve-driver-alertness/. Accessed Feb. 17, 2025.
10. Brown, H., P. Edara, C. Sun, S. Kim, J. B. Bracy, Q. Zeng, H. J. Baek, G. Ndungu, and University of Missouri. Department of Civil and Environmental Engineering. *Effectiveness of Temporary Rumble Strips in Work Zones*. Publication cmr 22-004. 2022.
11. Maryland Department of Transportation State Highway Administration. *Use of Portable Changeable Message Sign with Speed Display in Work Zones*. Maryland Department of Transportation, 2005.
12. Firman, U., Y. Li, and Y. Bai. Determining the Effectiveness of Portable Changeable Message Signs in Work Zones. 2009.
13. Sorrell, M., W. Sarasua, W. Davis, and A. Dunning. Use of Radar Equipped Portable Changeable Message Sign to Reduce Vehicle Speed in South Carolina Work Zones. 2007.
14. Insurance Institute for Highway Safety. U.S. Speed Camera Communities. *IIHS-HLDI crash testing and highway safety*. https://www.iihs.org/topics/speed/speed-camera-communities. Accessed Feb. 17, 2025.
15. Kapitanov, M. C. Overview of Work Zone Speed Safety Cameras. Oct, 2024.
16. Federal Highway Administration and State Partners Presentation Materials at the Work Zone Peer Exchange. Oct, 2024.
17. Illinois Department of Transportation. Automated Enforcement. https://idot.illinois.gov/transportation-system/transportation-safety/roadway-safety/enforcement/automated-enforcement.html. Accessed Feb. 17, 2025.
18. Tobias, P. Automated Speed Enforcement Slows Down Drivers in Work Zones. 2011.

19. PennDOT. *2024 Annual Report: Automated Work Zone Speed Enforcement*. Penna Turnpike, Pennsylvania State Police, and Pennsylvania Department of Transportation, 2024.
20. Code of Virginia. § 46.2-882.1. Use of Photo Speed Monitoring Devices in Highway Work Zones, School Crossing Zones, and High-Risk Intersection Segments; Civil Penalty. https://law.lis.virginia.gov/vacode/title46.2/chapter8/section46.2-882.1/. Accessed Feb. 17, 2025.
21. Telephone Interview with Marc Lipschultz, VDOT Work Zone Program Manager. Jan 02, 2025.

Appendix A: Speed Summary by Work Zone

Table 3 Speed Data Summary Work Zone 1

WZ1 I-3306: I-40 Widening						
	Westbound			Eastbound		
Measures	**Both Lanes**	**Inner Lane**	**Outer Lane**	**Both Lanes**	**Inner Lane**	**Outer Lane**
Sample Size	29,741	21,357	8,384	33,905	21,009	12,896
Work Zone Speed Limit, mph	55-65	55-65	55-65	55-65	55-65	55-65
Minimum Speed, mph	12	12	12	10	10	10
Maximum Speed, mph	106	106	95	106	106	103
Average Speed, mph	67.0	68.1	64.4	66.8	68.3	64.4
Standard Deviation	7.8	7.2	8.6	9.1	8.7	9.1
Skewness	-0.9	-0.8	-0.9	-2.0	-2.3	-1.9
Kurtosis	4.7	4.9	4.3	9.5	11.8	8.7
Mean Difference from Speed Limit	2.0	3.1	-0.6	1.8	3.3	-0.6
Interquartile Range	8	8	12	8	8	11
15th Percentiles Speed, mph	59	63	58	60	64	58
50th Percentiles Speed, mph	66	70	64	66	71	65
85th Percentiles Speed, mph	73	73	72	73	73	72
95th Percentiles Speed, mph	75	76	75	75	77	74
99th Percentile Speed, mph	86	86	86	86	87	86
100 mph or more (count)	4	4	0	7	6	1
100 mph or more (%)	0.0	0.0	0.0	0.0	0.0	0.0
Over WZ Lower Speed Limit (%)	95.1	96.9	90.6	95.1	96.1	93.3
5 mph Over WZ Lower Speed Limit (%)	83.1	87.1	72.8	85.4	91	76.2
10 mph Over WZ Lower Speed Limit (%)	64.2	70.1	49.3	66.4	76.1	50.6
15 mph Over WZ Lower Speed Limit (%)	46.8	53.4	30.1	46.8	57.4	29.6
20 mph Over WZ Lower Speed Limit (%)	6.2	6.7	5.1	5.9	7.0	4.1
Over WZ Upper Speed Limit (%)	64.2	70.1	49.3	66.4	76.1	50.6
5 mph Over WZ Upper Speed Limit (%)	46.8	53.4	30.1	46.8	57.4	29.6
10 mph Over WZ Upper Speed Limit (%)	6.2	6.7	5.1	5.9	7.0	4.1
15 mph Over WZ Upper Speed Limit (%)	3.6	3.9	2.7	3.4	4.2	2.2
20 mph Over WZ Upper Speed Limit (%)	1.9	2.1	1.5	2.0	2.4	1.4

