

Defensive Driving Tips for CMV Drivers: An Internet-Based Approach



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

September 2009

FOREWORD

The Federal Motor Carrier Safety Administration (FMCSA) awarded a contract to develop a web-based training tool. The purpose of this website is to show common driving errors made by Commercial Motor Vehicle (CMV) drivers. This website will be available to the public through the FMCSA website (<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/index.htm>), and is intended to be used by fleet safety managers and CMV drivers as part of their training process. The purpose of this report was to document the steps taken in developing the website and to show the final content.

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Technical Report Documentation Page

1. Report No. FMCSA RRT-09-003	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle DEFENSIVE DRIVING TIPS FOR CMV DRIVERS: AN INTERNET-BASED APPROACH		5. Report Date September 2009	
		6. Performing Organization Code:	
7. Author(s) Santosh Gupta, Rebecca Olson, Richard Hanowski		8. Performing Organization Report No.	
9. Performing Organization Name and Address Center for Truck and Bus Safety Virginia Tech Transportation Institute 3500 Transportation Research Plaza (0536) Blacksburg, VA 24061		10. Work Unit No.	
		11. Contract or Grant No. DTMC75-07-D-00006 (Task Order #2)	
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Motor Carrier Safety Administration 1200 New Jersey Avenue, SE Washington, DC 20590		13. Type of Report and Period Covered Final Report July 2007–October 2008	
		14. Sponsoring Agency Code	
15. Supplementary Notes This program was managed by the Federal Motor Carrier Safety Administration (FMCSA). The Contracting Officer's Technical Representative was Martin Walker, PhD.			
16. Abstract The main objective of this study was to develop a web-based driving tips website to be used by commercial motor vehicle (CMV) drivers and fleet safety managers to show common large-truck driving errors and to provide tips on how to avoid such errors. The website, hosted on the FMCSA website, is accessible to the public. The website is intended to be used as a supplemental CMV driver training tool and is not intended to replace any of the current classroom or on-road training methods that are currently being used. The website contains real-world video clips of CMV drivers who were recorded making various driving errors. It is hoped that the CMV web-based driving tips website, with support from the naturalistic driving video clips, will provide drivers with compelling information to support safe driving.			
17. Key Words commercial motor vehicle, CMV, defensive driving, driving tips, website, naturalistic data, internet, training		18. Distribution Statement No restrictions.	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 102	22. Price

SI* (MODERN METRIC) CONVERSION FACTORS

Table of 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 yards	0.836	square meters	m ²
ac	acres	0.405	hectares	ha
mi ²	square miles	2.59	square kilometers	km ²
VOLUME				
Note: Volumes greater than 1000 L shall be shown in m ³				
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
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				
°F	Fahrenheit	$5 \times (F-32) \div 9$ or $(F-32) \div 1.8$	Temperature is in exact degrees 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

Table of APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
AREA				
mm ²	square millimeters	0.0016	square inches	in ²
m ²	square meters	10.764	square feet	ft ²
m ²	square meters	1.195	square yards	yd ²
ha	hectares	2.47	acres	ac
km ²	square kilometers	0.386	square miles	mi ²
VOLUME				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m ³	cubic meters	35.314	cubic feet	ft ³
m ³	cubic meters	1.307	cubic yards	yd ³
MASS				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
TEMPERATURE				
°C	Celsius	$1.8C + 32$	Temperature is in exact degrees Fahrenheit	°F
ILLUMINATION				
lx	lux	0.0929	foot-candles	fc
cd/m ²	candela/m ²	0.2919	foot-Lamberts	fl
Force & Pressure or Stress				
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in ²

* 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, Section 508-accessible version September 2009)

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LIST OF ACRONYMS

Acronym	Definition
CDL	commercial driver's license
CMV	commercial motor vehicle
DAS	data acquisition system
DDWS FOT	Drowsy Driver Warning System Field Operational Test
DMV	Department of Motor Vehicles
FMCSA	Federal Motor Carrier Safety Administration
GVWR	gross vehicle weight rating
HOS	hours of service
IRB	Institutional Review Board
L/SH	local/short haul
LTCCS	Large-Truck-Crash Causation Study
NHTSA	National Highway Traffic Safety Administration
SUV	sport utility vehicle

EXECUTIVE SUMMARY

This report presents the work completed for the project titled *Defensive Driving Tips for CMV Drivers: An Internet-Based Approach*. The objective of this project was to develop a driving tips website for commercial motor vehicle (CMV) drivers and fleet safety managers to show common large-truck driving errors. The website is to be included on the Federal Motor Carrier Safety Administration (FMCSA) website as web-based training tool.

Given the impact of driver error on safety, there has been a keen interest in developing driver training programs that focus on driver behaviors, and specifically those programs that train drivers to avoid specific driver errors. CMV drivers receive classroom and on-road training in order to obtain their commercial driver's license (CDL). Horn and Tardif (1999) emphasize the need for driver improvement training that also focuses on defensive driving. Defensive driving programs teach drivers to be patient, to be courteous to others, to anticipate others' mistakes, and to be on constant lookout for potentially hazardous situations and conditions. There are a number of sources for driver improvement training programs offered by various organizations. These programs focus on educating drivers to drive defensively and to think, see, and react more quickly to driving challenges. Though such programs claim to have an impact on driver improvement, their biggest limitation is that their training material may not be readily accessible to all CMV drivers and fleets. In addition, it is not known if the training information used by these programs is based on empirical data.

Because of the limitations of current driver improvement training programs, this project was initiated with the purpose of creating a supplemental defensive driving tips training program that would be accessible to the public and based on naturalistic driving data. The goal of the CMV Web-based Driving Tips project was to develop a web-based training tool whereby defensive driving tips information is supported by real-world video examples of safety-critical events. These examples will serve to educate CMV drivers in how to avoid making the same mistakes as those shown in the videos. The intent of this project is not to replace existing training programs, but to provide supplemental training information to CMV drivers and fleet managers.

Between May 2004 and September 2005, naturalistic driving data was collected from 103 volunteer CMV driver participants as part of the Drowsy Driver Warning System Field Operational Test (DDWS FOT) (Hanowski et al., 2008). The DDWS FOT produced 46,000 hours of driving data spanning 2.3 million miles (a distance equivalent to almost 96 trips around the world, or 770 coast-to-coast trips across the United States). Video data were continuously collected during the DDWS FOT, providing a repository of video examples of driver errors for use in driver improvement training.

The following tasks were completed in order to develop the final website. First, a literature review was conducted which detailed information on website usability guidelines, driver error, driver training, and naturalistic studies. The literature review resulted in information about specific driver behavior errors along with their preventive measures (driving tips). Then a focus group was conducted with subject matter experts to further maximize the usability of the driving tips content. Upon revision, the new driving tips included key information content, such as the importance of each tip and "did you know?" facts. In the content revision phase, some driving

tips were eliminated on the basis of being too elementary, as was indicated by subject matter experts' input in the review group.

To ensure that the website content was submitted in a format suitable for placement on FMCSA's website, the researchers obtained the website technical requirements from FMCSA's website managers and staff. In addition, to include driver videos for training purposes on a public website, special driver permissions were sought. Despite the challenges faced in contacting drivers (given their transient nature), permission was obtained from 11 drivers for 16 video data clips. Each of the top driver errors was represented by at least one video data clip. Once the driver permissions were obtained and video data clips were edited, work began on preparing the content for the draft website. The final CMV Web-Based Driving Tips website design was later revised again based on the peer review results of the draft website design.

The final CMV Web-Based Driving Tips website is included on the FMCSA website and is accessible to the public. The website includes an introductory homepage and different web pages for each driver error category. The homepage welcomes the audience to the website and provides a brief overview of the purpose of the website, its organization, and instructions on how to use the website. Each of the driver error categories includes key information content. Each category first introduces an operational definition of the driver error, followed by the driving tip content (such as the importance of each driving tip), "did you know?" fact(s), naturalistic driving video example(s), and training exercises. It is expected that the training questions will serve to ensure driver attention during the training program, as the questions quiz the driver for each video example. It is hoped that this will further assist CMV drivers in retaining the necessary information about those specific driver-related behaviors or errors to avoid.

1. INTRODUCTION

PROJECT OVERVIEW

Large trucks, defined as vehicles weighing more than 10,000 lb, are involved in a large number of crashes annually. In 2005, when this study was conducted, a total of 442,000 large trucks were involved in traffic crashes in the United States, and 4,932 were involved in fatal crashes which resulted in 5,212 fatalities (Federal Motor Carrier Safety Administration [FMCSA], 2007). Although the overall fatality rate of crashes across all vehicle types dropped 0.6 percent between 2003 and 2005, the total number of fatalities related to large-truck crashes increased by 4.8 percent. This is the third highest increase, behind motorcycle and sport utility vehicle (SUV) fatalities (FMCSA, 2007). This increase in the number of large-truck-related fatalities underscores the need to identify contributing factors associated with critical incidents (i.e., crashes and near-crashes). Once such contributing factors are identified and understood, steps can be taken to develop countermeasures to reduce the number of crashes and as a result, the number of related fatalities.

To understand fully the large number of factors contributing to crashes, one must take into account environmental factors (e.g., weather, other vehicles), vehicular factors (e.g., brakes, tire wear), organizational design factors (e.g., hours-of-service regulations, fleet safety management practices) and driver factors (e.g., driver behavior, distractibility) (Emery & Trist, 1960). However, research has found that driver factors (or driver errors) are the most prominent causes of traffic crashes (Treat et al., 1979; Sabey & Taylor, 1980; Wierwille et al., 2002; Craft, 2004). For example, Treat et al. determined that human error is the probable cause of 70–90 percent of traffic crashes.

In 2003, FMCSA reported that five common driver errors account for the majority of large-truck fatal crashes. These five driver errors are the following:

- Driver inattention.
- Running off the road or out of the lane.
- Failure to yield the right of way.
- Excessive speed for conditions.
- Failure to obey traffic lights and stop signs.

These same errors were found to be predominant in the Large Truck Crash Causation Study (FMCSA, 2005), which assessed the causes of, and factors contributing to, crashes involving large trucks. The LTCCS found that large trucks were coded with a critical reason in 55 percent (78,000) of the crashes (i.e., the large truck was considered to be responsible for the crash) and that truck driver errors accounted for 87.3 percent (68,000) of the crashes (FMCSA, 2005). The most frequently cited critical reasons were driver recognition errors (28.4 percent) and decision errors (38 percent). Specifically, factors such as driving too fast for conditions, driver inattention, fatigue, performing illegal maneuvers, and following too closely were cited as the primary causes of large-truck crashes, thus supporting the findings of the previously mentioned FMCSA (2003) analyses.

Similarly, a naturalistic (i.e., on-road, or real-world) study found that 91.5 percent of the critical reasons assigned to large-truck safety incidents were driver errors (Hickman et al., in press). This included 30.5 percent recognition errors (e.g., not seeing another vehicle), 47.5 percent decision errors (e.g., misjudgment of another vehicle's speed), 11.9 percent performance errors (e.g., improper turning maneuver), and 1.6 percent non-performance errors (e.g., fatigue). These categorizations are discussed in more detail in later sections of this report.

The studies cited above suggest the same conclusion—driver error is a primary factor contributing to large-truck crashes. In addition, it is interesting to note that these studies identified similar, if not identical, associated driver errors/factors, such as driver recognition and decision errors. Such findings suggest that future driver improvement training programs would do well to focus on driver behaviors, and specifically on those which may prevent or contribute to crash likelihood. It is recommended that drivers be trained to engage in or avoid these behaviors as appropriate.

OBJECTIVES

The goal of this CMV Web-Based Driving Tips project was to develop a web-based training tool where behavioral “do’s” and “don’ts” (driving tips) for CMV drivers are demonstrated in video segments of actual safety-critical events captured in recently completed naturalistic driving studies. The “don’ts” represent video segments demonstrating safety-critical events, and the “do’s” represent preventive measures (driving tips) in the form of text appearing alongside the videos. Providing real-world examples of safety-critical events, and the behaviors that lead up to them, is a useful learning tool, as the examples may serve to motivate CMV drivers to avoid making these mistakes themselves. The intent of this project was not to replace existing training programs, but to provide supplemental training information to CMV drivers and fleet managers regarding defensive driving tips.

2. LITERATURE REVIEW

The purpose of this chapter is to identify the most informative content for this web-based training tool. The following sections contain information on the following areas: web design guidelines, the need for driver improvement training and available training sources, the benefits of using naturalistic data, and the justification for the use of video examples to demonstrate driver error. Driver error and the various driver error models that are found in the literature are also discussed. The final sections of this chapter begin by summarizing information gathered from key naturalistic studies, and conclude with synergized information about specific driver behavior errors and the measures to prevent those errors (driving tips).

2.1 WEB DESIGN GUIDELINES

The Internet has become an increasingly powerful, dynamic, and interactive tool for delivering specific information to targeted and widespread audiences. The use of the Internet as an educational tool has provided users with a wide range of new and interesting learning experiences that may not be obtainable in traditional in-class education (Khan, 1997). The FMCSA website “No-Zone” (online at: <http://www.sharetheroadsafely.org/noZone/noZone.asp>) is one such educational site. “No-Zone” aims to provide supplemental training information to truck drivers and fleet carriers about the need for driving safety, speed management, distance maintenance, and blind-zone awareness, as well as the importance of driver wellness programs.

The aim of this project was to create a website that would provide training information similar to “No-Zone,” along with additional information about naturalistic driver-related factors that increase the likelihood of large-truck crashes. The Internet was seen as an ideal medium for this project because it makes possible the sharing of large amounts of information with the intended audience, in this case fleet managers and CMV drivers. In addition, the use of the Internet allows the fleet managers and CMV drivers greater flexibility, as they can access it at their own pace and at convenient times. It is important to note, however, that following certain guidelines when providing e-learning applications helps to ensure the usability of the developed website.

2.1.1 User-Centered Design

In the design of a website, there are many design methods and approaches that require careful consideration of usability principles. The most important component is a user-centered design approach. Norman (1990, p. 188) defines user-centered design as a, “philosophy based on the needs and interests of the user, with an emphasis on making products usable and understandable.” It is a philosophy that puts the user “in control,” and seeks to drive development and design of the product based on the user’s knowledge, intention, and skills. A user-centered philosophy is about understanding the needs of the end-user who will use the product.

An effective user-centered design engages its end-users actively. The need for such a design approach is great, especially when introducing a new method or service to users. This CMV Web-Based Driving Tips project intended to reach out to its users (fleet managers and CMV drivers) through a newly designed website. Since using the Internet is a relatively new approach

to providing training to CMV drivers and fleet managers, it is necessary to develop a user-centered design methodology that will serve these end-users most effectively. To achieve this, a focus group was conducted, via webinar, to understand what information would best serve the carriers, managers, and drivers. During the meeting the following topics were discussed, with the goal of involving the users directly in the design and development of the proposed website:

- User profile: A description of specific user characteristics—such as computer literacy, expected frequency of use, and level of experience—should be determined for the intended user population. This information will aid in creating a tailored user interface design (Ratner, 2002, p. 9).
- User needs: User needs determine the quality of training information and the content that users intend to seek. There is a need for different training materials and videos, and they should be prioritized based on their relevance to users. The organization of the information on the website should also be discussed, along with detailed task analysis of users' navigation-patterns while using the website.
- Website usability goals: The primary usability goals should be ease of navigation, design simplicity and clarity, and ease of accessibility of information and learning.
- User expectations: The educational background and experience of users should be discussed to identify their needs and expectations. For example, in this study, carriers who are interested only in video examples will have different expectations from those who are also interested in other relevant information about defensive driving. The knowledge of end-user expectations should allow designers to later synergize potential users' requirements, if they are identified to be feasible.
- Platform capabilities and constraints: Ratner (2002, p. 11) states that many times designers have to assume users' hardware and software platforms and capabilities when designing user interfaces. For example, screen size and resolution, modem speed, browser capabilities, installed applications such as plug-ins, etc. (Ratner, 2002). Therefore, this step is necessary to ensure that the designed application is usable on a wide variety of platforms.

The feedback obtained from the webinar meeting about these topics was incorporated in the design of the website. This user-centered approach provides a basis for planning how to maximize the impact of the provided service/tool.

2.1.2 Usability Guidelines

The second most important component of a good website is the usability of its design. Usability refers to the ability to use a product without any interference. Website usability not only ensures that everything on the designed user interface works, but also enables the user to make use of the provided information quickly and easily.

There are many guidelines in the literature that discuss the usability of a website. The guidelines most relevant to this study are website purpose and goals, content relevance and usefulness to audience, appealing layout and style, simplicity and clarity, appropriate navigation, engaging user-friendly design, and the testing of developed design and final website or website. The details of these methods are as follows:

- Website purpose and goals: It is necessary to identify the goal of the website, namely whether the website is intended for education, training, information, business, or entertainment purposes. This knowledge helps in determining the type of targeted audience, desired content and functionality, and appropriate appearance.
- Content relevance and usefulness: Usable content is one of the most essential components of a website—without it, the site is meaningless. Content refers to information provided to intended users. Usable website content is content that provides information that is useful, relevant, engaging, and meaningful to targeted users.
- User-centered design: A user-centered design allows users to make the most of the site’s content and resources. Design that is developed around the user ensures that user expectations are met either completely or almost completely. To ensure a user-centered design, involve users during the design stage.
- Appealing layout and style: To improve the website’s appearance and layout, the following design improvements can be implemented:
 - Page layout:
 - Build short pages that highlight major points and require minimum scrolling.
 - Avoid horizontal scrolling, as it is a tedious process.
 - Avoid text that moves or changes.
 - Use of frames is also discouraged by “usability guru” Jakob Nielsen, who states on his website (<http://www.useit.com>) that frames make user navigation complex and separated. In addition, browser capabilities make using frames difficult.
 - Scannable Content: Nielsen states, “People rarely read web pages word by word; instead, they scan the page, picking out individual words and sentences” (<http://www.useit.com/alertbox/9710a.html>). As a solution, Nielsen suggests the following guidelines:
 - Use highlighted keywords.
 - Use F-shape patterned website design: Nielsen and Pernice (2007) state that “eye-tracking visualizations show that users often read web pages in an F-shaped pattern: two horizontal stripes followed by a vertical stripe.”
 - Use relevant and meaningful headings/subheadings.
 - Use bulleted lists.
 - Use inverted pyramid style, which starts with the conclusion or the most important points first, followed by the less important ones.
 - Use consistent font style and text formatting.
 - Do not use underlines for text unless it is associated with a hyperlink.
 - Use different colors for visited and unvisited links.
 - Use short texts and an informal style of writing.
 - Use dark colors for text on a light background; avoid using dark background colors.
- Font size: Avoid small font sizes. Allowing users to change font size is a preferred method.

- Usable videos: when using videos on a website:
 - State the size of the file if the video is larger than 50 kb.
 - Videos must have captions or associated text.
 - Video previews are preferred (for example, a screenshot of a significant part of the video allows users to know what to expect from the video before clicking on it).
- Simplicity and clarity: User interface must be simple, with minimum clutter.
- Navigation: Persistent navigation is a must. Navigation must be meaningful and comprehensively provided between different web pages. Users must be provided with a method to go back to the home page.
- User-friendly design: The user interface must be designed to be compatible with a variety of computer configurations and internet browsers. Most important, the user-interface design must be intuitive. Links and website components must be organized in those positions where users would most likely expect them.
- Testing the developed website: A website must be tested by a wide range of users. Following testing, recommendations must be implemented in the website design. Upon design reengineering, another round of testing must be conducted to ensure that users approve of modified changes and find the website user-friendly.

2.1.3 Summary

The usability guidelines discussed in this section were noted and implemented in the design of the CMV Web-Based Driving Tips website. A combination of usability and user-centered design was the major focus of the developed site. The information content, further discussed in later sections of this chapter, was prioritized and organized on the site based on its importance to the users. Video examples are provided to support the information content.

2.2 DRIVER TRAINING

The main purpose of this study was not to replace training programs, but to fill in the gaps in existing training programs. Below is a review of existing training programs and their purpose. This will help to determine where new recommendations and methods may be helpful.

2.2.1 Purpose of Driver Training

CMV drivers undergo several phases of training prior to driving on the road. The first phase is to pass the CDL exam. To obtain a CDL, one must pass the CDL knowledge test and skills test. However, the trucking industry suggests that once a driver has obtained a CDL from the Department of Motor Vehicles (DMV), he or she receive additional classroom and on-road training. This helps to ensure that drivers have the additional skills to help improve the safe operation of CMVs. This recommendation is one of the reasons that the benefits of supplemental driver training have been widely realized. Some CMV carriers offer their own in-house training programs to their drivers, designed to meet the safety goals of the company. These training programs include formal training for entry-level drivers, driver-finishing training for new hires, driver refresher training for all drivers in the fleet, and remedial training for “problem drivers.”

One of the most popular driver improvement methods used by trucking companies and public training schools is a driver-finishing training program. In driver-finishing programs, a veteran driver/trainer accompanies the entry-level driver during the on-road part of the training. The main task of the veteran driver is to supervise the novice driver, pinpoint bad habits, and provide skills training and feedback in the identified problem areas of vehicle operations and inspection. It is important to note, however, that knowledge about vehicle operations is not enough. Horn and Tardif (1999) emphasize the need for driver improvement training that also focuses on defensive driving. Defensive driving principles include driving at a safe speed, anticipating other vehicles' mistakes, staying alert, checking blind spots, maintaining a safe following distance, avoiding road rage, being courteous to other vehicles, obtaining adequate sleep, and maintaining good health. Defensive driving programs are useful in increasing driver safety, because they teach drivers to be patient and courteous to others, to anticipate others' mistakes, and to be on constant lookout for potentially hazardous situations and conditions. Several reviews of transportation safety literature show that incorporating defensive driving tips in fleet training programs has reduced critical incidents (Cleaves, 1997) and resulted in safety improvements (Kiell, 1989).

