COMMERCIAL MOTOR VEHICLE SAFETY IN WORK ZONES
TARGETED ACTION PLAN

Publication No. FHWA-HOP-20-027

June 2023

U.S. Department of Transportation
Federal Highway Administration

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

NHTSA
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
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Since 2016, over 2 percent of all fatal crashes in the United States every year happen in work zones. According to the National Highway Traffic Safety Administration’s Fatality Analysis Reporting System, 687 fatal crashes occurred in work zones in 2016. Commercial motor vehicles (CMVs) (i.e., large trucks and buses) were involved in 196 of these crashes (29 percent). The number of fatal work zone crashes involving CMVs increased to 227 (32 percent) in 2017, remained relatively constant at 215 (32 percent) in 2018, and increased to 252 (33 percent) in 2019. In 2020, 774 fatal crashes occurred in work zones. CMVs were involved in 208 of these crashes (27 percent). For comparison purposes, CMV involvement in non-work zone fatal crashes has remained fairly constant over time at about 13 percent. Even though there was a slight decrease in CMV-involved work zone fatal crashes in work zones in 2020, CMVs are consistently overrepresented in fatal work zone crashes compared to fatal non-work zone crashes. Thus, there is a need to specifically address CMV safety in work zones. While many CMV and work zone safety initiatives indirectly benefit CMV safety in work zones, this document is centered on specific actions that can be taken to address CMV safety in work zones. The report also includes a voluntary, targeted action plan that transportation agencies, such as State Departments of Transportation, and other stakeholders can use to reduce the risk of CMV work zone crashes.
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**NOTE:** Volumes greater than 1,000 L shall be shown in m³.

| **MASS** | | | | |
| oz | ounces | 28.35 | grams | g |
| lb | pounds | 0.454 | kilograms | kg |
| T | short tons (2000 lb) | 0.907 | Megagrams (or "metric ton") | Mg (or "t") |

**TEMPERATURE (exact degrees)**

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<th>°C</th>
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</table>

**FORCE and PRESSURE or STRESS**

| lb | poundforce | 4.45 | newtons | N |
| lbf/in² | poundforce per square inch | 6.89 | kilopascals | kPa |

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003)*
# TABLE OF CONTENTS

CHAPTER 1. INTRODUCTION ................................................................................................ 1
  BACKGROUND ..................................................................................................................... 1
  OBJECTIVE .......................................................................................................................... 2
  STAKEHOLDERS ................................................................................................................... 2
  STRUCTURE OF DOCUMENT............................................................................................. 3

CHAPTER 2. TARGETED ACTION PLAN ............................................................................. 5
  INTRODUCTION..................................................................................................................... 5
  ENGINEERING....................................................................................................................... 5
    Action Items for FHWA ....................................................................................................... 5
    Action Items for FMCSA ..................................................................................................... 6
    Action Items for NHTSA...................................................................................................... 7
    Voluntary Action Items for Transportation Agencies....................................................... 7
    Voluntary Action Items for Trucking Industry, Transit Agencies, Commercial Bus
    Entities, and Other Related Entities.................................................................................... 8
    Voluntary Action Items for Contractors ............................................................................ 8
    Voluntary Action Items for Transportation Safety Groups ............................................. 8
    Voluntary Action Items for Academic Transportation Centers.................................... 8
  ENFORCEMENT..................................................................................................................... 8
    Action Items for FMCSA ..................................................................................................... 9
    Action Items for NHTSA...................................................................................................... 9
    Voluntary Action Items for Transportation Agencies....................................................... 9
    Voluntary Action Items for Law Enforcement .................................................................. 9
  DRIVER EDUCATION ........................................................................................................... 9
    Action Items for FHWA ....................................................................................................... 9
    Action Items for FMCSA ..................................................................................................... 10
    Action Items for NHTSA...................................................................................................... 10
    Voluntary Action Items for Transportation Agencies....................................................... 10
    Voluntary Action Items for Trucking Industry, Transit Agencies, Commercial Bus
    Entities, and Other Related Entities.................................................................................... 10
    Voluntary Action Items for Insurance Industry ............................................................... 10
    Voluntary Action Items for Contractors .......................................................................... 11
    Voluntary Action Items for Transportation Safety Groups, Passenger Vehicle Driver
    Education Organizations, and Public Health Entities....................................................... 11
LIST OF TABLES

Table 1. Stakeholders and Key Emphasis Areas................................................................. 4