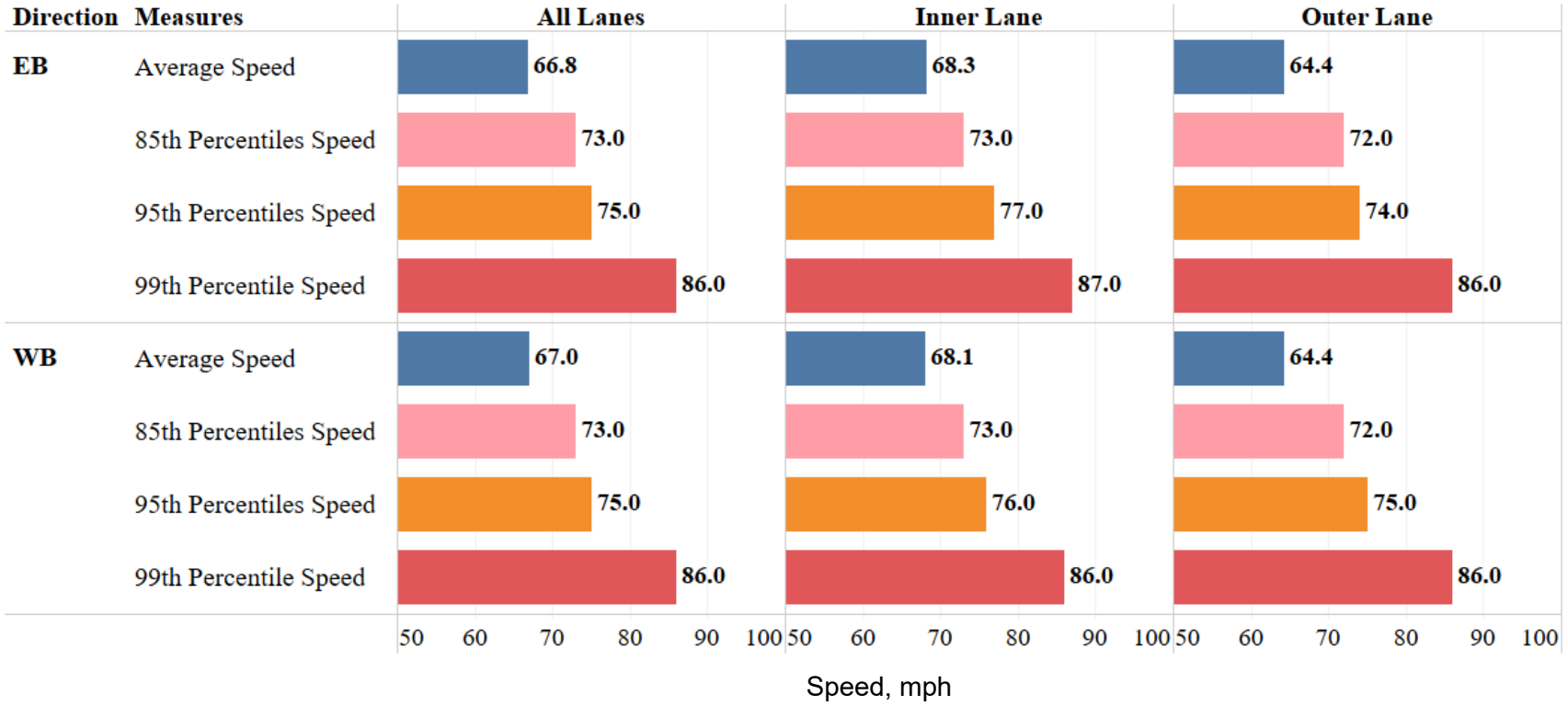

Figure 6 Speed Distribution by Lane and Direction at Work Zone 1 (Work Zone Speed Limit: 55-65 mph; Sample Size: 33,905 (EB) and 29,741 (WB))

Table 4 Speed Data Summary Work Zone 2

WZ2 I-5987 and I-6064: I-95 Widening						
	Westbound			Eastbound		
Measures	**Both Lanes**	**Inner Lane**	**Outer Lane**	**Both Lanes**	**Inner Lane**	**Outer Lane**
Sample Size	18,974	8,429	10,545	21,945	8,505	13,440
Work Zone Speed Limit, mph	55-70	55-70	55-70	55-70	55-70	55-70
Minimum Speed, mph	12	12	14	20	20	26
Maximum Speed, mph	106	106	99	98	98	90
Average Speed, mph	68.5	71.6	66.0	66.2	70.3	63.6
Standard Deviation	8.7	9.7	6.9	7.2	6.7	6.2
Skewness	-0.5	-1.1	-0.5	0.2	0.0	0.2
Kurtosis	4.0	4.9	5.4	0.9	1.8	1.5
Mean Difference from Speed Limit	13.5	16.6	11.0	11.2	15.3	8.6
Interquartile Range	9	8	7	8	8	7
15th Percentiles Speed, mph	63	64	59	58	64	58
50th Percentiles Speed, mph	69	72	65	65	72	64
85th Percentiles Speed, mph	74	81	72	73	74	71
95th Percentiles Speed, mph	85	86	74	77	84	73
99th Percentile Speed, mph	88.27	91	86	86	87	82
100 mph or more (count)	11	11	0	0	0	0
100 mph or more (%)	0.1	0.1	0.0	0.0	0.0	0.0
Over WZ Lower Speed Limit (%)	96.5	96.1	96.8	95.6	98.9	93.6
5 mph Over WZ Lower Speed Limit (%)	87.5	91.3	84.5	79.4	94.3	70.1
10 mph Over WZ Lower Speed Limit (%)	68.3	82.9	56.6	55.3	80.9	39.1
15 mph Over WZ Lower Speed Limit (%)	49.9	71.8	32.4	36.7	64.0	19.4
20 mph Over WZ Lower Speed Limit (%)	13.3	23.9	4.8	6.5	13.3	2.1
Over WZ Upper Speed Limit (%)	49.9	71.8	32.4	36.7	64.0	19.4
5 mph Over WZ Upper Speed Limit (%)	13.3	23.9	4.8	6.5	13.3	2.1
10 mph Over WZ Upper Speed Limit (%)	9.5	17.7	3.0	4.3	8.9	1.4
15 mph Over WZ Upper Speed Limit (%)	6.1	11.5	1.8	2.2	4.7	0.6
20 mph Over WZ Upper Speed Limit (%)	0.6	1.3	0.1	0.1	0.1	0.0

