

COMMERCIAL MOTOR VEHICLE SAFETY IN WORK ZONES TARGETED ACTION PLAN



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16. Abstract <p>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.</p>			
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APPROXIMATE CONVERSIONS TO SI UNITS				
Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	Km
AREA				
in ²	square inches	645.2	square millimeters	mm ²
ft ²	square feet	0.093	square meters	m ²
yd ²	square yard	0.836	square meters	m ²
ac	acres	0.405	hectares	ha
mi ²	square miles	2.59	square kilometers	km ²
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft ³	cubic feet	0.028	cubic meters	m ³
yd ³	cubic yards	0.765	cubic meters	m ³
NOTE: Volumes greater than 1,000 L shall be shown in m ³ .				
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)				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
ILLUMINATION				
fc	foot-candles	10.76	lux	lx
fl	foot-lamberts	3.426	candela/m ²	cd/m ²
FORCE and PRESSURE or STRESS				
lbf	poundforce	4.45	newtons	N
lbf/in ²	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)

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Figure 1. Graph. Commercial Motor Vehicle (CMV) Involvement Rate in Fatal Crashes1

LIST OF ABBREVIATIONS

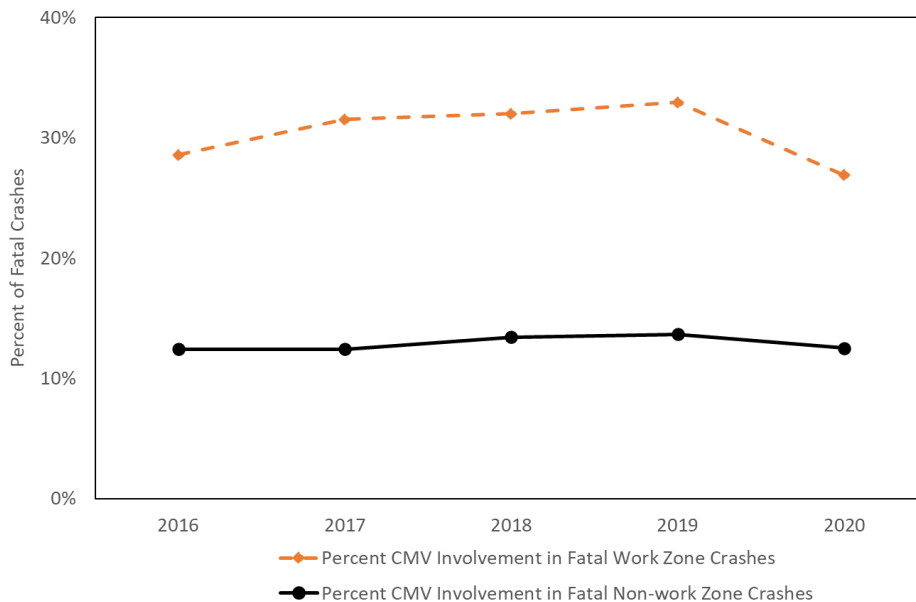
ADAS	Advanced Driver Assistance Systems
ARTBA	American Road & Transportation Builders Association
AASHTO	American Association of State Highway and Transportation Officials
ATA	American Trucking Associations
ATSSA	American Traffic Safety Services Association
CMV	commercial motor vehicle
CVSP	Commercial Vehicle Safety Plan
DOT	Department of Transportation
FARS	Fatality Analysis Reporting System
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
GVWR	gross vehicle weight rating
ITS	Intelligent Transportation Systems
MCSAP	Motor Carrier Safety Assistance Program
MUTCD	Manual on Uniform Traffic Control Devices
NHTSA	National Highway Traffic Safety Administration
SHSOs	State Highway Safety Offices
SHSP	Strategic Highway Safety Plan
TTC	Temporary Traffic Control
TTI	Texas A&M Transportation Institute
USDOT	United States Department of Transportation
WZDI	Work Zone Data Initiative
WZDx	Work Zone Data Exchange

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),¹ 687 fatal crashes occurred in work zones in 2016. Commercial motor vehicles (CMVs) (i.e., large trucks² and buses³) 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.¹



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.