LIST OF FIGURES

Figure 1. Graph. Commercial Motor Vehicle (CMV) Involvement Rate in Fatal Crashes .....1
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>ADAS</td>
<td>Advanced Driver Assistance Systems</td>
</tr>
<tr>
<td>ARTBA</td>
<td>American Road &amp; Transportation Builders Association</td>
</tr>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
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<td>ATSSA</td>
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<td>commercial motor vehicle</td>
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<td>Commercial Vehicle Safety Plan</td>
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<td>DOT</td>
<td>Department of Transportation</td>
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<td>FARS</td>
<td>Fatality Analysis Reporting System</td>
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<tr>
<td>GVWR</td>
<td>gross vehicle weight rating</td>
</tr>
<tr>
<td>ITS</td>
<td>Intelligent Transportation Systems</td>
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<tr>
<td>MCSAP</td>
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<td>MUTCD</td>
<td>Manual on Uniform Traffic Control Devices</td>
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<td>NHTSA</td>
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<td>Strategic Highway Safety Plan</td>
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<td>Work Zone Data Exchange</td>
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CHAPTER 1. INTRODUCTION

BACKGROUND

Since 2016, over 2 percent of all fatal crashes in the United States every year happen in work zones. According to the National Highway Traffic Safety Administration’s (NHTSA) Fatality Analysis Reporting System (FARS), 687 fatal crashes occurred in work zones in 2016. Commercial motor vehicles (CMVs) (i.e., large trucks and buses) were involved in 196 of these crashes (29 percent). The number of fatal work zone crashes involving CMVs increased to 227 (32 percent) in 2017, remained relatively constant at 215 (32 percent) in 2018, and increased to 252 (33 percent) in 2019. In 2020, 774 fatal crashes occurred in work zones. CMVs were involved in 208 of these crashes (27 percent). For comparison purposes, CMV involvement in non-work zone fatal crashes has remained fairly constant over time at about 13 percent. Even though there was a slight decrease in CMV-involved work zone fatal crashes in work zones in 2020, figure 1 shows that relative to fatal crashes occurring outside of work zones, CMVs are consistently overrepresented in fatal work zone crashes.

Figure 1. Graph. Commercial Motor Vehicle (CMV) Involvement Rate in Fatal Crashes.

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1 NHTSA FARS was used to determine the fatal motor vehicle crashes in work zones from the 50 States and the District of Columbia for 2016–2020 (the latest year available when this analysis was performed). NHTSA FARS defines a work zone crash as a motor vehicle traffic crash in which the first harmful event occurred within the boundaries of a work zone or on an approach to or exit from a work zone, resulting from an activity, behavior, or control related to the movement of traffic through a work zone.

2 The analysis identified large trucks as vehicles with a gross vehicle weight rating (GVWR) of more than 10,000 pounds (lbs) (FARS body type codes 60–64, 66–67, 71–72, and 78). Large trucks do not include motor homes.

3 The analysis identified buses as school buses, cross-country/intercity buses, transit (city) buses, van-based buses (GVWR more than 10,000 lbs), and other types of buses (e.g., FARS body type codes 50–59). Buses do not include van-based buses with a GVWR of 10,000 lbs or less.
Several possible reasons exist for this overrepresentation of CMVs in fatal work zone crashes, relative to CMV involvement in non-work zone fatal crashes. The first possible reason is physical constraints due to the temporary degradation of roadway geometrics and operating conditions that are necessary to complete some projects. Lane closures, restricted lane widths and lateral clearances, shortened merge and diverge areas, and other changes can make it more challenging for CMVs to negotiate a work zone and may lead to a higher crash involvement relative to other vehicle types. A second possible reason for CMV overrepresentation in work zone crashes is that CMV travel and work zone activity times are often correlated. Furthermore, work zone operations tend to be more heavily concentrated on primary roadways that increase capacity and maintain an acceptable quality roadway. These are the same facilities where CMV travel is more heavily concentrated. Third, in many work zones, multiple large truck trips to and from a job site are required to deliver materials and to remove dirt and debris. These activities increase the relative exposure of CMVs in and around the work zone relative to what may exist on a facility when the work zone is not present.

According to FARS, from 2016 to 2020, large trucks accounted for 98 percent of all CMV-related fatal work zone crashes. Buses accounted for 2 percent. Other key takeaways include:

- CMV-involved work zone crash fatalities were most often occupants of non-CMVs (71 percent).
- The front and back of the CMV were the initial point of contact in 47 and 38 percent of all CMV-involved fatal work zone crashes, respectively.
- Most CMV-involved fatal work zone crashes occurred on interstates (52 percent). These crashes were evenly divided between rural and urban areas, and the most common type of crash involving a CMV was a rear-end collision (46 percent).

Many agencies have developed resources to promote strategies that can be used to reduce the risk of CMV crashes in work zones (see appendix A). In addition, many State Departments of Transportation (DOTs) and other stakeholders are already working to improve work zone safety and CMV safety in general. Yet, CMVs are consistently overrepresented in fatal work zone crashes compared to fatal non-work zone crashes. Thus, there is a need to address CMV safety—more specifically work zones.

**OBJECTIVE**

The Federal Highway Administration (FHWA), Federal Motor Carrier Safety Administration (FMCSA), and NHTSA developed this document to provide a coordinated strategy that stakeholders at the national, State, and local levels could use to reduce the risk of CMV crashes in work zones.

