Efficacy of Web-Based Instruction to Provide Training on Federal Motor Carrier Safety Regulations

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

May 2011

FOREWORD

The current report presents the findings of a study evaluating the effectiveness of Web-based instruction (WBI) for training Government regulations. A literature review, two surveys and a review of other Federal and State agency practices were conducted as part of this effort. Based on the findings, the study outlined a set of best practices for developing Web-based instruction to provide training on Federal motor carrier safety regulations. The study also proposed a set of measures to evaluate the efficacy of future WBI systems for training motor carriers and drivers about safety regulations. This information will be useful to fleet safety managers and public sector training professionals seeking to utilize Web-based instruction for training Government regulations.

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16. Abstract

This report presents an evaluation of the current state-of-the-art Web-based instruction (WBI), reviews the current computer platforms of potential users of WBI, reviews the current status of WBI applications for Federal Motor Carrier Safety Administration (FMCSA) stakeholders, and sets out specific instances of WBI successes in other Government regulatory agencies. The report also presents a set of measures that the FMCSA can use to measure the efficacy of any future WBI system that may be used to inform motor carriers and drivers, as well as Federal and State enforcement personnel, about regulations. Also included in this report is a literature review of general WBI literature, FMCSA and U.S. Department of Transportation uses of WBI, and other Federal and State Government WBI applications.

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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		
in²	square inches	645.2	square millimeters	mm²
ft²	square feet	0.093	square meters	m²
yd²	square yards	0.836	square meters	m²
Ac	Acres	0.405	hectares	ha
mi²	square miles	2.59	square kilometers	km²
		VOLUME	Note: Volumes greater than 1000 L shall be shown in m³	
fl oz	fluid ounces	29.57	milliliters	mL
Gal	Gallons	3.785	liters	L
ft³	cubic feet	0.028	cubic meters	m³
yd³	cubic yards	0.765	cubic meters	m³
		MASS		
Oz	ounces	28.35	grams	g
Lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE	Temperature is in exact degrees	
°F	Fahrenheit	5 × (F-32) ÷ 9 or (F-32) ÷ 1.8	Celsius	°C
		ILLUMINATION		
Fc	foot-candles	10.76	lux	lx
Fl	foot-Lamberts	3.426	candela/m²	cd/m²
		Force and Pressure or Stress		
Lbf	poundforce	4.45	newtons	N
lbf/in²	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		
mm²	square millimeters	0.0016	square inches	in²
m²	square meters	10.764	square feet	ft²
m²	square meters	1.195	square yards	yd²
Ha	hectares	2.47	acres	ac
km²	square kilometers	0.386	square miles	mi²
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m³	cubic meters	35.314	cubic feet	ft³
m³	cubic meters	1.307	cubic yards	yd³
		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	Temperature is in exact degrees	
°C	Celsius	1.8C + 32	Fahrenheit	°F
		ILLUMINATION		
Lx	lux	0.0929	foot-candles	fc
cd/m²	candela/m²	0.2919	foot-Lamberts	fl
		Force & Pressure or Stress		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in²

* 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 ABBREVIATIONS AND ACRONYMS

CDC	Centers for Disease Control and Prevention
CDL	commercial driver's license
CMV	commercial motor vehicle
DHHS	Department of Health and Human Services
DOI	Department of the Interior
EDF	experimental design framework
FDA	U.S. Food and Drug Administration
FEMA	Federal Emergency Management Administration
FMCSA	Federal Motor Carrier Safety Administration
FMCSR	Federal Motor Carrier Safety Regulation
Hazmat	hazardous materials
HAZWOPER	Hazardous Waste Operations and Emergency Response
ISD	instructional systems design
NOAA	National Oceanic and Atmospheric Administration
NRC	Nuclear Regulatory Commission
ORA	Office of Regulatory Affairs
OSHA	Occupational Safety and Health Administration
STS	Special Transportation Service
TSI	Transportation Safety Institute
USDOT	U.S. Department of Transportation
WBI	Web-based instruction

EXECUTIVE SUMMARY

PURPOSE, RATIONALE, AND BACKGROUND

The Federal Motor Carrier Safety Administration (FMCSA) is exploring concepts of Web-based instruction (WBI) because of its potential to reach a relatively large audience at relatively low cost. Resource constraints have led FMCSA to consider using state-of-the-art training methods to reach the more than 4 million commercial drivers and 514,000 interstate motor carriers the Agency regulates. Additionally, FMCSA relies on a large number of Federal and State employees to carry out its safety and regulatory mission. These employees must know and be certified as knowing Federal Motor Carrier Safety Regulations (FMCSRs). Therefore, FMCSA funded research to examine the efficacy of using Web-based instruction (WBI) to disseminate information and train personnel about FMCSRs. This research is focused on these study questions:

- What is the efficacy of WBI to provide training on FMCSRs?
- Is there enough research literature to gauge the efficacy of WBI? If not, how should WBI be evaluated?
- Do other regulatory agencies have experience in WBI?
- How is security protected in WBI applications, and what is the appropriate use of WBI in regulatory environments?
- What are the barriers to WBI use in the motor carrier industry?
- What are best practices for use of WBI in a regulatory environment?

PROCESS

This project evaluates the current state-of-the-art WBI, reviews current computer platforms for potential users of WBI, reviews the current status of WBI applications for FMCSA stakeholders, and seeks out specific instances of WBI successes in other Government regulatory agencies. As a result, the current project aims to develop a set of measures to enable the FMCSA to measure the efficacy of future WBI systems that could be used to inform motor carriers and drivers, as well as Federal and State Enforcement personnel, about Federal regulations. Included in this project is a literature review of general WBI literature, FMCSA and U.S. Department of Transportation (USDOT) uses of WBI, and other Federal and State Government WBI applications.

STUDY FINDINGS

Literature Review

Web-based instruction, if well-designed, has been shown to be effective in a wide variety of settings, both inside and outside the Government. The literature review concludes that WBI provides a delivery method where costs and time can be significantly reduced as personnel can

access training materials online (Cornford & Pollock, 2003) and new information can be updated easily and efficiently (Rosenberg, 2001). Evidence also suggests that technology-based instruction, including WBI, is less costly and potentially more effective than traditional instructional methods when developed by staff experienced in the design of online training (Bartley & Golek, 2004). Furthermore, the benefits of WBI increase when instructional equipment (e.g., computers, projectors, televisions, and software) is incorporated and a large number of personnel are involved (Dodds & Fletcher, 2004). Dodds and Fletcher identified a "rule of thirds" from their assessment of the benefits of technology-based instructional methods (including WBI). The researchers found that technology-based instruction reduced instruction costs by approximately 33 percent, reduced the instruction time by approximately 33 percent, and increased learning by approximately 33 percent. WBI can be especially useful in organizations and Government agencies that train personnel across a wide geographic area, especially those agencies with personnel in isolated locations (Taylor, 2002). WBI provides these individuals the opportunity to learn from their current location without the need to travel to a central location. This is particularly advantageous for the motor carrier industry as drivers, fleet safety managers, or other field personnel can complete training as long as they have a computer and access to the Internet.

While many regulatory agencies and organizations provide WBI to their employees, WBI is not frequently used by the Government to disseminate information to the motor carrier industry. There are some examples of private transportation training schools that use WBI, and some businesses that use WBI for driver training. However, few State and Federal Government agencies have used WBI to train motor carrier vehicle drivers. The literature review did identify some specific FMCSA applications of WBI. USDOT's Transportation Safety Institute (TSI) is discussed in detail.

Other State and Federal regulatory agencies also use WBI as a training tool. These agencies include the Office of Regulatory Affairs (ORA), the National Oceanic and Atmospheric Administration (NOAA), the Department of Health and Human Services (DHHS), the U.S. Department of the Interior (DOI), the Federal Emergency Management Administration (FEMA), and the Nuclear Regulatory Commission (NRC). Despite the existence of these programs, many do not have published data evaluating the effectiveness of their in-house programs. The literature review describes several of these programs in detail.

To gauge the current level of use of WBI that is provided by private sector businesses and organizations to motor carriers, the authors conducted a search for online training options provided by industry stakeholders. The results of this search indicated that there are a significant number of Web-based training products and services available to motor carriers, which provides some evidence that such programs are both utilized and effective. The authors analyzed the information by placing trucking industry WBI users into two categories: managers and drivers. The literature review describes the content and technologies of several key WBI programs.

Surveys

As part of this study, two surveys were conducted—the first posed general questions related to WBI to trucking company safety professionals, and the second asked respondents to answer questions related to FMCSA's commercial motor vehicle (CMV) Driving Tips Web pages. Survey responses were received from 62 fleet safety managers.

The results from the first survey suggest that WBI can be a powerful training tool in CMV operations when properly developed. The greatest benefit in using WBI to provide training on Federal Motor Carrier Safety Regulations (FMCSRs) is the convenience of delivering instruction via the Internet. Trainees would no longer need to meet in a physical location to participate in training. Instead, they could simply log in to a secure Web site to complete training.

Results from the second survey indicate that the CMV Driving Tips Web pages are an effective WBI application. Fleet safety managers identified the CMV Driving Tips Web pages as more engaging and interesting than receiving the same information via traditional classroom instruction or by reading a book.

Despite the strengths of WBI, respondents noted a number of weaknesses pertaining to the use of WBI to provide training on motor carrier regulations. Many safety managers expressed concern over replacing classroom instruction with WBI, noting that classroom instruction provides trainees with an important opportunity to interact with both other trainees and the instructor. Many respondents believed classroom instruction should not be replaced, but that WBI could complement traditional classroom instruction.

Fleet safety managers identified initial costs as a barrier to implementing WBI, but the reduction in long-term costs were considered a benefit. Because WBI is delivered via the Internet, recurrent costs associated with instruction and materials could be minimized. Additionally, costs associated with updating training for new regulations would be substantially less. Using WBI to provide FMCSR training also affords FMCSA the ability to track, monitor, and store information on those who have completed training and testing, and to identify those who have not completed (and may need) training.

Fleet safety managers responded that security issues should also be addressed prior to implementing WBI application on FMCSRs. As personal information would be submitted to track progress, ensuring trainees' privacy would be critical. Another barrier indicated by fleet safety managers was the potentially limited computer proficiency of commercial drivers. Lastly, managers responded that some individuals may be hesitant to complete WBI. Developing an interactive, enjoyable, useful, and secure WBI application is likely to alleviate some of these concerns.

Based on the results from fleet safety manager respondents, an effective WBI program should be designed to complement traditional classroom instruction. Discussion or message boards should be integrated into WBI to build rapport between trainers and trainees as well as provide trainees with the opportunity to ask questions and receive prompt answers to these questions. Despite these weaknesses and barriers in implementing WBI, the questionnaire results suggest that the ease of customizing and updating training materials was viewed as a significant advantage of WBI compared to traditional classroom lectures.

Section 2 includes a summary of the authors' interviews with key FMCSA staff members. The two major findings from these interviews are that individual units in FMCSA are implementing WBI applications and there is little to no coordination among these various FMCSA units.

CONCLUSIONS

An analysis of the literature reviews and surveys produced a set of best practices for WBI systems. These are:

- A WBI training program should provide an interactive learning experience for the user. It should be able to tailor instruction to the individual needs of the trainee, and the trainee should be able to ask the program questions and seek advice, feedback, and tips.
- The WBI should allow each user to enter and exit the training course as desired.
- The WBI should be easy to use.
- The WBI should be visually rich.
- Learning in the WBI should be recorded in a common database to document progress and completion. This information can be used to track progress through the program and the information can be used to show proof of completion.
- Trainees should be able to set their own pace throughout the WBI.
- The WBI should include objective criteria to assess learning.
- Any one-time event (e.g., webinar) should be kept online for a set period of time to allow users to access the event after it has occurred.

1. INTRODUCTION

1.1 PROJECT PURPOSE

The Federal Motor Carrier Safety Administration (FMCSA) is exploring concepts of Web-based instruction (WBI) because of its potential to reach a relatively large audience at relatively low cost. Resource constraints have led FMCSA to consider using state-of-the-art training methods to reach the more than 4 million commercial drivers and 514,000 interstate motor carriers the Agency regulates. Additionally, FMCSA relies on a large number of Federal and State employees to carry out its safety mission. These employees must know and be certified as knowing FMCSA regulations (FMCSRs). Therefore, FMCSA funded research to examine the efficacy of using Web-based instruction to disseminate information and train personnel who work for motor carriers about FMCSRs This research is focused on these study questions:

- What is the efficacy of WBI to provide training on FMCSRs?
- Is there enough research literature to gauge the efficacy of WBI? If not, how should WBI be evaluated?
- Do other regulatory agencies have experience in WBI?
- How is security protected in WBI applications, and what is the appropriate use of WBI in regulatory environments?
- What are the barriers to WBI use in the motor carrier industry?
- What are best practices for use of WBI in a regulatory environment?

1.2 GENERAL OVERVIEW OF WBI

Computer access and the World Wide Web (also referred to as the Web) have become embedded in the lives of individuals and organizations around the world to the extent that, in 2004, nearly 75 percent of all technology-driven courses offered by organizations were conducted via the Internet (Sugrue & Rivera, 2005). Thus, the adoption of the Internet as both a personal and business necessity has led many Government and educational institutions to emphasize Web-based instruction (WBI) and training (Web-Based Education Commission, 2000, Bartley & Golek, 2004).

In *Web-based instruction: An introduction* (Khan, 1998), WBI is defined as "a hypermedia-based instructional medium, which utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported" (p. 63). In other words, WBI is a distance learning tool that facilitates the learning of specific information via the features and resources of the Internet.

Since WBI is a relatively new and emerging concept, there currently is not a standard term that has been coined to describe such activities. Other terms that refer to Web-based instruction include:

- Distance learning.
- Electronic Learning, E-Learning or eLearning.
- Web-based learning or Web-based education.
- Online training or online class(es).
- Web-based seminar or webinar.

The last item, Web-based seminar, or webinar, is specifically defined as "a workshop or lecture delivered over the Web" (PC Magazine, n.d.). Webinars may be a one-way Web cast, or there may be interaction between the audience and the presenters.

This definition introduces important distinctions within WBI activities. A distinction is whether an instructor or instructors are required as part of the education process. The webinar format typically includes instructors or presenters disseminating information to large, dispersed groups. The need for an instructor in this format also requires that a specific time be set for occurrences of this type of WBI, although a webinar may also be archived for future on-demand access.

Other WBI activities, however, exist only in the form of electronic files that are accessed by a user/student. Therefore, neither an instructor nor a specific timeframe is required for such WBI activities.

Regardless of format, WBI is only practical and feasible if a sound technological format is being used. WBI has recently become a prominent tool in businesses and Government institutions due to advances in Internet bandwidth, enhanced standards for technology, and increased diffusion of personal computers (Clarke & Hermens, 2001). However, several other practical reasons for the proliferation of WBI as a means to educate and train employees include:

- Simplicity and cost effectiveness of updating training materials and information.
- Eliminates travel costs and reduces time associated with face-to-face instruction.
- Ability to reach a larger audience than traditional classroom instructional techniques allow.
- Standardized, just-in-time training technique to help employees receive information as it is needed (Evans & Haase, 2001).

1.3 PROJECT APPROACH

This project aims to evaluate the current state-of-the-art WBI, review the current computer platforms of potential users of a Web-based instruction system, review the current status of WBI applications for FMCSA stakeholders, and seek out specific instances of WBI successes in other

Government regulatory agencies. As a result, the current project aims to develop a set of measures that the FMCSA can use to measure the efficacy of any future WBI system that may be used to inform motor carriers and drivers, as well as Federal and State enforcement personnel, about FMCSRs. Included in this project is an extensive literature review of WBI across public domains. The purpose of the literature review is to evaluate the potential for the development of a WBI service. More specifically, this literature review focuses on the following questions:

- What is the current WBI state-of-the-art in both the United States and around the world?
- What are the best practices and barriers for using WBI in a regulatory environment?
- How has WBI been applied in the motor carrier industry?
- What has been the experience of other Federal and State regulatory agencies that have used, or are using, WBI to disseminate information regarding Government regulations?
- What is the efficacy of WBI to provide training about FMCSRs?
- Are there any indications that WBI for Government-required motor carrier training is structurally different than that for other types of intensive, regulatory mandated training in other areas of transportation and throughout the economy?
- Are there current computer links that cross jurisdictional boundaries for the sharing of regulatory information?
- What is the installed base of potential users of an FMCSA-led WBI information dissemination program?

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2. LITERATURE REVIEW

2.1 GENERAL OVERVIEW

2.1.1 Benefits of WBI

The production and distribution of public information is one of several effective policy tools available to administrative bodies that are tasked with improving public safety. Traditionally, such information is given in the form of printed documents, face-to-face presentations and instruction, and public announcements, to name a few delivery vehicles. Economic pressures to reduce the distribution costs of such information, however, have caused many Government agencies and organizations to examine the ability of WBI training methods to educate individuals effectively in a more cost-efficient manner than traditional classroom teaching methods.

The rationale behind exploring WBI as a training and public information dissemination tool for Government begins first with the audience, which, at the Federal level, is often a large, highly dispersed, and seemingly remote population. The use of the Internet to deliver information to this audience may provide greater training and information access to all populations and may represent a more cost efficient means to do so. Secondly, regulations and best practices (i.e., "information") often change; WBI may offer a means by which changes in information can be quickly updated and distributed in a highly efficient manner.