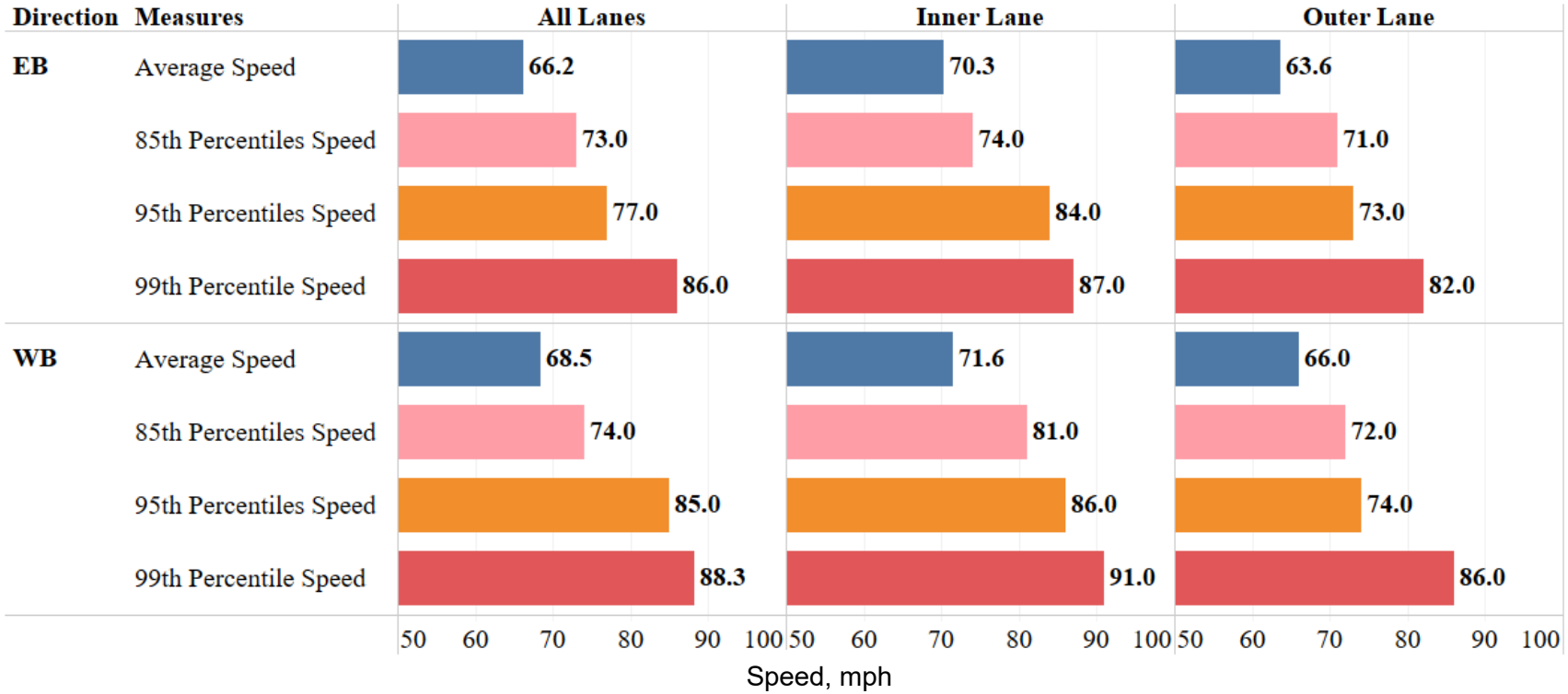

Figure 7 Speed Distribution by Lane and Direction at Work Zone 2 (Work Zone Speed Limit: 55-70 mph; Sample Size: 21,945 (EB) and 18,974 (WB))