Table 1. Stakeholders and Key Emphasis Areas.

Stakeholders	Engineering	Enforcement	Education
Federal Highway Administration	X		X
Federal Motor Carrier Safety Administration	X	X	X
National Highway Traffic Safety Administration	X	X	X
Transportation agencies	X	X	X
Trucking industry and related entities	X		X
Transit agencies and other public bus entities	X		X
Commercial bus industry and related entities	X		X
Law enforcement		X	
Insurance industry			X
Contractors	X		X
Transportation safety groups	X		X
Passenger vehicle driver education organizations			X
Academic transportation centers	X		X
Public health entities			X

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.⁴
 - Promote Work Zone Data Exchange (WZDx) activities.⁵
 - 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).

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.
 - 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.
 - 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.

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>
- FHWA National Work Zone Awareness Week Webpage:
https://ops.fhwa.dot.gov/wz/outreach/wz_awareness.htm
- American Road and Transportation Builders Association (ARTBA) National Work Zone Safety Information Clearinghouse Website:
<https://www.workzonesafety.org/>
 - Improving Large Truck Safety in Work Zones Web Page:
[https://workzonesafety.org/training/webinar-improving-large-truck-safety-through-the-design-and-operation-of-work-zones/National and State Specific Crash Data Involving Large Trucks in Work Zones Dash Board:](https://workzonesafety.org/training/webinar-improving-large-truck-safety-through-the-design-and-operation-of-work-zones/National%20and%20State%20Specific%20Crash%20Data%20Involving%20Large%20Trucks%20in%20Work%20Zones%20Dash%20Board)
<https://www.workzonesafety.org/crash-information/work-zone-fatal-crashes-fatalities/#national>
- 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

- Design and Operation of Work Zone Strategies to Improve Large Truck Safety Publication:
<https://www.workzonesafety.org/publication/design-and-operation-of-work-zone-strategies-to-improve-large-truck-safety/>
- 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:
https://www.workzonesafety.org/files/documents/training/fhwa_wz_grant/artba_separate_large_trucks_factsheet-508.pdf
- 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:
https://www.workzonesafety.org/files/documents/training/courses_programs/rsa_program/RSP_Guidance_Documents_Download/RSP_Access_Egress_Download.pdf
- Use of Smart Work Zone Technology to Improve Work Space Access Point Safety:
https://www.workzonesafety.org/files/documents/training/fhwa_wz_grant/artba_use_swz_technology-508.pdf
- 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%:
https://www.workzonesafety.org/files/documents/training/courses_programs/rsa_program/RSP_Guidance_Documents_Download/RSP_EndOfQueueWarning_Guidance_Download.pdf
- Work Zone Designer Series: Oversize/Overweight Vehicle Accommodation in Work Zones:
https://www.workzonesafety.org/files/documents/training/fhwa_wz_grant/uw_wz_designer_series_OSOW_vehicles_wz-508.pdf

CONFERENCE, SYMPOSIUM, AND WEBINARS

- 2018 National Work Zone Management Conference, Large Trucks in Work Zones Session:
<https://workzonesafety.org/event/2018-national-work-zone-management-conference-2/>
- 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:
<https://www.workzonesafety.org/training/webinar-improving-large-truck-safety-through-the-design-and-operation-of-work-zones/>
- 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:
https://www.workzonesafety.org/files/documents/training/webinar/safe_trucking_wz_presentation.pdf
- FMCSA Work Zones Safety Tips:
<https://www.fmcsa.dot.gov/ourroads/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:
<https://www.trucking.org/news-insights/truck-drivers-share-safety-tips-national-work-zone-awareness-week>