2.2.2 Driver Improvement Training Sources

There are a number of sources for driver improvement training programs, including those offered by public, private, and Federal agencies. One of the most popular programs in the trucking industry is the *Smith System*, which is a for-profit organization. According to its website (<http://www.smith-system.com>), Smith System claims "to have reduced collisions and increased profits for fleets at over half of today's Fortune 500 companies." Most of its driver improvement training programs are based on the principles of defensive driving techniques and on countermeasures to eliminate driver-related errors. Its programs claim to help CMV drivers think, see, and react more quickly to driving challenges. The main focus of the educational programs at Smith System is collision prevention. Its training programs are based mainly on Smith System's Five Keys[®] of Space Cushion Driving principles, which have been designed to inform drivers of various ways to prevent collisions. Smith System's website states that its five keys would give drivers "space for the vehicle, visibility for the driver, and time to make decisions." The details of these five keys are as follows:

- *Aim high in steering*[®]: Defined as recognizing, evaluating, and reacting to avoid an incident based on available information.
- *Get the big picture*[®]: Smith System states that fewer mistakes will be made when the driver has a complete mental picture of the traffic situation. For example, drivers should anticipate other vehicles ahead of them, while also anticipating the actions of other vehicles and how they may affect traffic flow.
- *Keep your eyes moving*[®]: Referred to as proper scanning techniques (i.e., having constant situational awareness by scanning the driving environment).
- *Leave yourself an out*[®]: Defined as leaving sufficient space to maneuver out of a collision-imminent situation.
- *Make sure they see you*[®]: Referred to as making eye contact with others and communicating with other drivers via warning devices (e.g., turn signals).

Smith System uses these five keys in its training programs. Smith System primarily uses video and web-based aids in its training programs, but also provides training books, reminders and awards, and audio and video products. Although the driver improvement training programs offered by Smith System appear to be effective and relevant to the goals of this study, the limitation of the program is that it is proprietary and one must pay a registration fee to use its training materials.

J.J. Keller and Associates is another training organization that offers onsite and online defensive driving training programs. Some of their new programs are focused on training drivers to deal with different real world scenarios, followed by “what-did-you-see/what-would-you-do” quiz questions to improve driver information processing and reaction time. The different programs offered are called: “7-Minute Solutions: Defensive Driving,” “Hazard Perception Challenge,” “EYE ON Speed and Space Management,” and “Safe SimTM Truck Driving Simulator” (<http://www.jjkeller.com/index.html>). These programs incorporate audio and video examples that use a defensive driving training format, and are aimed at providing near real world driving scenarios. The programs come equipped with a trainer’s guide containing answers to challenge questions, driver booklets that highlight the key concepts of the training program, and video scenario descriptions. The critical elements of their defensive driving program, according to their on line training materials, are:

- Visual scanning.
- Identifying road hazards.
- Communicating with other motorist.

J.J. Keller claims that their new program is beneficial not only for novice drivers but also for veteran drivers looking to refresh their skills. As with the Smith System, the J.J. Keller training is limited in that one must pay a registration fee to obtain the training materials and information.

2.2.3 Summary

In this section, two popular defensive driving training programs of interest to the trucking industry were discussed. While these programs claim to have an impact on driver improvement, they are both limited by the fact that their training material is not freely accessible to all CMV drivers and fleets. In addition, it is not clearly known if the training information used by these programs is based on empirical data. The CMV Web-Based Driving Tips website is based on empirical data and uses naturalistic video data as examples. The video examples were selected from naturalistic driving databases for use on the FMCSA website.

The next section briefly discusses the importance of naturalistic driving data and the availability of such data to support the new program.

2.3 NATURALISTIC DATA AND VIDEO EXAMPLES

2.3.1 Naturalistic Data Availability

Crash reports have consistently shown that driver-related factors are the preeminent cause of safety-critical incidents (Treat et al., 1979; Sabey, 1980; Wierwille et al., 2002; Craft, 2004). However, one limitation of these reports (which are often the primary source of information reflected in crash databases) is that they are based on police reports, witness accounts, driver-behavior-questionnaires, and other subjective measures. Such methods are useful in describing the type of crash and the primary reason for the crash, but they do not necessarily identify associated factors that contributed to the crash. For example, police report data are retrospective. Police officers attempt to recreate the crash scene by interviewing drivers and witnesses. Often, drivers do not remember details of what happened prior to the crash (e.g., reaching for the radio, feeling drowsy), or may be hesitant to report it to the officer for fear of negative consequences (e.g., driving violation). Additionally, crashes are rare occurrences compared to near-crashes or other close-calls, providing only a limited amount of behavior-specific data to use for classification purposes. For the same reasons, the crash databases are also not true representations of driver behavior. This fact underlines the need for naturalistic driving data to provide a more complete picture of the driver's behavior prior to a crash.

Taking the above into consideration, a CMV naturalistic data collection method collects data during the normal operations of an instrumented vehicle. In this method, each vehicle contains several video cameras (e.g., face, front view, and right/left side view) and vehicle sensors to collect data on such variables as vehicle speed, global positioning system position, braking intensity, steering patterns, forward range to a lead vehicle, etc. These data are collected continuously—that is, the data collection system starts as soon as the vehicle ignition is turned on and continues to record until the vehicle is turned off. This data collection method has proved to be very beneficial, as researchers can see exactly what the driver was doing prior to an incident and what type of driving environment the driver was in (e.g., road type, traffic conditions, weather conditions, etc.).

This continuous data collection approach also provides a greater amount of data for analysis than that given in crash databases, as it captures more than just crash data. For example, a continuous data collection method enables the recording of near-crashes, as well as baseline data (i.e., “normal” driving where a safety-critical incident is not occurring) to be used as a comparison. Another significant advantage of using naturalistic data over self- or other-reported data is that the availability of video data allows direct viewing of the driver's normal working environment, in addition to the driver's behavior and environment prior to a critical incident.

In terms of data collected the DDWS FOT is the largest naturalistic driving study ever conducted on long-haul commercial driving, and is among the first to perform systematic analysis of safety-critical events and driver-exposure risks (Hickman et al., in press). The participant sample in the DDWS FOT study included two different long-haul operation types (truckload and less-than-truckload) and was intended to be generally representative of the long-haul commercial driver population. A total of 103 volunteer CMV driver participants drove 46 instrumented truck tractors that were operated by three motor carriers. Three types of data were collected continuously by the Data Acquisition System (DAS): video, dynamic sensor, and, occasionally,

audio data. Low-level infrared lighting illuminated the vehicles' cabs so the drivers' faces could be viewed during nighttime driving. The drivers drove a total of 2.3 million miles over 46,000 hours in a 17-month data collection period. No experimenter was present, and data collection instrumentation was unobtrusive. Hickman et al. states that, in addition to documenting many thousands of hours of generally safe driving, the DDWS FOT database contains many extreme cases of driving behavior and performance, including fatigue, judgment error, risk-taking, distraction and related behaviors, and traffic violations. In a preliminary analysis conducted by Hickman et al. that included only part of the total 2.3 million mile data set, 915 safety-relevant events (crashes and near-crashes) were identified. Due to the nature of the data collection effort and the richness of the data, a variety of safety-critical events representing different driver-related errors were available in this database for use in the current project.

The CMV Web-Based Driving Tips website uses video examples of driver errors to demonstrate driver behaviors to be avoided. The next section discusses the benefits of such an observational learning approach.

2.3.2 Purpose and Effectiveness of Video Examples

In a widely accepted theory of human learning and motivation, Bandura (1977) states that human behavior is often motivated by observing the consequences of others' behavior. For example, if one driver watches another driver suffer negative consequences (e.g., a crash) due to a particular behavior, then the observer will be motivated to not make the same mistake, thus avoiding similar negative outcomes. Conversely, if one driver observes another driver experience a positive outcome (e.g., a friendly wave from another motorist who was allowed room to merge in front of the driver's vehicle), then the observer will be motivated to engage in similar behaviors to obtain the same reward.

As part of his Social Learning Theory, Bandura (1977) states that observational learning will not occur without the implementation of four components: attention, retention, motor reproduction, and incentive and motivation. Regarding attention, Bandura states that observational learning will not occur unless the learner is paying attention to the learning environment. To ensure attention of drivers in the training program, it is recommended that individuals using the CMV Web-Based Driving Tips website be quizzed on each video example. For example, they could be asked about behavioral mistakes observed in the video and respective countermeasures which may have prevented the crash-relevant situation. According to Bandura, humans store the behavioral information they observe in the form of mental images or verbal descriptions, and are later able to recall the image or description to reproduce the observed behavior. Based on this theory, it is believed that the use of video examples would assist CMV drivers in retaining the necessary mental images of those specific driver-related behaviors or errors to avoid.

2.4 DRIVER ERROR

This section discusses definitions of driver error, as well as how driver error is categorized in the transportation safety research literature. It then discusses several key CMV-related naturalistic driving studies that have identified specific driver-related factors as “contributing factors” to fatal crashes.

Reason et al. (1990) divided driver error into two main classes, called “mistakes” and “violations.” *Mistakes* are considered deviations from intended actions which result in unintended consequences; for example, underestimating the speed of an oncoming vehicle when overtaking it (Reason et al., 1990). *Violations* are considered deliberate actions, such as becoming impatient with a slow vehicle and overtaking it on the wrong side (Reason et al., 1990). Violations are known to be driven by motivational factors, as risk-taking behavior (such as speeding) can reward the individual (when they arrive at their destination early). Because of their likelihood to result in road crashes, driver mistakes and violations are of special interest in driving research studies.

2.4.1 Categorizing Driver Error

Various models of driver error have been developed to describe the fundamental concept and to differentiate between types of driver error (e.g., Treat et al., 1979; Reason et al., 1990; Dewar, Olson, & Alexander, 2002; Rimmo, 2002). Of these, the driver error model used by Treat et al. (1979) is considered the most comprehensive. The details of this model and its relevance to this study are discussed in this section.

The Indiana Tri-Level model developed by Treat et al. (1979) is one of the first driver error models, and is still widely used. Data were taken from documented accident cases, on-site accident investigation reports, and the case evaluations of a multidisciplinary team of experts. The resulting model divided driver error into four main categories, which included several sub-categories. The categories are as follows:

- *Recognition Errors*: Delayed perception, reaction, and comprehension are recognition errors. Driver distraction (internal or external), inattention, and “improper lookout” (i.e., looked but did not see) are examples of driver recognition errors.
- *Decision Errors*: A conscious decision to take a risk or to otherwise drive unsafely is referred to as a decision error. Examples include excessive speed for conditions, tailgating, misjudging another vehicle’s speed or distance, taking inadequate evasive action to avoid potential conflict situations, etc.
- *Performance Errors*: The execution of improper motor responses is referred to as a performance error. Examples include driver panicking/freezing, improper directional control, overcorrection, etc.
- *Critical Non-Performance Errors*: Errors that occur due to impairment, drowsiness, fatigue, and poor driver health are examples of non-performance errors.

Though Treat et al. (1979) developed this error categorization scheme to categorize passenger vehicle driver errors, both the LTCCS database and DDWS FOT naturalistic study (Hanowski et

al., 2008) have found it to be useful in categorizing CMV drivers' errors. Since this study summarizes driving tips based on the findings of the LTCCS and naturalistic studies, the categorization scheme developed by Treat et al. is considered ideal for the current project.

In the next section, the findings from key naturalistic driving studies and the LTCCS will be discussed, and will later be classified as driver behavior errors using the error categorization scheme described above.

2.5 NATURALISTIC DRIVING STUDIES

The association between CMV driver error and crash causation has been investigated in several naturalistic driving studies and this section discusses several of these naturalistic driving studies.

2.5.1 Review of CMV Driving Studies

In a naturalistic study of local/short-haul (L/SH) truck driving, Hanowski et al. (2000) found that driver fatigue and drowsiness (based on both subjective and objective measures) was one of the major contributing factors in critical incidents where the driver was judged to be at fault. Younger and/or inexperienced drivers were reported to exhibit higher levels of on-the-job drowsiness and were involved in more critical incidents than older and/or experienced drivers. In addition, several lane-change incidents and traffic violations were reported to be associated with driver drowsiness. The study showed that when drowsy, drivers paid attention to relatively unimportant sections of their field-of-view and spent less time scanning the environment. The study also reported the following additional behavioral errors as contributing factors to critical incidents:

- Driver inattention
- Improper lane change
- Driver stress due to time pressure
- Inadequate surveillance
- Driver overconfidence

The L/SH study suggested improved driver sleep hygiene, training, screening, and monitoring as preventive measures to improve driver performance.

In a naturalistic study of long-haul truck driving, Dingus et al. (2002) assessed the impact of sleeper berth usage on operator's alertness. Similar to the L/SH study, driver drowsiness and fatigue was found to be one of the major factors contributing to critical incidents. For example, it was noted that in conditions where the drivers were rated extremely tired or drowsy, they tended to push themselves to continue to drive, thereby increasing their chances of experiencing a safety-critical event.

Other driver behavior errors identified as primary contributors to safety-critical events were:

- Abrupt changes in steering.
- Inattention.

- Improper lane change.
- Hard braking.
- Following too closely.

In another study with CMV drivers, researchers used 12 months of naturalistic data from the DDWS FOT to analyze a total of 14 crashes, 14 tire strikes, 98 near-crashes, and 789 crash-relevant conflicts (Hickman et al., in press). Table 1 below lists the frequency and percentage of different driver-related factors when the monitored truck was assigned fault (i.e., critical reason) for the incident. The table lists driver errors using Treat's (1979) classification scheme. As more than one factor could be selected, the column total exceeded 100 percent (the denominator being the total number of events).

Table 1. Frequency and Percentage of Potential Driver-Related Factors

Critical Reason	Driver-Related Factor	Crashes - Number	Crashes - Percent	Crashes: Tire Strike, Number	Crashes: Tire Strike, Percent	Near-Crashes - Number	Near-Crashes - Percent	Crash-Relevant Conflicts - Number	Crash-Relevant Conflicts - Percent	Total Safety-Critical Events - Number	Total Safety-Critical Events - Percent
Critical reason not coded to this vehicle	N/A	1	7.1%	0	0.0%	29	29.6%	145	18.4%	175	19.1%
Sleep—that is, actually asleep	Critical Non-Performance	0	0.0%	0	0.0%	0	0.0%	1	0.1%	1	0.1%
Heart attack or other physical impairment of the ability to act	Critical Non-Performance	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Drowsiness, fatigue, or other reduced alertness	Critical Non-Performance	0	0.0%	0	0.0%	1	1.0%	10	1.3%	11	1.2%
Other critical non-performance	Critical Non-Performance	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Unknown critical non-performance	Critical Non-Performance	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Inattention (i.e., daydreaming)	Recognition	0	0.0%	0	0.0%	1	1.0%	22	2.8%	23	2.5%
Internal distraction	Recognition	1	7.1%	0	0.0%	15	15.3%	83	10.5%	99	10.8%
External distraction	Recognition	1	7.1%	0	0.0%	6	6.1%	50	6.3%	57	6.2%
Inadequate surveillance (e.g., failed to look)	Recognition	0	0.0%	0	0.0%	8	8.2%	23	2.9%	31	3.4%
Other recognition error	Recognition	0	0.0%	0	0.0%	0	0.0%	10	1.3%	10	1.1%
Unknown recognition error	Recognition	0	0.0%	0	0.0%	0	0.0%	6	0.8%	6	0.7%
Too fast for conditions	Decision	0	0.0%	0	0.0%	4	4.1%	45	5.7%	49	5.4%
Too slow for traffic stream	Decision	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Misjudgment of gap or other's speed	Decision	1	7.1%	0	0.0%	2	2.0%	49	6.2%	52	5.7%
Following too closely to respond to unexpected actions	Decision	0	0.0%	0	0.0%	2	2.0%	42	5.3%	44	4.8%

Critical Reason	Driver-Related Factor	Crashes - Number	Crashes - Percent	Crashes: Tire Strike, Number	Crashes: Tire Strike, Percent	Near-Crashes - Number	Near-Crashes - Percent	Crash-Relevant Conflicts - Number	Crash-Relevant Conflicts - Percent	Total Safety-Critical Events - Number	Total Safety-Critical Events - Percent
False assumption of other road users' actions	Decision	0	0.0%	0	0.0%	0	0.0%	26	3.3%	26	2.8%
Apparently intentional sign/signal violation	Decision	0	0.0%	0	0.0%	0	0.0%	1	0.1%	1	0.1%
Illegal U-turn	Decision	0	0.0%	0	0.0%	1	1.0%	0	0.0%	1	0.1%
Other illegal maneuver	Decision	0	0.0%	0	0.0%	0	0.0%	18	2.3%	18	2.0%
Failure to turn on head lamps	Decision	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Inadequate evasive action (e.g., braking only, not braking and steering)	Decision	0	0.0%	0	0.0%	3	3.1%	125	15.8%	128	14.0%
Aggressive driving: Intimidation	Decision	0	0.0%	0	0.0%	0	0.0%	2	0.3%	2	0.2%
Aggressive driving: Wanton, neglectful, or reckless behavior	Decision	0	0.0%	1	7.1%	0	0.0%	7	0.9%	8	0.9%
Other decision error	Decision	0	0.0%	1	7.1%	1	1.0%	15	1.9%	17	1.9%
Unknown decision error	Decision	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
DRIVER-RELATED: Apparent recognition or decision error (unknown which)	Decision	0	0.0%	0	0.0%	5	5.1%	0	0.0%	5	0.5%
Panic/Freezing	Performance	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Overcompensation	Performance	0	0.0%	0	0.0%	0	0.0%	15	1.9%	15	1.6%
Poor directional control	Performance	2	14.3%	3	21.4%	6	6.1%	18	2.3%	29	3.2%
Other performance error	Performance	0	0.0%	0	0.0%	1	1.0%	40	5.1%	41	4.5%
Unknown performance error	Performance	0	0.0%	0	0.0%	0	0.0%	3	0.4%	3	0.3%
DRIVER-RELATED: Type of driver error unknown	Performance	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Source: Hickman et al., (in press)

Table 1 shows that inadequate evasive action accounted for the highest percentage (14 percent) of safety-critical events, followed by internal (10.8 percent) and external distractions (6.2 percent), misjudgment of gap or other's speed (5.7 percent) and driving too fast for conditions (5.4 percent). In a separate analysis of at-fault and drowsiness-related safety-critical events, it was found that actually falling asleep or otherwise being drowsy or fatigued accounted for 13 percent of the safety-critical events identified in this study.

All three naturalistic studies discussed above show that driver inattention, drowsiness/fatigue, and improper lane changes are primary contributing factors to incidences of safety-critical events. The larger number of at-fault drowsiness-related incidents committed by younger and inexperienced drivers suggests differences in individual defensive driving skills and practices, emphasizing the need for driver improvement training.

2.5.2 Review of the Large Truck Crash Causation Study

In addition to collecting descriptive data, the LTCCS assessed contributing factors for fatal crashes involving large trucks (FMCSA, 2005). This assessment is recognized as the most comprehensive safety database for crashes involving large trucks. The LTCCS collected data on crashes at 24 sites in 17 states from 2001 through 2003. The investigators traveled to crash sites to collect crash scene data, conducted thorough interviews with drivers about their conditions before the crash, and conducted inspections of the trucks. For assessing crash risk, LTCCS coded for critical events, critical reason, and other crash-associated factors. Table 2 shows, in descending order, the top 15 driver-errors that were coded when the large truck was assigned the critical reason for the crash. The results shown in Table 2 are national estimates for the 141,000 large trucks that were estimated by FMCSA to have been involved in fatal and injury-causing crashes during the study period. The LTCCS reports that the estimates may differ from the true values since they are based on a probability sample of crashes and not a census of all crashes.

Table 2. Driver Error Assigned in Large-Truck Crashes

Driver-Related Factor	Number of Trucks	Percent of Total (%)
Traveling too fast for conditions	41,000	29
Unfamiliarity with roadway	31,000	22
Over-the-counter drug use	25,000	17
Inadequate surveillance	20,000	14
Fatigue	18,000	13
Felt under work pressure from carrier	16,000	10
Illegal maneuver	13,000	9
Inattention	12,000	9
External distraction	11,000	8
Following too closely	7,000	5
Jackknife	7,000	5
Illness	4,000	3

Driver-Related Factor	Number of Trucks	Percent of Total (%)
Internal distraction	3,000	2
Illegal drugs	3,000	2
Alcohol	1,000	1

Source: (FMCSA, 2005)

Based on the data presented in Table 2, driving too fast for conditions was the most frequently reported contributing factor (29 percent), followed by unfamiliarity with roadway conditions (22 percent). Driver drowsiness/fatigue is reported to be the fifth-most critical contributing factor in large-truck crashes.

The LTCCS study recommended additional analyses of these data to establish correlations between crash liability and driver’s specific crash risk factors. These analyses will aid in developing necessary countermeasures to reduce the incidence of large-truck crashes. The key takeaway from Table 2 is that it provides useful information for identifying specific key driver behaviors (i.e., don’ts).

2.5.3 Summary

In this section, the findings of the naturalistic and LTCCS driving studies as related to driver error were discussed. The results of these studies suggest steps to address those driver errors that are associated with large-truck crashes.

Although the L/SH study and the sleeper berth study had limited samples of field data, the findings of these two studies support the findings of both the DDWS FOT study and the LTCCS study. It is noteworthy that all of these studies identified similar driver errors, such as driver inattention, inadequate surveillance, drowsiness/fatigue, and improper lane changes, as primary contributing factors to large-truck incidents. In addition, the safety-critical events that were identified by the DDWS FOT study are also identified in the LTCCS study as having contributed to fatal and injury large-truck crashes.

The LTCCS study is one of the most comprehensive studies ever conducted, and findings from other studies support its findings. As a result, the current study has developed driving tips based on those driver errors identified by the LTCCS study. In addition, availability of naturalistic video examples from the DDWS FOT study was a major consideration in short-listing the most frequently occurring driver errors of the LTCCS study. Nine major driver errors detailed by the LTCCS study were considered, along with one prominently reported driver error of “inadequate evasive action” described in the DDWS FOT study. The list below summarizes the most frequent driver errors, which are considered in the next section:

- Traveling too fast for conditions.
- Unfamiliarity with roadway.
- Inadequate surveillance.
- Fatigue.
- Illegal maneuver.

- Inattention.
- External distraction.
- Following too closely.
- Internal distraction.
- Inadequate evasive action.

Using this list of driver errors, the preliminary¹ content of the CMV Web-Based Driving Tips website was established. These are detailed in the next section of this chapter.

2.6 DRIVING TIPS

2.6.1 Driver Errors and Associated Preventative Measures

The driver errors were classified in four categories as identified by Treat et al. (1979). The LTCCS study also found this categorization scheme useful in classifying driver errors. Below is the categorized list of errors, followed by detailed descriptions of driving tips to help drivers avoid these behaviors.

2.6.1.1 *Non-Performance-based driver error:*

- Fatigue.