Table 5 Speed Data Summary Work Zone 3

WZ3 I-5111: I-40 Widening										
	Westbound					Eastbound				
Measures	All Lanes	Innermost Lane	Inner-Inner Lane	Inner-Outer Lane	Outermost Lane	All Lanes	Innermost Lane	Inner-Inner Lane	Inner-Outer Lane	Outermost Lane
Sample Size	42,130	6,522	13,326	12,644	7,584	38,839	9,003	12,385	10,578	6,873
Work Zone Speed Limit, mph	70	70	70	70	70	70	70	70	70	70
Minimum Speed, mph	19	24	19	20	21	14	24	20	14	14
Maximum Speed, mph	106	106	106	101	106	106	106	99	99	99
Average Speed, mph	72.5	80.8	75.2	71.3	68.7	72.2	77.5	73.4	69.1	68.2
Standard Deviation	9.4	7.0	7.5	6.1	7.3	8.3	7.3	6.3	7.9	8.9
Skewness	-0.9	-1.7	-1.3	0.0	-0.9	-0.8	-0.6	-0.4	-0.9	-1.4
Kurtosis	2.2	7.9	7.4	2.4	4.0	4.1	2.7	5.1	4.9	5.5
Mean Difference from Speed Limit	8.8	8.3	9.8	9.9	6.3	2.2	7.5	3.4	-0.9	-1.9
Interquartile Range	7	10	8	7	8	8	10	4	8	9
15th Percentiles Speed, mph	65	73	72	65	64	65	72	69	63	62
50th Percentiles Speed, mph	73	84	73	72	71	72	77	73	70	70
85th Percentiles Speed, mph	84	86	84	74	74	81	85	80	75	74
95th Percentiles Speed, mph	86	87	86	84	79	86	87	85	82	82
99th Percentile Speed, mph	88	90.79	88	87	87	89	91	88	88	88
100 mph or more (count)	213	19	99	72	17	13	13	0	0	0
100 mph or more (%)	0.5	0.3	0.7	0.6	0.2	0.0	0.1	0.0	0.0	0.0
Over WZ Speed Limit (%)	88.0	87.0	90.2	91.7	80.1	71.8	91.3	83.7	54.2	51.5
5 mph Over WZ Speed Limit (%)	69.2	66.8	73.5	75.2	55.8	29.2	58.3	28.2	15.6	13.8
10 mph Over WZ Speed Limit (%)	40.8	37.1	46.4	46.6	27.9	18.2	42.8	15.7	7.8	6.6
15 mph Over WZ Speed Limit (%)	16.7	13.8	21.0	19.2	9.2	7.2	16.9	6.0	3.1	2.8
20 mph Over WZ Speed Limit (%)	5.3	3.7	7.4	5.9	2.5	0.7	1.6	0.5	0.4	0.3

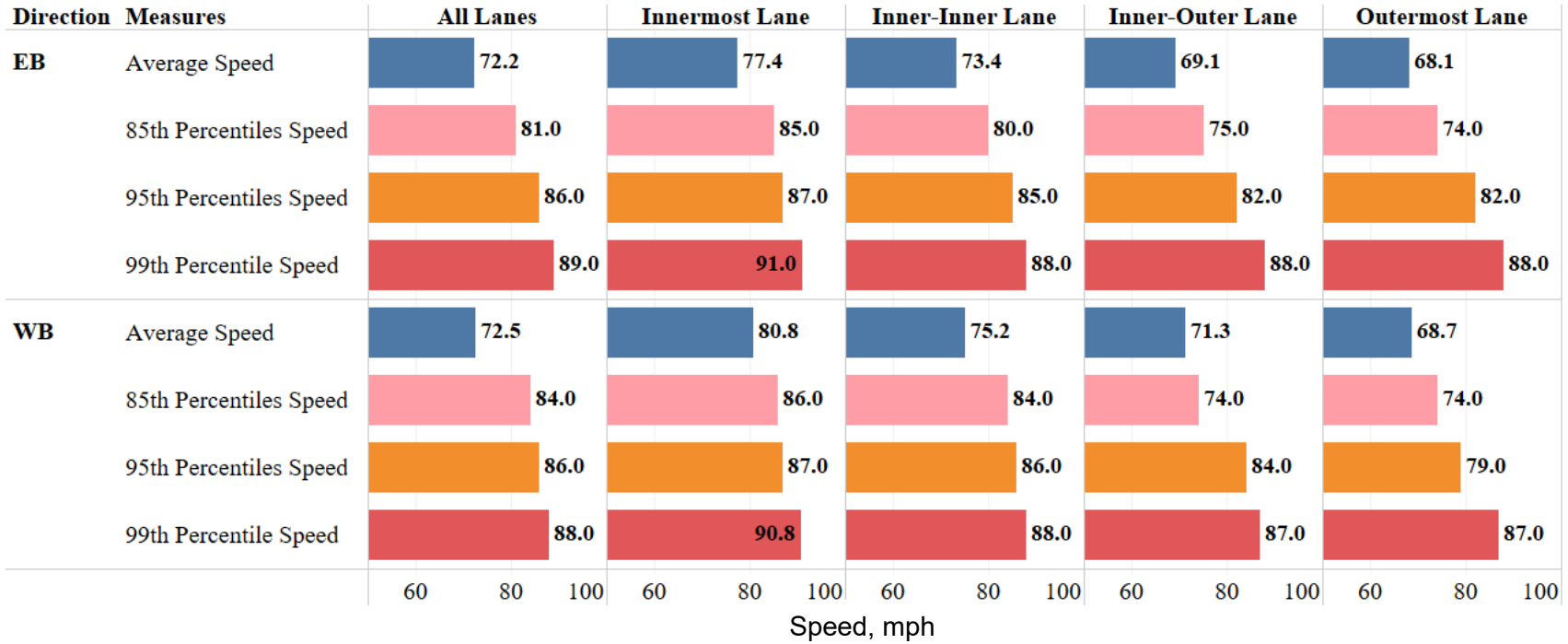

Figure 8 Speed Distribution by Lane and Direction at Work Zone 3 (Work Zone Speed Limit: 70 mph; Sample Size: 38,839 (EB) and 42,130 (WB))