**STAKEHOLDERS**

Transportation agencies, such as State DOTs, typically lead efforts to improve CMV safety in work zones, since they own, operate, and maintain the roadways. As such, State DOTs will find that they need to identify a champion to spearhead efforts in this area. However, many stakeholders are critical to improving CMV safety in work zones.
Strategic stakeholders include, but are not limited to:

- Federal agencies (e.g., FHWA, FMCSA, and NHTSA).
- Transportation agencies (e.g., State DOTs, American Association of State Highway and Transportation Officials [AASHTO], cities, metropolitan planning organizations, and tolling authorities).
- Trucking industry and related entities (e.g., American Trucking Associations [ATA], Commercial Vehicle Safety Alliance, Owner-Operator Independent Drivers Association, and Commercial Vehicle Training Association).
- Transit agencies and other public bus entities.
- Commercial bus industry and related entities.
- Law enforcement.
- Insurance industry.
- Contractors (e.g., general, prime, sub, temporary traffic control, and material).
- Transportation safety groups (e.g., American Road & Transportation Builders Association [ARTBA] and American Traffic Safety Services Association [ATSSA]).
- Passenger vehicle driver education organizations (e.g., American Automobile Association).
- Academic transportation centers.
- Public health entities.

**STRUCTURE OF DOCUMENT**

There are many resources available that provide information about a broad range of strategies that can be used to improve the safety of work zones for all users, including CMV operators. Similarly, there are many policies and approaches that can be used to improve the safety of CMVs (e.g., increase availability of truck parking, increase the number of inspections, and conduct impaired driving checks). While many CMV and work zone safety initiatives benefit CMV safety in work zones indirectly, this document is centered on voluntary actions that can be taken to address CMV safety specifically in work zones. The report also includes a voluntary, targeted action plan that transportation agencies (typically State DOTs) and other stakeholders can use to reduce the risk of CMV work zone crashes.

This document shares other optional actions that States might take to help reduce CMV crashes in work zones. These options fall into three key emphasis areas: engineering, enforcement, and driver education.

Within the transportation context, **engineering** has traditionally included agencies that:

- Play a critical role in analyzing crash data.
- Design and operate the work zone.
- Identify, design, and implement safety improvements.
- Evaluate improvements.
- Coordinate with other stakeholders.
- Develop guidelines/standards.
- Design and conduct staff training.
In this document, the term “engineering” also includes the design of CMVs, and the use of in-vehicle technology aimed at reducing CMV work zone crashes.

Typically, enforcement is focused solely on actions taken by law enforcement agencies. However, this document also discusses actions that could enhance the effectiveness of enforcement by highlighting Federal policies, requirements, and strategies to address CMV safety in work zones. This document discusses only those actions and strategies that focus specifically on CMV safety in work zones. While many of the actions taken by law enforcement (e.g., crash report data collection; speeding, distracted driving, and impaired driving enforcement; CMV inspections; and safety audits) can indirectly benefit CMV safety in work zones, they are typically not undertaken to specifically address CMV safety in work zones. As such, action items such as extending weigh station operation hours and increasing the number of enforcement personnel trained to enforce CMV-specific laws are not included herein.

Driver education includes the development and delivery of public service announcements, behavioral safety campaigns, and training targeted at CMV and non-CMV drivers when driving through work zones.

Table 1 shows which key emphasis area action items are specified in the voluntary targeted action plan for each stakeholder.

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X=Action items specified in voluntary targeted action plan.
CHAPTER 2. TARGETED ACTION PLAN

INTRODUCTION

FHWA developed the voluntary, targeted action plan to provide a coordinated strategy that stakeholders at the national, State, and local levels could use to reduce the risk of CMV crashes in work zones. It was based on a review of literature and existing resources, as well as findings from a 2019 virtual roundtable and in-person workshop (see appendix B). Action items that stakeholders may opt to use to reduce the risk of CMV crashes in work zones are organized into three key emphasis areas: engineering, enforcement, and education. Transportation agencies should consider establishing a key stakeholders regional task force to review, add, and prioritize the action items, determine the appropriate methods to accomplish the action items, and set goals for moving the action items forward.

ENGINEERING

Engineering plays a critical role in the design and operation of work zones. Engineering also involves analyzing crash data; identifying, designing, and implementing safety improvements; evaluating improvements; coordinating with other stakeholders; developing regulatory or voluntary, consensus-based guidelines/standards; and designing and conducting training of staff. In addition, engineering has a role in the design of CMVs and of in-vehicle technology aimed at reducing CMV work zone crashes. As such, engineering is not solely a Federal agency and transportation agencies emphasis area.