2.6.1.2 *Recognition-based driver error:*

- Inadequate surveillance.
- Inattention.
- External distraction.
- Internal distraction.

2.6.1.3 *Decision-based driver error:*

- Traveling too fast for conditions.
- Unfamiliarity with roadway.
- Making an illegal maneuver.
- Following too closely.
- Inadequate evasive action.

¹ It should be noted that the development of the Driving Tips website was an iterative process; some of the driving tips listed in this section of the report, and discussed during the webinar with safety fleet experts, were not included in the final website content. These 10 driving tips were the starting point for further refinement and are presented here to show the systematic, iterative approach taken in developing the web content.

2.6.2 Non-Performance-Based Driver Errors

2.6.2.1 *Driver Fatigue*

Fatigue is the result of physical or mental exertion that impairs performance (Williamson, Feyer, & Friswell, 1996). Thieriez, Radja, and Toth (2002) considered a driver to be fatigued when any one of the following conditions was met:

- The driver had not received adequate sleep.
- The driver was tired/fatigued due to extended work hours.
- The driver was tired/fatigued due to strenuous recreational or non-work activities.
- The driver was tired/fatigued due to a combination of factors.

The LTCCS (FMCSA, 2005) reported that 13 percent of truck crashes were caused by driver fatigue.

CMV Driving Visual Examples: Visible indicators of driver fatigue include rubbing the face or eyes, yawning, nodding head, scratching, moving restlessly in the seat, drifting between lanes, tailgating, missing traffic signs, jerking the truck back into the lane, drifting off the road, narrowly missing a crash, etc.

Consequences: Due to lack of driver alertness, the CMV may drift from its intended path of travel or the driver may not be able to react to an emergency situation if one arises while the driver's eyes are closed.

Driving Tips:

- Get enough sleep before getting behind the wheel.
- If you get sleepy, stop driving at the nearest safe place.
- Stay healthy and well rested, or do not drive.
- Rest during your off-duty times.
- Recognize the signals and dangers of drowsiness.
- Do not upset your body clock more than necessary.
- Avoid any kind of medication and drugs that induce drowsiness (those that have a label warning against operating vehicles or machinery).
- Schedule your driving trips at times when you are normally awake.
- If you can't stop for the night, pull off at a safe place and take a nap.
- Do not rely on coffee, radio, open window, or other tricks to keep you awake.

References: Hanowski et al., 2000; Share the Road Safely Program, 2007; Accident Countermeasures Manual, 2007; Montana Commercial Driver License Manual 2005–2006.

2.6.3 Recognition-Based Driver Error

2.6.3.1 *Inadequate Surveillance*

Thieriez et al. (2002) described inadequate surveillance as instances where drivers reported that they “failed to look or looked but did not see.” Thieriez et al. (2002) gave examples of inadequate surveillance incidents that include lane changes and turns at intersections where the driver looks in the required direction, but fails to recognize the approaching traffic. The LTCCS (FMCSA, 2005) reported that 14 percent of truck crashes occurred due to inadequate surveillance.

CMV Driving Visual Examples: Examples of inadequate surveillance demonstrate that the driver is not scanning the driving environment frequently, not checking the mirrors regularly, etc.

Consequences: Due to inadequate surveillance, drivers may rear-end a lead vehicle or side-swipe/cut off a vehicle in the adjacent lane. In some instances, drivers may engage in abrupt steering or hard-braking maneuvers at the last possible moment to avoid a critical incident.

Driving Tips:

- Focus your eyes 12–15 seconds ahead. At lower speeds this is about one city block, and at highway speeds about a quarter of a mile.
- Scan far enough ahead to be able to react safely to approaching situations.
- Shift your attention back and forth, near and far.
- Learn to recognize driving situations that can be hazardous.
- Look for vehicles coming onto the highway or into your lane, or turning.
- Check your mirrors regularly. Use them to spot overtaking vehicles and to know where other vehicles are around you.
- Assume that other drivers will make errors.
- Scan frequently to the side and rear for passing or approaching vehicles.
- Scan thoroughly before changing speed or direction.
- Watch for brake lights from slowing vehicles.

References: Accident Countermeasures Manual, Michigan Commercial Driver License manual.

2.6.3.2 *Inattention*

Zaidel, Paarlberg, and Shinar (1978) defined inattention as lapses in attention due to “wandering of mind” and “recognition failure” due to distraction, misperception, or improper lookout. In an effort to distinguish inattention from distraction, Pettit, Burnett, and Stevens (2005) stated that “The result of distraction is inattentive driving; however, inattention is not always caused by distraction” (p. 3). The authors listed daydreaming and fatigue as some examples of inattention. Thieriez et al. (2002) used the inattention category for drivers who were typically focusing on internal thoughts (e.g., daydreaming, problem-solving, worrying about family problems, etc.)

and not focusing attention on the driving task. The LTCCS (FMCSA, 2005) reported that 9 percent of truck crashes occurred due to driver inattention.

CMV Driving Visual Examples: An inattentive driver is one who is not looking forward, not paying attention to the forward scene, is engaged in a secondary, non-driving-related task, or a combination of all of the above.

Consequences: Consequences of inattention may be not seeing a potential conflict situation in time to perform an evasive maneuver, violation of a traffic law, or a lane deviation.

Driving Tips:

- Pay attention to the forward scene.
- Keep eyes on the road, keep them moving.
- Know where you are going before you leave.
- Do not engage in secondary non-driving-related tasks.
- Know what the traffic is doing around you.
- Watch out for other distracted drivers.
- Prevent “drift” lane departures.

References: Smith System, 2007; Virginia Commercial Driver’s Manual, 2007; Accident Countermeasures Manual, 2007; Hickman et al., in press.

2.6.3.3 External Distraction

Pettit et al. (2005) suggested that “all forms of external distraction could be said to be non-driver-initiated, e.g., the unpredictable behavior of a drunk pedestrian” (p. 6). However, the authors stated that a driver’s unfamiliarity with the roadway is one exception to the standard of non-driver-initiated external distraction. Some examples as listed by Thieriez et al. (2002) for external distraction include searching for a street address, interacting with construction activity, looking at a building or scenery, looking at a sign, looking at a previous crash site, etc. It is also stated that distractions are distinguished from inattention in that distractions induce the driver to focus attention on the distraction (Thieriez et al., 2002). The LTCCS (FMCSA, 2005) reported that external distraction was a factor in 8 percent of truck crashes.

CMV Driving Visual Examples: An externally distracted driver is often looking outside at non-driving-related external objects and not looking forward toward the path of travel.

Consequences: Dire consequences such as a crash, near-crash, or crash-relevant conflicts could result, even with only a few seconds of external distraction.

Driving Tips:

- Do not look at an outside person, animal, store, object, or event.
- Give the drive your full attention.

- Do not take your eyes off the road.
- Stop and seek advice on an alternative road if you are diverted from your planned route.

References: Stutts et al., 2001; Michigan Commercial Driver License Manual, 2007; Hickman et al., in press.

2.6.3.4 Internal Distraction

Pettit et al. (2005) stated that, “Internal distractions can be categorized as both driver-initiated, e.g., making a mobile phone call, or non-driver-initiated, e.g., the unpredictable actions of a passenger” (p. 6). Some examples listed by Thieriez et al. (2002) for internal distractions include tuning the radio, adjusting the heating/cooling system, engaging in a conversation with a passenger, using a cell phone, retrieving fallen objects, reading books/magazines/maps/invoices, etc. The LTCCS (FMCSA, 2005) reported that 2 percent of truck crashes occurred due to driver internal distraction.

CMV Driving Visual Examples: Internal distraction examples often demonstrate that the driver is preoccupied with cigarettes, maps, food, cell phones, or other objects; is drifting over the lane divider lines or within his/her own lane; is traveling at inconsistent speeds; is involved in conversation with other occupants, etc.

Consequences: Similar to other distractions, dire consequences such as a crash, near-crash, or crash-relevant conflicts could result, even with only a few seconds of internal distraction.

Driving Tips:

- Do not look at or for objects within the cab.
- Clear the vehicle of any unnecessary objects.
- Avoid smoking and/or lighting a cigarette while driving.
- Do not use a cell phone while driving (cell phones and radios are visual and cognitive distracters).
- Do not attempt to read or write while you drive.
- Avoid eating and drinking while you drive.
- Review maps and plan your route before getting behind the wheel.
- Do not engage in complex or emotionally intense conversations with other occupants.

References: Montana Commercial Driver License Manual 2005–2006; Dingus et al., 2006; Hickman et al., in press.

2.6.4 Decision-Based Driver Error

2.6.4.1 Too Fast For Conditions

Thieriez et al. (2002) stated that “driving too fast for conditions” is associated with drivers traveling at a speed that is greater than a reasonable standard of safe driving. Examples of “too fast for conditions” include traveling at an unsafe speed in conditions such as wet roadway (e.g.,

rain, snow, ice), reduced visibility (fog), uneven road, construction zones, curves, intersections, gravel roads, high traffic, etc. The LTCCS (FMCSA, 2005) reported that 23 percent of crashes occurred when CMV drivers were traveling too fast for conditions.

CMV Driving Visual Examples: Speeding in curves, in construction zones, in adverse weather conditions, or in high-traffic conditions suggest that the driver is driving too fast for conditions.

Consequences: Driving too fast may result in hard braking or loss of control of the vehicle due to braking or vehicle skid.

Driving Tips:

- In work zones, drive at or below the work zone's posted speed limit before traveling on a downgrade; downshift and use engine braking. Adjust turning and braking to road surface conditions.
- In curves, braking can lock wheels and cause a skid.
- In curves, maintain a lower speed than the curve advisory because the shifted (high) center of gravity of trucks can cause a roll-over.
- Reduce speed by about one-third on a wet road, one-half on packed snow.
- In adverse conditions, add extra seconds to your following distance.
- Drive slowly with a loaded trailer. Loaded trucks take twice as long to stop.
- Drive slowly with an empty trailer. An empty vehicle has less traction.

References: Accident Countermeasures Manual, 2007; FMCSA Share the Road Safely Program, 2007; Virginia Commercial Driver's Manual, 2007.

2.6.4.2 Unfamiliarity with Roadway

In defining apparent unfamiliarity with roadway, Klauer et al. (2006) stated that "Driver's behavior is consistent with being lost in a particular location. Examples: performing repeated U-turns, reading maps/papers, etc." (p. 87). In discussing distraction and road unfamiliarity, Pettit et al. (2005) stated that "When a driver is distracted from the primary driving task because they are lost, looking for street signs or buildings, and so on, it could be suggested that they have given priority to their route finding task at the expense of the safe control of their vehicle" (pp. 6-7). Unfamiliarity with roadway resulted in 22 percent of CMV crashes in the LTCCS (FMCSA, 2005).

CMV Driving Visual Examples: Roadway unfamiliarity examples may be indicated by a CMV driver changing direction suddenly, continuously scanning for something, using brakes often or stopping in middle of an intersection, or changing lanes for no apparent reason.

Consequences: Unfamiliarity with roadway may increase the risk of a crash, near-crash, or crash relevant conflict with other road users.

Driving Tips:

- Check your route before you leave.
- If you are unfamiliar with where you're going, study a road map to plan your route.
- Do not try to read the map while driving.
- Do not take shortcuts.
- Do not change direction suddenly or stop without warning.

References: Montana Commercial Driver License Manual 2005–2006; Michigan Commercial Driver License Manual, 2007.

2.6.4.3 *Illegal Maneuvers*

The Motor Carrier Safety Act of 1999, in section 111, describes illegal maneuvers as making unsafe lane changes, following too closely, violating traffic laws, and disregarding traffic controls. Thieriez et al. (2002) stated that drivers committed an illegal maneuver if, for example, they crossed full barrier lines while passing, passed on the right, turned right from the left lane or turned left from the right lane, initiated an illegal U-turn, failed to stop for a traffic control device, drove the wrong way on a one-way road, etc. Illegal maneuvers resulted in 9 percent of CMV crashes in the LTCCS (FMCSA, 2005).

CMV Driving Examples: Changing lanes without sufficient gap, crossing a solid yellow line in a no-passing zone, and making an illegal U-turn are examples of illegal maneuvers.

Consequences: May result in a crash or traffic violation.

Driving Tips:

- When changing lanes, maintain proper spacing.
- Do not attempt improper or erratic traffic lane changes.
- Do not change lanes at intersections.
- Do not drive faster than legal posted speed limit.
- Do not engage in an illegal U-turn.
- Go to the next exit if you miss an exit or a turn; do not back up.
- Prepare to stop when you see a yellow caution traffic light.
- When going uphill, do not pass other slow vehicles unless you can pass quickly and safely.
- Always yield when appropriate.
- Do not pass in a no-passing zone.
- Do not cross double yellow lines.
- Read signs carefully and obey them; obey all traffic laws.

- Do not drive beside other vehicles; drop back or pull forward.
- Signal your intentions.

References: Virginia Commercial Driver’s Manual, 2007; Accident Countermeasures Manual, 2007; Illinois Commercial Driver License Study Guide, 2007.

2.6.4.4 *Following Too Closely*

Dingus et al. (2006) considered drivers to be following too closely when they were not allowing adequate spacing between their vehicle and the lead vehicle. Thieriez et al. (2002) stated that following too closely to respond to unexpected situations “is used for situations in which one vehicle is following another vehicle so closely that even if the following driver is attentive to the actions of the vehicle ahead, he/she could not avoid a collision in the circumstance when the lead driver brakes suddenly.” The LTCCS (FMCSA, 2005) reported that 5 percent of large-truck crashes occurred when the CMV driver was following the lead vehicle too closely.

CMV Driving Examples: A truck driver not leaving enough/recommended space between the lead vehicle and his/her own vehicle is a good example of following too closely.

Consequences: Perhaps the most common consequence of following too closely is that the driver may not have enough space and time to execute an evasive maneuver if necessary, which may result in a crash.

Driving Tips:

- At speeds below 40 mi/h, maintain at least 1 second for each 10 feet of vehicle length.
- At speeds above 40 mi/h, add a second for safety. For example:
 - For a 60-foot truck (under 40 mi/h) = maintain a 6-second time interval.
 - For a 40-foot truck (above 40 mi/h) = 4 + 1 = maintain a 5-second time interval.
- Leave enough space ahead in case you must suddenly stop.
- Anticipate lead vehicle driver’s actions.
- Be prepared and expect the unexpected.
- If you are going to be later than you expected—deal with it. Take a deep breath and accept the delay.
- Be a cautious and courteous driver.

References: Virginia Commercial Driver’s Manual, Michigan Commercial Driver License Manual; FMCSA Share the Road Safely Program.

2.6.4.5 *Inadequate Evasive Action*

Thieriez et al. (2002) described inadequate evasive actions as instances in which drivers are braking only, and/or not braking and steering in response to a conflict situation. Thieriez et al. coded drivers with inadequate evasive action in situations when they failed to execute a proper evasive maneuver by not using sufficient steering inputs, not using sufficient brake pedal, or not using a combination of steering and braking inputs. Hickman et al. (in press) reported that

14 percent of safety-critical events occurred when the CMV driver executed an inadequate evasive action.

CMV Driving Visual Examples: A CMV driver failing to slow in advance for stopped or stopping traffic and, as a result, braking or steering abruptly, represents a good example of inadequate evasive action.

Consequences: Perhaps the most common consequences of inadequate evasive action are roadway departure, steering to wrong side of roadway, cargo or trailer-shift, excessive braking creating potential hazard, loss of control, and locking of brakes.

Driving Tips:

- Watch for brake lights from slowing vehicles.
- Adjust your speed depending on driving conditions.
- Stay alert to changing traffic conditions.
- Adjust your space to conditions.
- Anticipate other road users' actions.
- Slow down in high traffic conditions and at intersections.
- Be aware of the size and weight of your vehicle when you cross or enter traffic.

References: Montana Commercial Driver License Manual 2005–2006; Michigan Commercial Driver License Manual, 2007.

2.6.5 Summary

In this section, various driver errors were discussed and preventive countermeasures for such errors were identified. As a result of this discussion, the first set of defensive driving tips was formulated. The Treat et al. (1979) driver-error categorization scheme was used to organize the driving tips based on driver error classifications. Due to the iterative review process used in this study, the driving tips presented above do not represent the final content, which resulted after several rounds of modifications were made.

Based on the literature, the driving tips selected were done so to reflect frequently encountered driver errors in CMV driving. To support the new program further, video examples demonstrating the driving tips were identified from naturalistic driving databases for use on the FMCSA website.

2.7 SUMMARY OF LITERATURE REVIEW

As noted earlier, naturalistic data have consistently shown that driver error or driver behavior is the major contributing factor in large-truck crashes (Hanowski et al., 2000; Dingus et al., 2002; FMCSA, 2005; Hickman et al., in press). Research recommends improving driver behavior and safety by implementing driver training programs (Uzgiris & Dilich, 1991; Beilock, Capelle, & Page, 1989), thus emphasizing the fact that driver training is key to safety.

In the trucking industry, numerous driver training programs (e.g., Smith System, 2007; Keller, 2007) exist that claim to have a significant effect on driver improvement training in the area of defensive driving. These programs, however, are not freely accessible to all CMV drivers and fleets. The current study aims to develop a supplemental driver program to be used in conjunction with current training. The new training information will be made freely accessible to the general public through a site hosted on FMCSA's website. The information in this new training program is based on naturalistic data collected during the DDWS FOT study.

The new program is comprised of two key components. The first component provides training information about driver errors and associated driving tips to help prevent these errors, resulting in a list of defensive driving tips. Naturalistic driving videos are also included to show real-world examples of driving errors that may result if the tips are not followed.

The second component is the use of the Internet as a means to provide this training program to its intended users. The website was designed with CMV drivers and fleet carriers as the intended audience. A webinar meeting of subject matter experts, including fleet managers, was conducted to obtain relevant information, to ensure usability of the driver training information content, and to ensure the program's user-friendliness. The goal of this study is to provide CMV drivers and fleet managers with information about defensive driving techniques and video examples of driver driving tips via a user-friendly website accessible from FMCSA's website.

3. A WEBINAR WITH SUBJECT MATTER EXPERTS ON DEFENSIVE DRIVING TIPS FOR CMV DRIVERS

3.1 INTRODUCTION

An integral part of the development of this website was to include feedback/input from subject matter experts, who included CMV fleet safety managers. Due to the remote locations of these subject experts, an online focus group meeting (webinar) was chosen as the best option for reviewing and discussing the contents of the site. A webinar is an Internet-based web conferencing application that allows remote users to log in to an Internet site and view presentations, conduct meetings and discussions, share applications, and post feedback. As this is an efficient and practical method for sharing ideas and soliciting feedback, researchers scheduled and conducted a webinar with CMV subject matter experts in January 2008.

The main objective of this webinar was to obtain expert opinions about the driving tips being developed. The driving tips were selected based on the frequency of particular crash precursors in large-scale studies (e.g., the LTCCS and the DDWS FOT). In addition, the research team was interested in obtaining additional driving tips from the subject matter experts.

3.2 PRE-WEBINAR PROCEDURES

Five subject matter experts participated online via a webinar hosting client. The participants had expressed interest in participating in such studies previously, when interacting with researchers on other projects.

Prior to the webinar, an informed consent document and webinar materials were e-mailed to the participants (see Appendix A). The informed consent document discussed the objectives and procedures of the webinar, the risks involved, participants' responsibilities, and the benefits of participation. Participants understood that logging in to the webinar session was considered consent to participate.

3.3 WEBINAR PROCEDURE

Once all participants were logged in to the webinar session and introduced, the presenters gave a brief summary of the webinar procedure. Then, a slide presentation file was uploaded to cover the following topics:

- **Background Session:** The session began with discussion on the objectives of the Driving Tips project and instructions for the webinar. Participants were informed that the entire session would be recorded and that they were free to withdraw at any time.
- **Discussion of Top 10 Driving Tips:** During the session, an author presented the top 10 driver errors identified in previous research, along with the associated driving tips for avoiding such errors. Each driving error was to be presented with a video example obtained from naturalistic driving databases.

- Detailed Discussion/Critiquing of Driving Tips: The participants were asked for their comments on each driving tip and its usefulness to CMV drivers. This step was conducted for each driver error individually. Participants were also asked how the driving tips could be modified to ensure their usefulness to CMV drivers. All participants actively participated in this step and provided comments, ideas, and suggestions.
- Final Comments: Following the discussion and critiquing of all driving tips for the 10 driver errors, subject matter experts were asked for final comments and suggestions. Participants were informed that they were welcome to send any additional comments and suggestions after the webinar. They were then thanked for their participation, and dismissed. The entire webinar session lasted approximately two hours.

3.4 RESULTS

While reviewing the driving tips, all participants actively participated in the discussions and made suggestions to modify the tips to make them relevant and practical for CMV drivers. Additional tips were also recommended for each driver error. It is important to note that while the driving tips presented to the participants have been supported by research, the suggested additional tips are based solely on expert opinion, and have not necessarily been empirically validated.

This section discusses the results of the webinar. The input obtained from the participants during Step 3 of the webinar procedure is organized below for each driver error, given in the order in which they were discussed. Note that the results from the webinar comprise the first round of revisions.

3.4.1 Driver Error #1: Traveling Too Fast for Conditions.

Operational definition: *Thieriez et al. (2002) stated that “driving too fast for conditions” is associated with drivers traveling at a speed that is greater than a reasonable standard of safe driving. Examples of too fast for conditions include traveling at an unsafe speed in conditions such as wet roadway (rain, snow, ice), reduced visibility (fog), uneven road, construction zones, curves, intersections, gravel roads, and high traffic. The LTCCS (FMCSA, 2005) study reported that 23 percent of crashes occurred when CMV drivers were traveling too fast for conditions.*

Driving Tip: *“In work zones, drive at or below the work zone’s posted speed limit.”*

As a result of the discussion, the following driving tip modifications were agreed upon:

- Decrease your speed before entering the work zone. This will allow you to enter the work zone safely.
- In adverse road and/or weather conditions, decrease your speed even further below the posted work-zone speed limit. Adverse conditions cause reduced traction and reduced visibility.

Driving Tip: *“In curves, maintain lower speed than the curve advisory because the shifted (high) center of gravity of trucks can cause a rollover.”*

As a result of the discussion, the following driving tip modifications were agreed upon:

- Decrease your speed before entering a curve. Decrease your speed more than the posted curve advisory speed limit. Tests have shown that trucks with a high center of gravity can roll over at the posted speed limit for a curve.
- Do not ever exceed the posted speed limit for a curve. You may roll over.