Table 6 Speed Data Summary Work Zone 4

WZ4 15830 I-4400/I-4700: I26 Widening						
	Westbound			Eastbound		
Measures	**Both Lanes**	**Inner Lane**	**Outer Lane**	**Both Lanes**	**Inner Lane**	**Outer Lane**
Sample Size	25,457	12,127	13,330	27,040	12,270	14,770
Work Zone Speed Limit, mph	55 -65	55 -65	55 -65	55 -65	55 -65	55 -65
Minimum Speed, mph	12	12	12	10	12	10
Maximum Speed, mph	99	99	98	99	99	95
Average Speed, mph	65.9	68.1	64.0	64.3	67.5	61.6
Standard Deviation	7.2	7.6	6.2	7.5	7.1	6.7
Skewness	-0.9	-1.7	-0.5	-0.6	-0.9	-0.7
Kurtosis	6.7	10.3	5.3	4.0	5.5	6.4
Mean Difference from Speed Limit	10.9	13.1	9.0	9.3	12.5	6.6
Interquartile Range	9	8	7	8	8	7
15th Percentiles Speed, mph	60	63	58	57	62	56
50th Percentiles Speed, mph	65	69	64	64	68	61
85th Percentiles Speed, mph	72	73	70	72	73	68
95th Percentiles Speed, mph	77	79	73	74	77	73
99th Percentile Speed, mph	83	85	80	82	84	76
100 mph or more (count)	0	0	0	0	0	0
100 mph or more (%)	0.0	0.0	0.0	0.0	0.0	0.0
Over WZ Lower Speed Limit (%)	96.8	97.4	96.4	92.8	96.9	89.5
5 mph Over WZ Lower Speed Limit (%)	86.2	93	80	72	89	57.8
10 mph Over WZ Lower Speed Limit (%)	55.5	72.8	39.8	47.3	68.9	29.4
15 mph Over WZ Lower Speed Limit (%)	32.6	48.1	18.6	27.1	44	13.1
20 mph Over WZ Lower Speed Limit (%)	7.3	11.4	3.5	4.5	8.1	1.5
Over WZ Upper Speed Limit (%)	55.5	72.8	39.8	47.3	68.9	29.4
5 mph Over WZ Upper Speed Limit (%)	32.6	48.1	18.6	27.1	44	13.1
10 mph Over WZ Upper Speed Limit (%)	7.3	11.4	3.5	4.5	8.1	1.5
15 mph Over WZ Upper Speed Limit (%)	2.9	4.7	1.4	1.8	3.2	0.6
20 mph Over WZ Upper Speed Limit (%)	0.6	1.1	0.2	0.5	0.9	0.1

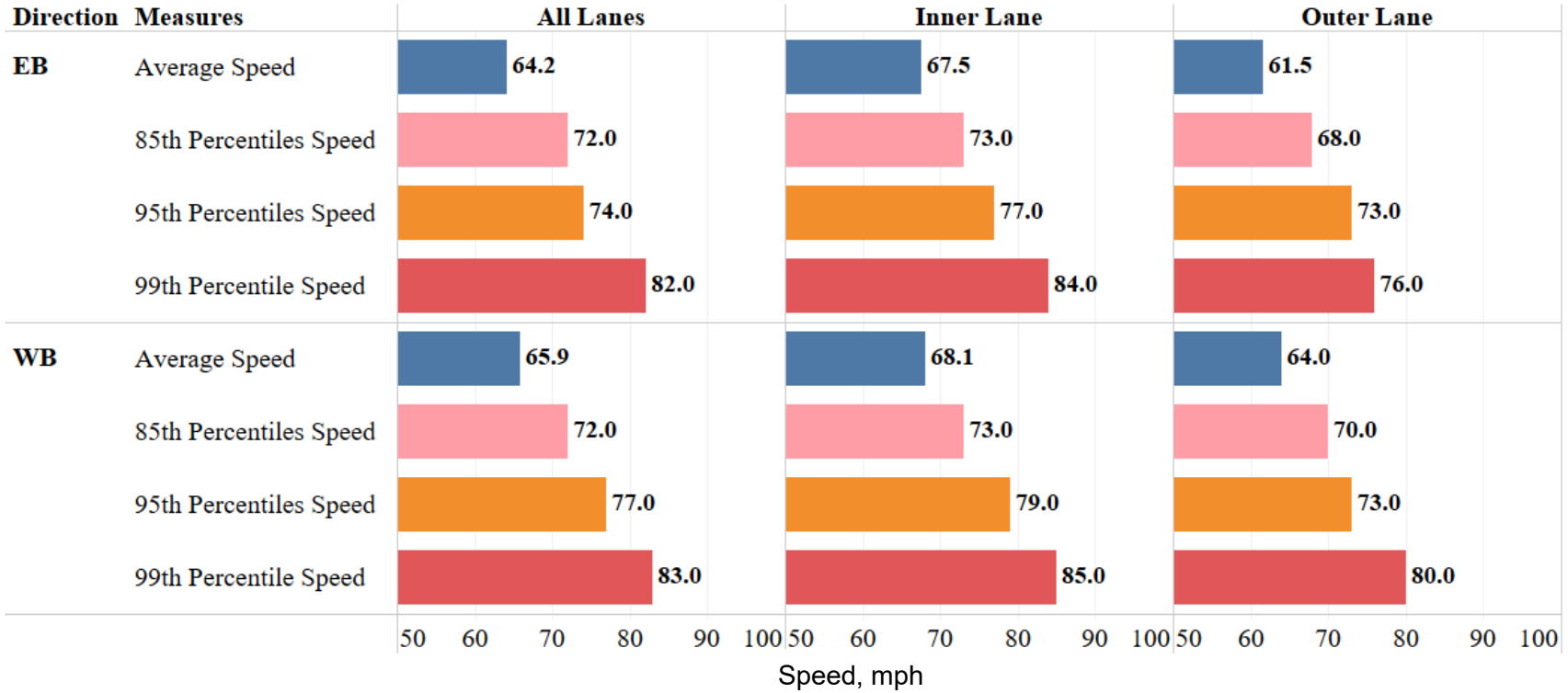

Figure 9 Speed Distribution by Lane and Direction at Work Zone 4 (Work Zone Speed Limit: 55-65 mph; Sample Size: 27,040 (EB) and 25,457 (WB))