Action Items for FHWA

- Continue to provide leadership for initiatives that target and highlight the issue (e.g., symposiums, virtual roundtables, workshops, peer exchanges, and National Work Zone Awareness Week) (see appendix A). In coordination with NHTSA and FMCSA, FHWA will aim to:
  - Conduct virtual roundtables with transportation agencies to target individual challenges and needs.
  - Conduct peer exchanges to share best practices.
- Continue to work with FMCSA and NHTSA to enhance CMV safety in work zones.
- Continue to provide resources that aid transportation agencies in training their staff on CMV-involved work zone risks and mitigation strategies (e.g., Work Zone Safety Grant products) (see appendix A).
  - Deliver webinars on best practices and new tools.
- Consistent with applicable law, engage with field offices to encourage transportation agencies to:
  - Include specific CMV work zone safety strategies in the State’s Strategic Highway Safety Plan (SHSP).
  - Seek innovative work zone design and operation methods that reduce the risk of CMV crashes in work zones.
Actively collect, store, and use work zone event data (i.e., information regarding when, where, and how work zones are deployed), so it can be used to better quantify the CMV safety in work zones issue and help agencies focus their mitigation efforts.  
- Promote Work Zone Data Exchange (WZDx) activities.  
- Work with multiple transportation agencies to pilot the WZDx initiative.

Emphasize the importance of considering the design of temporary traffic control plans and CMV operations in work zones during reviews of transportation management plans.

Encourage pilot implementation of the innovative work zone design and operation methods that reduce the risk of CMV crashes, consistent with applicable law.

Work with stakeholders to identify data gaps or research needs to better understand the demographic, behavioral, and other characteristics that correlate with CMV crashes in work zones, consistent with applicable law. The research should also identify methods to obtain critical data that are currently missing and make recommendations regarding changes to existing procedures to be able to facilitate missing critical data collection and use.

Work with AASHTO to raise awareness of and promote design practices to improve CMV safety in work zones. One resource is the Design and Operation of Work Zone Strategies to Improve Large Truck Safety publication that includes practices from leading States (see appendix A). Example practices include:
- Provide at least one 12-foot lane for trucks in construction projects or a truck-only lane during construction.
- Minimize large design speed reductions for lane shifts, crossovers, or other critical geometric features in work zones.
- Avoid short or no acceleration lane entrance ramps for high CMV traffic.

Action Items for FMCSA

- Continue to provide resources to aid transportation agencies in training their staff on CMV-involved work zone risks and mitigation strategies (see appendix A).
- Continue to encourage transportation agencies to develop innovative solutions and/or demonstrate new technologies to improve CMV safety in work zones (e.g., Motor Carrier Safety Assistance Program [MCSAP] and the High Priority Program).
- Continue to work with FHWA and NHTSA to enhance CMV safety in work zones.
- Encourage State MCSAP lead agencies to work with transportation agencies to identify specific work zone safety issues regarding CMVs and incorporate activities to address these in their Commercial Vehicle Safety Plan (CVSP).
- Partner with the trucking industry to encourage and accelerate the voluntary adoption of in-vehicle safety technologies aimed at reducing CMV work zone crashes (e.g., Advanced Driver Assistance Systems [ADAS], such as forward collision avoidance systems and work zone notification systems).

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4 FHWA’s Work Zone Data Initiative launched in 2017 and is an effort to enable easier sharing and application of work zone event data across the country. Work zone event data is the “what,” “where,” and “when” of work zone activities. Find out more information at https://ops.fhwa.dot.gov/wz/wzdx/index.htm.
5 Find out more information about FHWA’s WZDx project at https://ops.fhwa.dot.gov/wz/wzdx/index.htm.
• Coordinate with FHWA and NHTSA about initiatives that target and highlight the issue (e.g., symposiums, virtual roundtables, workshops, peer exchanges, and National Work Zone Awareness Week) (see appendix A).

Action Items for NHTSA

• Continue to work with FHWA and FMCSA to enhance CMV safety in work zones.
• Coordinate with FHWA and FMCSA about initiatives that target and highlight the issue (e.g., symposiums, virtual roundtables, workshops, peer exchanges, and National Work Zone Awareness Week) (see Appendix a).

Voluntary Action Items for Transportation Agencies

• Consider reviewing and analyzing CMV-involved work zone crashes to quantify the issue and identify trends to determine where to focus mitigation efforts.6
• Consider reviewing available work zone design and operations strategies to reduce the risk of CMV crashes (see Design and Operation of Work Zone Strategies to Improve Large Truck Safety and other resources in appendix A). Use CMV-involved work zone crash analyses to determine which strategies should be integrated into standard practices and procedures and which strategies should be considered on a project-by-project basis.
  o For strategies to be integrated into standard practices and procedures:
    ▪ Review and update transportation management plan guidelines, temporary traffic control (TTC) standards, and specifications.
    ▪ Review and make needed changes to current design processes and procedures for long-term work zones.
    ▪ Develop and implement training to educate designers of the changes to TTC standards and specifications, as well as design processes and procedures.
  o For strategies to be considered on a project-by-project basis, develop and implement training to elevate designer awareness of CMV design considerations and methods available to reduce CMV crash risk in work zones.
• Consider establishing information-sharing procedures to enhance awareness of CMV restrictions and crash mitigation measures in work zones through improved coordination with other CMV stakeholders (including transportation agency personnel in other groups, such as permitting). For example, the agency could adopt work zone event data collection practices based on the Work Zone Data Initiative (WZDI)7 framework and WZDx8 specification that would facilitate information sharing and coordination.