Driving Tip: *“Reduce Speed by about one-third on a wet road and one-half on packed snow.”* The participants seemed to disagree with the specifics of this tip. One of the experts suggested that stating fractions by which to reduce the speed is not helpful. The following driving tip modifications were agreed upon during the discussion:

- In adverse road and/or weather conditions, “substantially” reduce your driving speed. This will help you keep the vehicle under control.
- Schedule your trip by taking into account the effect of inclement weather on your driving. This will keep you prepared in adverse road and/or weather conditions.

Driving Tip: *“Drive slowly with a loaded trailer. Loaded trucks take twice as long to stop.”* As a result of the discussion, the following driving tip modification was agreed upon:

- A loaded vehicle is more difficult to control in adverse road and/or weather conditions. Slowing down will help you maintain vehicle control.

In addition to the modifications to the original driving tip as listed above, the following additional tips were suggested:

- Reduce speed before entering an on-ramp. A majority of CMV roll-overs occur on ramps. Anticipate your approach to ramps ahead of time and adjust your speed as necessary.
- Identify wet or slick surfaces. When the road is slippery, it will take longer to stop, and it will be difficult to turn without skidding.
- Adjust speed according to traffic in urban driving situations. For example, slow down when driving in the vicinity of pedestrians or in a municipal area.
- Drive at a speed that is comfortable to you. Do not succumb to “chatter from peers on CB radio” or pressure from other drivers to increase your speed.
- Keep your eyes moving to get the “big picture” of your driving environment.
- Scan the environment for potentially dangerous situations. Be prepared to account for others’ mistakes.

3.4.2 Driver Error #2: Unfamiliarity with Roadway.

Operational Definition: *In defining apparent unfamiliarity with the roadway, Klauer et al. (2006) stated that “Driver’s behavior is consistent with being lost in a particular location. Examples: performing repeated U-turns, reading maps/papers, etc.” (p. 87). In discussing distraction and road unfamiliarity, Pettit et al. (2005) stated that “When a driver is distracted from the primary driving task because they are lost, looking for street signs or buildings, and so on, it could be suggested that they have given priority to their route finding task at the expense of*

the safe control of their vehicle” (pp. 6–7). Unfamiliarity with roadway resulted in 22 percent of CMV crashes in the LTCCS (FMCSA, 2005) study.

None of the driving tips was modified based on participants’ input. However, the following additional driving tips were suggested:

- Use technology (for example, global positioning systems) to aid you when you are unfamiliar with the roadway. However, do not read a map or consult the computer while driving.
- Do not suddenly change your direction of travel if you miss a turn or an exit. Pass the turn and find a safe way to change direction.
- Slow down when traveling on unfamiliar roads. This will provide you more time to recognize road signs.

3.4.3 Driver Error #3: Inadequate Surveillance.

Operational Definition: *Thieriez et al. (2002) described inadequate surveillance as instances in which drivers reported that they “failed to look or looked but did not see.” Thieriez et al. gave examples of inadequate surveillance that include lane changes and turns at intersection where the driver looks in the required direction, but fails to recognize the approaching traffic. The LTCCS (FMCSA, 2005) reported that 14 percent of truck crashes are caused by inadequate surveillance.*

Driving Tip: *“Focus your eyes 12 to 15 seconds ahead. At lower speeds it is about one block in the city and at highway speeds it is about one-quarter of a mile.”*

The following modification to the above driving tip was agreed upon during the discussion:

- Focus your eyes at least 15 seconds ahead. This will allow you to react safely to approaching situations.

Driving Tip: *“Learn to recognize driving situations that can be hazardous.”*

The following modifications to the above driving tip were agreed upon during the discussion:

- Keep your eyes moving to get the “big picture” of your driving environment.
- Scan the driving environment for potentially dangerous situations. Be prepared to account for others’ mistakes.

Driving Tip: *“Check your mirrors regularly. Use them to spot overtaking vehicles and to know where other vehicles are around you.”*

The participants suggested that this tip would be more useful to CMV drivers if it was modified to provide a frequency range for checking mirrors. The following modification to this driving tip was agreed upon during the discussion:

- Check your mirrors every 5 to 6 seconds. Frequent scanning allows awareness of the passing and approaching traffic around you.

Driving Tip: “Assume other drivers will make errors.”

The following modification to the above driving tip was agreed upon during the discussion:

- Assume other drivers will make errors. Adjust your speed and allow enough space to prevent a conflict with other drivers.

Driving Tip: “Watch for brake lights from slowing vehicles.”

The following modification to this driving tip was agreed upon during the discussion:

- Focus on several lead vehicles ahead. Focusing far ahead helps to anticipate a braking/stopping situation.

In addition to the modifications to the original driving tip as listed above, the following additional tips were suggested:

- Watch the actions of other vehicles around you and expect trouble. Other vehicles may drift into your lane or make high-risk maneuvers.
- Drive defensively. Defensive driving is the ability to avoid accidents caused by the actions of others.
- As a professional driver, you should be checking what is going on around you to help you avoid getting in an accident.
- Check left-right-left before entering an intersection.

During the webinar session, it was pointed out that the following tip was similar to the driving tip of “Focus your eyes 12 to 15 seconds ahead” and that therefore it should be removed:

- “Scan far enough ahead to be able to react safely to approaching situations.”

3.4.4 Driver Error #4: Driver Fatigue.

Operational Definition: *Fatigue is the result of physical or mental exertion that impairs performance (Williamson et al., 1996). Thieriez et al. (2002) considered a driver to be fatigued when it was determined the driver had not received adequate sleep, was tired/fatigued due to extended work hours, was tired/fatigued due to strenuous recreational activities or strenuous non-work activities, or was tired/fatigued due to a combination of factors. The LTCCS (FMCSA, 2005) reported that 13 percent of truck crashes occurred due to driver fatigue.*

None of the driving tips for this driver error was modified based on participant input. However, during the discussion of driver fatigue, circadian rhythm was discussed. One participant mentioned that in his driver training program, trainers regularly educate drivers about the effects of circadian rhythm. In light of this discussion, the following additional driving tip was suggested:

- Drive within your body’s normal wake/sleep cycles (i.e., circadian rhythm) and keep those cycles in sync by making sure you get enough sleep. The circadian rhythm refers to the wake/sleep cycle that the body goes through each day and night. The cycle involves the internal clock and controls the daily pattern of alertness in a human body.

In addition, one participant suggested that it would be meaningful to link driver fatigue with impaired states. The participant mentioned a study (Dawson & Reid, 1997) that links fatigue-induced impairments to those caused by alcohol. The study suggests that “a person kept awake for 17 hours will perform at a standard comparable to that of someone with a blood-alcohol concentration (BAC) of 0.05 percent. After 24 hours without sleep, a person will have capabilities similar to someone with a BAC of 0.10 percent” (p. 235).

Also during the discussions, the following additional driving tip was suggested:

- Do not drive after a heavy meal. Your body will naturally want to rest after eating.

3.4.5 Driver Error #5: Illegal Maneuver.

Operational Definition: *Section 111 of the Motor Carrier Safety Act of 1999, described illegal maneuvers as making unsafe lane changes, following too closely, violating traffic laws, and disregarding traffic controls. Thieriez et al. (2002) state that drivers committed an illegal maneuver if, for example, they crossed full barrier lines while passing, passed on the right, turned right from the left lane or turned left from the right lane, initiated an illegal U-turn, failed to stop for a traffic control device, or drove the wrong way on a one-way road. Illegal maneuvers resulted in 9 percent of CMV crashes in the LTCCS (FMCSA, 2005) study.*

Driving Tip: “*When changing lanes, maintain proper spacing.*”

The following modifications to this driving tip were agreed upon during the discussion:

- Use turn signals first to indicate your intent to change lanes; next, visually scan for adjacent traffic and road hazards, and then execute a safe lane change.
- Make smooth and gradual lane changes of at least a 6-second time interval. This will allow you to compensate for other drivers’ errors.

Driving Tip: “*Do not drive alongside other vehicles. Drop back or pull forward.*”

The following modification to this driving tip was agreed upon during the discussion:

- Do not hover beside other vehicles. You could be in the other vehicle’s (or vehicles’) blind spot(s) and the driver(s) may not realize that you are there.

Driving Tip: “*Signal your intentions.*”

The following modification to this driving tip was agreed upon during the discussion:

- Signal your intentions early. This will help you communicate with surrounding drivers and safely execute driving maneuvers.

During the webinar session, it was pointed out that the following driving tips were too elementary and therefore should be removed:

- Do not drive faster than the legal posted speed limit.
- Do not engage in an illegal U-turn.
- Always yield when appropriate.

- Do not pass in no-passing zone.
- Do not cross double yellow lines.
- Read signs carefully and obey them. Obey all traffic laws.

3.4.6 Driver Error #6: Inattention.

Operational Definition: *Zaidel et al. (1978) defined inattention as a lapse in attention due to “wandering of mind” and recognition failure due to improper lookout, distraction, or misperception. In an effort to distinguish inattention from distraction, Pettit et al. (2005) stated that “The result of distraction is inattentive driving; however, inattention is not always caused by distraction” (p. 3). The authors list daydreaming and fatigue as some examples of inattention. Thieriez et al. (2002) used the inattention category for drivers who were typically focusing on internal thoughts (i.e., daydreaming, problem-solving, worrying about family problems, etc.) and not focusing attention on the driving task. The LTCCS (FMCSA, 2005) reported that 9 percent of truck crashes occurred due to driver inattention.*

Driving Tip: “Pay attention to the forward scene.”

The following modification to this driving tip was agreed upon during the discussion:

- Focus on several lead vehicles ahead. Focusing far ahead helps to anticipate a braking/stopping situation.

In addition to modifying the original driving tip listed above, the following additional tips were suggested:

- Keep your mind engaged with driving-related information. This will help you update the position of other vehicles around you.
- Keep your eyes moving to get the “big picture” of your driving environment.

3.4.7 Driver Error #7: External Distraction.

Operational Definition: *Pettit et al. (2005) suggested that “All forms of external distraction could be said to be non-driver-initiated, e.g., the unpredictable behavior of a drunk pedestrian” (p. 6). However, the authors also stated that a driver’s unfamiliarity with the roadway is one exception to non-driver-initiated external distractions. Some examples, as listed by Thieriez et al. (2002), for external distraction include searching for a street address, interacting with construction activity, looking at a building or scenery, looking at a sign, looking at a previous crash site, etc. It is also stated that distractions are distinguished from inattention in that distractions induce the driver to focus attention on the distraction. The LTCCS (FMCSA, 2005) reported that 8 percent of truck crashes occurred due to driver external distraction.*

Driving Tip: “Do not look at outside person, animal, store, object or event.”

The following modifications to this driving tip were agreed upon during the discussion:

- Do not fixate on non-driving-related objects. External distractions are dangerous. Dingus et al. (2006) reported that driver distraction was the most frequent factor in a crash or a near-crash.

- Make eye contact only with those who might be looking back at you. This will help keep you prepared to avoid any conflicts.

Driving Tip: *“Do not take your eyes off the road.”*

The following modifications to this driving tip were agreed upon during the discussion:

- Keep your eyes moving to get the “big picture” of your driving environment.
- Scan the driving environment for potentially dangerous situations. Be prepared to account for others’ mistakes.

During the discussion, participants pointed out that the following driving tip was too elementary and should be removed.

- Give the drive your full attention.

3.4.8 Driver Error #8: Following Too Closely.

Operational Definition: *Dingus et al. (2006) considered drivers to be following too closely when they did not allow adequate spacing between their vehicle and the lead vehicle. Thieriez et al. (2002) stated that following too closely to respond to unexpected situations “is used for situations in which one vehicle is following another vehicle so closely that even if the following driver is attentive to the actions of the vehicle ahead, he/she could not avoid a collision in the circumstance when the lead driver brakes suddenly.” The LTCCS (FMCSA, 2005) reported that 5 percent of large-truck crashes occurred when the CMV driver was following the lead vehicle too closely.*

Driving Tip: *“Leave enough space ahead in case you must suddenly stop.”*

The following modifications to this driving tip were agreed upon during the discussion:

- Maintain proper following distance to enhance your ability to see further.
- Leave at least 15 to 20 ft of free space in front of your vehicle when stopped. This will prevent you from being “pinned in” in conditions of stopped traffic.

Driving Tip: *“At speeds below 40 mi/h, maintain at least 1second for each 10 ft of vehicle length,”* and

Driving Tip: *“At speeds above 40 mi/h, add a second for safety.”*

The following modification to the above driving tips was agreed upon during the discussion:

- When following vehicles, maintain at least a 6-second time interval. Rear-end crashes lead to automatic liability.

In addition to modifying the original driving tip listed above, the following additional tips were also suggested:

- In adverse conditions, double your following distance. This will allow you to stop in time.

- Focus on several lead vehicles ahead. Focusing far ahead helps to anticipate a braking/stopping situation.

3.4.9 Driver Error #9: Internal Distraction.

Operational Definition: *Pettit et al. (2005) stated that “internal distractions can be categorized as both driver-initiated, e.g., making a mobile phone call, or non-driver-initiated, e.g., the unpredictable actions of a passenger” (p. 6). Some examples listed by Thieriez et al. (2002) for internal distractions included tuning the radio, adjusting the heating/cooling system, engaging in a conversation with a passenger, using a cell phone, retrieving fallen objects, reading books/magazines/maps/invoices, etc. The LTCCS (FMCSA, 2005) reported that 2 percent of truck crashes occurred due to driver internal distraction.*

Driving Tip: “Clear the vehicle of any unnecessary objects.”

The following modification to this driving tip was suggested during the discussion:

- Place in-cab objects out of reach to avoid internal distraction.

Driving Tip: “Do not use a cell phone while driving. Cell phones and radios are visual and cognitive distracters.”

The following modification to this driving tip was suggested during the discussion:

- Turn off your cell phone while driving. Cell phones are visual and cognitive distracters.

Driving Tip: “Avoid eating and drinking while you drive.”

The following modifications to this driving tip were suggested during the discussion:

- Minimize eating and drinking behaviors while driving to avoid any distractions.
- Do not place large drinking cup(s) on the dash. Large cup(s) could block your visibility.

3.4.10 Driver Error #10: Inadequate Evasive Action.

Operational Definition: *Thieriez et al. (2002) described inadequate evasive action as instances in which drivers are braking only, and/or not braking and steering in response to a conflict situation. Thieriez et al. coded drivers with inadequate evasive action in situations where they failed to execute a proper evasive maneuver by not using sufficient steering inputs, not using sufficient brake pedal, or not using a combination of steering and braking inputs. Hickman et al. (in press) reported that 14 percent of safety-critical events occurred when the CMV driver executed an inadequate evasive action.*

None of the original driving tips presented was modified based on participant input. However, the following additional driving tip was suggested:

- Practice good scanning habits and maintain proper spacing to avoid the need for evasive action.

3.5 SUMMARY

During the webinar session, all participants actively joined in the discussion. The comments obtained were relevant and useful in the development of the final set of driving tips.

While discussing the driving tips for each driver behavioral error, participants unanimously suggested that the tip include a reason *why* it is important. Safety managers believed this would help CMV drivers remember the driving tips. For some of the driving tips, the safety managers thought that they were too elementary and should be replaced with more compelling tips for CMV drivers. In discussing the usefulness of various driving tips, the researchers and participants agreed that some driving tips could be repeated for different driver errors, where applicable. It was also agreed that the CMV Web-Based Driving Tips Website should allow its audience to leave feedback, in order to keep the driving tips information content up-to-date with current driving practices and safety procedures.

The safety managers were receptive to many of the driving tips presented. Throughout the webinar session, the participants suggested many new creative and thoughtful modifications to the driving tips, as well as suggestions for additional ones. Overall, the webinar session was successful in terms of receiving valuable input from fleet managers regarding the various CMV driving tips.

4. WEBSITE TECHNICAL REQUIREMENTS

4.1 TECHNICAL REQUIREMENTS

To ensure that the Driving Tips website content was submitted in a format suitable for placement on FMCSA's website, site technical requirements were obtained from FMCSA's website managers and staff. On December 14, 2007, a teleconference meeting was conducted between project personnel and website staff to discuss and obtain the technical requirements of the CMV Web-Based Driving Tips Website from FMCSA's website managers and staff. Discussion topics included:

- Website Section 508 compliance requirements.
- HTML coding requirements.
- Uploading of video content and inclusion procedure.
- Navigational links.
- Website search and site meter.
- CMV Web-Based Driving Tips Website content development.

4.2 SUMMARY

The teleconference meeting resulted in a successful discussion and understanding of the required website technical requirements and team responsibilities. The information and suggestions obtained from this discussion supported the remainder of the project work.

5. OBTAINING PERMISSION TO USE VIDEOS

5.1 DRIVER PERMISSION

One of the key parts of the development of the CMV Web-Based Driving Tips Website was the inclusion of include real-world video clips of safety-critical events captured in the DDWS FOT. The drivers in the DDWS FOT study signed a consent form that allowed researchers to use their videos for research purposes only. This project does not fall under the rubric of research purposes. Therefore, to include these videos for training purpose on a public website, special driver permission was sought.

This chapter summarizes the procedure used to contact selected drivers and to obtain permission to use videos of them for the CMV Web-Based Driving Tips Website. First, several video clips were reviewed and selected to represent various common driver error scenarios that will be candidates for the final CMV Web-Based Driving Tips Website. Next, driver permission to use the selected video data clips on the website was obtained. The details of these subtasks are discussed in the following paragraphs.

5.1.1 Review and Selection of Video Data Clips

Based on the top 10 driver error categories identified in Task 3 of this project, video data from the DDWS FOT study database was reviewed. As part of the review process, one video for each of the 10 error categories was selected. Each video contained a different driver. As a result, a total of 10 videos, each with a different driver, was initially selected. However, considering the challenge of re-establishing contact with each of these 10 drivers from the study, an additional 20 videos with different drivers were selected. This strategy was used as a precaution in case some of the drivers initially identified could not be contacted or otherwise objected their video being used for this purpose. Once the videos were selected, they were edited in preparation for use on the CMV Web-Based Driving Tips Website.

5.1.2 Contacting Drivers

Next, the drivers shown in the selected video clips were contacted to obtain permission to use their videos on the website. Despite the numerous challenges faced in obtaining driver contact information from the available sources, contact was established with 13 drivers, although two of these drivers indicated that they did not wish to participate. (Note that to ensure company good will, each participating driver's company was contacted beforehand and to secure permission to contact their drivers. In response, all companies approached gave permission to contact their drivers.)

5.1.3 Obtaining Driver Permission/Consent to Use Videos

All drivers granted permission to use their video data clips on the website. Based on legal input, the preliminary procedure for obtaining electronic consent was modified to a procedure which involved obtaining a signed hard copy of the informed consent document. As per the revised method, participants received two hard copies in the mail (one copy for them to keep and the other to mail back) of the informed consent document (Appendix B) and instructions explaining how to view their password-protected video data clips on a secure website (Appendix C). This

was necessary to ensure receipt of a signed and valid informed consent document from the participants, and to allow participants to view their video data clips at a convenient time and location.

Upon reviewing the videos, the participating drivers completed the informed consent document and mailed it back. Due to the limited number of contacts established with drivers, for some driver error categories permission to use multiple video data clips was sought from that same driver. This was necessary to ensure that each driver error category was supported with an example of at least one relevant video data clip. As a result of this effort, 11 consents were secured for 16 video clips.

5.2 SUMMARY

This section outlined the review, selection, and editing of video data clips, as well as the search for permission from drivers to use their selected video data. Despite the challenges faced in contacting drivers (given their transient nature), permission was obtained from 11 drivers.

6. DEVELOPMENT OF THE CMV WEB-BASED DRIVING TIPS WEBSITE

6.1 WEBSITE FORMAT

Key results gathered from the literature review, focus group research, website technical requirements, and selection of naturalistic video examples were used to organize the driving tips content in a layout suitable for the FMCSA website. The driving tips content is supported with video examples, where applicable. For each video, a brief description was generated which preceded a series of training questions, serving as a web-based training tool.

The website includes an introductory homepage and eight categories of driver error, each with a navigation link to a separate web page. The homepage welcomes the audience to the CMV Web-Based Driving Tips Website and provides a brief overview of the purpose of the site, its organization, and instructions on how to use it. Each of the driver error category web pages includes key information content. First, an operational definition of the driver error is provided, followed by the driving tip content (such as the importance of each driving tip), “did you know?” fact(s), naturalistic driving video example(s), and training exercises. Screenshots of the final CMV Web-Based Driving Tips Website are shown in Appendix D.

6.2 DRAFT REVISION PROCESS

The draft content of the website was submitted to website staff for coding, so that the content could be viewed in the final website format. A review committee was formed, consisting of FMCSA staff, five subject matter experts from the original focus group, and project staff. Each person was asked to review the website and to provide any feedback on its content. Once all feedback was received, all comments were incorporated, and changes were sent to website staff for the coding of the second draft of the website. An iterative review process took place until the final website was ready.

7. SUMMARY

The main objective of this study was to develop a CMV Web-Based Driving Tips Website to be used by CMV drivers and fleet safety managers to show common large-truck driving errors and to provide tips on how to avoid such errors. The site would be hosted on the FMCSA website and accessible to the public. The site is intended to be used as a supplemental driving training tool and is not intended to replace any of the classroom or on-road training methods that are currently being used. The website contains real-world video clips of CMV drivers who were recorded making various driving errors. It is hoped that the CMV Web-Based Driving Tips Website, with support from the naturalistic driving video clips, will provide drivers with compelling information to support safe driving.

The following is a brief summary of the tasks completed by to produce the final website. First, a literature review was conducted to provide empirical evidence on the importance of the suggested driving tips and to show supporting research for each tip. The driving tips categories (Too Fast for Conditions, Unfamiliarity with Roadway, etc.) were based on some of the key error categories identified in the LTCCS (FMCSA, 2005), which investigated large-truck crashes between 2001 and 2003 and determined the main cause of each crash. The most common contributing factors were selected as a starting point for the current study. The top 10 contributing factors from the LTCCS were chosen and supporting evidence was gathered for each. In addition, real-world video clips were selected for each category to show drivers using the website what mistakes may occur if they do not practice safe, defensive driving. The video clips were recorded during the DDWS FOT data collection project, wherein 103 drivers drove instrumented trucks over the course of 18 months. The system collected data continuously, resulting in a large dataset of safety-critical events. Since the LTCCS data coding manual was used during data reduction of the DDWS FOT data, it was possible to find video clips representing each of the top 10 categories. Once video clips were selected, special permission was obtained from each driver to include his or her video clip(s) on the website.