Table 7 Speed Data Summary Work Zone 5

WZ5 I-5507: I-485 Widening, Express Lanes						
	Westbound			Eastbound		
Measures	**Both Lanes**	**Inner Lane**	**Outer Lane**	**Both Lanes**	**Inner Lane**	**Outer Lane**
Sample Size	43,611	22,510	21,101	45,363	21,649	23,714
Work Zone Speed Limit, mph	55-70	55-70	55-70	55-70	55-70	55-70
Minimum Speed, mph	9	9	11	17	19	17
Maximum Speed, mph	97	97	95	102	102	89
Average Speed, mph	59.5	62.1	56.8	65.3	69.3	61.7
Standard Deviation	15.6	16.2	14.6	8.3	7.1	7.6
Skewness	-1.0	-1.0	-1.1	-0.3	-0.5	-0.3
Kurtosis	-0.2	-0.3	0.1	1.1	2.5	1.7
Mean Difference from Speed Limit	4.5	7.1	1.8	10.3	14.3	6.7
Interquartile Range	17	15	12	18	8	7
15th Percentiles Speed, mph	36	36	34	58	64	55
50th Percentiles Speed, mph	64	70	62	65	71	63
85th Percentiles Speed, mph	72	74	70	73	74	71
95th Percentiles Speed, mph	79	80	72	77	82	73
99th Percentile Speed, mph	81	82	80	85	86	81
100 mph or more (count)	0	0	0	2	2	0
100 mph or more (%)	0.0	0.0	0.0	0.0	0.0	0.0
Over WZ Lower Speed Limit (%)	74.9	76.1	73.6	90.9	97.2	85.2
5 mph Over WZ Lower Speed Limit (%)	66.0	73.3	58.2	72.7	91.2	55.9
10 mph Over WZ Lower Speed Limit (%)	45.4	61.8	27.8	52.4	75.6	31.2
15 mph Over WZ Lower Speed Limit (%)	35.3	52.3	17.2	37.3	59.1	17.4
20 mph Over WZ Lower Speed Limit (%)	8.4	13.7	2.8	6.8	11.5	2.5
Over WZ Upper Speed Limit (%)	35.3	52.3	17.2	37.3	59.1	17.4
5 mph Over WZ Upper Speed Limit (%)	8.4	13.7	2.8	6.8	11.5	2.5
10 mph Over WZ Upper Speed Limit (%)	4.2	6.8	1.5	3.9	6.8	1.3
15 mph Over WZ Upper Speed Limit (%)	0.2	0.3	0.1	1.6	3.0	0.4
20 mph Over WZ Upper Speed Limit (%)	0.1	0.1	0.0	0.0	0.1	0.0