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6 Dependent upon personnel workload and available funding, a transportation agency may choose to focus on analyzing fatal CMV-involved work zone crashes. While fatal crashes can be compared nationally, sample size limitations may make it difficult to truly quantify the issue and establish trends. Thus, a transportation agency may want to include serious injury CMV-involved work zone crashes or all non-fatal CMV-involved work zone crashes in the analyses.
7 Find out more about FHWA’s WZDI and the framework at https://ops.fhwa.dot.gov/wz/wzdx/index.htm.
8 Find out more information about FHWA’s WZDx project and the specification at https://ops.fhwa.dot.gov/wz/wzdx/index.htm.
• Consider including specific CMV work zone safety strategies in the State’s SHSP (not just work zone safety or CMV safety) and engaging CMV stakeholders in SHSP efforts.
• Consider developing a CVSP with key CMV stakeholders that considers work zone issues. A CVSP must be submitted and approved by FMCSA to receive MCSAP grant funding.

Voluntary Action Items for Trucking Industry, Transit Agencies, Commercial Bus Entities, and Other Related Entities

• Consider leveraging resources and perspectives participating in the implementation of the State’s SHSP.
• Consider working with transportation agencies and other CMV stakeholders to establish processes for disseminating work zone project-related information that influences CMV travel decisions/actions, so CMV drivers are better informed about work zone conditions and detours.
• Consider encouraging the voluntary adoption of in-vehicle technology aimed at reducing CMV work zone crashes (e.g., forward collision avoidance systems, adaptive cruise control, lane assist, and work zone notification systems).
• Consider developing a standardized mode of on-board communication among large trucks that can be used to provide real-time work zone information inside the cab to facilitate implementation of such systems.

Voluntary Action Items for Contractors

• Consider training personnel on best practices for access point design principles and use the information to help design and locate access points when not specified in contract plans (see Design and Operation of Work Zone Strategies to Improve Large Truck Safety, Guidelines on Work Zone Access and Egress, and other resources in appendix A).

Voluntary Action Items for Transportation Safety Groups

• Consider assisting in the dissemination of training materials about CMV-involved work zone risks and mitigation strategies.

Voluntary Action Items for Academic Transportation Centers

• Consider assisting with efforts to target and highlight the issue (e.g., symposiums, virtual roundtables, workshops, and peer exchanges).
• Consider supporting CMV-involved work zone crash analyses.
• Consider identifying and evaluating strategies aimed at reducing the risk of CMV-involved work zone crashes.

ENFORCEMENT

Enforcement actions include those to address unsafe and illegal driving behaviors in work zones that impact CMV safety. Actions that could enhance enforcement include highlighting Federal
policies, requirements, and strategies to address CMV safety in work zones. As such, enforcement is not solely a law enforcement agency emphasis area.

**Action Items for FMCSA**

- Continue to partner with State CMV enforcement agencies and provide grant funding to implement automated enforcement (e.g., United States Department of Transportation [USDOT] number readers) or other innovative enforcement techniques in work zones that identify CMVs operating unsafely and target the carriers/drivers for inspections and/or investigations, consistent with applicable law.

**Action Items for NHTSA**

- Encourage State Highway Safety Offices (SHSOs) to consider the use of Federal grant funds to increase enforcement efforts in work zones as supported by the State’s problem identification process.

**Voluntary Action Items for Transportation Agencies**

- Consider using law enforcement in work zones per 23 CFR 630.1108(d).
- Consider using Federal grant funds to increase enforcement techniques in work zones.
- Consider collaborating with the MCSAP lead agency to leverage (via sub award) MCSAP grant funding to increase enforcement and safety activities targeting CMVs in work zones.

**Voluntary Action Items for Law Enforcement**

- Consider partnering with FMCSA, NHTSA, and transportation agencies to use proven or innovative enforcement techniques in work zones to identify CMVs operating unsafely and target the carriers/drivers for investigations.
- Consider assisting transportation agency with enforcing truck lane restrictions established in work zones to encourage compliance.

**DRIVER EDUCATION**

Driver education includes the development and delivery of public service announcements, behavioral safety campaigns, and training targeted at CMV and non-CMV drivers when driving through work zones.

**Action Items for FHWA**

- Continue work with FMCSA and NHTSA to develop CMV and non-CMV driver-focused outreach materials that highlight the CMV-involved work zone safety risks and that identify and encourage behaviors to reduce those risks (e.g., National Work Zone Awareness Week outreach efforts), consistent with applicable law.
- Work with trucking associations, insurance companies, and other stakeholders to develop and implement a CMV safety in work zones campaign.
Action Items for FMCSA

- Continue to work with FHWA and NHTSA to develop CMV and non-CMV driver-focused outreach materials that highlight the CMV-involved work zone safety risks and that identify and encourage behaviors to reduce those risks (e.g., National Work Zone Awareness Week outreach efforts), consistent with applicable law.