What Brock, McFann, Inderbitzen and Bergoffen et al. (2007) said about computer-based instruction (CBI) can be applied to WBI, as well:

> *CBI is not intrinsically good. If instructional programs are not well designed, if student needs are not met, if incorrect or incomplete content is presented, and if student performance is not measured, then all that the computer does is provide an efficient means for bad instruction to be distributed (Brock, 1997, 2003). CBI can be more interesting than conventional instruction; it can be more engaging, more entertaining, more individualized, and more exciting. Nevertheless, if the result of the instruction is not measurably improved human performance, it does not make any difference. (p. 7).*

But the power of computers to instruct and provide information is significant. Computers can provide graphics, video, and sound of the highest quality. Computers can adapt pace, mode, and content to meet the information needs of each user.

Within the literature, it has been stated that WBI provides a delivery method where costs and time can be significantly reduced as personnel can access training materials online (Cornford & Pollock, 2003) and new information can be updated easily and efficiently (Rosenberg, 2001). Evidence also suggests that technology-based instruction, including WBI, is less costly and potentially more effective than traditional instructional methods when developed by staff experienced in the design of online training (Bartley & Golek, 2004). Furthermore, the benefits of WBI increase when instructional equipment (e.g., computers, projectors, televisions, and software) is incorporated and a large number of personnel are involved (Dodds and Fletcher,

2004). Dodds and Fletcher identified a "rule of thirds" from their assessment of the benefits of technology-based instructional methods (including WBI). The researchers found that technology-based instruction reduced instruction costs by approximately 33 percent, reduced the instruction time by approximately 33 percent, and increased learning by approximately 33 percent. WBI can be especially useful in organizations and Government agencies that train personnel across a wide geographic area, particularly those agencies with personnel in isolated locations (Taylor, 2002). WBI provides these individuals the opportunity to learn from their current location without the need to travel to another location. This is particularly advantageous for the motor carrier industry as drivers, fleet safety managers, or other field personnel can complete training as long as they have a computer and access to the Internet.

2.1.2 Limitations of WBI

Although there are many benefits of WBI, there are several occasions when WBI may not be as effective as traditional classroom instruction. Replacing all classroom instruction with WBI should be considered cautiously as WBI could result in a less knowledge retained compared to classroom instruction (Arbaugh, 2005; Dumont, 1996; LaRose & Whitten, 2000; Sitzmann, Kraiger, Stewart & Wisher, 2006). For example, when teaching declarative knowledge (i.e., memorization of facts and principles), classroom instruction has been found to be 20 percent more effective than a comparable WBI that did not offer the individual control, practice, and performance feedback (Sitzmann, Kraiger, Stewart & Wisher, 2006). Declarative knowledge refers to an understanding of the tasks and specifics required to perform a job. In other words, if WBI does not provide the individual with the ability to control the pace of instruction, ample practice scenarios, questions, and feedback, classroom instruction is more effective when teaching specific occupational regulations.

Research has also found that WBI is a poor method when training individuals on procedural knowledge (Taylor, 2002; Welsh, Wanberg, Brown & Simmering, 2003). Procedural knowledge refers to information on how to physically perform a certain task, such as welding or construction. These tasks involve the performance of behavior that is learned over successive approximations, and lend themselves more thoroughly to hands-on and/or on-the-job training techniques.

2.1.3 Effectiveness of WBI

There is an abundance of research examining the effectiveness and usefulness of WBI in organizations (Sitzmann et al., 2006). Sitzmann et al., operationally defined training effectiveness as the trainee's retention of knowledge obtained from the instruction method. Therefore, in order to assess the effectiveness of WBI it is important to examine the trainee's ability to retain information presented and how he/she reacts to WBI.

Some research that has compared the effectiveness of WBI to traditional classroom instruction did not find a statistically significant difference in general effectiveness of the two instructional methods (Zhao, Lei, Lai & Tan, 2005). Zhao et al., performed a meta-analysis of 51 journal articles that compared distance learning instructional methods (including WBI) with classroom instruction. When all the studies were considered as a whole, the researchers found no statistical difference between distance learning and classroom instruction. This suggests that WBI is as effective as traditional classroom instruction. While the meta-analysis found both approaches to

be equal, 66 percent of the studies in the meta-analysis found distance learning to be more effective than classroom instruction; the remaining 34 percent reported classroom instruction to be more effective. One moderating variable identified in the meta-analysis was the date the studies were published. Studies conducted after 1998 reported distance learning to be more effective because of improved technical advances in instructional technologies, such as online communication software (e.g., email, message boards, and chat rooms). Zhao et al. (2005) also found the level of instructor involvement and the education level of the trainee to affect effectiveness. As instructor involvement increased, the effectiveness of distance learning also increased. Moreover, distance learning tended to be more effective for trainees who have a high school diploma or above; however, there was not a significant difference between distance learning and classroom instruction for trainees who had at least a 2-year college degree.

Other research studies, however, have found WBI to be more effective than traditional classroom instruction. Sitzmann et al. (2006) completed a meta-analysis of 96 studies that included 19,331 trainees across 168 different courses. Results indicated that WBI was 6 percent more effective than classroom instruction when teaching declarative knowledge. In addition, trainees were equally satisfied with both instructional methods. The authors also found that WBI tended to be more effective for older trainees and those trainees who were allowed to self-select their instructional method. This suggests that the ability to select the instructional method and self-manage learning are important factors in the retention of knowledge. Sitzmann et al., concluded that classroom instruction and WBI were both effective instructional methods, but WBI was more effective with older individuals (who presumably are better at self-managing their learning) when the information being taught was declarative knowledge.

In another meta-analysis of 46 studies (Liao, 1999), the effectiveness of hypermedia instruction (i.e., WBI) was compared with non-hypermedia instruction (i.e., computer-based instruction, classroom instruction, and video). Liao found a mean positive effect size of 0.41, indicating that hypermedia instruction resulted in greater learning than non-hypermedia instruction. Additionally, results indicated that hypermedia instruction may be used to teach a variety of content areas such as business and computer science, and has the potential to be an effective instructional method.

Dodds and Fletcher (2004) reviewed 233 studies of basic technology-based instructional methods (e.g., video) and 44 studies of interactive multimedia instruction (e.g., computer) and intelligent tutoring systems (e.g., WBI). Results indicated that the intelligent tutoring system was the most effective instruction method. The intelligent tutoring system improved trainees' scores by 1.05 standard deviations over classroom instruction as compared to 0.39 and 0.50 for technology-based and multimedia instruction, respectively. Therefore, Dodds and Fletcher concluded that WBI was the most effective instructional method compared to other technology-based instruction.

Despite these conflicting research results, the overall consensus is that WBI is as effective as traditional classroom instruction when designed to provide the individual with control, feedback, and practice. However, there is strong support for implementing WBI given the significant cost and time benefits of WBI compared to traditional classroom instruction (Sitzmann et al., 2006).

2.1.4 Generational Learning Styles

A wealth of research exists in the area of generational learning and specific characteristics attributed to people based on the era during which they were born and grew up (e.g., Coates, 2006; Oblinger, 2003; Dede, 2007). Studies have identified four generations currently in the workforce, determined by birth years, where societal change and technological growth affected their experiences and later preferences in school and work. The following discussion is taken from a report to the Department of Energy by Seitz (2009).

Table 1 shows the generations by birth year and common labels attributed to the generation:

Table 1. Four Generations in the Workplace

Veterans (Traditionalists, Silent Generation)	Baby Boomers	Generation X	Generation Y (Millennials)
Born prior to 1946	1947–1964	1965–1979	1980–2000

Source: Seitz, 2009

The point of this brief overview of generational differences is to highlight the need for effective WBI systems to adapt to those differences among the system's users.

As an organization comes to the best possible understanding of their employees through these lenses, it develops the ability to design and implement opportunities to learn, grow, and develop their collective knowledge wealth. The following are brief descriptions of generational characteristics and learning styles identified by various sources.

Veterans (also known as Traditionalists, Silent Generation) share values at work that include conformity, hard work, discipline, logic, and conservative spending (many Veterans experienced the Depression and World War II, or the effects of these events). When engaged in learning, they often expect a demonstration of respect for a person's background and experience, content that includes real-world connections and examples, and inclusion of all test content within classroom materials and instruction.

Baby Boomers are an optimistic generation who often seek personal gratification from work. They value team-oriented corporate cultures, a person's experience, and a drive to succeed. Their approach to learning includes structured introductions/ice breakers, content that occurs in a logical progressive manner, opportunities to practice new skills, and positive feedback.

Generation Xers share the experience of growing up during the rise of the Internet and a technologically driven economy. Their work preferences are known to reflect values that mirror the digital era; they have a sense of entitlement, are confident with high expectations for personal growth, and are accustomed to being nurtured. Most notable is their ability to multitask. Generation Xers define high-quality learning as flexible and accommodating their personal preferences. They enjoy learning that is formatted in game scenarios and simulations rather than content that requires remote learning. Lectures are a possible format for learning, but Generation Xers prefer lectures to include engaging content that incorporates interaction with the audience.

Generation Yers (also known as Millennials) are a unique combination of characteristics from previous groups engaged in learning through multiple formats and contexts. Like Veterans, Generation Yers believe civic duties are important, and they are optimistic like their Baby Boomer colleagues. They have never known a world without the Internet, sharing the tech-savvy skills of the Generation Xers. Generation Yers thrive in cultures of collaboration and integrate sociability elements throughout their work and personal lives. A distinctive feature of this generation is its rejection of learning material content that is presented in a predetermined linear format. Rather, Generation Yers prefer to choose their own starting point and navigate through materials in the manner they see fit.

In summary, we envision a broad spectrum of WBI possibilities, with the styles to be used for any particular instruction program customized based on the expected generation(s) using the instruction. For example, the young, technologically savvy user will be comfortable with the WBI but the more experienced Veterans and Baby Boomers may need more intuitive systems rich with help and prompting components.

2.1.4.1 Driver demographics

The target audience of the WBI discussed in this report is the U.S. truck driver population. In 2006, this group numbered 3.48 million, which includes 5.2 percent female drivers and 31.1 percent minority drivers. (American Trucking Associations, 2007).

Regarding the age/generation of U.S. truck drivers, data from 2000 shows that among those drivers who that worked specifically in the truck transportation industry, the highest population of drivers fell in the age range of 35–44 (see Figure 1), and the overwhelming majority were 35 years of age or older. (Global Insight, 2005).

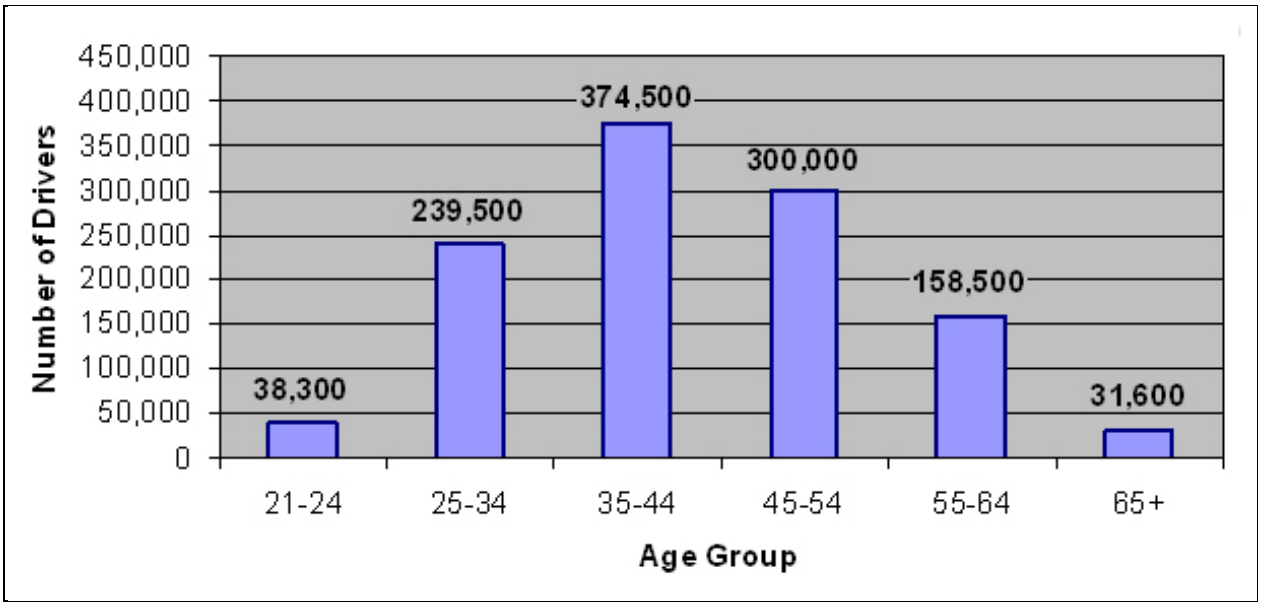

Figure 1. Population of U.S. Truck Drivers by Age Group

2.1.5 General Guidelines for WBI Implementation

The authors' literature review identified two reports with relevant guidelines for the implementation of WBI. The first report (Bartley & Golek, 2004) presents the model for Instructional Systems Design (ISD). The ISD model includes a five-step process (see Figure 2) for effective use of any instructional methods. The ISD five-step process is:

1. Analyze the current training needs of the organization (often performed though a needs analysis).
2. Design the learning objectives of the instructional system based on the identified needs of the organization.
3. Develop the actual training material and delivery method.
4. Implement the training to personnel.
5. Evaluate the training method (including an assessment of the trainees' reactions, amount of information retained, effect on job performance, and effect on organizational performance) (Bartley & Golek, 2004).

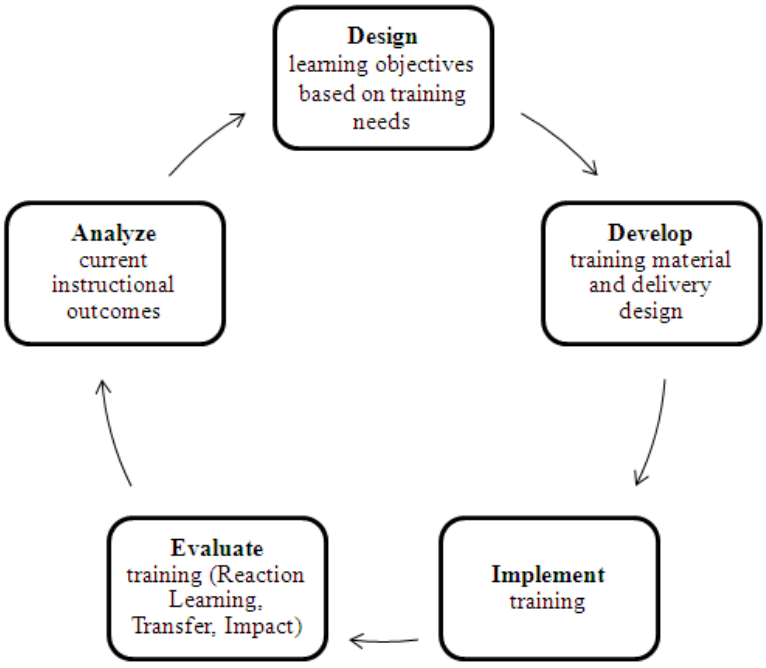

Figure 2. The ISD Model

Brock, McFann, Inderbitzen, and Bergoffen (2007) examined the effectiveness of driver training in the motor carrier industry. Part of their review examined similarities and differences in current motor carrier training programs and how various computer-based instruction methods (including WBI) and simulators could be used to improve these training programs. The authors concluded that well-designed computer-based instruction, including WBI and driving simulations, can improve drivers' performance in the areas of defensive driving and safe passing behavior. Based on this review, the authors developed 10 characteristics that should be incorporated when implementing WBI:

- WBI should provide an interactive learning experience where the trainee is asked frequent questions to assess learning. The WBI program should then be able to tailor instruction to the individual needs of the trainee. Furthermore, the trainee should be able to ask the program questions and seek out advice, feedback, and tips (Dodds & Fletcher, 2004).
- Effective WBI allows flexibility to enter and exit the training course as desired. A major advantage of WBI is the ability to complete training at an individual's desired pace.
- WBI should be easy to use. Trainees should not have difficulty with the use of WBI. The font should be large enough so that it is easy to read and the reading level should be relatively low so those with poor verbal skills do not have difficulty understanding the material.
- WBI should be visually rich. In other words, instructional programs should include realistic videos and photos. Additionally, computers and the Web have the capability to use many different multimedia components to aid learning. This multimedia should be integrated to provide a stimulating, positive learning experience.

- Effective WBI programs are customized to each individual's learning needs. Instruction should be "as easy or difficult, specific or abstract, and applied or theoretical, as necessary … [and be able to] adjust to the students most efficient learning styles (collaborative or individual, verbal or visual, and so forth)" (Dodds & Fletcher, 2004). For example, if an individual learns more effectively by self-pace and through the visual presentation of information, WBI should be able to modify the way information is presented to provide visual examples of the material. On the other hand, if another individual learns better verbally and needs to know how to apply the information on the job, WBI should be adjusted to include audio and should focus on the application of training material.
- Effective WBI involves a high retention of information by trainees. Information presented in WBI must be retained for later use. For example, trainees must be able to remember and apply the information discussed during WBI.
- Learning in WBI should be recorded in a common database to document progress and completion. This information can be used to track progress through the program and the information can be used to show proof of completion.
- Trainees should be able to set their own pace through WBI. Each trainee should be able to proceed through the instruction as fast or as slow as needed to meet the learning objectives. It should not matter how much time the trainee spends on instruction as long as the trainee achieved learning.
- WBI should include objective criteria to assess learning. For example, specific learning criteria should be evaluated; this assessment will track progress through the course.
- Finally, WBI should provide modal consistency. Instruction should reflect the information expected to be learned. For example, if trainees are expected to learn Hours-of-Service regulations, the WBI must incorporate visual displays that provide examples of the regulations. In other words, simply providing text or audio about visual information would not provide adequate instruction.