Next, a webinar with five subject matter experts presented the preliminary driving tips and solicited feedback on what might be most relevant to CMV drivers, optimal ways to present the information, and any other suggestions they might have. All notes from the webinar were combined to develop a first draft of the website. The draft website content was submitted to website staff so that it could be formatted to the FMCSA website specifications and the video clips could be inserted. Once the draft site was complete, it went through several iterations, as a result of review by FMCSA staff, project staff, and the subject matter experts from the webinar, culminating in the final website. The final CMV Web-Based Driving Tips Website is on FMCSA's website: <http://www.fmcsa.dot.gov/about/outreach/education/driverTips/index.htm>

It is expected that as fleet safety managers and drivers use it, updates and modifications may be required. For example, to stay current as new research is conducted, it is recommended that relevant results be included and the website be updated. During the project final briefing, a few specific improvement areas were identified that could be implemented in the next revision. Each of these improvement areas is described in more detail below.

7.1 CMV DRIVER FEEDBACK

As part of the CMV Web-Based Driving Tips Website development, a webinar with five subject matter experts was held. This group was comprised primarily of fleet safety managers from large truck fleets. During the webinar, the subject matter experts gave feedback on the content of the website and how relevant they believed the information would be to CMV drivers. This information was very useful and was used to develop the final version of the site. However, feedback was not obtained directly from CMV drivers. One way to obtain such feedback would be to include a brief questionnaire on the site, so that users (i.e., CMV drivers and fleet safety managers) could provide their feedback on specific areas, such as the look and feel of the website and its usability and content. The results from these questionnaires could be used for subsequent modifications and improvements.

7.2 VIDEO NARRATION

As mentioned previously, real-world video examples are used throughout the website to show CMV drivers what may result from specific driving errors. The video examples are followed by a brief narrative description describing the situation that unfolds in the video. Because of the format of the website and the four camera views in video examples, users may have to watch the videos several times to determine what is taking place. In the next revision of the website, it may be useful to include video captions (such as closed captioning on a television) in the appropriate camera view or a voice-over narration of the video clip, so that users can more easily follow what is happening while the video is playing.

7.3 VISOR TIP SHEETS

A third suggestion that came from the project final briefing was to develop a “cheat sheet”-type resource that CMV drivers could take with them and perhaps clip to their cab visor. An overview and brief description of the driver errors from the website would provide drivers with useful and easily accessible information. This resource would support the more detailed content available on the site and provide drivers with a brief take-along document to support safe driving.

APPENDIX A: INFORMED CONSENT DOCUMENT FOR WEBINAR WITH FLEET SAFETY MANAGERS

Informed Consent Form

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Informed Consent for Participants of Investigative Projects

Title of Project: Defensive Driving Tips For CMV Drivers: An Internet-Based Approach
Investigators: Rich Hanowski, Santosh Gupta, Stephanie Baker

I. The Purpose of this Research/Project

The purpose of this webinar project is to obtain your expert opinions and ideas on driving tips for commercial motor vehicle (CMV) drivers. The feedback obtained during this webinar will help the Virginia Tech Transportation Institute (VTTI) generate appropriate driving tips that may be used to assist CMV drivers and carriers in enhancing driver performance and driving safety.

II. Procedures

You will be taking part in a one and one half hour webinar session. During the course of the webinar, you will be asked to anonymously provide your ideas and critiques regarding the 'Driving Tips and Video examples' that are presented to you. The discussions occurring during the entire webinar session (including your comments) will be continuously recorded by the web-hosting client's software. Video conferencing is not a requirement for participation in the webinar. Use of video is left to the discretion of each participant.

III. Risks

There are no more than minimal risks involved in participation. As individuals provide their opinions and input, some may find that others might not agree completely with them. This may cause some mild discomfort. However, to minimize this risk, the facilitator will ensure that the discussion remains productive.

IV Benefits of this Project

No promise or guarantee of benefits will be made to encourage you to participate. You may find participation in the webinar to be interesting and informative and your participation may inform the development of driving tips that will benefit CMV drivers and fleet carriers.

V. Extent of Anonymity and Confidentiality

Since the primary focus of this study is to discuss/critique the information presented during the webinar, all participating members will be able to view other participant's comments and ideas. However, upon completion of the webinar session and dismissal, a code will be created for each fleet safety manager to ensure their anonymity and confidentiality. Your name will be separated from your personal data and comments. A coding scheme will be employed that will assign a

unique number to you (e.g., Participant No. 1) that will then be used to identify your comments. Data collected will be stored at the Virginia Tech Transportation Institute and access to the data will be under the supervision of Dr. Rich Hanowski and Santosh Gupta.

VI. Compensation

There will be no compensation for participation in this webinar.

VII. Freedom to Withdraw

As a participant in this research, you are free to withdraw at any time for any reason without any penalty.

VIII. Approval of Research

This research was approved by the Institutional Review Board for Research Involving Human Subjects at Virginia Polytechnic Institute and State University. This form is valid for the period listed at the bottom of the page.

IX. Participant Responsibilities

If you voluntarily agree to participate in this study, you will have the following responsibilities:

1. Review the Driving Tips PowerPoint presentation prior to the webinar.
2. Log in to the webinar session at the agreed upon date and time.
3. Provide responses (i.e., ideas, opinions, critiques, etc.) during the webinar.
4. Respect the opinions of others.

X. Participant's Permission

I have read and understand this document and the conditions of this webinar project. I have had any questions regarding this informed consent document answered via correspondence with Santosh Gupta. I hereby acknowledge the above and give my voluntary consent for participation in this webinar project.

By logging in to the webinar session, I understand that I am providing my consent to VTTI for participation.

If I participate, I may withdraw at any time without penalty and may refuse to answer any questions.

Should I have any questions about this research or its conduct, I may contact:

Santosh Gupta	(540) 231-1049
Rich Hanowski	(540) 231-1513
David Moore (Institutional Review Board Chair)	(540) 231-4991

APPENDIX B: INFORMED CONSENT DOCUMENT FOR OBTAINING DRIVER PERMISSION TO USE VIDEO CLIPS

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Informed Consent for Participants of Investigative Projects

Title of Project: Defensive Driving Tips For CMV Drivers: An Internet-Based Approach
Investigators: Rich Hanowski and Santosh Gupta

I. The Purpose of this Research/Project

The goal of this study is to provide large truck drivers with examples of what truck drivers do well and what behaviors need to be changed. The ideas and safe driving tips will be useful for driver safety programs and training for common large truck safety events.

II. Procedures

During the course of this experiment you will be asked to perform the following tasks:

1. Log in to VTTI's secure website.
2. Review your video clip(s) for which the consent is required; alternatively, if you do not want to review the video clips, you can consent to our use of the clips without reviewing them.
3. Log out of the website.
4. Provide your consent to use your video clip(s) for the defensive driving tips website by:
 - a. Marking the appropriate checkbox in the 'Participant's Acknowledgement' section on page 3 of this document, and
 - b. Signing and printing your name in the 'Participant's Permission' section on page 3 of this document.
5. Complete the W-9 form in its entirety and sign it.
6. Mail back the completed informed consent form and the W-9 form back to VTTI using the self-addressed stamped envelope.
7. Receive your payment for participating in this study.

III. Risks

There are risks or discomforts to which you may be exposed by providing your consent for this research. They include the following:

1. Your video clip(s) will be accessible to the general public via the internet.
2. Your video clip(s) will show your face, the forward view, side views, and your actions in response to the driving situation as demonstrated through the video.
3. Through your video clip(s), you may be identified by those who know you.
4. There is a risk of the website's security being breached by a hacker or for the website content to be accessed for purposes not related to this study. For example, individuals may be able to "hack" the website to allow them to save the video content on their personal computer and circulate it for other purposes.

The following precautions will be taken to ensure minimal risk to you:

1. The video clip(s) will be posted on the website in "view-only" format. This limits one's ability to save the video content to their computer hard-drive.
2. The video clip available on the website will be free of content that may create any undue risk to your identification. For example, specific areas in the video that may reveal your truck company name, your name tag, etc., will be edited out/concealed.
3. Your video clip(s) will not reveal your name or your affiliation to your employer.
4. All reasonable and appropriate security and website design measures will be taken to minimize the risk of the website being breached by an outside party.

IV. Benefits of this Project

While there are no direct benefits to you from this research, you may find the study and its goals interesting. Participation in this study may contribute to the improvement of commercial motor vehicle driver training. No promise or guarantee of benefits is made to encourage you to participate.

V. Extent of Anonymity and Confidentiality

Your data in this study will be treated with confidentiality. The researchers will release only that data that you consent to use on the public website. If you choose to not give your consent, VTTI will not turn over the digital video of your image to anybody.

VI. Compensation

You will be paid \$100 per video clip that is used. Upon receiving the signed informed consent document and completed W-9 form, VTTI will mail a check to you. If your payments are in excess of \$600 dollars in any one calendar year, then by law, Virginia Tech is required to file Form 1099 with the IRS. For any amount less than \$600, it is up to you as the participant to report any additional income as Virginia Tech will not file Form 1099 with the IRS. Also note that you must provide your social security number on the W-9 form to allow us to process your

payment. For tax recording purposes, the fiscal and accounting services office at Virginia Tech requires that all participants provide their social security number on the W-9 form to receive payment for participation in our studies.

VII. Freedom to Withdraw

If you feel you need to withdraw from this study, you are free to do so without any penalty. Once the website is finalized, it will be under the control of the Federal Motor Carrier Safety Administration. If at a later time you decide you would like your video(s) removed from the website, you may contact the Virginia Tech Transportation Institute at 540-231-1500 (ask for the Center for Truck and Bus Safety) and every effort will be made to remove your video clip(s) from the website.

VIII. Approval of Research

Before data can be collected, the research must be approved, as required, by the Institutional Review Board for Research Involving Human Subjects at Virginia Polytechnic Institute and State University. You should know that this approval has been obtained. This form is valid for the period listed at the bottom of the page.

IX. Subject's Responsibilities

If you voluntarily agree to participate in this study, you will have the following responsibilities:

1. You will have the opportunity to review your video clip(s) online using the secure website.
2. On the website, you may review your video clip(s) as many times as you like.
3. On the website, upon reviewing the video clips, you will complete this informed consent document by marking the appropriate check-box in the 'Participant's Acknowledgement' section and signing and printing your name in the 'Participant's Permission' section below.

X. Participant's Acknowledgments

Check the following:

I do **not** have any objections to VTTI using my selected video clip for this project and I've been informed of the possible risks of signing this consent form.

I do **have objections** to VTTI using my selected video clip(s) on the public website and I do not wish to give my consent to participate in this study.

XI. Participant's Permission

I have read and understand the Informed Consent and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent for participation in this project and understand that I must provide a copy containing my signature in a manner indicated above. If I participate, I may withdraw at any time without penalty and request that my video clip(s) be removed from the website.

By signing and printing my name below along with today's date I provide my consent to VTTI to use my video data and I agree to abide by the rules of this project.

Participant's Signature	Participant's Name (Print)	Date
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Experimenter's Name (Print)	Initial	Date
-----------------------------	---------	------

Should I have any questions about this research or its conduct, I may contact:

Santosh Gupta	(540) 231-1049
Rich Hanowski	(540) 231-1513
David Moore (Institutional Review Board Chair)	(540) 231-4991

APPENDIX C: COVER LETTER FOR DRIVER INSTRUCTIONS

[DATE]

Subject: Instructions to participate in the defensive driving tips study.

Dear [Participant's Name]:

The Virginia Tech Transportation Institute would like to thank you for agreeing to review these materials for our "Driving Tips" study. The purpose of this study is to develop a webpage on defensive driving safety information with video examples of "do's" and "don'ts" for commercial motor vehicle drivers. This webpage will be accessible to the general public via the Federal Motor Carrier Safety Administration's (FMCSA) website.

To view your video clip(s), please go to <https://webdav.hosting.vt.edu/www.secure.vtti.vt.edu/DrivingTips/Truck01> and log in to this website by entering the following information in the username and password fields:

Username: XXXX

Password: XXXX

After logging in, you will be given instructions for how to review your video(s) and indicate whether you are willing for it/them to be on the website.

If you wish to give your consent for use of your videos without reviewing them, you have the option to do so. Please just complete and return the informed consent form provided.

Enclosed you will find two copies of Informed Consent Form as well as the W-9 form that was mentioned during our telephone conversation. One copy of the informed consent form is for you to keep and the other copy is for you to send back to us. Please read the Informed Consent form and complete it by marking the appropriate check box either allowing/declining use of your video clip(s) on the public website. If you are willing to participate please also complete the W-9 form providing your name, social security number, address and your signature. This form is used for tax purposes only and will enable us to compensate you \$100 per video clip used. Please note that for tax recording purposes, the fiscal and accounting services office at Virginia Tech requires that all participants provide their social security number on the W-9 form to receive payment for participation in our studies.

Once these forms have been completed, please use the self-addressed stamped envelope provided to mail them back to us. Your prompt response to this will allow for faster processing of your payment. Again, thank you for your time. If you have any questions please feel free to call me at 540-231-1088, or email me at kstanley@vti.vt.edu and I will be happy to answer your questions.

Sincerely,

Kelly Stanley

APPENDIX D: SCREENSHOTS OF FINAL CMV WEB-BASED DRIVING TIPS WEBSITE

CMV WEB-BASED DRIVING TIPS

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/index.htm>

U.S. Department of Transportation Keyword Links | Contact Us | Español

Federal Motor Carrier Safety Administration

Home | Rules & Regulations | Registration & Licensing | Forms | Safety & Security | Facts & Research | Cross Border | About FMCSA

Home > About FMCSA > CMV Web-Based Driving Tips Search All FMCSA Sites

CMV Web-Based Driving Tips Print

Even the most well-trained, safety-conscious Commercial Motor Vehicle (CMV) driver is at risk of engaging in driving behaviors that could lead to a crash on today's crowded highways. Weather conditions or road conditions change and suddenly "driving too fast for conditions" becomes a risk factor. Failing to look or looking and not seeing, impaired performance because of fatigue, inattention or daydreaming or an unexpected external distraction can all lead to a truck crash.

This Web site was developed to raise the consciousness of CMV drivers about common driving errors and to provide valuable driving tips through an easily accessible tool, the Internet. Fleet safety managers can also use this Web site for their driver training programs. These tips offer preventive measures that CMV drivers can take to help avoid crashes.

The driving tips, ideas, and suggestions on this Web site are supported with real-world video clips (25- to 30-second video clips) recorded in a naturalistic (open roadway, non-test track) driving study conducted by the Virginia Tech Transportation Institute (VTTI). The video clips show examples of driver errors that will serve to motivate CMV drivers to become safer drivers and thereby avoid dangerous driving situations. Also, as a training exercise, each video clip is followed by a set of questions to help encourage you to think about and examine the driver's behavior.

Please click on any of the error categories (left navigation bar) under the "Driving Tips" section. Under each category you will find driving tips, interesting facts, video clips, a video description, and the training exercise questions.

- Project Background
- Failure to Buckle Up
- Too Fast for Conditions
- Unfamiliar Roadway
- Inadequate Surveillance
- Driver Fatigue
- Driver Distraction
- Following Too Closely
- Inadequate Evasive Action
- Documents
- References

CMV WEB-BASED DRIVING TIPS PROJECT BACKGROUND

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Project-Background.htm>

U.S. Department of Transportation Keyword Links | Contact Us | Español

Federal Motor Carrier Safety Administration

[Home](#) | [Rules & Regulations](#) | [Registration & Licensing](#) | [Forms](#) | [Safety & Security](#) | [Facts & Research](#) | [Cross Border](#) | [About FMCSA](#)

Home > [About FMCSA](#) > CMV Web-Based Driving Tips Project Background Search All FMCSA Sites

CMV Web-Based Driving Tips Project Background Print

↑ Outreach & Education

CMV Driving Tips

- [Project Background](#)
- [Failure to Buckle Up](#)
- [Too Fast for Conditions](#)
- [Unfamiliar Roadway](#)
- [Inadequate Surveillance](#)
- [Driver Fatigue](#)
- [Driver Distraction](#)
- [Following Too Closely](#)
- [Inadequate Evasive Action](#)
- [Documents](#)
- [References](#)

Because "driver error" is a primary contributing factor in large-truck crashes, the Commercial Motor Vehicle (CMV) web-based driving tips project was developed to provide defensive driving safety information to CMV drivers. Several studies, including many conducted by FMCSA-VTTI, identified specific driver behavior and performance errors, or "error categories." For example, the 2002 Large Truck Crash Causation Study (LTCCS) results assigned the critical reason to large trucks in 55 percent of the crashes studied and to driver errors in 87 percent of the cases. The 2005 Drowsy Driver Warning System Field Operational Test (DDWS FOT) results assigned the critical reason to large trucks in 71 percent of safety-critical events and to driver errors in 57.9 percent of safety-critical events. The LTCCS critical event framework was used as a basis for the error categories in this project.

Driving tips relating to each error category were developed from a literature review of previous research. Specific video examples from the DDWS FOT are used to support each category, and special permission was obtained from the drivers whose videos are used in this project. The image below shows the four camera views in each video.



Forward view - In the top right corner is an image forward roadway. In this picture you can see the truck and a two-lane, divided road. There are vehicles on the road.

VTTI hosted a webinar where five subject matter experts, who were mostly fleet safety managers, reviewed this Web site. They provided comments and suggestions on the relevance of the content to the intended audience (CMV drivers and fleet safety managers) and the readability and flow of the Web site. The webinar feedback was used to develop a prototype of the Web site. The Web site was reviewed a second time by the same subject matter experts, FMCSA staff, and VTTI staff. Additional input from the second review was incorporated into the final Web site.

CMV WEB-BASED DRIVING TIPS: FAILURE TO BUCKLE UP

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/safetyBelt.htm>

The screenshot shows the website for the Federal Motor Carrier Safety Administration (FMCSA). At the top, there is a navigation bar with links for Home, Rules & Regulations, Registration & Licensing, Forms, Safety & Security, Facts & Research, Cross Border, and About FMCSA. Below this is a search bar and a breadcrumb trail: Home > About FMCSA > Failure to Buckle Up. The main content area is titled "Failure to Buckle Up" and includes a "Print" button. The text explains that a safety belt is a harness designed to secure occupants and is the most important in-cab safety device. It cites the National Highway Traffic Safety Administration (NHTSA) and the Large Truck Crash Causation Study (LTCCS). A sidebar on the left lists "CMV Driving Tips" such as "Failure to Buckle Up", "Too Fast for Conditions", "Unfamiliar Roadway", "Inadequate Surveillance", "Driver Fatigue", "Driver Distraction", "Following Too Closely", "Inadequate Evasive Action", "Documents", and "References".

U.S. Department of Transportation Keyword Links | Contact Us | Español

Federal Motor Carrier Safety Administration

Home | Rules & Regulations | Registration & Licensing | Forms | Safety & Security | Facts & Research | Cross Border | About FMCSA

Home > About FMCSA > Failure to Buckle Up Search All FMCSA Sites

Failure to Buckle Up Print

A safety belt, often referred to as a seat belt, is a harness designed to secure occupants inside the vehicle, and you have to buckle up to use it. Without question, a safety belt is the most important in-cab safety device that will protect an occupant in the event of a sudden stop or crash. The National Highway Traffic Safety Administration (NHTSA) notes that in 2001, safety belts saved over 12,000 American lives.¹

Safety belts are not just for light-vehicle drivers and occupants, but must also be worn by Commercial Motor Vehicle (CMV) drivers. Though some drivers may have excuses for not buckling up,² such as thinking the belt is uncomfortable, the data are clear that wearing your safety belt can save your life.³ The Large Truck Crash Causation Study (LTCCS) reported that 23 percent of combination truck, single-vehicle crashes involved the driver not wearing a safety belt.⁴ A Virginia Tech Transportation Institute (VTTI) naturalistic study of truck driver safety belt use found that in baseline events (i.e., non-crash), 39.6 percent of drivers were un-belted. However, in incidents, that number jumped to 66.5 percent indicating that not wearing a safety belt may be indicative of other risky driving behaviors.⁵

Below are some tips on the benefits of wearing safety belts.

↑ Outreach & Education

CMV Driving Tips

- Project Background
- Failure to Buckle Up**
- Too Fast for Conditions
- Unfamiliar Roadway
- Inadequate Surveillance
- Driver Fatigue
- Driver Distraction
- Following Too Closely
- Inadequate Evasive Action
- Documents
- References

CMV WEB-BASED DRIVING TIPS: FAILURE TO BUCKLE UP

TIP #1: Always Wear Your Safety Belt

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/safetyBelt.htm>

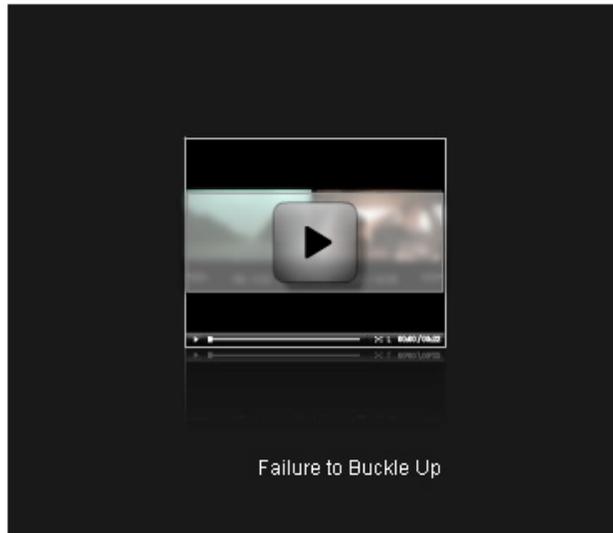
References

TIP # 1: Always Wear Your Safety Belt

It is critical that when you are driving, either short distances or on long trips, you should always wear your safety belt. It is also critical that if you have a passenger, he/she should buckle up as well. In case of a sudden stop or crash, a safety belt will keep you secured to the seat, helping prevent injury or death that may occur from you being thrown from your seat into the steering wheel, dash, or windshield. From 2001 data, NHTSA reported that 60 percent of all passengers killed in traffic crashes were unrestrained.⁶

Did You Know? Wearing your safety belt is the law, and violations are subject to monetary fines? Section 392.16 of the Federal Motor Carrier Safety Association (FMCSA) Regulations indicates that a CMV which has a seat belt assembly installed at the driver's seat shall not be driven unless the driver has properly restrained himself/herself with the seat belt assembly.⁷

An example of a driver not wearing his safety belt is shown in the video clip below. This video clip is from DriveCam.⁸ Training exercise questions follow the video clip.