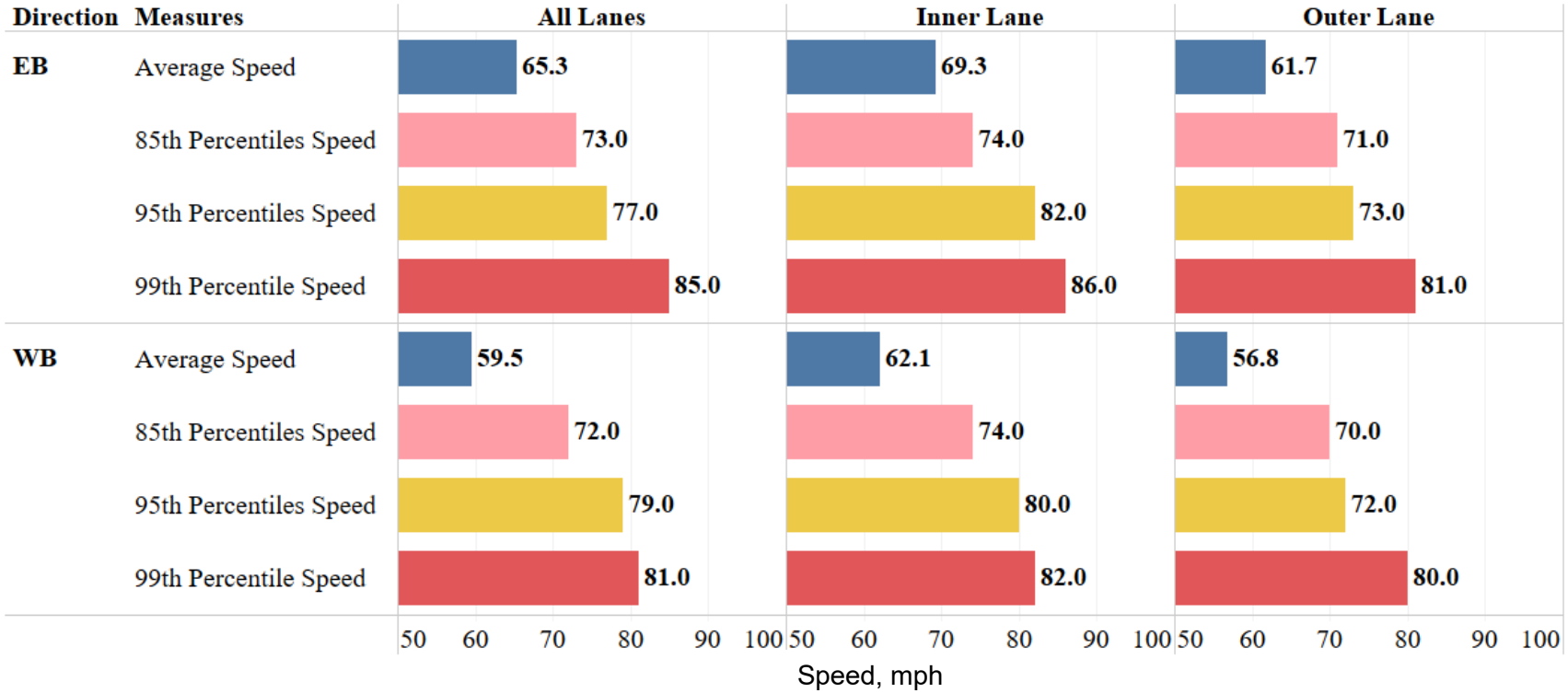

Figure 10 Speed Distribution by Lane and Direction at Work Zone 5 (Work Zone Speed Limit: 55-70 mph; Sample Size: 45,363 (EB) and 43,611 (WB))

Table 8 Speed Data Summary Work Zone 6

WZ6 U-2719/U-4437: I-440 Widening						
	Northbound			Southbound		
Measures	**Both Lanes**	**Inner Lane**	**Outer Lane**	**Both Lanes**	**Inner Lane**	**Outer Lane**
Sample Size	33,596	20,126	13,470	33,116	17,733	15,383
Work Zone Speed Limit, mph	55	55	55	55	55	55
Minimum Speed, mph	12	16	12	10	10	10
Maximum Speed, mph	101	101	95	102	99	102
Average Speed, mph	62.8	64.9	59.7	57.3	59.3	55.0
Standard Deviation	7.5	7.6	6.2	14.5	15.1	13.4
Skewness	-0.1	-0.3	-0.1	-1.3	-1.3	-1.4
Kurtosis	2.5	3.3	3.0	1.3	1.1	2.1
Mean Difference from Speed Limit	7.8	9.9	4.7	2.3	4.3	-0.1
Interquartile Range	8	9	7	7	11	10
15th Percentiles Speed, mph	57	58	53	42	39	45
50th Percentiles Speed, mph	64	64	58	61	64	58
85th Percentiles Speed, mph	71	72	65	71	72	65
95th Percentiles Speed, mph	73	75	71	73	73	72
99th Percentile Speed, mph	85	87	74	81	85	76
100 mph or more (count)	1	1	0	1	0	1
100 mph or more (%)	0.0	0.0	0.0	0.0	0.0	0.0
Over WZ/Typical Speed Limit (%)	89.6	94.2	82.7	74.1	79.2	68.1
5 mph Over WZ Speed Limit (%)	62.2	77.3	39.6	51.5	66.8	33.9
10 mph Over WZ Speed Limit (%)	36.9	49.1	18.8	30.1	41.8	16.7
15 mph Over WZ Speed Limit (%)	19.2	27.4	7.0	16.4	24.7	6.9
20 mph Over WZ Speed Limit (%)	3.4	5.3	0.7	2.2	2.9	1.3