These characteristics were used as a set of guidelines to evaluate current WBI systems in this study.

2.1.6 Barriers to Implementation

Despite the benefits of WBI, there are several barriers to implementing WBI. Some barriers to WBI implementation include:

- Transforming face-to-face instruction to WBI.
- A lack of face-to-face interaction.
- Ability to access the Internet.
- Up-front costs associated with implementing WBI.

Perhaps the most challenging aspect of WBI implementation is transforming traditional classroom instructional lessons into a dynamic, stimulating online lesson with interactive

features that help the trainee understand the information (Bartley & Golek, 2004; Shaw, 2001). Many individuals view online education as static tutorials or online text instruction (Kilby, 2001). Simply placing printed material online without adding multimedia (e.g., graphics, video, audio, and photos) creates a dull learning environment for the user. This results in negative consequences, such as limited attention, misunderstanding, and decreased learning (Bartley & Golek). When designing WBI, it is critical to incorporate a variety of resources for the trainee to use that will elicit better understanding and comprehension of the information presented.

Another challenging barrier is the lack of face-to-face interaction between instructor and trainee (Welsh et al., 2003). In traditional classroom instruction, face-to-face interaction between the trainee and instructor can facilitate learning by developing rapport and asking direct questions. Thus, when designing WBI it is important to incorporate technologies that allow trainees to ask questions and receive answers. Message boards and discussion groups, moderated by an expert, can be created where trainees can post relevant questions and discussion topics online. These tools allow trainees to interact and develop a more thorough understanding of course topics.

Although Internet access has become widespread, some individuals may not have access to the Internet, or their computers may not have the processing power (or Internet bandwidth) to view rich media in a timely manner (Sitzmann et al., 2006). Furthermore, trainees may lack the technical or computer skills necessary to complete training successfully. Thus, it is important for organizations to assess each individual's needs prior to training. If an individual does not have access to a computer, the organization may provide one to the individual, require the individual to come to a central location, or make suggestions regarding public Internet access (e.g., a library). If the individual lacks the skills necessary for WBI, the organization may provide the individual with basic computer or technical training.

Lastly, substantial up-front costs are associated with the design and development of WBI (Bartley and Golek, 2004). Well-designed WBI systems require experienced staff capable of developing WBI and the information technologies necessary to design an effective instructional system. While there are considerable up-front costs, these costs are outweighed by the reduced costs involved in updating training materials, associated travel time, time off work, and expenses associated with face-to-face instruction.

2.2 SPECIFIC APPLICATIONS OF WBI IN STATE/FEDERAL GOVERNMENTS

While many regulatory agencies and organizations provide WBI to their employees, other than FMCSA and possibly National Highway Transportation Safety Administration, WBI is not frequently used by the Federal Government to disseminate information to the motor carrier industry. There are some examples of private transportation training schools that use WBI (e.g., ProTek Group, Carriers Edge, and Safetek), and some businesses that use WBI for driver training (e.g., General Electric, Schneider Trucking, UPS, Smithway Motor, Ryder, and Frito Lay).

The U.S. Department of Transportation's (USDOT) Transportation Safety Institute (TSI) provides WBI for FMCSA and motor carrier vehicle drivers (see www.motorcarriertraining.com). Courses from the Motor Carrier Division were designed by

USDOT's subject matter experts to ensure the quality and validity of training content. The courses encompass the same material that is presented in TSI's traditional classroom course in Oklahoma City, OK. This WBI program aims to deliver FMCSR training to motor carrier vehicle drivers, safety managers, owner/operators, and other transportation personnel.

The purpose of TSI's WBI is to:

- Deliver FMCSR training that is readily accessible and cost efficient.
- Boost familiarity and understanding of FMCSR requirements.
- Help drivers and transportation personnel identify and reference information within the FMCSRs.
- Build drivers' knowledge and skills necessary for FMCSR compliance.
- Provide procedures for record maintenance as required by the FMCSRs.
- Provide motor carrier organizations with tools to achieve a "satisfactory safety rating."

The WBI courses offered by TSI are:

- Defensive driving for commercial motor vehicle (CMV) drivers that teaches how to avoid crashes associated with: start-up and back-up procedures; parking; changing lanes; passing; driving in adverse conditions; the negotiation of intersections; curves and turns; and interaction with passengers and pedestrians.
- A guide to the commercial driver's license (CDL) requirements that covers the process for obtaining a CDL and teaches drivers to recognize CDL requirements, disqualifications, and penalties.
- A guide to driver qualification regulations, which covers the purpose and requirements of driver qualification regulations.
- A guide to driving CMVs that helps drivers recognize general safety practices, such as vehicle inspection practices and taking precautions before driving.
- A guide to drug and alcohol regulations that requires trainees to learn restrictions, consequences, and testing procedures for the use of alcohol and controlled substances.
- A guide to the Hours-of-Service regulations that teaches the goals and revisions to the Hours-of-Service regulations. In addition, this course covers the maximum driving times allowed for CMV drivers, the Out-of-Service criteria for violations, exceptions to the maximum driving times, and the required contents of the Record of Duty Status.
- A guide to CMV inspection requirements to fulfill the driver's inspection requirements in teaching the proper procedures for vehicle deficiency and safe operation requirements.
- A guide to the Hours-of-Service regulations for oilfield operations that covers the oilfield exceptions to the Hours-of-Service regulations and applications to real-life scenarios.
- A combination course of all the previously mentioned topics with certification.

- Management courses in all previously mentioned areas.

To effectively train personnel, TSI's WBI incorporates interactive multimedia, audio, auxiliary material for additional help, real-world scenarios to apply knowledge, and exams to gauge learning. To support the training, this WBI uses a learning management system featuring easy-to-use interfaces, automatic recordkeeping of training courses, and the online creation of reports. The time it takes to complete the courses ranges from 30 minutes to 2 hours and 30 minutes. Several State agencies and transportation organizations have officially begun using TSI's WBI for CMV driver training.

Other than the WBI offered through TSI there is limited use of State and Federally sponsored WBI in commercial vehicle operations. However, one example of these programs is offered through the State of Minnesota Commercial Vehicle Operations, which administers several WBI courses that allow commercial vehicle drivers to learn at their own pace and convenience. The WBI courses offered by the State of Minnesota Commercial Vehicle Operations included the following (State of Minnesota Commercial Vehicle Operations, n.d.):

- CMV driver training to introduce drivers to the basic regulations and fundamental requirements of CMV operation in the State of Minnesota. Topics covered in this course included:
  - Online access requirements and important CMV definitions.
  - Driver qualifications and drug and alcohol testing regulations.
  - Hours-of-Service regulations.
  - CMV inspection, repair, and maintenance.
  - CMV driver requirements.
  - CMV parts and accessories requirements.
  - Interaction with law enforcement officials.
  - CMV safe driving practices.
- Hazardous materials (hazmat) training for preparing and transporting hazardous materials on public highways. Topics covered in this course included:
  - The hazardous materials table.
  - Shipping paper requirements.
  - Marking and labeling hazardous materials.
  - Hazardous material placards.
  - Packaging, security, training, and transporting hazardous material by highway.
- Training how to prepare for a DOT audit. Topics covered in this course included:
  - Different types of CMV audits.
  - CMV insurance requirements.
  - CMV driver qualifications and drug and alcohol testing.

  - Hours-of-Service regulations.
  - CMV maintenance requirements.
  - Hazardous materials.
- Training for the initial motor carrier contractor to meet compliance standards required by the State of Minnesota. This course included a summary of safety regulations for For-Hire CMV drivers, the operating authority permit required to provide for-hire transportation services, and driver registration requirements.
- Training for limousine drivers in Minnesota. Topics in this course included:
  - The definitions and requirements for limousine drivers.
  - Vehicle and limousine driver requirements.
  - Recordkeeping requirements.
  - Vehicle registration requirements.

An introduction to the Minnesota New Entrant Safety Assurance Program. This course offered two modules. The first module was a guide to improving highway safety for CMV drivers, while the second module was a guide to the transport of hazardous materials for CMV drivers.

- Training for special transportation service providers. Topics covered in this course included:
  - The definition of special transportation service (STS) provider.
  - STS provider requirements.
  - STS driver requirements.
  - STS vehicle and equipment requirements.
  - A review of the annual evaluations.
  - An introduction to STS provider assessment.

Trainees are required to proceed through a series of modules which cover a specific topic, such as the hazardous materials regulations. (See Figure 3 and Figure 4 for screenshots from the State of Minnesota Commercial Vehicle Operations WBI training module.) After completing each module, a series of questions are asked to gauge knowledge and learning. The training module will only proceed when the correct answers are provided.

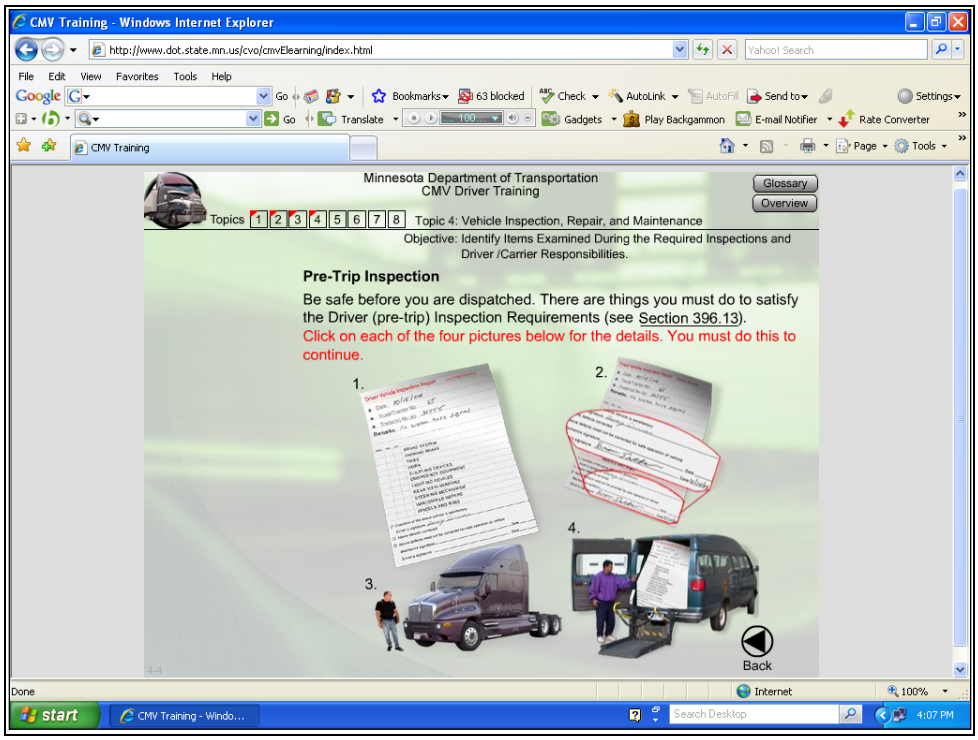

Figure 3. Screenshot of the State of Minnesota Commercial Vehicle Operations' CMV Driving Training

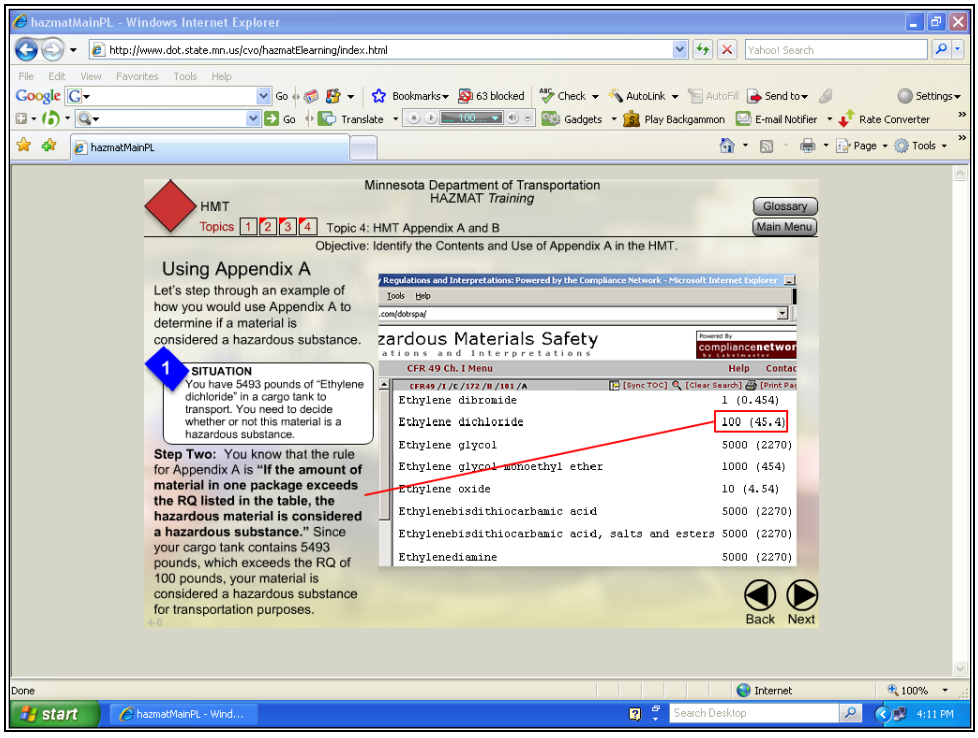

Figure 4. Screenshot from the State of Minnesota Commercial Vehicle Operations' Hazardous Materials Training

2.2.1 WBI in Other Regulatory Agencies

After an extensive literature search, the authors could not find any published literature on WBI provided by Government to the motor carrier industry outside of those previously mentioned. However, other State and Federal regulatory agencies use WBI as a training tool. These agencies include the Office of Regulatory Affairs (ORA), the National Oceanic and Atmospheric Administration (NOAA), the Department of Health and Human Services (DHHS), the U.S. Department of the Interior (DOI), the Federal Emergency Management Administration (FEMA), and the Nuclear Regulatory Commission (NRC). Despite the existence of these programs, many have not published data evaluating the effectiveness of their in-house programs. The NRC, NOAA, and DHHS have each published anecdotal data concerning the effectiveness of their respective programs. The remainder of this section will provide brief descriptions of each WBI application within these agencies.

The ORA, as a division of the U.S. Food and Drug Administration, offers a number of WBI courses though their ORA University. These programs aim to teach the regulatory community trainees current rules, regulations, and best practices associated with the regulation of foods and drugs within the U.S. Some on-line training programs are delivered through other government agencies, such as the Centers for Disease Control and Prevention (CDC). The Agency's WBI programs vary in design. Some programs use case studies that require the trainee to apply knowledge of rules and procedures to real-life scenarios. In these modules, the trainee is provided a description of the problem and some basic background information. Then, the trainee is asked what steps should be taken to resolve the issue and to prevent the issue from occurring in the future. For example, one WBI program, which is delivered through CDC, in a case study about botulism in Argentina, trainees advance through a number of interactive sections covering different aspects of the case and how the case was handled (CDC, 2009). In each section trainees are asked several questions regarding what they would do in the situation and what should have been done differently (Figure 5).

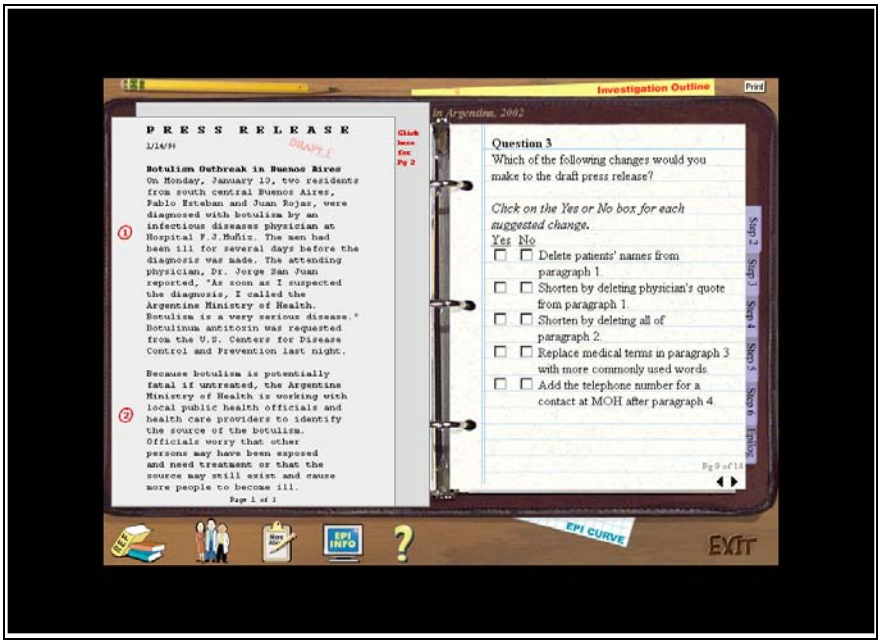

Figure 5. Screenshot from ORA's Computer-Based Case Study: "Botulism in Argentina"

In other programs, trainees proceed through interactive guides that are presented in the form of realistic photos and explanatory scenarios. Following each section of the program, trainees are presented with quizzes to assess learning and comprehension. For example, in a course designed to familiarize personnel with food defense awareness, trainees proceed through a series of sections covering the various steps associated with the ALERT food defense strategy (Assure, Look, Employees, Reports, and Threat). In each section, trainees are provided with information about why that step in food defense is important (FDA, 2007). Then they are given the opportunity to apply what was discussed by responding to a real-life scenario (Figure 6).