VIDEO DESCRIPTION: The driver, who is not wearing his safety belt, is driving on a divided highway. He is drowsy and loses control of this vehicle. He crashes into the guard rail on the right shoulder and then spins out of control back across the highway. He rolls and crashes against the median guardrail. During this sequence, the driver, because he is not wearing his safety belt, is tossed around the cab and ends up in the back seat, smashing his head on the rear-side window.

TRAINING EXERCISE: After viewing the video, try to answer the following questions:

- What poor driving habits with regard to steering control did you notice?
- What does the driver do just before losing control of his vehicle?
- Are you surprised at how the un-belted driver was tossed around in the cab?
- Based on the integrity of the seats and cab at the end of the clip, do you think a safety belt would have prevented injury for this driver?

CMV WEB-BASED DRIVING TIPS: FAILURE TO BUCKLE UP

TIP #2: Safety Belts Prevent Ejection from a Vehicle in a Crash

TIP #3: Even the Best Drivers Need to Wear Safety Belts at All Times

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/safetyBelt.htm>

TIP # 2: Safety Belts Prevent Ejection from a Vehicle in a Crash

Many people mistakenly believe it's better to be thrown clear of the wreckage in the event of a crash, but this could not be further from the truth. The fact is an occupant is four times as likely to be fatally injured when thrown from the vehicle. In 2006, 217 truck occupants and drivers died when they were ejected from their cabs during a crash.³

Did You Know? When you are not wearing a safety belt, your chances of being killed are almost 25 times higher if you are thrown from a vehicle in a crash.⁹ Safety belts can keep you from being thrown through the windshield, from being dragged and scraped along the ground, or from being crushed by your own truck or another vehicle.

Did You Know? Danny Cloud, a 51-year-old McAlester man, was killed on January 22, 2008, when his pickup collided with a tractor-trailer rig in Hughes County, OK. Cloud's pickup went left of center, hit the semi and became lodged under it. Cloud was pinned for two hours and was pronounced dead at the scene of the crash. The semi was driven by 59-year-old Anthony Wayne Green of McAlester who was also pinned for 1 ½ hours. He was taken to McAlester Regional Hospital with arm and back injuries. Neither Green nor Cloud wore a safety belt nor had any passengers.¹⁰

Did You Know? Michael Berggren, a 55-year old truck driver, was fatally wounded in a crash while not wearing a safety belt. Involved in a single-vehicle rollover on December 26, 2006, Berggren was ejected from the truck cab, which resulted in the truck rolling over him and crushing his chest. Berggren's employer and spouse indicated that he habitually wore his safety belt.¹¹ This tragic story highlights that drivers must buckle up each and every time, with no exceptions.

TIP # 3: Even the Best Drivers Need to Wear Safety Belts at All Times

While good drivers do not usually cause accidents, it is possible that during your driving career you will be involved in a crash caused by a bad driver, bad weather, mechanical failure, or tire blowout. Wearing a safety belt prevents injuries and fatalities by preventing ejection and by protecting your head and spinal cord.³

Did you know? On March 17th, 2008, Joseph Karichu of Colony, Texas, was involved in a crash after his truck cab fell nearly 40 feet. Karichu was traveling north on I-380 near Cedar Rapids when he swerved to avoid a car, hit the guardrail, and went up and over the railing, falling 40 feet below. Police noted that because he was wearing his lap and shoulder safety belt, Karichu walked away from the crash.¹²

CMV WEB-BASED DRIVING TIPS: TOO FAST FOR CONDITIONS

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Too-Fast-for-Conditions-all.htm>

The screenshot shows the FMCSA website header with the U.S. Department of Transportation logo and navigation links. The main banner features a truck and bus against an American flag background. A red navigation bar contains links for Home, Rules & Regulations, Registration & Licensing, Forms, Safety & Security, Facts & Research, Cross Border, and About FMCSA. Below the navigation bar is a breadcrumb trail: Home > About FMCSA > Too Fast for Conditions. A search box is located on the right. The main content area has a left sidebar with 'Outreach & Education' and 'CMV Driving Tips' sections. The 'CMV Driving Tips' section lists: Project Background, Failure to Buckle Up, Too Fast for Conditions (highlighted), Unfamiliar Roadway, and Inadequate Surveillance. The main text area is titled 'Too Fast for Conditions' and includes a 'Print' icon. The text defines driving too fast for conditions and provides examples. A concluding sentence states: 'Below are some tips that will help you maintain a safe speed for various driving conditions.'

U.S. Department of Transportation Keyword Links | Contact Us | Español

Federal Motor Carrier Safety Administration

Home | Rules & Regulations | Registration & Licensing | Forms | Safety & Security | Facts & Research | Cross Border | About FMCSA

Home > About FMCSA > Too Fast for Conditions Search All FMCSA Sites

Too Fast for Conditions Print

↑ Outreach & Education

CMV Driving Tips

- Project Background
- Failure to Buckle Up
- Too Fast for Conditions**
- Unfamiliar Roadway
- Inadequate Surveillance

Driving too fast for conditions is defined as traveling at a speed that is greater than a reasonable standard for safe driving.¹³ Examples of conditions where drivers may find themselves driving too fast include: wet roadways (rain, snow, or ice), reduced visibility (fog), uneven roads, construction zones, curves, intersections, gravel roads, and heavy traffic.¹⁴ The Large Truck Crash Causation Study (LTCCS) reported that 23 percent of large-truck crashes occurred when Commercial Motor Vehicle (CMV) drivers were traveling too fast for conditions.¹⁵

Below are some tips that will help you maintain a safe speed for various driving conditions.

CMV WEB-BASED DRIVING TIPS: TOO FAST FOR CONDITIONS

Tip #1: Reduce Your Driving Speed in Adverse Road and/or Weather Conditions

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Too-Fast-for-Conditions-all.htm>

Driver Fatigue
Driver Distraction
Following Too Closely
Inadequate Evasive Action
Documents
References

TIP # 1: REDUCE YOUR DRIVING SPEED IN ADVERSE ROAD AND/OR WEATHER CONDITIONS

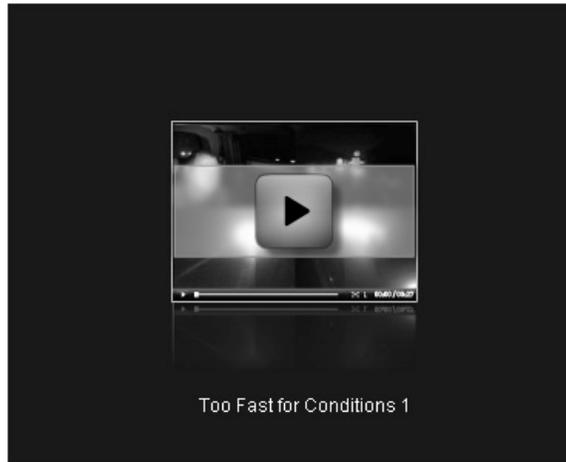
Adjust your speed to safely match weather conditions, road conditions, visibility, and traffic. Excessive driving speed is a major cause of fatal crashes,¹⁶ and higher speeds may cause more severe crashes.¹⁷ The Fatality Analysis Reporting System (FARS) recently reported that 25 percent of speeding-related large-truck fatalities occurred during adverse weather conditions.¹⁸

Did You Know? You should reduce your speed by 1/3 on wet roads and by 1/2 or more on snow packed roads (i.e., if you would normally be traveling at a speed of 60 mph on dry pavement, then on a wet road you should reduce your speed to 40 mph, and on a snow-packed road you should reduce your speed to 30 mph). When you come upon slick, icy roads you should drive slowly and cautiously and pull off the road if you can no longer safely control the vehicle.¹⁶

Did You Know? When it first starts to rain, water mixes with oil on the road making it particularly slippery.¹⁶

Did You Know? Manufacturers generally advise drivers not to use a retarder [also called a "Jake" brake] on wet or slippery roadway conditions. In fact, a Safety Board Investigation of a motor coach crash that occurred in Canon City, Colorado, in December 1999, revealed that an enabled retarder most likely triggered the loss of control and eventual crash of the motor coach on a snow-covered and mountainous roadway.¹⁹

An example of a driver traveling too fast for conditions is shown in the video clip below. Training exercise questions follow the video clip.



VIDEO DESCRIPTION: The CMV driver is traveling on a multi-lane highway on wet pavement at night. Traffic is heavy and moving slowly. The driver is inattentive and traveling too fast for conditions. Traffic slows as the driver passes an emergency vehicle on the side of the road and the driver has to brake quickly to avoid hitting the lead vehicle.

TRAINING EXERCISE: After viewing the video, try to answer the following questions:

- Did the driver adjust his vehicle's speed considering the traffic, road, and weather conditions?
- What caused the driver to brake excessively?
- What could the driver have done differently?

CMV WEB-BASED DRIVING TIPS: TOO FAST FOR CONDITIONS

Tip #2: Enter a Curve Slowly

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Too-Fast-for-Conditions-all.htm>

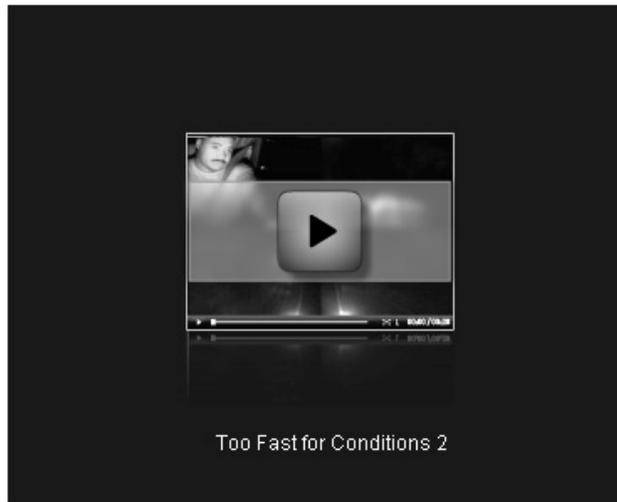
TIP # 2: ENTER A CURVE SLOWLY

Speed limits posted on curve warning signs are intended for passenger vehicles, not large trucks. Large trucks should reduce their speed even further. Studies have shown that large trucks entering a curve, even at the posted speed limit, have lost control and rolled over due to their high center of gravity.¹⁶

Did You Know? 40 percent of speeding-related fatalities occur on curves.²⁰

Did You Know? Braking in a curve can cause the wheels to lock up and the vehicle to skid.¹⁶

An example of a driver traveling too fast for conditions is shown in the video clip below. Training exercise questions follow the video clip.



VIDEO DESCRIPTION: The CMV driver is traveling on an undivided, two-lane road at night. The driver passes a curve warning sign but fails to reduce his speed. The driver is traveling too fast when he enters the curve and has trouble maintaining control of his truck. The driver has to brake hard and crosses onto the right shoulder.

TRAINING EXERCISE: After watching the video, try to answer the following questions:

- Did the driver slow down enough to safely enter the upcoming curve?
- What behavior indicates that the driver is driving too fast for conditions?
- What could the driver have done differently?

CMV WEB-BASED DRIVING TIPS: TOO FAST FOR CONDITIONS

Tip # 3: Reduce Your Speed Before Entering An Exit/Entrance Ramp

Tip # 4: Drive Slowly With A Loaded Trailer

Tip # 5: Slow Down In Work Zones

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Too-Fast-for-Conditions-all.htm>

TIP # 3: REDUCE YOUR SPEED BEFORE ENTERING AN EXIT/ENTRANCE RAMP

Approach an exit/entrance ramp at a safe speed. Truck rollovers are more likely to occur on exit/entrance ramps when the driver misjudges the sharpness of the ramp curve and enters the curve at an excessive speed.²¹

Did You Know? The posted speed limit on an exit/entrance ramp generally shows the safe speed for a passenger vehicle; the safe speed for a large truck is usually significantly lower than the posted speed.¹³

Did You Know? Even though ramps and interchanges make up less than 5 percent of all highway miles, 20 to 30 percent of all large-truck crashes occur on or near ramps.²²

TIP # 4: DRIVE SLOWLY WITH A LOADED TRAILER

Be more cautious with a loaded trailer. Loaded trailers have a higher center of gravity and sudden speed adjustment may cause the load to shift, leading to skidding or a rollover.¹⁶

Did You Know? Large trucks with fully loaded trailers are 10 times more likely to roll over than those with empty trailers.²³

Did You Know? Loaded trailers require 20 to 40 percent more braking distance than passenger vehicles to come to a complete stop.²⁴

TIP # 5: SLOW DOWN IN WORK ZONES

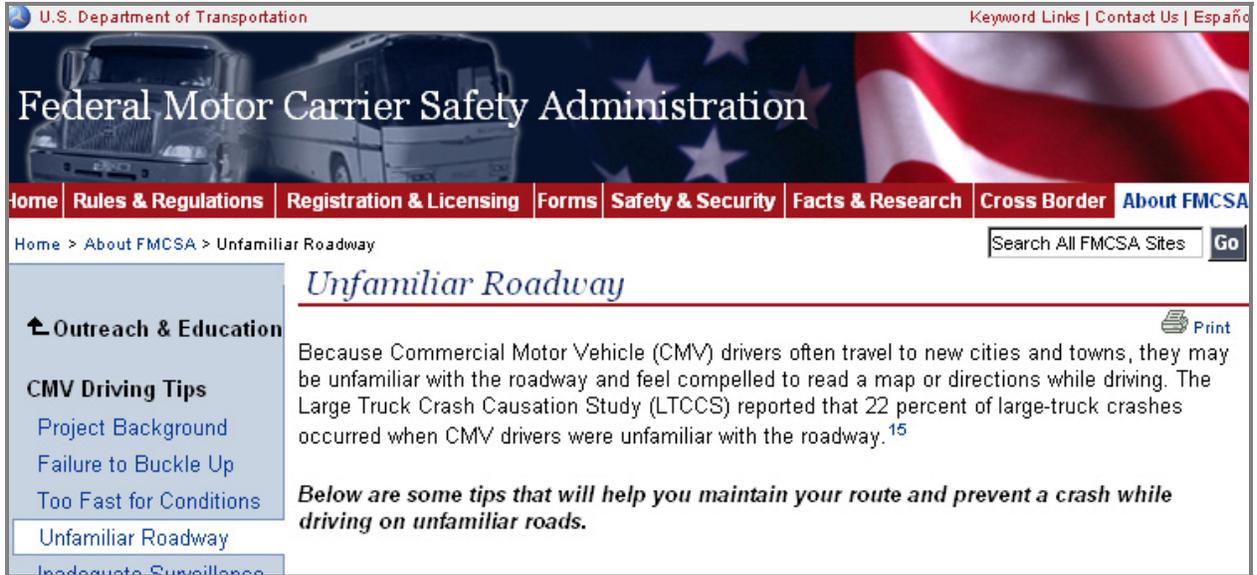
Before entering a work zone, decrease your speed, merge into the correct lane well ahead of any lane closures, and be prepared to slow down or stop suddenly.²⁵ Speed increases perception-reaction distance, braking distance, and stopping distance.¹⁷

Did You Know? Nearly a quarter of all work-zone deaths in 2006 involved a large truck.²⁶

Did You Know? In October 2003, a CMV driver was traveling at 60 mph in a 45 mph work zone on the Jane Addams Memorial Tollway in Illinois. The truck driver rear-ended a 25-passenger bus. The crash caused a five-vehicle pileup, killing 8 women and injuring about a dozen others. As a result of the crash, the truck driver was charged and convicted of reckless homicide and sentenced to 4 years in prison.^{27, 28}

CMV WEB-BASED DRIVING TIPS: UNFAMILIAR ROADWAY

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Unfamiliar-Roadway.htm>



The screenshot shows the website for the Federal Motor Carrier Safety Administration (FMCSA). At the top, there is a navigation bar with links for "Home", "Rules & Regulations", "Registration & Licensing", "Forms", "Safety & Security", "Facts & Research", "Cross Border", and "About FMCSA". The main header features the FMCSA logo and the text "Federal Motor Carrier Safety Administration" over a background image of a truck and a bus. Below the header, there is a search bar and a "Go" button. The main content area is titled "Unfamiliar Roadway" and includes a "Print" button. The text on the page states: "Because Commercial Motor Vehicle (CMV) drivers often travel to new cities and towns, they may be unfamiliar with the roadway and feel compelled to read a map or directions while driving. The Large Truck Crash Causation Study (LTCCS) reported that 22 percent of large-truck crashes occurred when CMV drivers were unfamiliar with the roadway.¹⁵" Below this text, there is a bolded statement: "Below are some tips that will help you maintain your route and prevent a crash while driving on unfamiliar roads." On the left side of the page, there is a sidebar with the heading "Outreach & Education" and a sub-heading "CMV Driving Tips". Under "CMV Driving Tips", there are several links: "Project Background", "Failure to Buckle Up", "Too Fast for Conditions", "Unfamiliar Roadway", and "Inadequate Surveillance".

CMV WEB-BASED DRIVING TIPS: UNFAMILIAR ROADWAY

Tip #1: Review Maps and Plan Your Route Before Driving

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Unfamiliar-Roadway.htm>

Driver Fatigue
Driver Distraction
Following Too Closely
Inadequate Evasive Action
Documents
References

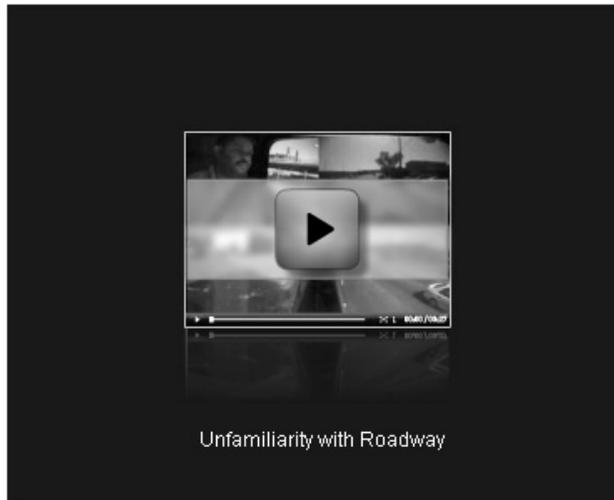
TIP # 1: REVIEW MAPS AND PLAN YOUR ROUTE BEFORE DRIVING

Be sure to plan your driving route before getting behind the wheel so you can keep your schedule and prevent distractions that may occur while trying to read a map or directions.²⁹ You may use electronic devices, such as a navigation system, to aid you when you are unfamiliar with the roadway. However, remember to use technology appropriately (pull safely to the side of the roadway or stop and take a break), otherwise it can be a source of distraction.

Did You Know? When transporting hazardous materials, remember that most states and localities have route restrictions and/or designated routes. You must carry a written copy of your route plan, and you must follow that plan if you are carrying Division 1.1, 1.2 or 1.3 explosives.¹⁶

Did You Know? An independent CMV driver from Philadelphia received a \$17,751 traffic ticket for exceeding the road weight limit when he got lost in a suburban neighborhood of East Whiteland Township, PA. He was unfamiliar with the area and had difficulty following the directions that were provided to him.³⁰

An example of a CMV driver, unfamiliar with the road he is driving on, is shown in the video clip below. Training exercise questions follow the video clip.



VIDEO DESCRIPTION: The CMV driver is traveling in the far right lane of a multi-lane highway during the day. The driver's lane becomes an exit lane and suddenly bears to the right. The driver brakes quickly and crosses two lanes of traffic to maintain his original route. The driver changes lanes directly in front of another vehicle.

TRAINING EXERCISE: After viewing the video, try to answer the following questions:

- What behaviors indicated that the driver was unfamiliar with the roadway?
- How did the driver behave when he recognized that he was in the wrong lane?
- Why was the driver's maneuver unsafe?

CMV WEB-BASED DRIVING TIPS: UNFAMILIAR ROADWAY

Tip #2: Do Not Suddenly Change Your Direction of Travel

Tip #3: Signal Your Intentions

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Unfamiliar-Roadway.htm>

TIP # 2: DO NOT SUDDENLY CHANGE YOUR DIRECTION OF TRAVEL

If you miss a turn or an exit, pass the turn and find a safe way to change direction. Do not take shortcuts. Trying to suddenly correct a missed turn or exit may result in you performing an illegal or unsafe maneuver which may threaten your safety and the safety of the vehicles around you.

Did You Know? From 2004 to 2007 almost 50,000 moving violations were classified as an improper turn or an improper lane change.³¹

TIP # 3: SIGNAL YOUR INTENTIONS

Use turn signals first to indicate your intent to change lanes, next visually scan for adjacent traffic and road hazards, and then execute a safe lane change. By signaling your intentions well in advance, you will be in a safer position to communicate with the surrounding drivers and you will be able to safely execute the desired driving maneuver.

Did You Know? A recent study reported that there are approximately 630,000 lane-change crashes annually (including both large trucks and passenger vehicles).³²

CMV WEB-BASED DRIVING TIPS: INADEQUATE SURVEILLANCE

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Inadequate-Surveillance-all.htm>

The screenshot shows the website for the Federal Motor Carrier Safety Administration (FMCSA). At the top, there is a navigation bar with links for 'Home', 'Rules & Regulations', 'Registration & Licensing', 'Forms', 'Safety & Security', 'Facts & Research', 'Cross Border', and 'About FMCSA'. Below this is a search bar with the text 'Search All FMCSA Sites' and a 'Go' button. The main content area is titled 'Inadequate Surveillance' and includes a 'Print' icon. The text explains that inadequate surveillance occurs when a driver fails to look in the appropriate place or direction. It references the Large Truck Crash Causation Study (LTCCS) and states that 14 percent of large-truck crashes occurred due to Commercial Motor Vehicle (CMV) driver's inadequate surveillance. Below the text, there is a bolded tip: 'Below are some tips that will help you stay aware of the vehicles and traffic around you.' On the left side, there is a sidebar with a 'CMV Driving Tips' section containing links for 'Project Background', 'Failure to Buckle Up', 'Too Fast for Conditions', 'Unfamiliar Roadway', and 'Inadequate Surveillance'.