Action Items for NHTSA

- Continue to work with FHWA and FMCSA to develop CMV and non-CMV driver-focused outreach materials that highlight the CMV-involved work zone safety risks and that identify and encourage behaviors to reduce those risks, consistent with applicable law.
- Encourage SHSOs to consider use of Federal grant funds to develop and implement outreach efforts about CMV-related work zone safety risks to CMV and non-CMV drivers as supported by the State’s problem identification process.

Voluntary Action Items for Transportation Agencies

- Consider developing and implementing outreach efforts about CMV-related work zone safety risks to CMV and non-CMV drivers.
- Consider requesting input from trucking industry, transit agencies, commercial bus entities, and other related entities when creating outreach materials about CMV-related work zone safety risks to CMV and non-CMV drivers.

Voluntary Action Items for Trucking Industry, Transit Agencies, Commercial Bus Entities, and Other Related Entities

- Consider assisting in the dissemination of outreach materials, especially to smaller trucking companies and independent drivers (in cooperation with FHWA, FMCSA, NHTSA, and transportation agencies), that highlight the CMV-involved work zone safety risks and behaviors to reduce those risks to CMV drivers.
- Consider using existing initiatives to target and highlight the issue (e.g., ATA’s Share the Road program).
- Consider incorporating information about work zone challenges and mitigation strategies to address those challenges in CMV driver training curriculum.

Voluntary Action Items for Insurance Industry

- Consider providing financial assistance (sponsorships) to develop outreach materials (in cooperation with FHWA, FMCSA, NHTSA, and transportation agencies) that highlight CMV-involved work zone safety risks and behaviors to reduce those risks in CMV drivers and non-CMV drivers.
- Consider assisting in the dissemination of outreach materials (in cooperation with FHWA, FMCSA, NHTSA, and transportation agencies) that highlight CMV-involved work zone safety risks and behaviors to reduce those risks.
Voluntary Action Items for Contractors

- Consider including construction delivery truck drivers in safety training requirements for employees. This could entail developing and implementing in-house training about best practices for entering and exiting the work space at access/egress points and acceleration/deceleration on an active roadway. Contractors could consider requiring construction delivery truck drivers (including subcontractors) to provide proof of such training.

- On a project-by-project basis, project supervisors should consider discussing access/egress points and acceleration/deceleration on an active roadway with construction delivery truck drivers and subcontractors to ensure they are entering and exiting the work space appropriately.

Voluntary Action Items for Transportation Safety Groups, Passenger Vehicle Driver Education Organizations, and Public Health Entities

- Consider working with FHWA and transportation agencies to assist in disseminating outreach materials that highlight CMV-involved work zone safety risks and behaviors to reduce those risks in CMV drivers and non-CMV drivers.

Voluntary Action Items for Academic Transportation Centers

- Consider assisting with the development and dissemination of outreach materials that highlight the CMV-involved work zone safety risks and identify/encourage behaviors to reduce those risks.
APPENDIX A. SELECT COMMERCIAL MOTOR VEHICLE SAFETY IN WORK ZONES RESOURCES

The Federal Highway Administration (FHWA) and the Federal Motor Carrier Safety Administration (FMCSA) have published several documents and conducted numerous webinars and conferences to enhance commercial motor vehicle (CMV) safety in work zones. Other stakeholders have also been actively engaged in producing information about CMV safety in work zones. Below is a list of select resources with hyperlinks for additional information.

GENERAL INFORMATION

- FHWA Work Zone Management Program Website: http://ops.fhwa.dot.gov/wz/
- FMCSA Safety Website: https://www.fmcsa.dot.gov/safety
- American Road and Transportation Builders Association (ARTBA) National Work Zone Safety Information Clearinghouse Website: https://www.workzonesafety.org/
- FMCSA Large Trucks and Buses by the Numbers Web Page: https://www.fmcsa.dot.gov/ourroads/large-trucks-and-buses-numbers

OTHER ARTBA NATIONAL WORK ZONE SAFETY INFORMATION CLEARINGHOUSE RESOURCES

- Improving Large Truck Safety in Work Zones Online Course: https://artba.ispringmarket.com/content/79/info/Improving_Large_Truck_Safety_in_Work_Zones_-_BETA_Version?use_referrer=1
- Separating Large Trucks From Non-truck Traffic in Work Zones Online Course: https://artba.ispringmarket.com/content/235/info/Separating_Large_Trucks_from_Non-Truck_Traffic_in_Work_Zones?use_referrer=1
Designing Work Space Access Points to Better Accommodate Large Trucks:
https://www.workzonesafety.org/files/documents/training/fhwa_wz_grant/artba_large_truck_work_space_access_points_factsheet-508.pdf

Designing Work Space Access Points to Better Accommodate Large Trucks Online Course:
https://artba.ispringmarket.com/content/247/info/Designing_Work_Space_Access_Points_to_Better_Accommodate_Large_Trucks?use_referrer=1