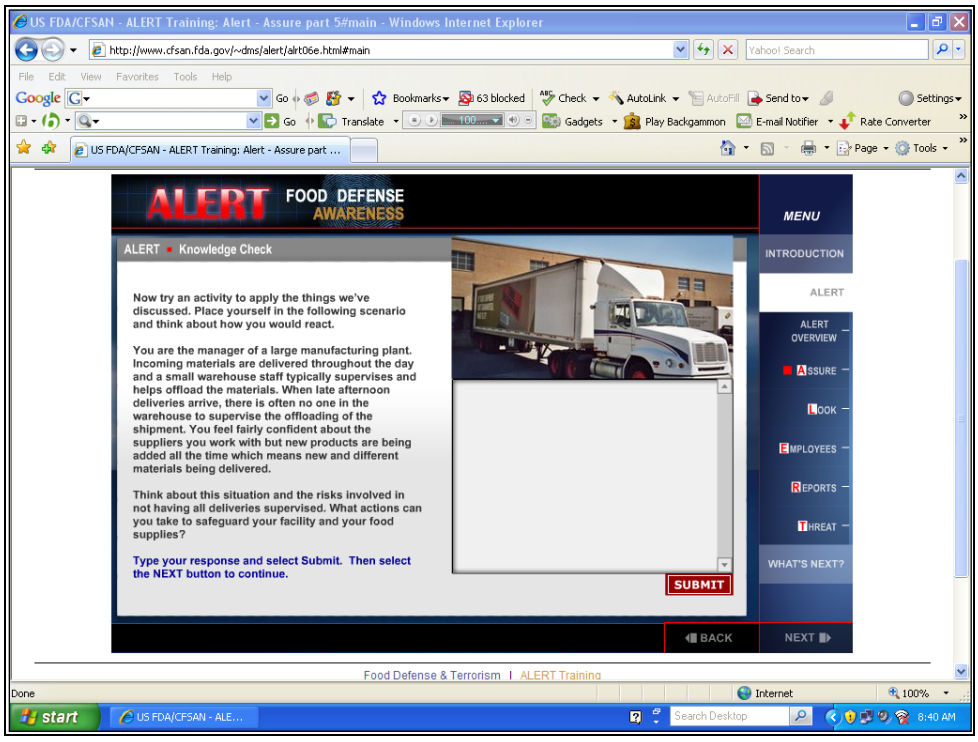

Figure 6. Screenshot for FDA's ALERT: Food Defense Awareness Training

NOAA provides a variety of Web-based training opportunities for employees. Each opportunity consists of a series of Web pages that provide background information on the specific topic. The modules also provide links to additional information, if the trainee needs supplementary material or practice. At the end of each module a series of questions help assess learning and identify problem areas that need to be addressed. Incorporated in the modules are visual displays, such as photos and graphs, and audio that can be played if desired. For example, in a Web-based training course on chemical hazards and reactions, trainees are taught how to recognize, evaluate, and control chemical hazards while on the job. (See Figure 7 for a screenshot from the NOAA program). The course includes a number of sections that cover the definition and types of chemical hazards, why chemical hazards are dangerous, how to avoid chemical reactions, and how to evaluate and control any hazards encountered. In each section, there are photos of various chemicals that are hazardous and information on how to safely handle them. There is also optional audio that can be played if desired. Throughout the course, practice quizzes and assessments allow the trainee to test his or her knowledge of the material. NOAA's Coastal Services Center delivers four different WBI programs. An analysis of Web site traffic over the first 10 months in 2008 revealed more than 38,500 initial Web site visits, 5,200 recurring Web

site visits, and 8,100 Web site visits where individuals completed the entire course (NOAA Coastal Services Center, 2008).

Figure 7. Screenshot from NOAA's WBI on Chemical Hazards and Reactions

DHHS offers a WBI program through the Hazardous Materials Training and Research Institute. This WBI program provides information to employees who need immediate training and cannot wait to schedule training in a traditional classroom setting. In addition to this WBI, training is usually supplemented with instructor-led, hands-on training at one of their partnering colleges or universities. For example, one of the courses offered is a Hazardous Waste Operations and Emergency Response (HAZWOPER) course designed to achieve HAZWOPER certification through both WBI and face-to-face instruction. (See Figure 8 for a screenshot of the DHHS HAZWOPER course). Included in this course are 24 hours of online instruction and 16 hours of traditional classroom instruction. The course consists of text, interactive online activities, additional Web links, self-assessment quizzes, and a final exam. After completing the WBI, trainees attend a 2-day workshop to complete the U.S. Occupational Safety and Health Administration's (OSHA) 40-hour training requirement. The Hazardous Materials Training and Research Institute evaluated the effectiveness of their HAZWOPER WBI program by surveying trainees after course completion. These data showed the following results:

- Fifty-four percent of the trainees thought the software and Web-based learning environment was "easy to use and accessible," while only 18 percent thought it was "not user-friendly" (28 percent were neutral).
- Eighty-one percent of the trainees believed WBI was "as good as" or "better" than a traditional classroom course, while only 18 percent thought it was "not as good as" than a traditional classroom course (1 percent were neutral).

- Thirty-six percent of the trainees thought the course was "O.K.," 36 percent thought the course was "good," and 18 percent thought it was "excellent," while 9 percent thought the course needed improvement (1 percent were neutral) (National Institute of Environmental Health Sciences, 2003).

Figure 8. Screenshot from the Hazardous Materials Training and Research Institute's HAZWOPER Training Course

DOI launched an online training Web site, DOI LEARN, which has separate sections accessible to either the public or to DOI personnel. The Web site serves to provide all of DOI's training needs on one Web site. The courses offered under DOI LEARN provide both the public and employed personnel with up-to-date information about specific policies, procedures, and best practices. DOI courses available to the public range from accounting classes to law enforcement classes. The DOI LEARN Web site allows individuals to access a variety of learning resources, such as examples of best practices, case studies, reference material for additional information, video presentations, and live satellite broadcasts. On the Web site, individuals can access information on all the courses offered by DOI, including WBI and classroom instruction. Additionally, DOI LEARN allows supervisors to view training requests from their employees and track individuals' progress through training.

FEMA implemented a WBI program designed to introduce trainees to the National Response Framework that describes how U.S. emergency response personnel should prepare for and provide unified service during natural disasters and emergencies. Individuals taking this course proceed through six lessons at their own pace. These lessons cover:

- The purpose of the National Response Framework.

- The roles and responsibilities of those who provide assistance and how to request assistance.
- What actions take place to respond to emergencies.
- An overview of the organizational structure of response organization.
- How planning for a response to natural disasters and emergencies takes place.
- A summary of the National Response Framework.

Within each lesson are a number of different sections covering specific topics, such as how local governments manage an emergency response. The lessons include video, audio, pictures, and supplementary information. (See Figure 9 for a screenshot from the FEMA program). Throughout each section individuals are instructed to take quizzes to assess their knowledge and to identify areas of information that need further explanation. If the individual does not get all the answers correct on the quiz, the program prompts the individual to try the quiz again. If the individual answers incorrectly on the second quiz, the answers, with explanations, are provided.

Figure 9. Screenshot of FEMA's WBI on the National Response Framework

NRC uses several methods to train personnel, including instructor-led traditional lecture and discussion, computer-based simulations, and WBI. WBI is used to provide inspectors with new and revised information concerning nuclear regulations (NRC, 2006). This WBI program is used both as an initial qualification training tool for new inspectors, as well as for refresher training of experienced inspectors. The commission also uses its Web portal to disseminate new information to both the public and employees about the Reactor Oversight Process as new information is

available. (See Figure 10 for a screenshot of NRC Web portal.) Furthermore, the NRC implemented a knowledge management tool via the Web to help personnel prepare for inspections and includes a message board to promote communication among inspectors. Evaluations of the program have shown that employees believe the program provides useful and accurate information in an efficient manner despite some reports that navigation through the Web site can be difficult and confusing (NRC, 2006). Initially, personnel reported difficulty navigating through the Web site to find pertinent information. After revising the Web site based on these suggestions, most personnel have provided positive feedback, stating that the site provides useful training information, nuclear plant assessment results, and updated regulatory information at appropriate times.

Figure 10. Screenshot of U.S. NRC's Reactor Oversight Process Web site

Lastly, OSHA's Office of Training and Education has recently provided employees with WBI and satellite broadcasts in conjunction with traditional classroom instruction. OSHA uses WBI as an initial training tool to provide the necessary rules, regulations, and information to personnel. After completing WBI, employees attend classroom instruction for more hands-on experience. Thus, WBI allows personnel to gain specific knowledge of OSHA rules and regulations at their convenience and ensures that all individuals who attend the classroom instruction possess the same fundamental knowledge. For example, in OSHA's first WBI course, "Introduction to Excavation, Trenching, and Soil Mechanics," the WBI portion of the course covers information traditionally found in textbooks, such as excavation site requirements, cave-in protection, and rock and soil analysis. Once trainees complete the WBI, a 5-day on-site course is required to present hands-on training with real-life scenarios. In addition to WBI geared specifically towards employees, OSHA has developed a number of Web-based modules available to the general

public concerning various occupational safety hazards, (e.g., eye and face protection, and hospital safety). These modules present information concerning OSHA regulations and how to maintain safe work environments. For example, in the hospital safety WBI course, 12 different modules are available concerning safety in each area of the hospital (e.g., administration, Intensive Care Unit, pharmacy, heliport, and laboratory). Common safety hazards and how personnel can prevent injuries from these hazards are the primary topics in these modules. (See Figure 11 for a screenshot of the OSHA hospital safety program.)

Despite the lack of objective data evaluating the effectiveness of these programs, the number of WBI courses in Government agencies is growing. These agencies have found that WBI is a cost-effective, expansive method for providing personnel with up-to-date information on agency rules, regulations, and training. The number of WBI programs currently available in Government agencies demonstrates that agencies value the benefits and convenience associated with WBI programs.

Figure 11. Screenshot of OSHA's Hospital eTool

2.3 PRIVATE SECTOR TRAINING ACTIVITIES

The freight trucking industry is in a unique position to benefit from the dissemination of information, training and regulations through WBI. The size and scope of the industry, with 8.7 million employees (including 3.48 million truck drivers) across 50 States (American Trucking Associations, 2007), demands that information be distributed to a highly decentralized population. Additionally, this workforce does not conduct business in a static location; on-the-road truck drivers may be away from a company facilities and/or households for weeks or even

months at a time. Thus, access to traditional training methods (e.g., in-classroom formats) may not be a convenient or cost-effective method to train drivers on new regulations or best practices.

There are, however, challenges that face the use of WBI in the trucking industry. As with any population, access and ability to use the Internet and/or a computer among truck drivers is not assured. Likewise, as has been stated previously, the literature indicates that traditional training practices can be more effective than WBI in some instances.

To gauge the current level of use of WBI that is provided by private sector businesses and organizations to motor carriers, the authors scanned online training options provided by seven industry stakeholders. The results of this scan indicate that there are a significant number of Web-based training products and services available to motor carriers, which provides some evidence that such programs are both utilized and effective. The authors analyzed the information by placing trucking industry WBI users into two categories: managers and drivers.

2.3.1.1 Trucking Company Manager Training through WBI

The trucking company manager category includes several different positions that may relate to finance, maintenance, general operations, or safety. For this discussion, the topic of WBI products has been categorized into those that are not safety-related, and those that deal specifically with an aspect of safety.

The first group of WBI training products that were identified can be described as non-safety-related training programs. The two central topics identified within this group were organizational and operational systems, and finance.

Among the identified safety-related, manager-based WBI topics are general safety courses, are the following topics:

- Identifying and eliminating of hazardous situations.
- Recording incidents.
- Inspecting vehicles.

Training for reasonable suspicion of drug or alcohol use/abuse was also a highly-visible WBI focus. Training topics for this subject include an overview of regulations, testing requirements and processes, determining when to test a driver, the symptoms and possible consequences of drug and alcohol use/abuse, how to order tests, and return-to-duty procedures.

Additionally, some WBI courses for managers specifically address 49 CFR §382.603 requirements for driver supervisors; such courses provide instruction related to alcohol misuse, and use of controlled substances, as required by FMCSRs.

2.3.1.2 Truck Driver Training through WBI

The topics taught through Web-based instruction for drivers were found to be more extensive than those available for managers. The authors categorized these courses into three areas:

- Truck driving basics.
- Operating practices.
- Instruction on specific regulations.

Courses on truck driving basics are, as the title implies, introductory courses for drivers. One area of WBI focus is equipment training, which intends to familiarize the driver with the following topics:

- Diesel engines.
- Cooling, heating, and electrical systems.
- Frames, suspension and axles.
- Transmissions and differentials.
- Tires.
- Brakes.
- Inspections and maintenance.

Another area of basic WBI for drivers focuses on paperwork and planning, and includes the following topics:

- Keeping log books.
- Planning routes.
- Reporting accidents.

Operating practices, the next WBI category for drivers, contains four subcategories. The first subcategory is general driver training; while WBI programs are not a substitute for actual on-site experience, programs such as this, which include the following topics, can act as a means to introduce drivers to basic these driving concepts:

- Professional behavior.
- Hazardous materials handling.
- Vehicle inspections.
- Turning and Backing.
- Space/speed management.
- Coupling/Uncoupling.
- Hazard identification.
- Accident procedures.

- Truck fires.
- Basic driving techniques.
- Emergency maneuvers.

General driving safety is another topic covered in the field of WBI. Specific training programs were identified that include some or all of the following topics:

- Developing and maintaining a healthy lifestyle.
- Operating safely among the motoring public.
- Driver code of ethics.
- Seatbelts.
- Fatigue.
- In-vehicle technology.
- Vehicle inspections and adjustments.
- Mirror adjustment.
- Road rage.
- Adverse weather conditions.
- Mental preparation.
- Interaction with other vehicles.
- Night driving.

The third operating practices subcategory is defensive driving. Such courses may cover the causes of preventable accidents, collision prevention techniques, traffic laws, and defensive driving strategies and techniques.

The final subcategory is drug and alcohol use and abuse, which may cover the following topics:

- Laws related to alcohol and drug use.
- Safety-sensitive functions.
- Pre-employment, post-accident, random, reasonable suspicion, return to duty.
- Testing procedures and refusal to test.
- Consequences of alcohol and drug use/abuse.

The final driver-oriented category identified by the authors is specific training related to FMCSRs. Training that was offered for specific regulatory requirements were:

- 49 CFR §395, Hours of Service Regulations for Commercial Motor Vehicle Drivers—This includes training on the regulations related to when and for how long a driver may legally operate a vehicle, as well as how a driver must record duty status.
- 49 CFR §382.601(b), Alcohol and Drug Use/Misuse—Such training fulfills the requirement that employers must train drivers on company policy that addresses alcohol misuse and drug abuse.
- 49 CFR §380 (E), Entry Level Driver Training—This WBI material satisfies portions of the Federal entry level driver training requirements.

2.3.1.3 OSHA Training

In addition to WBI courses that specifically target motor carriers, a number of courses are available that address regulations administered by OSHA. The following is an example of a WBI course that may be of interest to the trucking industry and/or related industries.

HAZWOPER training courses, as previously described, represent an example of WBI that are relevant to both the trucking industry and to related industries. Such courses, which address 29, CFR Part 1910.120 (e) (3) (i) training requirements, are intended to be taken by those who work in close proximity to hazardous materials, and typically focus on the following areas:

- OSHA background information.
- Hazard identification.
- Exposure detection, treatment and prevention.
- Education on hazardous material types.
- Education on protective equipment.
- Site control techniques.

3. SURVEYS OF ATTITUDES REGARDING WBI FOR THE MOTOR CARRIER INDUSTRY

Two surveys were conducted as part of this effort. The first, herein referred to as Survey #1, offered general questions related to WBI to trucking company safety managers. The second, Survey #2, asked respondents to answer questions related to an FMCSA-hosted Web page named Driving Tips.

3.1 SURVEY #1

American Transportation Research Institute conducted a survey of motor carrier safety managers as part of this WBI research. As part of this effort, a survey instrument was produced, reviewed by the authors, and developed into an online data collection tool. The survey is shown in Appendix A. A link to the survey was distributed to a limited list of safety managers via an email announcement; thus, the method used for the distribution process constitutes a convenience sample of trucking industry safety managers. In total, the survey link was distributed to 283 individuals. Of those, 37 responded.

3.1.1 Survey #1 Primary Finding

Respondents were first asked information related to title/position. The majority of answers to this question fell into three primary categories:

- Vice President of Safety.
- Director of Safety.
- Safety Manager.

Respondents were next asked the following: *What is your company's primary type of business?* The results, as shown in Figure 12, show a well-distributed survey population, with the most typical respondent being a truckload carrier.