U.S. Department of Transportation Keyword Links | Contact Us | Español

Federal Motor Carrier Safety Administration

[Home](#) | [Rules & Regulations](#) | [Registration & Licensing](#) | [Forms](#) | [Safety & Security](#) | [Facts & Research](#) | [Cross Border](#) | [About FMCSA](#)

[Home](#) > [About FMCSA](#) > [Inadequate Surveillance](#)

Inadequate Surveillance Print

Inadequate surveillance occurs when the driver is in a situation where he/she is required to look to safely complete a maneuver and either fails to look in the appropriate place or looks, but does not see.¹⁴ This may include lane changes or turns at intersections where the driver looks in the required direction, but fails to see the approaching traffic.¹⁴ The Large Truck Crash Causation Study (LTCCS) reported that 14 percent of large-truck crashes occurred due to Commercial Motor Vehicle (CMV) driver's inadequate surveillance.¹⁵

Below are some tips that will help you stay aware of the vehicles and traffic around you.

↑ Outreach & Education

CMV Driving Tips

- [Project Background](#)
- [Failure to Buckle Up](#)
- [Too Fast for Conditions](#)
- [Unfamiliar Roadway](#)
- [Inadequate Surveillance](#)

CMV WEB-BASED DRIVING TIPS: INADEQUATE SURVEILLANCE

Tip #1: Be Aware of Your “No-Zone”

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Inadequate-Surveillance-all.htm>

[Driver Fatigue](#)
[Driver Distraction](#)
[Following Too Closely](#)
[Inadequate Evasive Action](#)
[Documents](#)
[References](#)

TIP # 1: BE AWARE OF YOUR “NO-ZONE”

Be vigilant in watching for vehicles in the "No-Zone." Drivers around you may not be aware of the size of your truck's blind spots. As a CMV driver, you are aware that some of your blind spots are large enough that a passenger vehicle can virtually disappear from your view. Remember that other drivers unfamiliar with commercial driving probably don't realize this.³³

Did You Know? The "No-Zone" represents the areas around your truck where crashes are more likely to occur. One-third of all crashes between large trucks and cars takes place in the "No-Zone."³³

An example of inadequate surveillance is shown in the video clip below. Training exercise questions follow the video clip.



VIDEO DESCRIPTION: The CMV driver is traveling in the right lane of a two-lane highway during the day. The driver is approaching a slower-moving heavy vehicle. The CMV driver begins to change lanes to the left to go around the slower-moving vehicle, not recognizing a second vehicle is already in the left lane. The CMV driver has to brake suddenly and swerve to the right to avoid the vehicle. The vehicle also swerves to the right, onto the shoulder, to avoid the truck.

TRAINING EXERCISE: After viewing the video, try to answer the following questions:

- How vigilant was the driver in watching for vehicles in his "no-zone?"
- When did the driver notice that there was a vehicle in his "no-zone?"
- What happened as a result of the driver's inadequate surveillance?
- What could the truck driver have done differently?

CMV WEB-BASED DRIVING TIPS: INADEQUATE SURVEILLANCE

Tip #2: Always Drive Defensively

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Inadequate-Surveillance-all.htm>

TIP # 2: ALWAYS DRIVE DEFENSIVELY

Defensive driving is a way of operating your vehicle to avoid accidents due to the actions of others. To drive defensively you should: keep your distance, maintain a safe speed and stay alert. Recognizing potentially dangerous situations well in advance can allow you to safely maneuver past these situations.³⁴

Did You Know? A recent study on the interaction between light vehicles and heavy vehicles revealed that light-vehicle drivers initiated almost 83 percent of safety-related traffic events.³⁵ Therefore it is important to be aware of surrounding traffic and be ready to react to other drivers' mistakes.

Did You Know? Seventy-five percent of lane change/merge crashes involve a recognition failure by the lane-changing/merging driver.³⁶ The vast majority of these drivers (over 90 percent) are drivers of passenger vehicles.³⁷

Did You Know? On July 16, 1981, on the Long Island Expressway near Jericho, NY, musician and singer Harry Chapin decreased his speed and swerved left and right between lanes twice and ended right in front of a tractor-trailer. The truck was unable to brake in time and rear-ended the vehicle in which Chapin was travelling. It was later determined that Chapin died of cardiac arrest, and it was believed that he might have been trying to pull over when the tractor-trailer hit him.^{38, 39, 40}

An example of inadequate surveillance is shown in the video clip below. Training exercise questions follow the video clip.



VIDEO DESCRIPTION: The CMV driver is traveling in the left lane of a multi-lane road during the day. As the driver approaches an intersection, he looks out his left window at the same time that a pickup truck from the left turn lane changes lanes directly in front of the truck. The driver has to brake suddenly to avoid the pickup truck.

TRAINING EXERCISE: After viewing the video, try to answer the following questions:

- What lane was the CMV driver driving in and why?
- Describe the driver's alertness when approaching the intersection?
- What happened when the driver approached the intersection?
- What could the driver have done differently?

CMV WEB-BASED DRIVING TIPS: INADEQUATE SURVEILLANCE

Tip #3: Look Far Enough Ahead

Tip #4: Check Your Mirrors Often

Tip #5: Approach & Enter Intersections with Caution

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Inadequate-Surveillance-all.htm>

TIP # 3: LOOK FAR ENOUGH AHEAD

Look at least 15 seconds in front of you (approximately 1/4 of a mile on the interstate and 1 1/2 blocks in the city).¹⁶ Looking far ahead will allow you to respond early and smoothly to changing conditions ahead and to avoid dangerous, abrupt braking situations.⁴¹

Did You Know? The New York State Department of Motor Vehicles (DMV) states that "the speed of rotation and angle of the front wheels give you clues to whether the driver is slowing to stop or planning to turn in a certain direction. If the rotation does not appear to be slowing as the driver approaches a required stop, you should pad your brake and prepare to stop, and lightly tap your horn to get the other driver's attention."⁴²

Did You Know? It takes 3/4 of a second from the moment your brain sends the signal to your foot to move from the accelerator to when your foot actually applies the brake. In this short period of time, you may have already traveled up to 60 feet.¹⁶ Focusing on the vehicles ahead of you will help you react in a safe and timely manner.

TIP # 4: CHECK YOUR MIRRORS OFTEN

Check your mirrors regularly (at least every 5 to 8 seconds) and before you change lanes, turn, or merge.⁴³ Check your mirrors quickly and return your attention to the road ahead.¹⁶ Frequent scanning will allow you to be aware of changing traffic conditions around your truck.⁴⁴

Did You Know? If you check your mirrors regularly, they can help you spot overtaking vehicles. Mirrors will also help you monitor your surrounding environment and may help you identify if a vehicle has moved into your blind spot.⁴⁴

Did You Know? You can also use your mirrors to check your tires as you are driving down the road which may help you spot a tire fire. In addition, you can use the mirrors to check for loose straps, ropes, or chains when you are carrying open cargo.⁴⁴

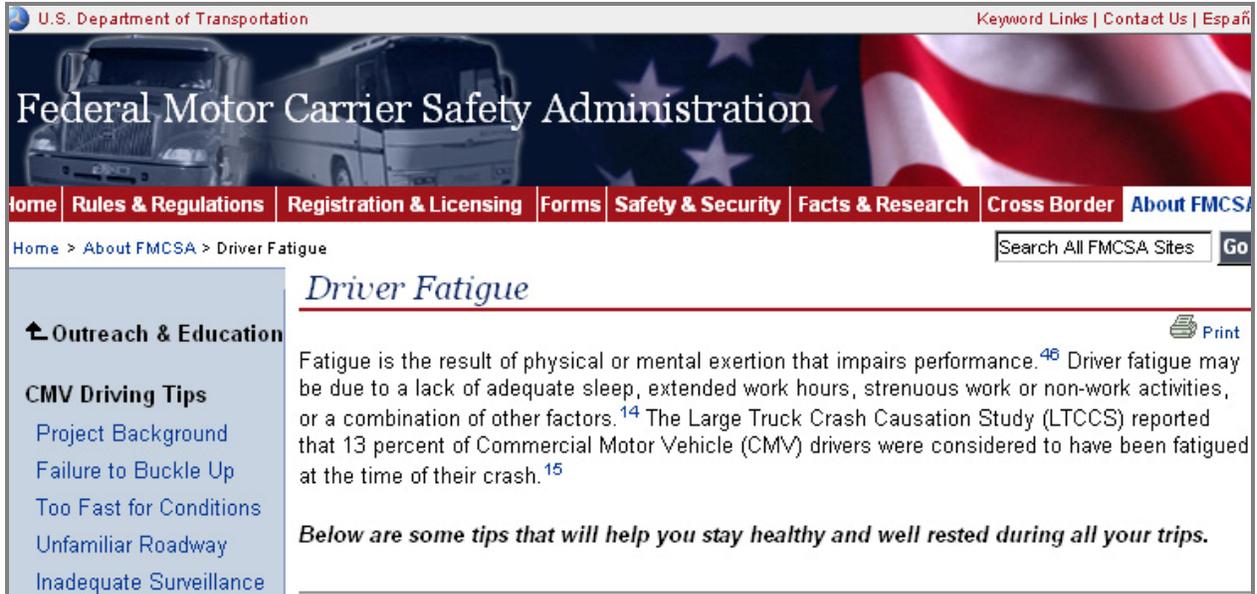
TIP # 5: APPROACH & ENTER INTERSECTIONS WITH CAUTION

Check left, right, and left again before entering an intersection. Being able to quickly glance in each direction (of the crossing traffic) will provide you sufficient time to recognize oncoming vehicles.

Did You Know? A report on "Rear-End Large Truck Crashes" stated that 14.6 percent of truck-striking crashes are intersection-related.⁶⁰

CMV WEB-BASED DRIVING TIPS: DRIVER FATIGUE

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Driver-Fatigue.htm>



The screenshot shows the FMCSA website with a header for the U.S. Department of Transportation and navigation links. The main content area is titled 'Driver Fatigue' and includes a definition of fatigue, a reference to the LTCCS study, and a list of tips for staying healthy and well-rested during trips. A sidebar on the left lists 'Outreach & Education' and 'CMV Driving Tips' with sub-links.

U.S. Department of Transportation Keyword Links | Contact Us | Español

Federal Motor Carrier Safety Administration

[Home](#) | [Rules & Regulations](#) | [Registration & Licensing](#) | [Forms](#) | [Safety & Security](#) | [Facts & Research](#) | [Cross Border](#) | [About FMCSA](#)

[Home](#) > [About FMCSA](#) > [Driver Fatigue](#)

Driver Fatigue Print

Fatigue is the result of physical or mental exertion that impairs performance.⁴⁶ Driver fatigue may be due to a lack of adequate sleep, extended work hours, strenuous work or non-work activities, or a combination of other factors.¹⁴ The Large Truck Crash Causation Study (LTCCS) reported that 13 percent of Commercial Motor Vehicle (CMV) drivers were considered to have been fatigued at the time of their crash.¹⁵

Below are some tips that will help you stay healthy and well rested during all your trips.

↑ Outreach & Education

CMV Driving Tips

- [Project Background](#)
- [Failure to Buckle Up](#)
- [Too Fast for Conditions](#)
- [Unfamiliar Roadway](#)
- [Inadequate Surveillance](#)

CMV WEB-BASED DRIVING TIPS: DRIVER FATIGUE

Tip #1: Look Far Enough Ahead

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Driver-Fatigue.htm>

<ul style="list-style-type: none">Inadequate SurveillanceDriver FatigueDriver DistractionFollowing Too CloselyInadequate Evasive ActionDocumentsReferences	<p>TIP # 1: GET ENOUGH SLEEP BEFORE GETTING BEHIND THE WHEEL</p> <p>Be sure to get an adequate amount of sleep each night. If possible, do not drive while your body is naturally drowsy, between the hours of 12 a.m. to 6 a.m. and 2 p.m. to 4 p.m. Driver drowsiness may impair a driver's response time to potential hazards, increasing the chances of being in a crash.¹⁶ If you do become drowsy while driving, be sure to choose a safe place to pull over and rest.</p> <p>Did You Know? The circadian rhythm refers to the wake/sleep cycle that our body goes through each day and night. The cycle involves our internal clock and controls the daily pattern of alertness in a human body. With inadequate sleep, the drowsiness experienced during natural "lulls" can be even stronger and may have a greater adverse effect on a driver's performance and alertness.⁴⁷</p> <p>Did You Know? A study by the Federal Motor Carrier Safety Administration (FMCSA) found that driver alertness was related to "time-of-day" more so than "time-on-task."⁴⁸ Most people are less alert at night, especially after midnight. This drowsiness may be enhanced if you have been on the road for an extended period of time.¹⁶</p> <p>Did You Know? A recent study conducted to determine the risk of having a safety-critical event as a function of driving-hour suggests that incidents are highest during the first hour of driving. The authors hypothesize that drivers may be affected by sleep inertia shortly after waking from sleep. This may be especially true for drivers who sleep in the sleeper berth.⁴⁹ Sleep inertia refers to impairment in a variety of performance tasks, including short-term memory, vigilance, cognitive functioning, reaction time, and ability to resist sleep.^{49, 50, 51, 52}</p> <p>An example of a fatigued driver is shown in the video below. Training exercise questions follow the video clip.</p> <div data-bbox="560 1094 1149 1575" style="text-align: center;"><p>Driver Fatigue</p></div> <p>VIDEO DESCRIPTION: The CMV driver is traveling in the right lane of a two-lane road at night. The driver is clearly drowsy, making it difficult for him to pay attention to the roadway. The driver drifts towards the right shoulder of the road, nearly hitting the curb, before he returns the truck to the lane.</p> <p>TRAINING EXERCISE: After viewing the video, try to answer the following questions:</p> <ul style="list-style-type: none">• What behaviors indicate that the driver is drowsy?• What happened as a result of the driver's drowsiness?• How did the driver correct his mistake?• What could the driver have done differently?
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CMV WEB-BASED DRIVING TIPS: DRIVER FATIGUE

Tip #2: Maintain a Healthy Diet

Tip #3: Take a Nap

Tip #4: Avoid Medication That May Induce Drowsiness

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Driver-Fatigue.htm>

TIP # 2: MAINTAIN A HEALTHY DIET

Skipping meals or eating at irregular times may lead to fatigue and/or food cravings. Also, going to bed with an empty stomach or immediately after a heavy meal can interfere with sleep.⁵³ A light snack before bed may help you achieve more restful sleep. Remember that if you are not well-rested, induced fatigue may cause slow reaction time, reduced attention, memory lapses, lack of awareness, mood changes, and reduced judgment ability.

Did you Know? A recent study conducted on the sleeping and driving habits of CMV drivers concluded that an unhealthy lifestyle, long working hours, and sleeping problems were the main causes of drivers falling asleep while driving.⁵⁴

TIP # 3: TAKE A NAP

If possible, you should take a nap when feeling drowsy or less alert. Naps should last a minimum of 10 minutes, but ideally a nap should last up to 45 minutes. Allow at least 15 minutes after waking to fully recover before starting to drive.⁵⁵

Did you know? Short naps are more effective at restoring energy levels than coffee.¹⁶

Did you know? Naps aimed at preventing drowsiness are generally more effective in maintaining a driver's performance than naps taken when a person is already drowsy.⁴⁷

TIP # 4: AVOID MEDICATION THAT MAY INDUCE DROWSINESS

Avoid medications that may make you drowsy if you plan to get behind the wheel. Most drowsiness-inducing medications include a warning label indicating that you should not operate vehicles or machinery during use.¹⁶ Some of the most common medicines that may make you drowsy are: tranquilizers, sleeping pills, allergy medicines and cold medicines.⁵⁶

Did You Know? In a recent study, 17 percent of CMV drivers were reported as having "over-the-counter drug use" at the time of a crash.¹⁵

Did You Know? Cold pills are one of the most common medicines that may make you drowsy. If you must drive with a cold, it is safer to suffer from the cold than drive under the effects of the medicine.¹⁶

CMV WEB-BASED DRIVING TIPS: DRIVER FATIGUE

Tip #5: Recognize the Signals and Dangers of Drowsiness

Tip #6: Do Not Rely on “Alertness Tricks” to Keep You Awake

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Driver-Fatigue.htm>

TIP # 5: RECOGNIZE THE SIGNALS AND DANGERS OF DROWSINESS

Pay attention: Indicators of drowsiness include: frequent yawning, heavy eyes, and blurred vision.⁵⁷

Did You Know? Research has indicated that being awake for 18 hours is comparable to having a blood alcohol concentration (BAC) of 0.08 percent, which is legally intoxicated and leaves you at equal risk for a crash.⁵⁷

Did You Know? A 2005 study suggests that three out of every four CMV drivers report having experienced at least one type of driving error as a result of drowsiness.⁵⁸

Did You Know? On October 16, 2005 at 2 a.m., a 23-year-old CMV driver fell asleep behind the wheel, causing him to enter a ditch and eventually roll his truck over on both west-bound lanes of Interstate 94. Minutes later, a charter bus carrying a school band crashed into the truck killing 5 and injuring 29 others. As a result of the crash, the CMV driver was charged with 5 counts of homicide by negligent operation of a vehicle and 29 counts of reckless driving that caused great bodily harm. If convicted he could have faced nearly 90 years in prison.^{59, 60, 61}

TIP # 6: DO NOT RELY ON “ALERTNESS TRICKS” TO KEEP YOU AWAKE

Behaviors such as smoking, turning up the radio, drinking coffee, opening the window, and other “alertness tricks” are not real cures for drowsiness and may give you a false sense of security.

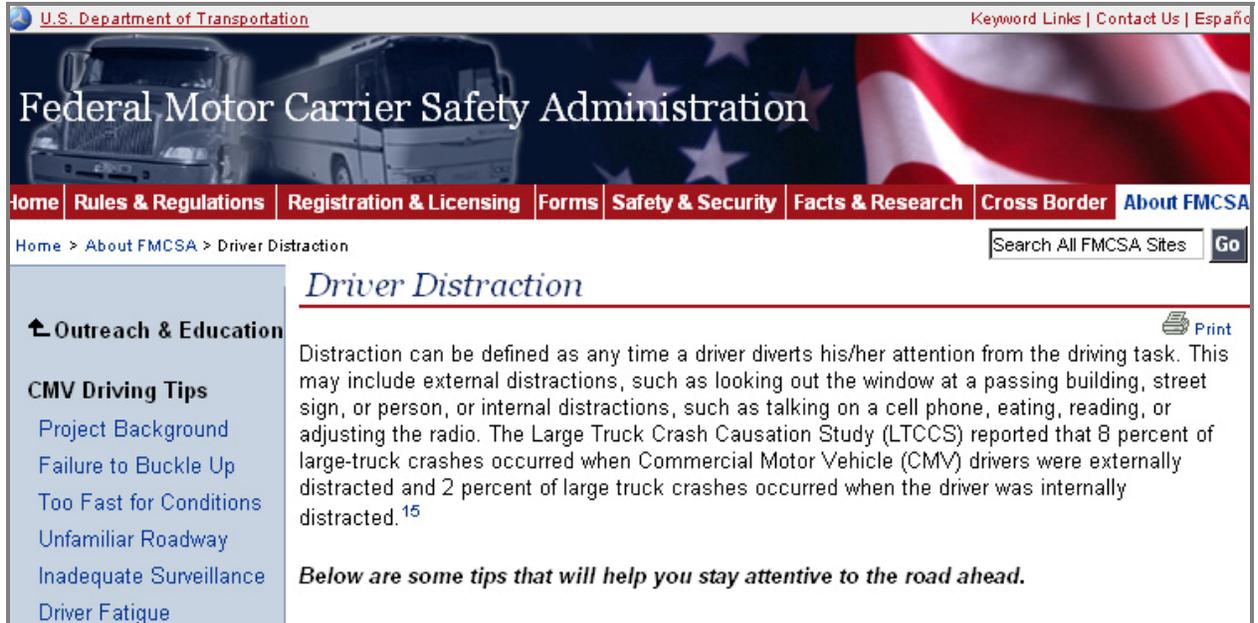
Did You Know? Excessive intake of caffeine can cause insomnia, headaches, irritability, and nervousness.⁶³

Did You Know? It takes several minutes for caffeine to get into your system and deliver the energy boost you need, so if you are already tired when you first drink a caffeinated drink, it may not take effect as quickly as you might expect. In addition, if you are a regular caffeine user, the effect may be much smaller.⁶²

Did You Know? Rolling the window down or turning the radio up may help you feel more alert for an instant, but these are not effective ways to maintain an acceptable level of alertness.⁶³

CMV WEB-BASED DRIVING TIPS: DRIVER DISTRACTION

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Driver-Distraction-all.htm>



The screenshot shows the FMCSA website's 'Driver Distraction' page. At the top, there is a navigation bar with links for 'U.S. Department of Transportation', 'Keyword Links', 'Contact Us', and 'Español'. Below this is a banner image featuring a semi-truck and a bus against a background of the American flag, with the text 'Federal Motor Carrier Safety Administration'. A secondary navigation bar includes links for 'Home', 'Rules & Regulations', 'Registration & Licensing', 'Forms', 'Safety & Security', 'Facts & Research', 'Cross Border', and 'About FMCSA'. A breadcrumb trail reads 'Home > About FMCSA > Driver Distraction'. A search box is located on the right with the text 'Search All FMCSA Sites' and a 'Go' button. The main content area is titled 'Driver Distraction' and includes a 'Print' icon. The text defines distraction as any time a driver diverts attention from driving, citing the Large Truck Crash Causation Study (LTCCS) which found that 8% of large-truck crashes were due to external distractions and 2% to internal distractions. A concluding sentence states: 'Below are some tips that will help you stay attentive to the road ahead.' On the left side, there is a sidebar with the heading 'Outreach & Education' and a sub-heading 'CMV Driving Tips'. Under this sub-heading, several links are listed: 'Project Background', 'Failure to Buckle Up', 'Too Fast for Conditions', 'Unfamiliar Roadway', 'Inadequate Surveillance', and 'Driver Fatigue'.

U.S. Department of Transportation Keyword Links | Contact Us | Español

Federal Motor Carrier Safety Administration

[Home](#) | [Rules & Regulations](#) | [Registration & Licensing](#) | [Forms](#) | [Safety & Security](#) | [Facts & Research](#) | [Cross Border](#) | [About FMCSA](#)

[Home](#) > [About FMCSA](#) > [Driver Distraction](#)

Driver Distraction Print

Distraction can be defined as any time a driver diverts his/her attention from the driving task. This may include external distractions, such as looking out the window at a passing building, street sign, or person, or internal distractions, such as talking on a cell phone, eating, reading, or adjusting the radio. The Large Truck Crash Causation Study (LTCCS) reported that 8 percent of large-truck crashes occurred when Commercial Motor Vehicle (CMV) drivers were externally distracted and 2 percent of large truck crashes occurred when the driver was internally distracted.¹⁵

Below are some tips that will help you stay attentive to the road ahead.