Guidelines on Work Zone Access and Egress:

Use of Smart Work Zone Technology to Improve Work Space Access Point Safety:

Using Smart Work Zone Technology to Improve Work Space Access Point Safety Online Course:
https://www.workzonesafety.org/training/using-smart-work-zone-technology-to-improve-work-space-access-point-safety/

Innovative End-of-Queue Warning System Reduces Crashes Up to 45%:

Work Zone Designer Series: Oversize/Overweight Vehicle Accommodation in Work Zones:

CONFEERENCE, SYMPOSIUM, AND WEBINARS

2018 National Work Zone Management Conference, Large Trucks in Work Zones Session:

2017 Large Truck Safety in Work Zones Webinar:
https://www.workzonesafety.org/training/large-truck-safety-work-zones/

2016 Improving Large Truck Safety Through the Design and Operation of Work Zones Webinar:

2016 Strategies to Enhance Large Truck Safety in Work Zones Webinar:
https://www.workzonesafety.org/training/strategies-to-enhance-large-truck-safety-in-work-zones/

2015 National Symposium on Work Zones and Large Trucks:
https://www.workzonesafety.org/meetings-and-events/wz_conferences/large_trucks_symposium_2015/

2014 Talking Freight – Work Zone Design and Large Trucks Webinar:
https://www.workzonesafety.org/training/talking-freight-work-zone-design-and-large-trucks/
DRIVER TRAINING RESOURCES

- ARTBA National Work Zone Safety Information Clearinghouse
  - Safe Trucking Through Work Zones Publication:
    https://www.workzonesafety.org/publication/safe-trucking-through-work-zones/
  - Safe Trucking Through Work Zones Presentation:
- FMCSA Work Zones Safety Tips:
- FMCSA Work Zone Safety: Shareable Material:
  https://www.fmcsa.dot.gov/ourroads/work-zone-safety-shareable-material
- FMCSA Voices of Safety:
  https://www.fmcsa.dot.gov/ourroads/voices-safety
- American Trucking Association Truck Drivers Share Safety Tips for National Work Zone Awareness Week:
APPENDIX B. OVERVIEW OF VIRTUAL ROUNDTABLE AND IN-PERSON WORKSHOP

BACKGROUND

Researchers obtained and analyzed data from the National Highway Traffic Safety Administration’s (NHTSA) Fatality Analysis Reporting System (FARS) to determine the fatal motor vehicle crashes in work zones involving commercial motor vehicles (CMVs) for each State, Washington, DC, and Puerto Rico for 2012–2017,\(^9\) which was the most recent data available at the time of the analysis. Based on the number of fatal work zone crashes involving CMVs and the number of associated work zone fatalities involving CMVs for the six-year period, the team identified the top 10 opportunity States. In 2019, representatives from these States and other stakeholders (i.e., Federal administrations, tolling agencies, trucking industry entities, transportation safety groups, law enforcement, and academic transportation centers) participated in a virtual roundtable and in-person workshop to:

- Review the characteristics of CMV-involved work zone crashes (fatal and non-fatal).
- Review previous and ongoing efforts to improve the safety of CMVs in work zones.
- Discuss what agencies are doing to reduce the overrepresentation of CMVs in work zone crashes.
- Share experiences with identifying, adopting, and evaluating strategies (successes and challenges).
- Identify other resources needed to help reduce CMV crashes in work zones.

VIRTUAL ROUNDTABLE

The Federal Highway Administration (FHWA) convened the CMV Safety in Work Zones Virtual Roundtable on March 7, 2019, from 2:00 p.m. to 3:30 p.m. EST. At least 70 participants attended. Participants represented the top 10 opportunity States, the United States Department of Transportation (USDOT) and its operating administrations, tolling agencies, trucking industry entities, transportation safety groups, and academic transportation centers.

The FHWA, Federal Motor Carrier Safety Administration (FMCSA), NHTSA, and the Texas A&M Transportation Institute (TTI) representatives provided overviews of ongoing efforts addressing CMV safety in work zones. TTI researchers also reviewed the characteristics of fatal work zone crashes involving CMVs based on data obtained from NHTSA’s FARS from 2012 to 2017. Participants were then encouraged to discuss what their agencies are doing to reduce the overrepresentation of CMVs in work zone crashes.

\(^9\) While the 2019 workshop considered data from 2012 to 2017, FHWA has updated all data presented in this report to reflect the 2016–2020 time period. The 2012–2016 data were taken from the FARS final data files, while the 2017 data were from the 2017 Annual Report File. NHTSA FARS defines a work zone crash as a motor vehicle traffic crash in which the first harmful event occurred within the boundaries of a work zone or on an approach to or exit from a work zone, resulting from an activity, behavior, or control related to the movement of traffic through a work zone.
Participants mentioned the following strategies:

- Include trucking associations on the State Strategic Highway Safety Plan implementation team.
- Use drug recognition experts at weigh stations to do impaired-driving checks.
- Implement smart work zone applications.
- Implement truck lane restrictions.
- Increase temporary barrier offset requirements to provide more space for all vehicles (2-ft on both motoring public and contractor sides).