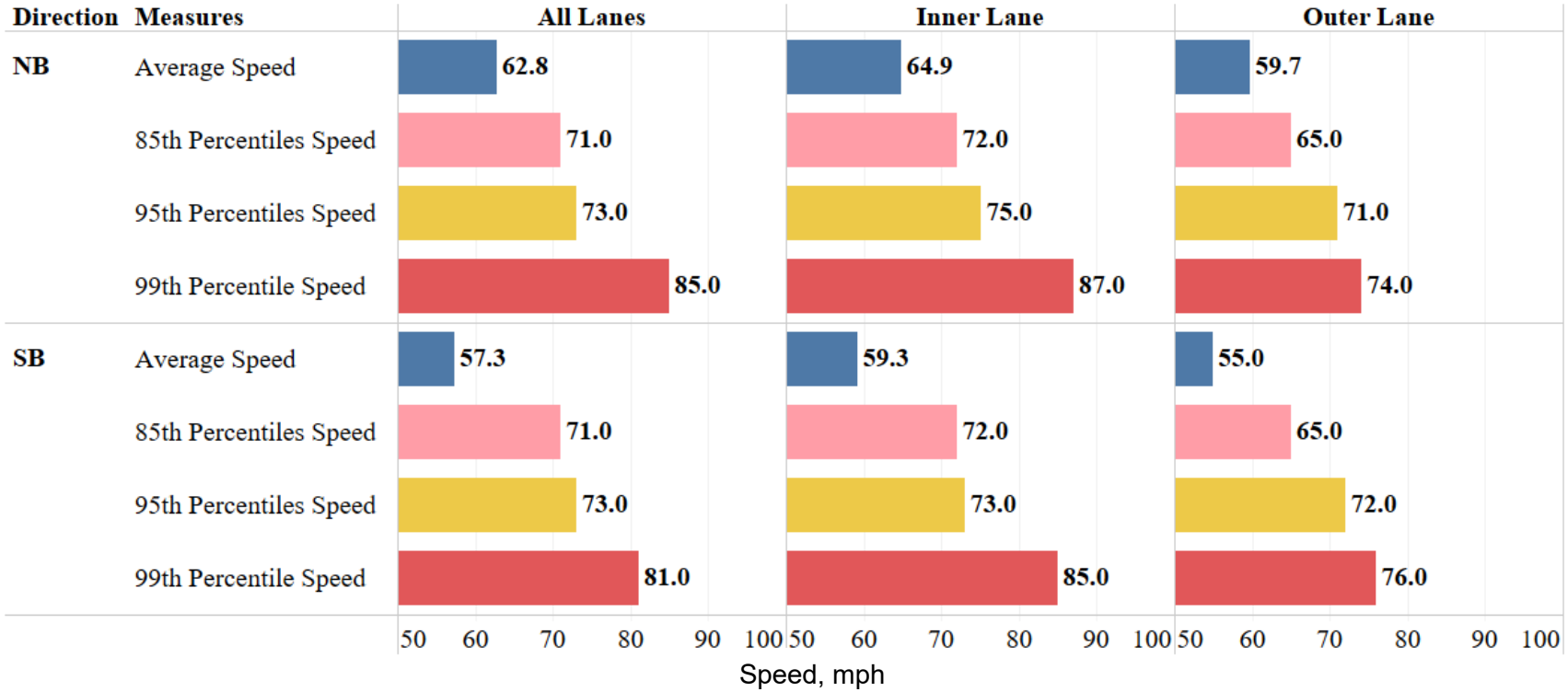

Figure 11 Speed Distribution by Lane and Direction at Work Zone 6 (Work Zone Speed Limit: 55 mph; Sample Size: 33,596 (NB) and 33,116 (SB))

Appendix B: Summary of Existing State Programs

Table 9 Overview of Existing State Programs

State	Year	Responsible Agency	Current Structure	Allowed Roadways	Provisions	Technology and Units
Colorado (pending)	Initiated in 2024	CDOT lead with Department of Revenue, Department of Safety, and local agencies	Civil penalty assigned to owner of vehicle	State roadways	Officer or government employee must be present; only allowed when workers are present	Radar and laser
Connecticut	2023 as pilot, expanded in 2024	CTDOT lead with contractor oversight and vendor to operate system; State police issue infractions and the Centralized Infractions Bureau processes the citations	Civil penalty assigned to owner of vehicle	Work zones on highways with posted speed limits of 45 mph or greater	No need for officer to be present Variable speed limits on limited access highways are allowed	Radar - Authorized for up to 15 work zones at a time
Delaware	2024 as a pilot, now 5-year program	DelDOT and the Delaware State Police are partners; vendor operated; DelDOT oversee the program implementation, management, and evaluation	Civil penalty assigned to owner of vehicle	Two or more criteria including over 45 mph, 85 percentile is 10 mph above posted, increased worker exposure, high pre-project crash rates and more	No need for officer to be present	LIDAR, started with one location, expanding now
Illinois	2004 (first in nation)	IDOT and Illinois State Police (ISP)	Civil penalty assigned to owner of vehicle		Officer must be present	Mobile van with LIDAR

State	Year	Responsible Agency	Current Structure	Allowed Roadways	Provisions	Technology and Units
Indiana	2023 as part of 5-year pilot	INDOT leads with support from contractor and vendor; hired new INDOT staff to manage under Traffic Operations	Likely administrative	Highway work zones	No need for officer to be present; allowed when workers present	LIDAR
Maryland	Began at county level in 2007	MDOT	Civil penalty assigned to owner of vehicle	45 mph or greater, originally only expressways and controlled access	No need for officer to be present; allowed when workers present; several provisions at site including flashing blue lights when enforcing and END ROAD WORK signs	
Minnesota	2025 Pilot	MnDOT and Mn Department of Public Safety with vendor support	Civil penalty assigned to owner of vehicle	Trunk highway system	No need for officer to be present	Pilot is 2 to 4 projects; maximum number allowed is based on population
Pennsylvania	2019 as pilot, now continuing	Interagency agreement – PennDOT, PA Turnpike Commission, State Police	Civil penalty assigned to owner of vehicle	Select PennDOT-operated and all Commission-operated highways in active work zones		17 mobile units

State	Year	Responsible Agency	Current Structure	Allowed Roadways	Provisions	Technology and Units
New York	2021	New York State Department of Transportation and the New York State Thruway Authority	Civil penalty assigned to owner of vehicle	Limited access roadways (Interstate system and parkways) Not allowed on ramps	No need for officer to be present Workers must be present Can only be used for maintenance and construction zones Site selection must consider speed data, crashes, and roadway geometry	20 Units for NYDOT, 10 for Thruway Authority
Vermont	Pilot now 2-year program in July	VTrans with many partners including Department of Public Safety; VTrans manages pilot, site selection, program evaluation, and compliance		Active work zones	No need for officer to be present	
Virginia (pending)	Anticipated 2025	State Police lead the program with a vendor; VDOT is on selection panel and will work with Police on selecting sites	Civil penalty assigned to owner of vehicle	Active work zones, construction or maintenance	Must have a Work Zone Speed Assembly (having required signs in place)	

State	Year	Responsible Agency	Current Structure	Allowed Roadways	Provisions	Technology and Units
Washington	Anticipated 2025	Washington DOT with many partners including Washington State Police; DOT's role is to implement, administer, procure, and operate program	Civil penalty assigned to owner of vehicle	State Highways	No need for officer to be present Workers must be present	