Outreach & Education

CMV Driving Tips

- [Project Background](#)
- [Failure to Buckle Up](#)
- [Too Fast for Conditions](#)
- [Unfamiliar Roadway](#)
- [Inadequate Surveillance](#)
- [Driver Fatigue](#)

CMV WEB-BASED DRIVING TIPS: DRIVER DISTRACTION

Tip #1: Recognize the Signals and Dangers of Drowsiness

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Driver-Distraction-all.htm>

<p>Driver Distraction</p> <p>Following Too Closely</p> <p>Inadequate Evasive Action</p> <p>Documents</p> <p>References</p>	<p>TIP # 1: DO NOT FIXATE ON NON-DRIVING RELATED OBJECTS</p> <p>When driving, keep your mind engaged with driving-related information and try to avoid focusing on external objects such as billboards or buildings or internal objects such as a cell phone or paperwork. Remember that all distractions can be dangerous. Paying attention to driving-related information will help you determine when and where there are vehicles around you and will also enable you to react more quickly to any unforeseen event.</p> <p>Did You Know? A study published in April 2006 found that driver inattention was the leading factor in crashes and near crashes. The study reports that nearly 80 percent of crashes involved some form of driver inattention within 3 seconds before the incident.¹⁴</p> <p>Did You Know? Inattention or other mental activities distracting you from driving can cause you to gaze blindly at the road and/or objects ahead without actually seeing/recognizing them because your attention is focused somewhere else.⁶⁴</p> <p>An example of an external distraction is shown in the video clip below. Training exercise questions follow the video clip.</p> <div data-bbox="573 989 1144 1451"></div> <p>VIDEO DESCRIPTION: The CMV driver is traveling in the right lane of a two-lane highway on wet pavement during the day. The driver becomes distracted with something out his right window as traffic begins to slow ahead of him. The driver returns focus to the forward roadway and has to brake quickly and move into the left lane.</p> <p>TRAINING EXERCISE: After viewing the video, try to answer the following questions:</p> <ul style="list-style-type: none">• How attentive was the driver to the forward roadway and the traffic around him?• What was the result of the driver's external distraction?• Were there any vehicles in the adjacent left lane?• What could the driver have done differently?
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CMV WEB-BASED DRIVING TIPS: DRIVER DISTRACTION

Tip #2: Avoid Smoking While Driving

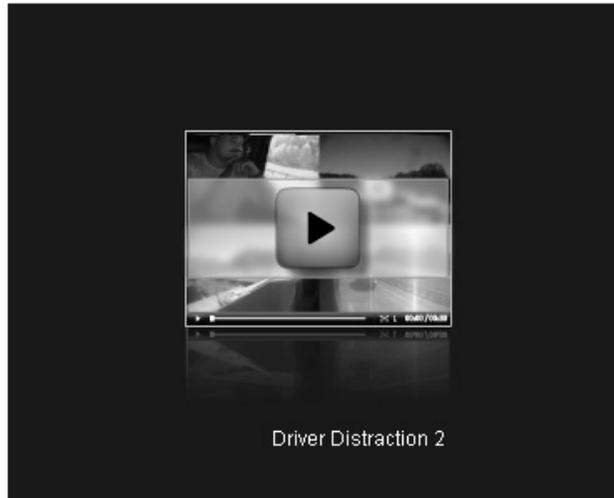
<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Driver-Distraction-all.htm>

TIP # 2: AVOID SMOKING WHILE DRIVING

Smoking while driving can be very distracting, as it requires you to remove one or both hands from the steering wheel to light a cigarette and to hold it for an extended period of time. Several studies have found that smoking while driving increases the risk of being involved in a crash.^{65, 66, 67}

Did You Know? Smoking was found to be a source of distraction in 0.9 percent of distraction-related crashes, which equates to approximately 12,780 crashes over the 5-year period examined.⁶⁸

An example of an internal distraction due to smoking is shown in the video clip. Training exercise questions follow the video clip.



VIDEO DESCRIPTION: The CMV driver is traveling in heavy traffic in the right lane of a two-lane highway during the day. The driver reaches for a cigarette and begins to light it, letting his truck slowly move forward. As the driver is trying to light the cigarette, he drops it in his lap as the traffic in front of him stops. The driver looks up and has to quickly brake to avoid a rear-end collision with the vehicle in front of him.

TRAINING EXERCISE: After viewing the video, try to answer the following questions:

- What driver behaviors indicate the driver was internally distracted?
- Why did the driver remove both of his hands from the steering wheel?
- Did the traffic conditions change while the driver was trying to light his cigarette?
- Why did the driver brake excessively?
- What could the driver have done differently?

CMV WEB-BASED DRIVING TIPS: DRIVER DISTRACTION

Tip #3: Turn Off Your Cell Phone While Driving

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Driver-Distracton-all.htm>

TIP # 3: TURN OFF YOUR CELL PHONE WHILE DRIVING

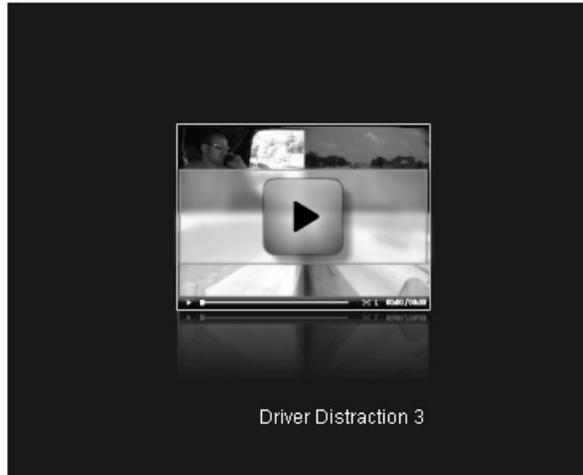
Avoid using your cell phone while driving. If you must use your cell phone, try to find a safe place to stop or pull off the road, and keep your conversations short.⁴⁴ The risk of a crash when using a cell phone is four times higher than the risk of a crash when a cell phone is not being used.⁵⁸

Did You Know? A recent study found the majority (55 percent) of crashes in which the driver's attention was diverted involved some kind of internal distraction such as objects, interacting with another person or animal, or interacting with instrumentation, including the radio or a cell phone.⁶⁹

Did You Know? Cell phones fit into each of the four major distraction categories. Cell phones are a visual (may require you to take your eyes off the road to dial), auditory (requires you to listen), biomechanical (requires you to operate them manually) and cognitive distracter (requires you to engage in a mental task other than driving).⁷⁰

Did You Know? A study by Gartner et al. (2002), reports that drivers made more lane deviations while dialing a cell phone than when operating a CD player.⁷¹

An example of a distracted driver is shown in the video clip below. Training exercise questions follow the video clip.



VIDEO DESCRIPTION: The CMV driver is traveling in the far right lane of a multi-lane highway during the day. The driver's lane is about to end and merge into the left lane due to construction. The driver is distracted while talking on a cell phone and does not notice the warning signs in time to merge safely. In addition, there is a vehicle to the left of the driver, preventing him from merging as soon as he realizes the lane is about to end. The driver has to brake hard to avoid the barrier once his lane ends. He quickly ends his cell phone conversation and waits until traffic allows him to merge.

TRAINING EXERCISE: After viewing the video, try to answer the following questions:

- What behaviors indicate that the driver was internally distracted?
- What happened while the driver was talking on his cell phone?
- What did the driver have to do to avoid a collision?
- What does this tell you about the driver's attention while driving?

CMV WEB-BASED DRIVING TIPS: DRIVER DISTRACTION

Tip #4: Minimize Eating and Drinking While Driving

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Driver-Distraction-all.htm>

TIP # 4: MINIMIZE EATING AND DRINKING WHILE DRIVING

Make sure to eat before getting behind the wheel or leave time to pull over and eat safely. Eating while driving may not only be messy, but dangerous, as it creates a physical and visual distraction for drivers. It usually requires drivers to remove one or both hands from the steering wheel while juggling food or beverage with the other.⁷²

Did You Know? A U.S. Department of Transportation (U.S. DOT) survey, across all driver types, found that 49 percent of drivers consider eating or drinking a potentially distracting behavior.⁷³

Did You Know? A recent study found that eating while driving was riskier than talking on a cell phone.⁷⁴

Did You Know? On May 23, 2008 a 51-year-old CMV driver crashed into the back of a stopped school bus, which was letting children out, on Highway 50 in western Kenosha County, WI. The CMV driver was distracted by drinking a soda and did not see the school bus which was stopped with its lights flashing and its stop-arm extended. After the crash, 14 children had to be taken to area hospitals, 4 of them with serious injuries. The large-truck driver was transported to a hospital in critical condition.^{75, 76}

CMV WEB-BASED DRIVING TIPS: FOLLOWING TOO CLOSELY

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Following-Too-Closely.htm>

The screenshot shows the FMCSA website with a header for the U.S. Department of Transportation and the Federal Motor Carrier Safety Administration. A navigation menu includes Home, Rules & Regulations, Registration & Licensing, Forms, Safety & Security, Facts & Research, Cross Border, and About FMCSA. The breadcrumb trail is Home > About FMCSA > Following Too Closely. A search bar is present with the text 'Search All FMCSA Sites' and a 'Go' button. The main content area is titled 'Following Too Closely' and includes a 'Print' icon. A left sidebar lists 'Outreach & Education' and 'CMV Driving Tips' with sub-links like 'Project Background', 'Failure to Buckle Up', 'Too Fast for Conditions', 'Unfamiliar Roadway', 'Inadequate Surveillance', 'Driver Fatigue', 'Driver Distraction', 'Following Too Closely', 'Inadequate Evasive Action', and 'Action'. The main text defines 'Following too closely' and provides tips for maintaining safe following distance.

U.S. Department of Transportation Keyword Links | Contact Us | Español

Federal Motor Carrier Safety Administration

Home | Rules & Regulations | Registration & Licensing | Forms | Safety & Security | Facts & Research | Cross Border | About FMCSA

Home > About FMCSA > Following Too Closely Search All FMCSA Sites

Following Too Closely Print

Following too closely may be defined as, "situations in which one vehicle is following another vehicle so closely that even if the following driver is attentive to the actions of the vehicle ahead he/she could not avoid a collision in the circumstance when the driver in front brakes suddenly."¹⁴

In addition to providing enough stopping time, proper following distance allows for more time to make good, well-planned decisions and affords other drivers the opportunity to scan the sides, look far enough ahead, and view the vehicle immediately in front.

The Large Truck Crash Causation Study (LTCCS) reported that 5 percent of truck crashes occurred when the Commercial Motor Vehicle (CMV) driver was following the lead vehicle too closely.¹⁵

Below are some tips that will help you maintain the correct following distance during various driving conditions.

- ↑ Outreach & Education
- CMV Driving Tips
 - Project Background
 - Failure to Buckle Up
 - Too Fast for Conditions
 - Unfamiliar Roadway
 - Inadequate Surveillance
 - Driver Fatigue
 - Driver Distraction
 - Following Too Closely**
 - Inadequate Evasive Action
 - Action

CMV WEB-BASED DRIVING TIPS: FOLLOWING TOO CLOSELY

Tip #1: Maintain a Safe Following Distance

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Following-Too-Closely.htm>

Documents
References

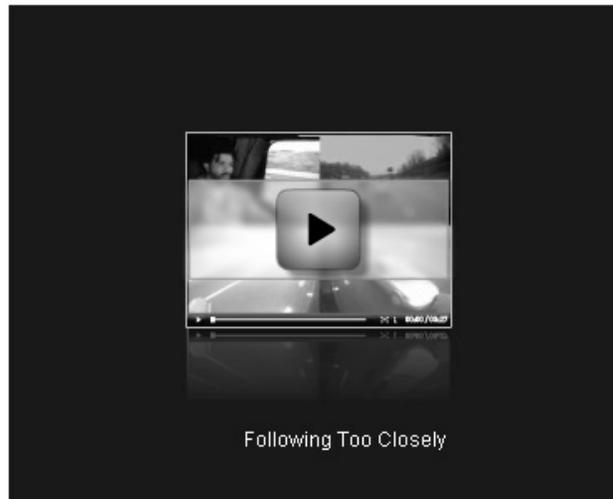
TIP # 1: MAINTAIN A SAFE FOLLOWING DISTANCE

Large trucks need additional space between vehicles to allow for safe braking and unexpected actions. In crashes, large trucks most often hit the vehicle in front of them.¹⁶

Did You Know? If you are driving below 40 mph, you should leave at least one second for every 10 feet of vehicle length. For a typical tractor-trailer, this results in 4 seconds between you and the leading vehicle. For speeds over 40 mph, you should leave one additional second.¹⁶

Did You Know? On October 15, 2007, as cars began to slow for construction in the left lane, a CMV driver failed to brake and crashed into the vehicle ahead of him, killing a 47-year-old woman. The crash also involved two other vehicles and shut down the roadway for 5 hours. The CMV driver was charged with misconduct with a motor vehicle, and following too closely.¹⁷

An example of a driver following too closely is shown in the video clip below. Training exercise questions follow the video clip.



VIDEO DESCRIPTION: The CMV driver is traveling in the far right lane of a three-lane highway during the day. There is an exit-only lane on the right, adjacent to the driver's lane. The driver is following a lead passenger vehicle closely. The passenger vehicle begins to slow in order to move to the left and into the middle lane. The CMV driver does not slow down appropriately and comes close to the rear of the passenger vehicle as it changes lanes.

TRAINING EXERCISE: After viewing the video, try to answer the following questions:

- Does the driver appear to adjust his vehicle's speed to maintain a safe following distance with the lead vehicle?
- Why was the lead vehicle slowing down?
- Why did the driver brake excessively?
- What could the driver have done differently?

CMV WEB-BASED DRIVING TIPS: FOLLOWING TOO CLOSELY

Tip #2: Double Your Following Distance in Adverse Conditions

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Following-Too-Closely.htm>

TIP # 2: DOUBLE YOUR FOLLOWING DISTANCE IN ADVERSE CONDITIONS

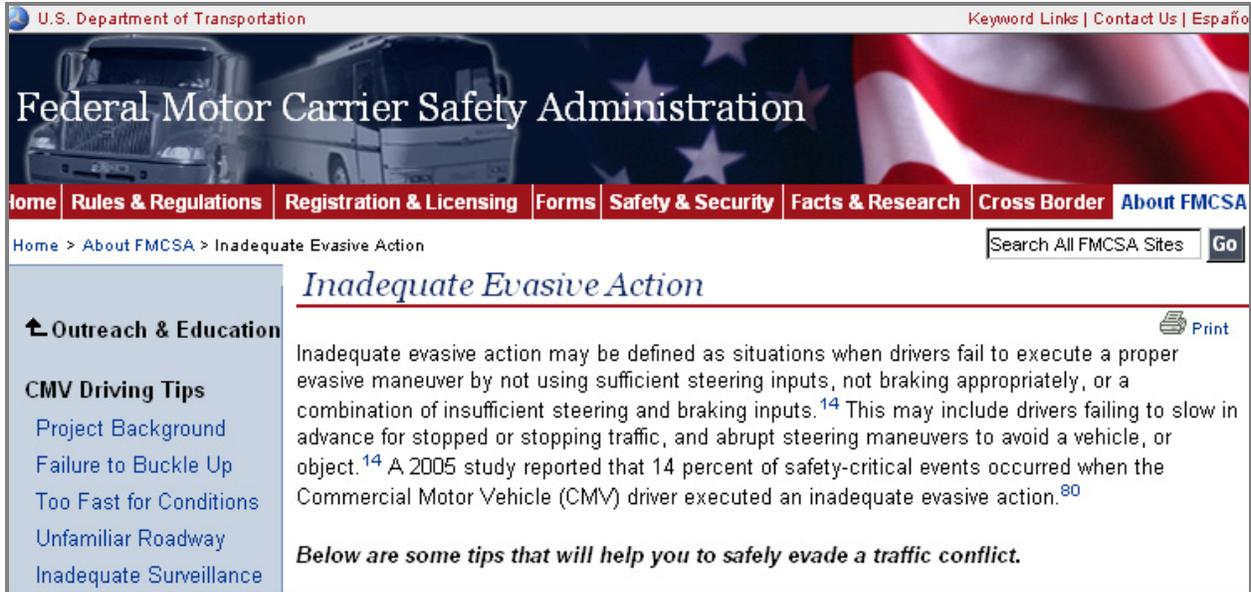
Adjust your following distance to appropriately match weather conditions, road conditions, visibility, and traffic. In emergency conditions, maintaining a safe distance from the vehicle in front of you will allow you to stop safely and/or to take necessary evasive action.⁷⁸

Did You Know? The average stopping distance for a loaded tractor-trailer traveling at 55 mph (in ideal conditions) is 196 feet, compared with 133 feet for a passenger vehicle.⁷⁹

Did You Know? Braking distance can be greatly affected by road surfaces, weather conditions such as rain, ice, and snow, or debris.⁷⁸

CMV WEB-BASED DRIVING TIPS: INADEQUATE EVASIVE ACTION

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Inadequate-Evasive-Action.htm>



The screenshot shows the top portion of a website. At the top left is the U.S. Department of Transportation logo. To the right are links for 'Keyword Links', 'Contact Us', and 'Español'. Below this is a banner image featuring a semi-truck, a bus, and an American flag. The text 'Federal Motor Carrier Safety Administration' is overlaid on the banner. A navigation menu below the banner includes: Home, Rules & Regulations, Registration & Licensing, Forms, Safety & Security, Facts & Research, Cross Border, and About FMCSA. Below the menu is a breadcrumb trail: Home > About FMCSA > Inadequate Evasive Action. To the right of the breadcrumb is a search box labeled 'Search All FMCSA Sites' with a 'Go' button. The main content area has a title 'Inadequate Evasive Action' and a 'Print' icon. The text defines inadequate evasive action and includes a citation. A sidebar on the left lists 'Outreach & Education' and 'CMV Driving Tips' with sub-links: Project Background, Failure to Buckle Up, Too Fast for Conditions, Unfamiliar Roadway, and Inadequate Surveillance. Below the main text is a bolded sentence: 'Below are some tips that will help you to safely evade a traffic conflict.'

U.S. Department of Transportation Keyword Links | Contact Us | Español

Federal Motor Carrier Safety Administration

Home | Rules & Regulations | Registration & Licensing | Forms | Safety & Security | Facts & Research | Cross Border | About FMCSA

Home > About FMCSA > Inadequate Evasive Action Search All FMCSA Sites

Inadequate Evasive Action Print

Inadequate evasive action may be defined as situations when drivers fail to execute a proper evasive maneuver by not using sufficient steering inputs, not braking appropriately, or a combination of insufficient steering and braking inputs.¹⁴ This may include drivers failing to slow in advance for stopped or stopping traffic, and abrupt steering maneuvers to avoid a vehicle, or object.¹⁴ A 2005 study reported that 14 percent of safety-critical events occurred when the Commercial Motor Vehicle (CMV) driver executed an inadequate evasive action.⁸⁰

Below are some tips that will help you to safely evade a traffic conflict.

Outreach & Education

CMV Driving Tips

- [Project Background](#)
- [Failure to Buckle Up](#)
- [Too Fast for Conditions](#)
- [Unfamiliar Roadway](#)
- [Inadequate Surveillance](#)

CMV WEB-BASED DRIVING TIPS: INADEQUATE EVASIVE ACTION

Tip #1: Watch For Brake Lights From Slowing Vehicles in Front of You

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Inadequate-Evasive-Action.htm>

<ul style="list-style-type: none">Driver FatigueDriver DistractionFollowing Too CloselyInadequate Evasive ActionDocumentsReferences	<p><i>TIP # 1: WATCH FOR BRAKE LIGHTS FROM SLOWING VEHICLES IN FRONT OF YOU</i></p> <p>Focus on several lead vehicles ahead, or at least 15 seconds in front of you.¹⁶ Focusing on the vehicles ahead of you and being aware of their brake lights will allow you to safely react to changing conditions.⁴¹</p> <p>Did You Know? It takes 3/4 of a second from the moment your brain sends the signal to your foot to move from the accelerator to when your foot actually applies the brake. In this short period of time, you may have already traveled 60 feet.¹⁶ Focusing on the vehicles ahead of you will help you react in a safe and timely manner.</p> <p>An example of a driver performing an inadequate evasive action is shown in the video clip below. Training exercise questions follow the video clip.</p> <div data-bbox="552 829 1177 1333" style="text-align: center;"><p>Inadequate Evasive Action</p></div> <p>VIDEO DESCRIPTION: The CMV driver is traveling in the right lane of a two-lane highway during the day. He is approaching stopped traffic ahead of him, but does not slow down and instead passes the stopped vehicle on the right side, crossing onto the shoulder. He then approaches a stop light and again fails to decelerate, this time passing the stopped vehicle from the left side and proceeding through the middle of an intersection.</p> <p>TRAINING EXERCISE: After viewing the video, try to answer the following questions:</p> <ul style="list-style-type: none">• What indicators of slowing traffic should the driver have taken notice of and responded to?• How did the driver behave in response to a slowing lead vehicle?• What could the driver have done differently?
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CMV WEB-BASED DRIVING TIPS: INADEQUATE EVASIVE ACTION

Tip #2: Practice Good Scanning Habits

<http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Inadequate-Evasive-Action.htm>

TIP # 2: PRACTICE GOOD SCANNING HABITS

Scan the driving environment and be aware of potential hazards. Recognize the hazards, determine what action to take, and then execute your actions safely. Knowing what hazards to be aware of will keep you prepared to execute proper evasive actions.

Did You Know? Two-vehicle crashes between large trucks and passenger vehicles result from inadequate evasive action 6.6 percent of the time.⁸¹

ACKNOWLEDGEMENTS

The authors would like to thank Ed Miller and Joon Song, of Wyle Information Systems, who also played a key role in the development of this website. In addition, we would like to thank the focus group participants—Vern Moore, Tom DiSalvi, Jerry Waddell, Scott Manthey, and Del Lisk—who provided valuable feedback and suggestions during the development phase of the website.

This project would not have been possible without the participation of the drivers during the Drowsy Driver Warning System Field Operational Test and their giving permission to use their video clips on the website.

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