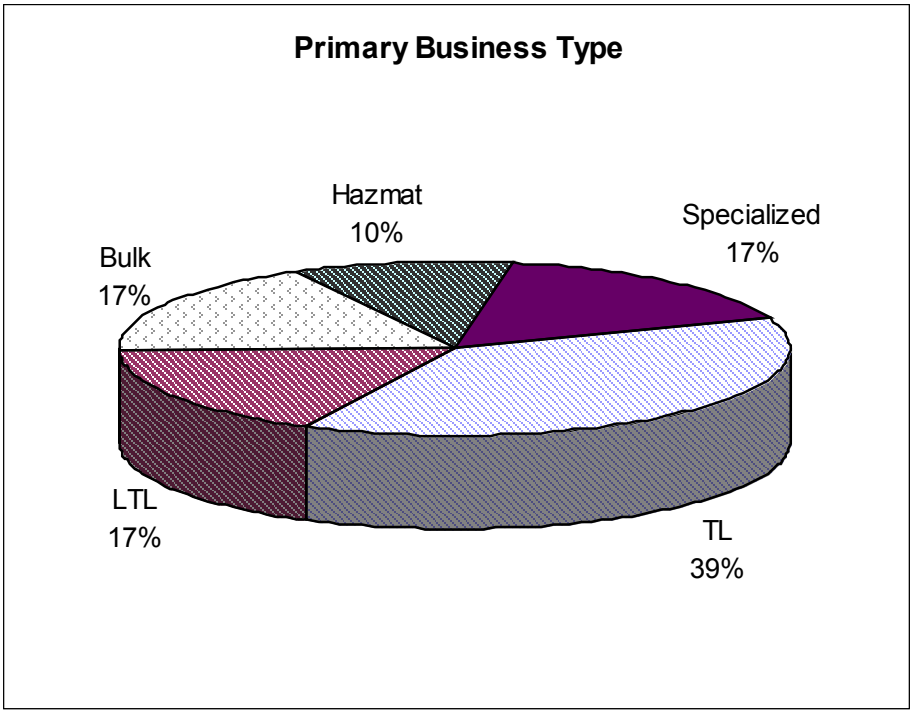

Figure 12. Primary Business Type

Respondents were next asked the following: *Does your company operate a private fleet or is it a for-hire carrier?* As is shown in Figure 13, approximately three-quarters of the respondents represented for-hire operations (76 percent).

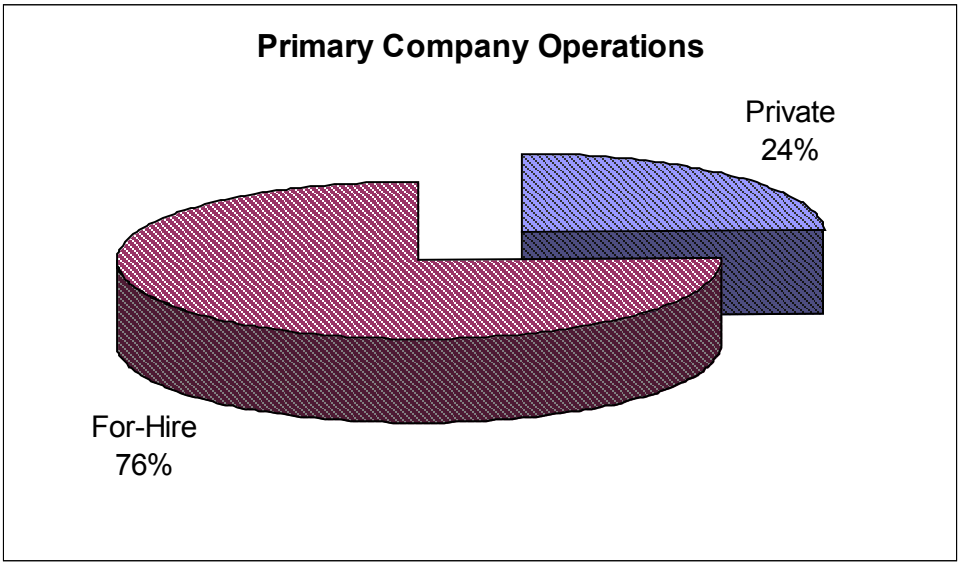

Figure 13. Primary Company Operations

Next the respondents were asked information related to the type of drivers that work for the fleet. Nearly 84 percent of those surveyed represented employ company drivers, while 16 percent utilize contract drivers (Figure 14).

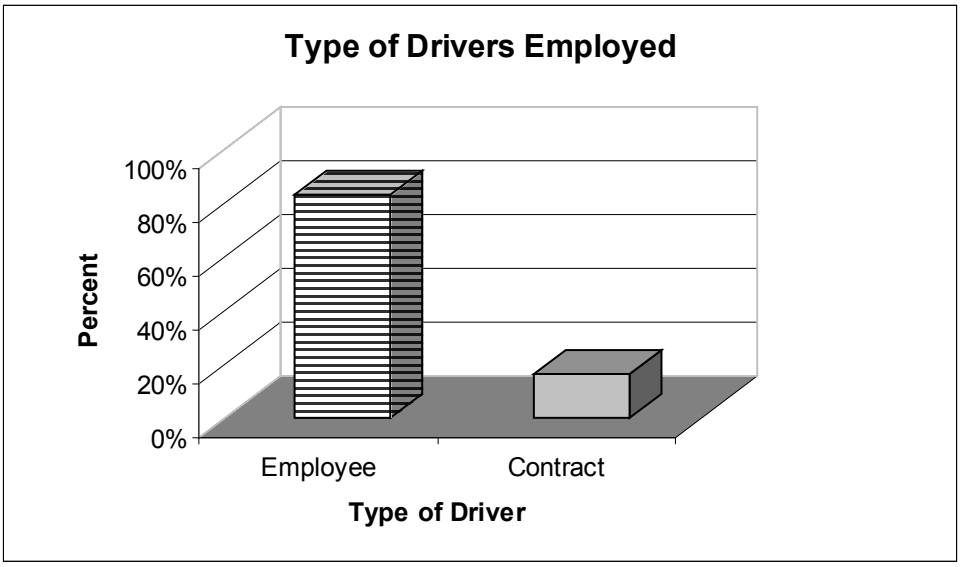

Figure 14. Types of Drivers Employed

More than 103,000 drivers were represented by the 37 carriers surveyed. The average number of employee drivers per carrier was 2,336 and the average number of contract drivers was 455. Median figures were 330 and 120 drivers, respectively.

Participants were then asked: *In very general terms, what is your standard training process for drivers who are new to your company?* For this open-ended question, respondents were asked to provide separate answers for new entry-level drivers and new drivers that enter the company as veterans. Drivers in the veteran category were said to have at least 2 or more years of experience.

Since this two-part question was open-ended, a variety of answers needed to be consolidated and filtered. The standard training formats for both new entry-level and veteran drivers are: classroom, computer, electronic media (video/CD), newsletters, orientation, senior/peer driver, simulator, skills evaluation, Web-based, and on-the-road.

Table 2 displays the subject areas covered for new entry-level drivers as reported by the survey respondents. It is important to note that some carriers in the dataset that do not hire and/or provide training to entry-level drivers.

Table 2. New Entry-Level Drivers

Subject Area	
• Air Systems • Company Policies and Procedures • Crash Prevention • Defensive Driving • USDOT Regulations • Driver Compliance • Freight Security • Fueling • Hazmat Handling	• Hours-of-Service • Level 1 Inspections • Office • Onboard Recorders • Safety • Trailer Operations • Type of Lading Transported • Vehicle Inspections • Work Zones

Answers related to the new veteran driver training subject areas covered are summarized in Table 3.

Table 3. Veteran Drivers

Subject Area	
• Accident Reporting • Air Systems • Company Policies and Procedures • Chaining • Crash Prevention • Defensive Driving • USDOT Regulations • Driver Compliance • Drug Testing • Equipment Inspection • Fatigue Management (proper sleep/diet) • Freight Security • Fueling • Hazmat Handling • Hours-of-Service	• Inclement Weather • Level 1 Inspections • Office • Onboard Recorders • Operational Interface • Regulatory Changes • Remedial • Road Testing • Safety • Trailer Operations • Type of Lading Transported • Vehicle Inspections • Work Zones • National Safety Council Defensive Driving Course for Professional Truck Drivers

Respondents were then asked the following question: *Do you conduct ongoing training for your drivers? This might include efforts to teach drivers about new regulations and best practices.*

Of the 37 respondents, only two indicated that no ongoing training was conducted. However, the 35 respondents who indicated a "yes" were prompted to further discuss these activities. The following is a synthesized list of the answers that were received:

- Accidents and Accident Reports.
- Backing.
- Bills of Lading/Shipment Documentation.
- Cargo Securing.
- Claim Prevention.
- Customer Service.
- Defensive Driving.
- Distracted Driver Prevention.
- Drug and Alcohol Awareness.
- Extreme Weather Driving.
- Fatigue Management.
- Following Distance.
- Fueling.
- General Regulatory Compliance Training for FMCSA, Pipeline and Hazardous Materials Safety Administration, OSHA and Environmental Protection Agency.
- General Safe Driving Techniques.
- Hazardous Materials Transport Training.
- Health and Wellness.
- Hours of Service.
- Internal Safety Policy Updates.
- Lift Gate Operation.
- Maneuvers.
- Manufacturing Plant Best Practices for Carriers.
- New Regulations and/or Regulatory Changes.
- Night Driving.
- Pre-Trip and Post Trip Inspection/General Equipment Inspection/Roadside Inspection.
- Proper Log Reporting.
- Remedial Training on Specific Topics.
- Rollover Prevention.
- Safe Lifting/Loading.

- Safety Practices Updates.
- Security Procedures.
- Slip and Fall Prevention/Jobsite Safety.
- Speed and Space Management.
- Training for New Equipment.
- Truck fires.
- Department of Homeland Security Transportation Worker Identification program, U.S. Customs-Trade Partnership Against Terrorism, U.S. and Canadian Free and Secure Trade program.
- Winter Driving/Tire Chaining.

Information related to the process for training managers was also collected. The standard training formats are: classroom, driver orientation, electronic media (video/CD), one-on-one, on-the-job, seminars, symposiums, teleconference classes, Web-based, and webinars. Trainer types and subject areas are shown in Table 4 (please note that these processes include, but are not limited to, safety managers).

Table 4. Training Managers

Trainer Type
• Industry Meetings • In-House • Insurance Companies • Missouri DOT Motor Carrier Services • North American Transportation Management Institute's Certified Director of Safety or Certified Safety Supervisor Certification • Professional Associations/Agencies • State Transportation Association • State Trucking Associations • Truckload Carriers Association, Inc. Safety/ Security Sessions
Subject Area
• Accident Reconstruction • Claims Management • Compliance • Defensive Driving • Drug/Alcohol Testing • Hazmat • Hours-of-Service • Loss Prevention • Physical Qualifications

Respondents were then asked a series of questions specifically related to Web-based instruction, beginning with: *How familiar are you with Web-based Instruction?* The participants were given three answer choices: very familiar, somewhat familiar, and not familiar at all. All respondents indicated some level of familiarity with WBI; this is not surprising since participation in the survey was self-selected. As indicated in Figure 15, roughly 57 percent of respondents were very familiar with WBI, and 43 percent were somewhat familiar.

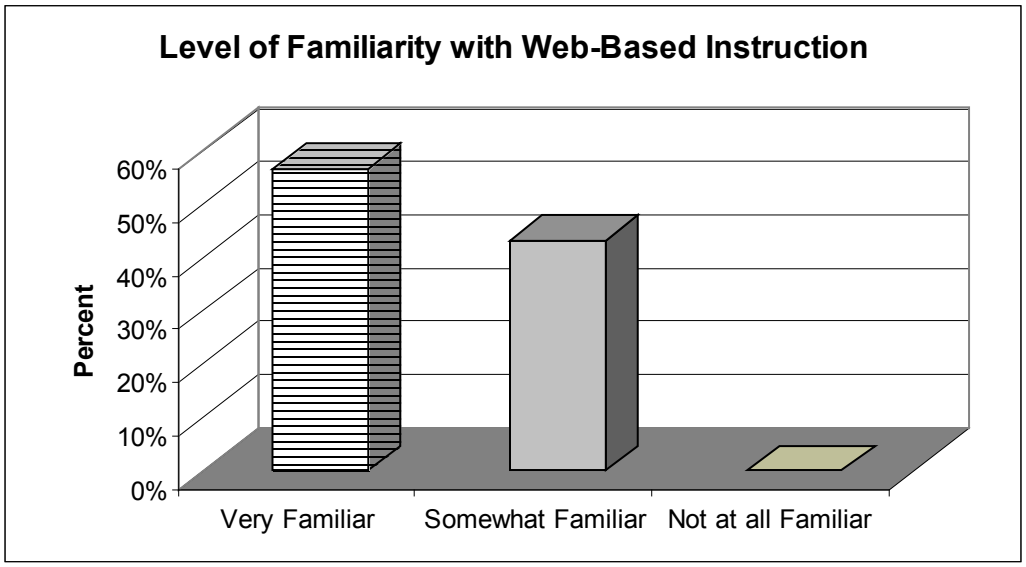

Figure 15. Level of Familiarity with Web-based Instruction

Next, all respondents were asked the following yes or no question: *Has a Web-based instruction course been used to train drivers in your fleet?* Approximately half of the respondents (57 percent) stated that WBI had not been used versus used (43 percent), as shown in Figure 16.

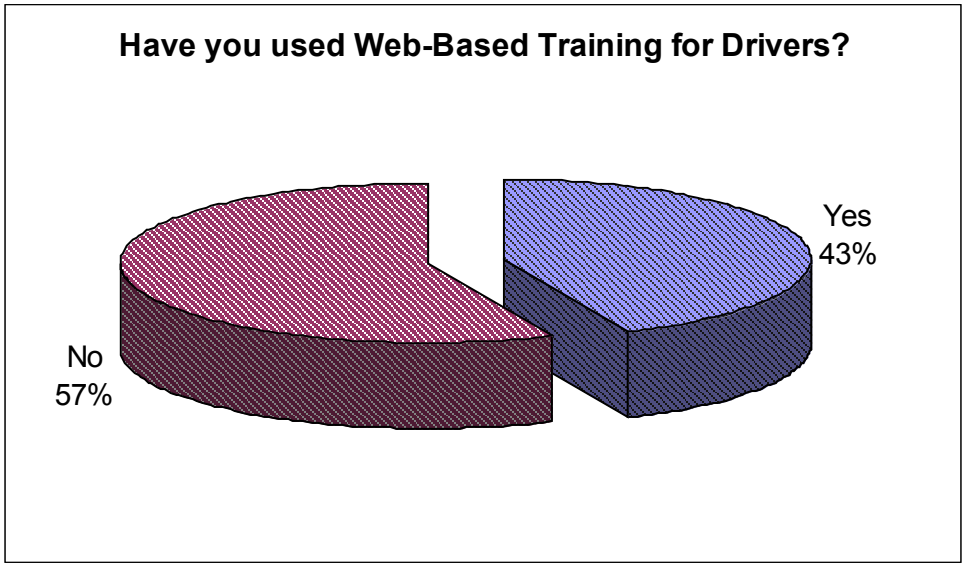

Figure 16. Have you used Web-Based Training for Drivers?

The answer to this key question in the survey determined the number and type of additional questions that a respondent would receive. If a "yes" answer was given, seven additional questions were asked. If a "no" answer was given, two questions were asked.

The first segment of the respondent population discussed is the "no" segment. The 21 respondents in this segment indicated that WBI had not been used, and were asked if there was any consideration within the company to select, develop or implement a WBI program. A majority (80 percent) of this sample segment stated that WBI had been or was currently being considered as a training tool. Typical descriptions of the current status of WBI selection among these particular non-users is as follows:

- We have or are currently testing programs/products.
- We are currently researching programs/products.
- We will implement a WBI program.
- We cannot overcome certain barriers (e.g., philosophical, union-related) to WBI implementation.

Next, the "no" respondents were asked: *In general, why has your company not used Web-based instruction?* The following is a list of synthesized answers:

- Technology limitations related to computers, driver access to computers and bandwidth.
- The driver access issue is especially true in the long haul trucking environment.
- Cost is too high.
- Drivers are at the terminal often enough to receive classroom instruction.
- Drivers are not committed to this format.
- Content is often not accurate or ideal.
- Other technology, such as simulators, is available.

The survey for the 21 member "no" population was then concluded.

As stated earlier, the 16 respondents that answered "yes" to the question "*Has a Web-based instruction course been used to train drivers in your fleet?"* were directed to the following seven questions.

The first question to this respondent subgroup asked which sections of the represented training process have incorporated WBI. Answers include the following:

- Annual training.
- Quarterly training.
- Monthly training.

- Remedial/Post accident training.
- Hazmat training.
- Defensive driving.
- General safe driving training.

The second question asked the 16 "yes" respondents how WBI courses are internally evaluated for effectiveness. Answers included the following evaluation criteria categories:

- Driver acceptance and through driver feedback.
- Ease of implementation.
- Feedback from managers.
- Measurement of metrics related to course content.

The third question asked what the advantages of WBI have been. The 16 respondents noted several advantages that fit into the following categories:

- There is 24/7 accessibility to training tools.
- Training is accessible from remote locations.
- Training is convenient for drivers.
- Training status can be tracked and validated.
- Training is standardized among all drivers.
- There is a savings in travel costs.
- With WBI, respondents are able to work with one driver at a time.
- WBI effectively teaches complex topics.
- WBI offers an overall cost savings.

The fourth question asked the respondents to describe the disadvantages of WBI. Answers were as follows:

- Cost.
- No student/teacher interaction and students have no control over the class.
- Less content.
- Less interaction with management.
- Computer access and issues.
- Internet speed constraints.