Participants noted the following challenges that hamper efforts to enhance CMV safety in work zones:

- The need for more physical space to implement some strategies. There is a balance between work space and space for road users.
- There is a lack of information about work zone exposure.
- There is not a unified mode of communication among CMVs, which makes it hard to communicate real-time work zone information with CMV operators.

Participants mentioned the need for the following:

- Educational outreach to non-CMV drivers about how to drive around CMVs.
- Case studies—including information about what other agencies are doing, what has been successful, what has not been successful, tips on what to do differently (lessons learned), cost to implement, and benefits.

**IN-PERSON WORKSHOP**

The FHWA held the CMV Safety in Work Zones Workshop on July 17, 2019, from 8:00 a.m. to 4:00 p.m. CDT in Arlington, Texas. Forty-one people participated in the workshop. Participants represented the top 10 opportunity States, USDOT and its operating administrations, tolling agencies, trucking industry entities, transportation safety groups, law enforcement, and academic transportation centers.

An FHWA representative gave an overview of ongoing agency efforts addressing CMV safety in work zones. A TTI researcher provided an overview of data discussed in the virtual roundtable (fatal crashes only), discussed the many challenges associated with quantifying the issue, and compared and contrasted crash data among the top 10 opportunity States (all severities). Representatives from the top 10 opportunity States provided information on what their respective agencies are doing to reduce work zone crashes and the overrepresentation of CMVs in work zone crashes, including why a specific strategy was chosen, how the strategy was implemented, effectiveness of the strategy, and lessons learned. Representatives from the FMCSA, American Trucking Association (ATA), American Traffic Safety Services Association, American Road & Transportation Builders Association, Texas Department of Public Safety, and TTI also provided information on strategies to reduce the overrepresentation of CMVs in work zone crashes, including those aimed at CMVs and passenger vehicles. Specific strategies discussed included:

- Improved positive guidance.
- Improved traffic flow.
• Use of intelligent transportation systems (ITS) (e.g., end-of-queue warning, dynamic lane merge, work zone egress warning system, and travel time).
• Adequate lane width.
• Buffer lanes/space.
• Work zone access point design.
• Transverse rumble strips.
• Revision of striping standards.
• Work zone speed limit reductions.
• Variable speed limits.
• Reduced speed differentials.
• Lane closure policy.
• Truck lane restrictions.
• CB wizard.
• Ramp metering.
• Use of law enforcement.
• Enforcing laws and regulations.
• Use of drug recognition experts to identify CMV drivers that are under the influence of drugs at weigh stations.
• Truck inspections and safety audits.
• Increasing availability and/or visibility of truck parking.
• Encouraging occupant protection usage in CMVs.
• Encourage development of new technology in CMVs (e.g., forward collision avoidance systems, adaptive cruise control, lane assist, and work zone notification systems) and rulemaking that requires new technology be implemented.
• Traffic incident management.
• Coordinating with emergency services.
• Public education (e.g., National Work Zone Awareness Week, ATA’s Share the Road program, and FMCSA’s Our Roads, Our Safety Campaign).

Workshop participants identified the following items that are needed to help agencies improve efforts to reduce CMV involvement in work zone crashes:
• Detailed data to better understand the issue. The attendees see the lack of detailed crash information as a hindrance to understanding the issue and developing appropriate strategies to reduce the overrepresentation of CMVs in work zone crashes. There is also a need to identify the gaps in existing work zone and CMV data, prioritize top data needs, make recommendations for how to collect/obtain priority data needs (could involve changes to crash reporting), and pilot in a top 10 opportunity State.
• More peer exchanges conducted to highlight strategies or best practices from agencies that have successfully mitigated CMV crashes in work zones.
• Case studies of specific strategies or best practices.
• Coordination with other agencies (e.g., NHTSA and law enforcement) early in the work zone design process, which might lead to more innovative countermeasures implementation.
• More information disseminated into the cab of the CMV, particularly work zone ITS information.
A more active role from trucking associations and Federal agencies, particularly to encourage the use of in-vehicle safety technologies for crash prevention (e.g., Advanced Driver Assistance Systems [ADAS], such as forward collision avoidance systems and work zone notification systems).

Non-State funding to help with the deployment of law enforcement in work zones.

Extended weigh station operation hours.

Increased public education about work zones and CMVs. Driver behavior is viewed as one of the key issues. Often, various engineering solutions are in place; however, a CMV-involved fatal work zone crash occurs because of driver inattention. More public awareness education for both passenger car and CMV drivers is needed to curb bad driving behaviors and to educate passenger vehicle drivers about CMV characteristics (e.g., safe following distance and distance to stop). There is also a need to provide educational material to smaller trucking companies and independent drivers, as well as other trucking companies that are not typically involved in trade associations.