- Feedback from students is not collected/no way to measure effectiveness.
- Many drivers are not familiar with computers.

The fifth question asked respondents if WBI for the trucking industry could be improved. An overwhelming majority stated that WBI could be improved (87 percent), as shown in Figure 17.

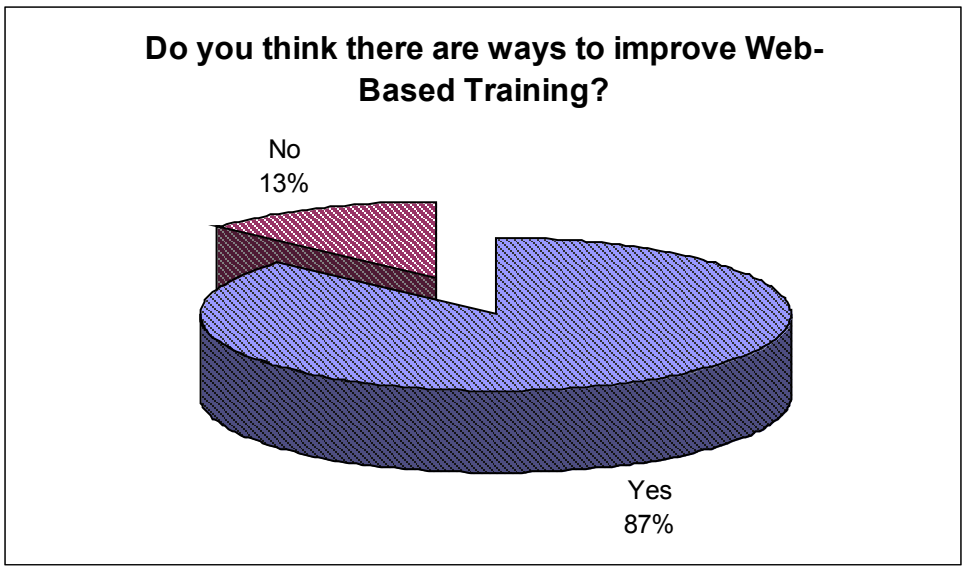

Figure 17. Do you think there are ways to improve Web-Based Training?

Suggestions for improvement and possible paths to improvement were given by the respondents, and included the following concepts:

- Presentation materials must be kept up-to-date.
- Training duration must be short and must focus on the most relevant content areas. Covering numerous topics/concepts is not effective.
- More involved, interactive training applications must be developed.
- There should be components that allow drivers to ask questions and receive responses during the training session.
- Training must be tailored for specific company operation (i.e., less-than-truckload, truckload, tanker, flatbed, refrigerated trailers, and van carriers).
- There must be more effective measures to determine driver acceptance of WBI and the drivers' level of participation.
- Conversion mechanisms must be developed to assist companies in transferring current training information that may be on DVD, tape or other formats to a web-based system;
- It must be ensured that the system is extremely user friendly and easy for participants to navigate.

- Courses should be expanded to include injury prevention and additional technical information that is practical for the industry (e.g., a program on how air brakes function);
- It would be beneficial to have additional streaming videos and quantifiable testing or certification.
- WBI must incorporate more details than it currently does for each subject area covered in the training.
- As more vendors enter the WBI market, competition will increase, and products will improve.

The 16 respondents currently utilizing WBI were asked the sixth key question: *Do you think it would be useful for the FMCSA to provide a Web-based instruction tool to your company to teach new regulations to your drivers?* As shown in Figure 18, the majority of respondents indicated that this would be useful.

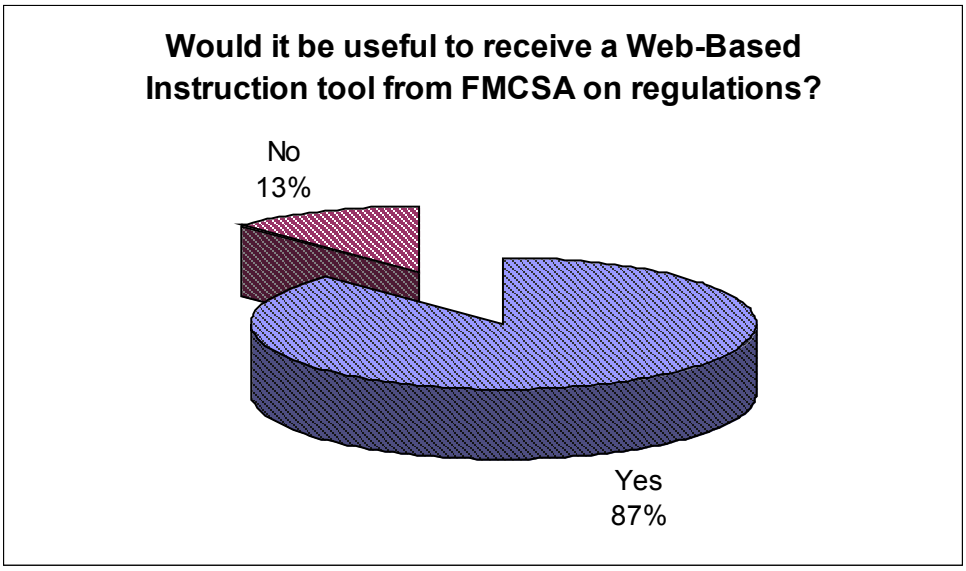

Figure 18: Would it be useful to receive a Web-based Instruction tool from FMCSA on regulations?

Many reasons were given by the group indicating why such instruction from FMCSA via WBI would be useful, including the following paraphrased answers:

- Such a program would relieve companies from the obligation to design and develop an internal training program, and would ensure that the information is accurate.
- Receiving training directly from FMCSA would provide drivers with first-hand information. Currently, drivers are constantly receiving regulatory information from various sources that may not be entirely accurate or interpreted correctly.
- Online FMCSR training is currently difficult for drivers to navigate, which often results in frustration and incomplete training. However, a web-based tool that educates drivers

on how to navigate through the system properly to access the needed material would likely expose more drivers to the FMCSRs.

- Such a tool from FMCSA may provide clarification to some of the regulations that are vague and difficult for drivers to interpret.
- The system would be extremely beneficial for both drivers and managers (which would likely include fleet managers, dispatchers, load coordinators and maintenance personnel) since all employees are required to stay current with new regulations.
- Obtaining information directly from FMCSA would provide companies with a better understanding of training expectations.
- This scenario would ensure that employees are kept up-to-date on changes to FMCSA regulations.

Finally, the 16 respondents were asked if it would be useful for FMCSA to provide a WBI instruction tool in order to teach best practices. The majority agreed that it would (Figure 19.)

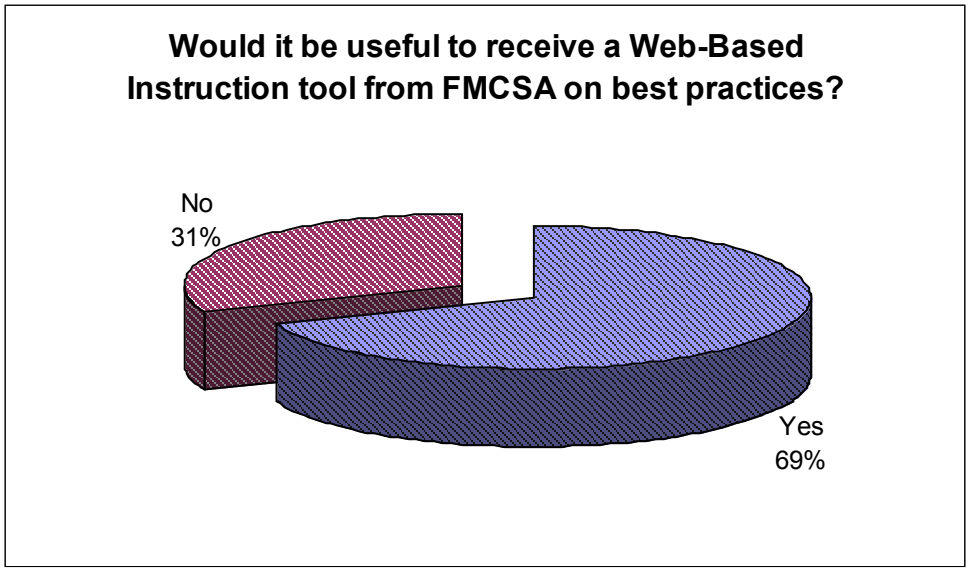

Figure 19. Would it be useful to receive a Web-based Instruction tool from FMCSA on best practices?

The reasons given by respondents in support of an FMCSA best practices tool are as follows:

- Drivers would be more likely to buy into the training process if material was received directly from FMCSA.
- Companies would have an easier time networking the information if one resource could contain the training content instead of several different sources.
- It may allow companies to remain current on new and useful tools that are designed to improve safety.

Several respondents that did not support an FMCSA best practices tool, and stated the following reasons:

- Companies should remain in control of training best practices to drivers.
- Best practices differ among individuals and the Web site may provide lawyers an opportunity to misconstrue the information in a court of law.
- Information may not be relevant to every driver or company since it would differ depending on the sector, market, and size of the carrier.
- The general lack of industry experience by the majority of regulators does not offer the proper background to develop a useful tool, but an enforcement-only based system would be acceptable.
- It may be difficult for FMCSA to develop universally accepted best practices since carriers often differ in regard to FMCSA concepts. It is also important to note that system use would need to be voluntary since many companies may not have access to the Web site.

3.1.2 Summary of Survey Results

In summary, the 37 safety managers who elected to take the survey were generally familiar and comfortable with WBI as a tool to teach safety concepts to drivers and managers. Of those who did not currently use WBI as part of training, there was a willingness to identify and test WBI-based safety courses.

There were, however, issues that face carriers: technology limitations, WBI product costs, driver access, and questions of the effectiveness of this type of distance learning. In cases where such answers were given, it is important to consider that the respondents were all familiar enough with the Internet enough to have taken the survey online. If survey takers had not been familiar enough to take the survey in an electronic, Internet format, it is likely that the general level of comfort would have been lower, and that insurmountable barriers would have emerged more often and with greater detail.

The respondents who currently use WBI indicated, in general, that this technology was effectively employed to teach safety concepts. The advantages of WBI were, generally speaking, that a remote work force could use the training product at any given time and at a lower cost than traditional training programs. Measuring the effectiveness of WBI does not appear to be a simple task, however, and was listed as a disadvantage by some respondents. Driver acceptance and feedback, as well as the implementation process, were listed as evaluation criteria. There appears, however, to be a dearth of outcome-based metrics to evaluate WBI to train drivers (though such metrics are mentioned in general terms by a small number of respondents). Effective and credible outcome-based evaluation criteria, therefore, while quite difficult to pinpoint, may the most useful selling point for WBI in training safety concepts and regulations to CMV drivers.

3.2 SURVEY #2

The second survey was in the format of an online questionnaire that was employed to gather data regarding the general effectiveness of WBI in regards to the FMCSA's Driving Tips Web pages hosted by FMCSA. The questionnaire was designed to assess current CMV fleet safety managers' perceptions and opinions regarding the relative strengths, weaknesses, benefits, and barriers to implementation of WBI in the motor carrier industry. See Appendix A for the questionnaire. This section describes the questionnaire methodology in greater detail, and the following section details the principal results.

3.2.1 Design and Content

Information gathered during the in-depth literature review guided the development of the questionnaire. WBI characteristics related to the retention of knowledge, as identified in the literature review, were included in the questionnaire, covering:

- Ease of use.
- Incorporation of multimedia.
- Practice opportunities.
- Relevance of information.
- Use of applied examples.

Moreover, general questions concerning the incorporation of WBI in the CMV industry were included to assess respondents' perceptions and opinions in regards to the usability and effectiveness of WBI. Once the list of potential questions was developed, subject matter experts were elicited for additional ideas and feedback, which were subsequently incorporated into the final questionnaire.

Based on the literature review and the feedback solicited from subject matter experts, questionnaire contained 49 questions, which were divided into six sections:

- *Section 1: Navigating the Driving Tips Web pages.* Questions 1–5 listed characteristics related to the navigation of WBI and assessed fleet safety mangers' experiences with a specific WBI program (i.e., the Driving Tips Web pages - http://www.fmcsa.dot.gov/about/outreach/education/driverTips/index.htm).
- Characteristics related to navigating the Driving Tips Web site included:
  - Organization of the Web site.
  - Participant's ability to locate information.
  - Participant's ability to read the text.
  - Participant's ability to understand the information presented.
  - Using a six-point scale (1=Strongly Disagree and 6=Strongly Agree), respondents were asked to rate how much they agreed with each statement.

- *Section 2: Usefulness of the Driving Tips Web site.* Questions 6–22 listed characteristics related to the usefulness of WBI in regards to the Driving Tips Web site. Characteristics related to the usefulness of WBI included: (a) use of specific, real-world examples, (b) WBI's ability to clarify misconceptions/misunderstandings, (c) use of multimedia, (d) inclusion of pertinent and applicable information and (e) availability of practice opportunities. Questions 6–21 asked respondents to rate how much they agreed with each statement using a 6-point scale (1=Strongly Disagree and 6=Strongly Agree). Question 22 was open-ended and requested that respondents list any issues or areas not covered in the Driving Tips Web site.
- *Section 3: Information on the Driving Tips Web site.* Questions 23–25 were considered "dishonesty" questions and were developed as a manipulation check to ensure respondents perused the Driving Tips Web site. These questions asked respondents specific questions regarding the Driving Tips Web site. Questions 23–25 used a multiple-choice format.
- *Section 4: General Web-based Instruction Questions.* Questions 26–35 were open-ended. These asked respondents to provide their opinions and perceptions regarding the use of WBI in the trucking industry. Questions were designed to gather qualitative data regarding the use of WBI in the respondent's fleet. Blank spaces were provided to write these opinions and perceptions. Questions 26–35
  - Questions 26–30 were answered by fleet safety managers who had employed WBI in their fleet. These questions asked respondents to list each WBI application and to rate its perceived effectiveness. Furthermore, respondents were asked to describe the strengths and weaknesses of those WBI applications and how to improve them. Fleet safety managers who had not employed WBI in their fleet were asked to skip these questions.
  - Questions 31–32 were answered by fleet safety mangers that had not employed WBI in their fleet. These questions asked respondents to describe why their carrier has not used WBI and if they thought WBI could be beneficial. Fleet safety managers who had employed WBI in their fleet were asked to skip these questions.
  - Questions 33–35 asked all respondents to comment on the use of WBI in the CMV industry. One question asked respondents to describe potential barriers to implementing WBI in the CMV industry, while the other two questions asked respondents to describe what they would like most/least about completing a WBI course on CMV regulations.
- *Section 5: Computer and Internet Proficiency.* Questions 36–43 assessed respondents' computer and Internet proficiency. Questions 36–37 asked respondents to rate how much they agreed with each statement using a six-point scale (1=Strongly Disagree and 6=Strongly Agree). Questions 38–43 used a multiple-choice format to describe their computer and Internet use.
- *Section 6: Demographic Questions.* Questions 44–49 collected survey respondent demographics, such as education level, size and operation of their fleet, job title, years of experience, and age.

3.2.2 Distribution and Analysis

A link to the questionnaire was posted on the Driving Tips Web site hosted on the FMCSA Web site. The questionnaire was advertised to fleet safety managers as seeking feedback on the Driving Tips Web site and the effectiveness of WBI in the CMV industry. Potential respondents followed the steps below to complete the online questionnaire.

Fleet safety managers clicked on the survey link on the Driving Tips home page and were directed to another Webpage indicating they were leaving the FMCSA Web site.

After 10 seconds, fleet safety managers were automatically directed to another Web page with information regarding informed consent procedures. Fleet safety mangers had the option of reading the informed consent form or going directly to the questionnaire. (See Appendix B for the informed consent form used in the current study.) If fleet safety mangers elected to read the informed consent form, they were instructed to check a box indicating they understood that completing the online questionnaire implied their consent.

After pressing the submit button, the fleet safety mangers were directed to a routing page with a link to the questionnaire.

Once the fleet safety manager clicked the routing link, they were directed to the online questionnaire.

After completing the questionnaire, fleet safety managers pressed the submit button and were directed to a routing page with a link to another Web page that included payment information.

Once respondents clicked on the link, they were directed to a Web page where they could submit payment information. Note that payment information and responses to the questionnaire could not be linked. Thus, all survey responses were anonymous.

3.2.3 Summary

A total of 125 fleet safety managers received the questionnaire. The questionnaire sample was characterized as a convenience sample and possibly represented those fleet safety managers who have strong opinions regarding WBI and/or the Driving Tips Web site. In other words, those safety managers who completed the questionnaire may have had stronger opinions (either positive or negative) of WBI compared to those safety managers who did not complete the questionnaire. Although a more systematic sampling method would have been preferable, study resources and project scope did not permit a systematic method and distribution.

Questionnaire responses were automatically entered into a database. This database was subsequently transferred into an SPSS database for analysis. All responses were anonymous; there was no link between personally identifiable information and questionnaire responses.

For all data analyses, ratings were considered as “interval scale ratings.” In other words, the difference between “Strongly Disagree” and “Moderately Disagree” was assumed equal to the difference between “Moderately Disagree” and “Slightly Disagree” and so forth. Thus, the mean scores were calculated and compared. In the analyses, response categories were created for the open-ended questions. Each response was subsequently coded into a specific response category.

Then the categories were analyzed to identify specific features critical to WBI. Means were calculated and compared in the analysis of the multiple-choice questions.

3.2.4 Principal Survey #2 Results

3.2.4.1 Questionnaire Demographics

Questionnaires responses were received from 62 fleet safety managers. The mean age of these respondents was 46.7 (Range = 24–69 years old) with an average of 17.5 years experience in the CMV industry (Range = 1–41 years of experience).

Respondents were also asked to indicate their highest level of education. Most respondents indicated a high school diploma (37 percent), followed by associate's degree (28 percent), bachelor's degree (26 percent), and master's degree (9 percent).

Fleet size and operation type varied widely. The average fleet size was 762.2 power units (range = 4–12,000 power units). Figure 20 displays the percentage of power units indicated by fleet safety manager survey respondents across three bins (fewer than 100 power units, 100–1,000 power units, and more than 1,000 power units). Responses indicated that most respondents were employed in smaller CMV fleets—47 percent were employed in fleets with fewer than 100 power units, 36 percent between 100 and 1,000 power units, and 17 percent had more than 1,000 power units.

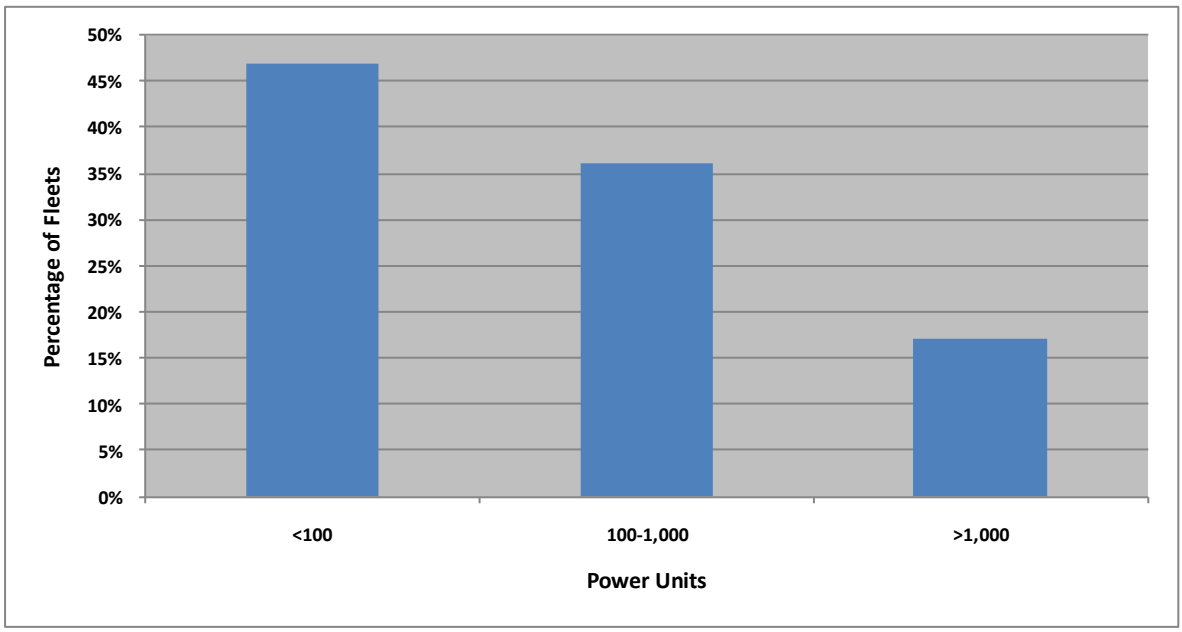

Figure 20. Percentage of Small, Medium, and Large Fleets

Respondents were also asked to indicate their fleet's primary operation type. Figure 21 displays the fleet safety manager respondent's primary fleet operation type. Most respondents indicated their fleet operation type as for hire: long-haul/truckload (39 percent); followed by private: local/short-haul (28 percent); for hire: local/short-haul (15 percent); other (less-than-truckload, regulatory compliance, 9 percent); private (day trip, private, road construction, customer specific.

9 percent); private: long-haul (7 percent), and passenger carrier: long-haul (2 percent). Nine respondents did not indicate their fleet's primary operation type.

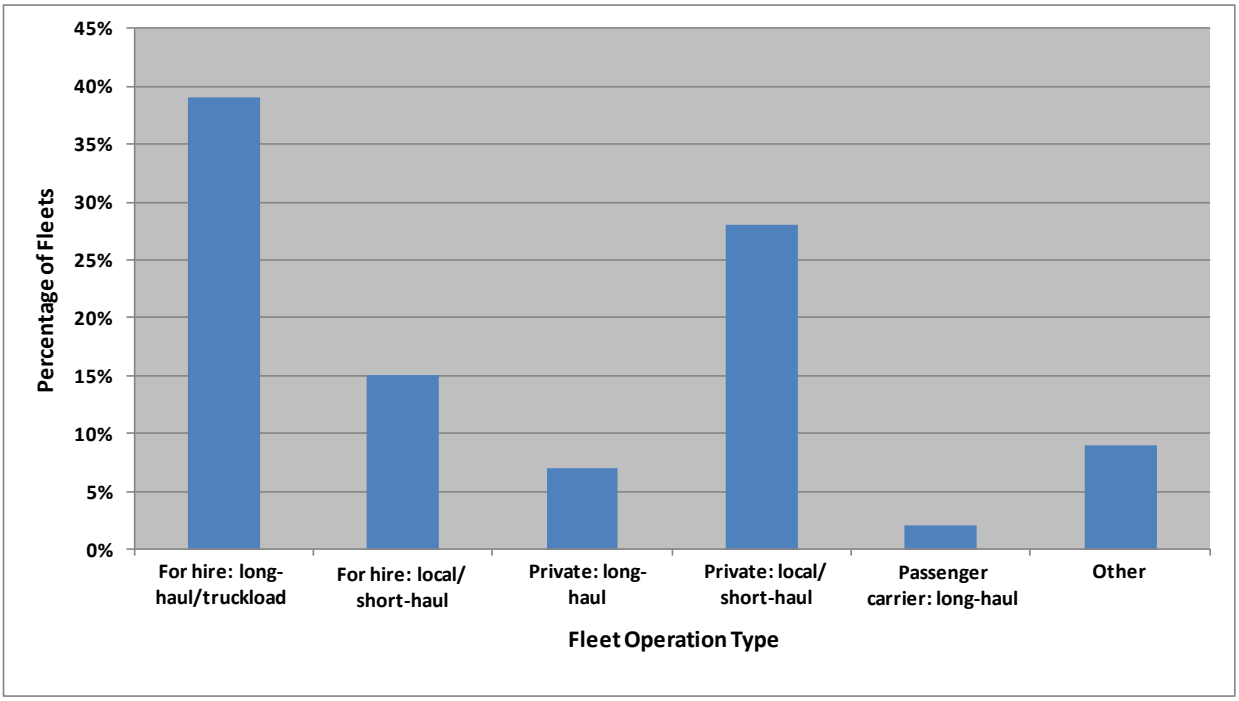

Figure 21. Percentage of Fleet Operation Type

3.2.4.2 Respondents' Computer and Internet Proficiency

The questionnaire included a section intended to gather information regarding respondents' computer and Internet proficiency. Table 5 displays fleet safety manager respondents' computer and Internet proficiency. As shown in Table 5, the first item asked respondents to indicate, on a six-point scale (1=Strongly Disagree; 6=Strongly Agree), if they did not have any problems operating a computer. As shown in Table 5, most respondents (79 percent) indicated they "strongly agreed" they did not have any problems operating a computer. The second item in Table 5 asked respondents to indicate, on a six-point scale (1=Strongly Disagree; 6=Strongly Agree), if they had difficulty locating information on the Internet. Most survey respondents (69 percent) indicated they "strongly disagreed" they have difficulty locating information on the Internet.

Table 5. Computer and Internet Proficiency

Item	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
I do not have any problems operating a computer.	1 out of 58 (2%)	2 out of 58 (3%)	2 out of 58 (3%)	1 out of 58 (2%)	6 out of 58 (10%)	46 out of 58 (79%)
I have difficulty locating information on the Internet.	40 out of 58 (69%)	12 out of 58 (21%)	2 out of 58 (3%)	1 out of 58 (2%)	2 out of 58 (3%)	1 out of 58 (2%)

Ninety-three percent of the respondents indicated they had a computer at home, while 100 percent of these respondents reported having a computer at work. Table 6 displays fleet safety manager respondents' type of Internet connection at home and work. As shown in Table 6, most respondents indicated they used a Digital Subscriber Line (DSL; 51 percent and 63 percent) or cable modem (32 percent and 21 percent) to connect to the Internet at home and work, respectively.

Table 7 displays fleet safety manager respondents' frequency of computer and Internet use. As shown in Table 7, almost all respondents reported daily use of a computer and connecting to the Internet (98 percent and 97 percent, respectively).

Table 6. Type of Internet Connection

Item	Dial-up Modem (28k)	Dial-up Modem (56k)	Cable Modem	DSL	No Internet Connection	Not Sure	No Computer
What type of Internet connection do you use at home?	1 out of 57 (2%)	2 out of 57 (4%)	18 out of 57 (32%)	29 out of 57 (51%)	0 out of 57 (0%)	3 out of 57 (5%)	4 out of 57 (7%)
What type of Internet connection do you use at work?	0 out of 57 (0%)	2 out of 57 (4%)	12 out of 57 (21%)	36 out of 57 (63%)	0 out of 57 (0%)	6 out of 57 (11%)	1 out of 57 (2%)

Table 7. Frequency of Computer and Internet Use

Item	Seldom or never	2 to 4 times a month	Weekly	Daily
How often do you use a computer?	1 out of 53 (2%)	0 out of 53 (0%)	0 out of 53 (0%)	52 out of 53 (98%)
How often do you connect to the Internet?	1 out of 53 (2%)	0 out of 53 (0%)	0 out of 53 (0%)	52 out of 53 (98%)

These results show that most respondents indicated they were proficient in their use of a computer and navigating the Internet without many (if any) problems. Moreover, most respondents had access to a high-speed Internet connection at work or home. Thus, WBI could be used as an effective learning tool for these respondents.

3.2.4.3 Navigating the Driving Tips Web site

The first five items in the questionnaire assessed respondents' perceptions regarding their ability to navigate the Driving Tips Web site. As indicated by Brock, McFann, Inderbitzen, and Bergoffen (2007), ease of navigation is a critical characteristic found in effective WBI programs (i.e., users should not have difficulty with the use of WBI). Table 8 displays respondents' mean (*M*) responses to these five questions, including frequency (*n*) and standard deviation (*SD*).

Table 8. Navigating the Driving Tips Web site

Item	*n*	*M*	*SD*
1. The Driving Tips Web site was easy to navigate?	61	4.75 (Moderately Agree)	1.34
2. I had trouble locating specific driving tips in the Driving Tips Web site?	60	2.37 (Moderately Disagree)	1.25
3. I had difficulty reading the information displayed?	60	2.02 (Moderately Disagree)	1.17
4. I was able to understand the specific driving tips presented in the Driving Tips Web site?	60	5.18 (Moderately Agree)	0.91
5. The information in the Driving Tips Web site was well organized?	61	5.00 (Moderately Agree)	0.84

The first five items asked respondents to indicate, on a six point scale (1=Strongly Disagree; 6=Strongly Agree), how much they agreed/disagreed with the item. The first item asked respondents to indicate if the Driving Tips Web site was easy to navigate. As shown in Table 9, respondents indicated they "moderately agreed" the Driving Tips Web site was easy to navigate. The second item asked respondents to indicate if they had trouble locating specific defensive driving tips in the Driving Tips Web site. Respondents indicated they "moderately disagreed" they had trouble locating driving tips in the Driving Tips Web site. Item three asked respondents to indicate if they had difficulty reading the information displayed in the Driving Tips Web site. Respondents indicated "moderately disagreed" in having difficulty reading the information displayed in the Web site. The fourth item asked respondents to indicate if they were able to understand the driving tips in the Driving Tips Web site. Respondents indicated they "moderately agreed" they were able to understand the specific driving tips presented in the Driving Tips Web site. The fifth item asked respondents to indicate if the Driving Tips Web site was well organized. As shown in Table 9, respondents indicated they "moderately agreed" the information in the Driving Tips Web site was well organized.

These results indicate the Driving Tips Web site was well organized. The majority of respondents did not have problems navigating the Web site, reading the information displayed, or understanding the driving tips discussed. Considering these results, it appears the Driving Tips Web site conforms to Brock, McFann, Inderbitzen, and Bergoffen's (2007) suggestion that effective WBI applications are easy to navigate.

3.2.4.4 Usefulness of the Driving Tips Web site

The second section of the questionnaire assessed respondents' perceptions regarding the usefulness of the Driving Tips Web site. Effective WBI applications need to foster a high retention and transfer of knowledge (Bartley & Golek, 2004; Brock et al., 2007; Dodds & Fletcher, 2004). Thus, these items were designed to measure the efficacy of the Driving Tips Web site to incorporate effective learning characteristics.

For example:

- How well did the Driving Tips Web site incorporate real-world examples?

- Was the information applicable to fleet safety managers?
- Were the driving tips easily accessible?
- Were there opportunities for practice?

Table 9 displays respondents' mean (*M*) responses to these 15 items, including frequency (*n*) and standard deviation (*SD*).

Table 9. Usefulness of the Driving Tips Web site

Item	*n*	*M*	*SD*
1. The Driving Tips Web site presented information in the context of real-world, commercial vehicle operations.	60	5.02 (Moderately Agree)	1.07
2. The Driving Tips Web site provided specific examples of the driving tips discussed.	59	5.00 (Moderately Agree)	0.95
3. The Driving Tips Web site did not help to clarify any misconceptions I had concerning safe driving in commercial vehicle operations.	58	2.95 (Slightly Disagree)	1.23
4. The videos were useful in my understanding of unsafe driving behaviors.	60	4.85 (Moderately Agree)	1.06
5. I believe I will be able to apply the information on safe driving behaviors I learned in the Driving Tips Web site to everyday commercial vehicle operations.	60	4.92 (Moderately Agree)	0.98
6, The learning objectives in the Driving Tips Web site were not clearly defined.	59	2.44 (Moderately Disagree)	1.21
7. I believe the Driving Tips Web site should have covered information on other driving issues.	58	4.09 (Slightly Agree)	1.03
8. The Driving Tips Web site helped to explain the concepts I previously misunderstood about unsafe driving behaviors in commercial motor vehicle operation.	57	3.47 (Slightly Disagree)	1.21
9. This Driving Tips Web site was more useful than receiving the same information through classroom instruction.	58	4.16 (Slightly Agree)	1.36
10. The Driving Tips Web site was more interesting than receiving the same information through classroom instruction.	58	4.40 (Slightly Agree)	1.36
11. The Driving Tips Web site was no different than reading a book.	58	2.36 (Moderately Disagree)	1.31
12. Hyperlinks to reference material in the Driving Tips Web site did not provide adequate supplemental information.	53	2.74 (Slightly Disagree)	0.90
13. The directions concerning how to use the Driving Tips Web site were not helpful.	55	2.53 (Slightly Disagree)	1.39
14. I had problems accessing the Driving Tips Web site.	52	2.10 (Moderately Disagree)	1.26
15. I was overwhelmed with the amount of information on driving behaviors presented in the Driving Tips Web site.	53	2.19 (Moderately Disagree)	1.18

The 15 items in Table 9 asked respondents to indicate, on a six-point scale (1=Strongly Disagree; 6=Strongly Agree), how much they agreed/disagreed with the items. Item 1 asked respondents to indicate if the Driving Tips Web site used real-world examples to present information concerning commercial motor vehicle operations. As shown in Table 9, respondents indicated they "moderately agreed" the Driving Tips Web site presented information in the context of real-world, commercial vehicle operations.

Item 2 asked respondents if the Driving Tips Web site used specific examples of the driving tips discussed on the Web site. Respondents indicated they "moderately agreed" the Driving Tips Web site provided specific examples of the driving tips discussed.

Item 3 asked respondents to indicate if the Driving Tips Web site did not help to clarify any misconceptions concerning commercial vehicle safe driving. Respondents indicated they "slightly disagreed" the Web site did not clarify any misconceptions they had concerning safe driving in commercial vehicle operations.

Item 4 asked respondents if the videos used in the Driving Tips Web site were useful in explaining unsafe driving behaviors. Respondents indicated they "moderately agreed" the videos were useful in their understanding of unsafe driving behaviors in commercial vehicle operations.

Item 5 asked respondents if they believed the information they learned from the Driving Tips Web site was applicable to everyday commercial vehicle operations. Respondents indicated they "moderately agreed" they would be able to apply the information they learned in the Driving Tips Web site to everyday commercial vehicle operations.

Item 6 asked respondents if the learning objectives in the Driving Tips Web site were not clearly defined. Respondents indicated they "moderately disagreed" the learning objectives in the Driving Tips Web site were not clearly defined.

Item 7 asked respondents if the Driving Tips Web site should have covered information on other driving issues. Respondents indicated they "slightly agreed" the Driving Tips Web site should have covered information on other commercial vehicle operations driving issues.

Item 8 asked respondents if the Driving Tips Web site helped to explain previously misunderstood concepts about unsafe driving behaviors in CMV operations. As shown in Table 9, respondents indicated they "slightly disagreed" the Driving Tips Web site helped to explain the concepts previously misunderstood about unsafe driving behaviors in CMV operations.

Item 9 asked respondents if the Driving Tips Web site was more useful than receiving the same information through traditional classroom instruction. Respondents indicated they "slightly agreed" the Driving Tips Web site was more useful than receiving the same information through classroom instruction.

Item 10 asked respondents if the Driving Tips Web site was more interesting than receiving the same information through traditional classroom instruction. Respondents indicated they "slightly agreed" the Driving Tips Web site was more interesting than receiving the same information through classroom instruction.

Item 11 asked respondents if the Driving Tips Web site was no different than reading a book. Respondents indicated they "moderately disagreed" the Driving Tips Web site was no different than reading a book.

Item 12 asked respondents if the hyperlinks to reference material did not provided adequate supplemental information. As shown in Table 9, respondents indicated they "slightly disagreed" the hyperlinks to reference material in the Driving Tips Web site did not provide adequate supplemental information.

Item 13 asked respondents if the directions concerning how to use the Driving Tips Web site were not helpful. Respondents indicated they "slightly disagreed" the directions regarding how to use the Driving Tips Web site were not helpful.

Item 14 asked respondents if they had problems accessing the Driving Tips Web site. Respondents indicated they "moderately disagreed" they had problems accessing the Driving Tips Web site.

Item 15 asked respondents if they were overwhelmed with the amount of information on driving behaviors presented in the Driving Tips Web site. Respondents indicated they "moderately disagreed" they were overwhelmed with the amount of information on driving behaviors presented in the Driving Tips Web site.

The second section of the questionnaire included an item that asked respondents if the Driving Tips Web site provided opportunities to review safe and risky driving concepts. Fleet safety manager respondents answered this item "Yes" or "No." Ninety-eight percent of fleet safety manager respondents indicated "Yes" to the Driving Tips Web site providing opportunities to review safe and risky driving concepts.

The results suggested the Driving Tips Web site was a useful tool for fleet safety managers in the presentation of CMV driving tips. For example, respondents believed the Driving Tips Web site included useful, real-world information that helped explain CMV safe driving behavior, and presented tips that can be used on the job. Moreover, the Driving Tips Web site was more useful and interesting than receiving the same information via traditional classroom instruction. Thus, it appears the Driving Tips Web site was an effective WBI application. Despite this positive feedback, there were several things the respondents did not like. For example, fleet safety manager respondents "slightly disagreed" the Driving Tips Web site helped clarify misunderstandings about safe driving behavior. Furthermore, the fleet safety manager respondents believed the Driving Tips Web site should have covered information on other driving issues.

3.2.4.5 Fleet Safety Manager Comments

Participants were also given the opportunity to comment on any other driving issues/areas the Driving Tips Web site should have included and discussed. Twenty-seven percent of respondents actually provided a comment (for a total of 27 suggestions). A content analysis was performed on these comments. Figure 22 illustrates the results from the content analysis of fleet safety manager comments regarding other driving issues/areas the Driving Tips Web site should have included and discussed. Most respondents indicated the Driving Tips Web site should have

included information on the proper or safe procedures for backing (traveling in reverse) and emergency maneuvering and prevention. For example, one respondent indicated, "Most of the issues addressed here were done well, but reverse or backing up is a major issue in CMV. This topic should have been addressed in detail as well." Other respondents indicated the following emergency maneuvering and prevention issues should be addressed, "jackknife prevention," "skid control," "hazmat response issues," and "equipment failure." Also, respondents indicated the Driving Tips Web site should have covered road rage, driving in inclement weather, the effects of drinking alcohol and drugs on driving performance, turning, parking, how to approach intersections, and driving in congested areas (e.g., truck stops, pick-up/delivery locations, etc.).

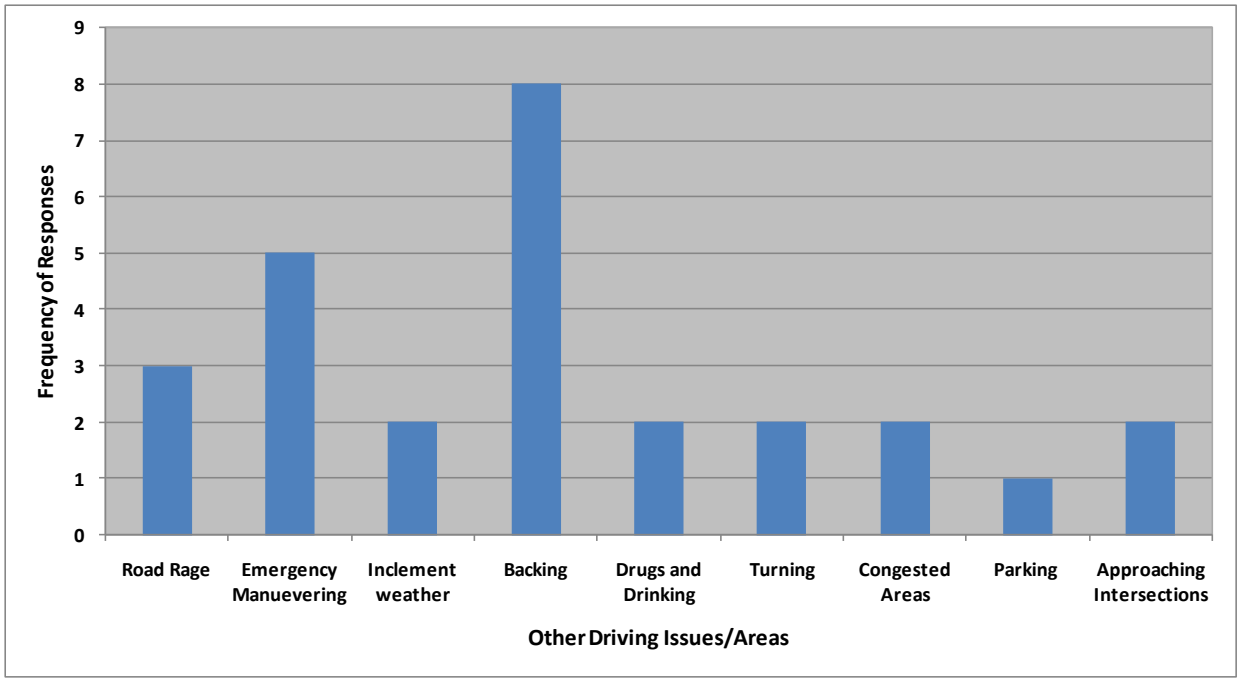

Figure 22. Frequency of Fleet Safety Manager Comments Regarding Other Driving Issues/Areas the Driving Tips Web site Should Have Discussed

3.3 WBI IN THE CMV INDUSTRY

3.3.1 Prior WBI Experience

The fourth section of the questionnaire was designed to provide in-depth knowledge about respondents' previous experiences, opinions, and perceptions with WBI in the CMV industry. Several questions were targeted to those respondents who had previous WBI experience. These questions sought information regarding the effectiveness of these prior WBI applications and the strengths/weaknesses of those applications. Moreover, respondents were asked for methods to improve those prior WBI applications. Twenty-one percent of the respondents (n = 13) indicated that WBI had been employed in their fleet. Of these respondents, 100 percent indicated those WBI applications were effective tools.

Figure 23 illustrates a content analysis of fleet safety respondents' comments regarding the strengths of those prior WBI. All respondents indicated that convenience of scheduling was a

strong point for WBI. One fleet safety manager made the following comment, "The primary advantage [of WBI] is the ability to allow drivers to take the course at their convenience, instead of trying to gather them all in one place at the same time." Another respondent indicated, "Easy application to each of the drivers in our fleet, they can get to them any where they can get to the Internet." Respondents also believed the ability to track usage and completion was another support for WBI. For example, one respondent indicated, "[WBI provides the] ability to reach intended locations, but most importantly, the ability to track usage." Another respondent indicated, "[WBI] can be done anywhere—scoring is automatic and we can track who is taking test."

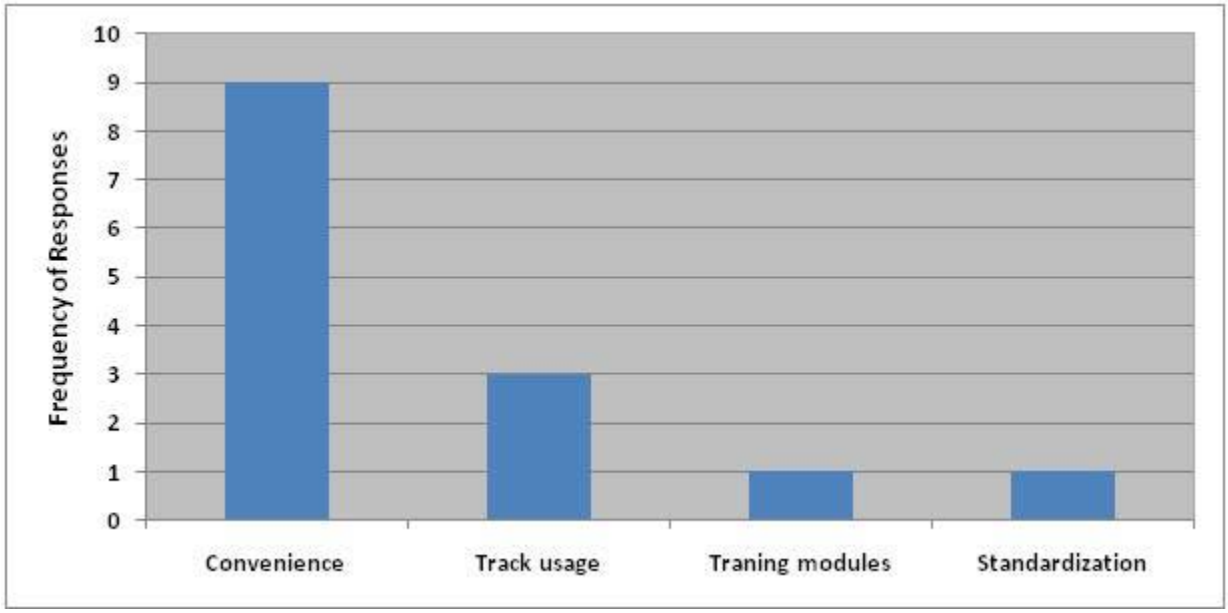

Figure 23. Frequency of Fleet Safety Manager Comments Regarding the Strengths of WBI

Respondents were also asked to indicate weaknesses of prior WBI. Figure 24 illustrates fleet safety manager respondents' comments on the weaknesses of those WBI. Responses were mixed; however, respondents indicated a lack of immediate feedback from drivers compared to traditional classroom instruction and "boring" applications were weaknesses in prior WBI. For example, one respondent stated, "[There is] not as much feedback from drivers as we would have gotten from classroom instruction." This was supported by another respondent, "[There is a] lack of opportunity for immediate feedback, had to stop the training to answer questions." Concerning "boring" applications, one respondent indicated, "It was agonizingly boring." Other weaknesses mentioned by respondents were slow start-ups, unwillingness of drivers to use the computer, drivers' potential lack of computer knowledge, drivers' potential lack of interactions with other trainees, and adding additional modules. For example, one respondent indicated, "[It was difficult] coming up with new modules for the drivers once they have viewed the first 2 years worth of them. Some are upgraded, others we are waiting on." These weaknesses of WBI have been identified in literature (e.g., Bartley & Golek, 2004; Welsh et al., 2003) and can be designed to minimize these issues. For example, WBI can be tailored to provide an individualized, multimedia learning environment to maintain trainees' attention. Moreover, WBI applications can be designed to automatically elicit feedback from users.

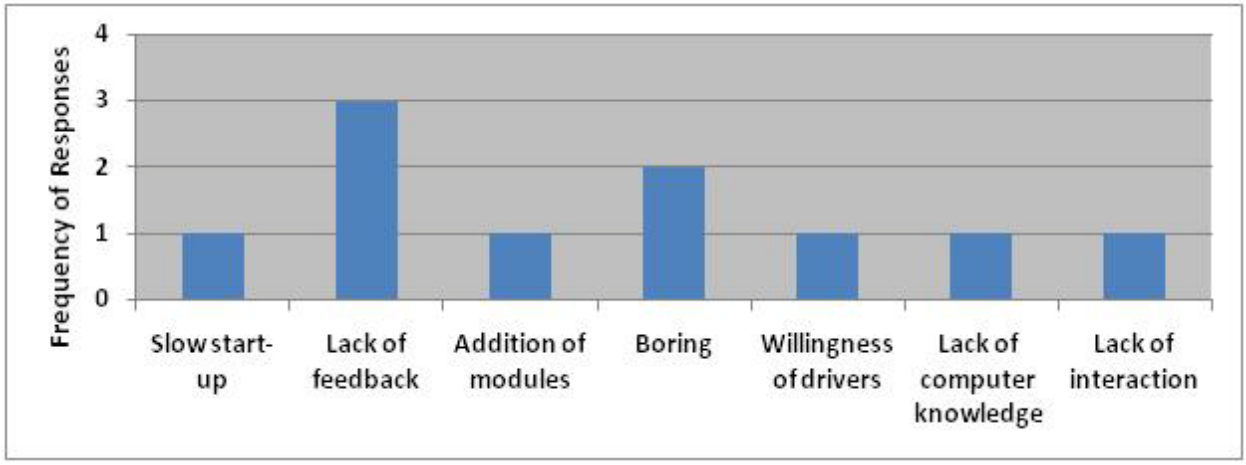

Figure 24. Frequency of Fleet Safety Manager Comments Regarding the Weaknesses of WBI

Respondents who had used WBI were also given the opportunity to provide suggestions concerning improvements to these WBI applications. Thirty-one percent of these respondents (n = 4) made comments regarding WBI improvements. Figure 25 illustrates a content analysis of fleet safety manager respondents' comments for improving WBI. Fleet safety manager respondents suggested the addition of more customized, individualized training options with multimedia. For example, one respondent indicated, "[WBI should] give access to downloadable information, videos we can keep and use throughout the year." Another respondent indicated, "[WBI should provide] more customized options." Other comments for improving WBI included improved security, the addition of more rigorous questions during testing, increased frequency of use, and improved driver accountability. One respondent stated, "[WBI should] improve accountability and test completion notification from the trainee."

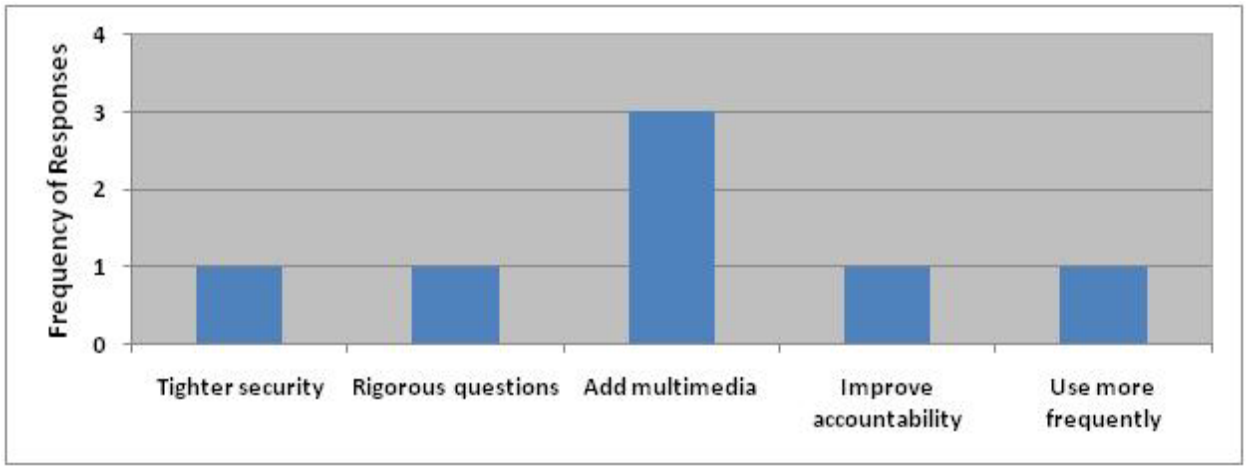

Figure 25. Frequency of Fleet Safety Manager Comments Regarding Improving WBI

In general, it appears few respondents had implemented WBI in their fleet. However, those respondents who had used WBI applications perceived them as useful and effective tools in providing new information. Despite the weaknesses in WBI, it appears the strengths justified WBI use in CMV fleets. The development of effective WBI takes considerable effort; however,

when designed by experienced staff, WBI should provide an effective solution that distributes standardized, up-to-date training and instruction.

3.3.2 No Prior WBI Experience

Seventy-nine percent of respondents indicated no prior WBI in their fleet. Several questions were designed to elicit feedback about the potential usefulness of WBI as a training tool. These questions sought information about the potential benefits of WBI and reasons WBI had not been employed in their fleet. Of these respondents, 96 percent believed some form of WBI could be beneficial in their fleet with the caveat WBI be well designed and properly deployed.

Figure 26 illustrates a content analysis of fleet safety manager comments regarding the benefits of WBI. Most respondents thought WBI would provide a convenient training method and believed WBI would help facilitate safety and training discussions in meetings. For example, one respondent stated, "It allows me the opportunity to let drivers access the site from home and turn in pre-printed tests." Another respondent made the following comment, "I do believe it could be of greater value to my drivers. It would allow them to examine the material at their leisure." One respondent made the following comment concerning the ability of WBI to facilitate safety and training discussions during meetings, "It would be very easy to present and discuss during safety meetings." Moreover, respondents believed WBI would reduce time and training materials, allow drivers to receive answers much faster, provide a method to stay current on safety regulations and practices, provide a visual aid to complement text, and help develop crash countermeasures.

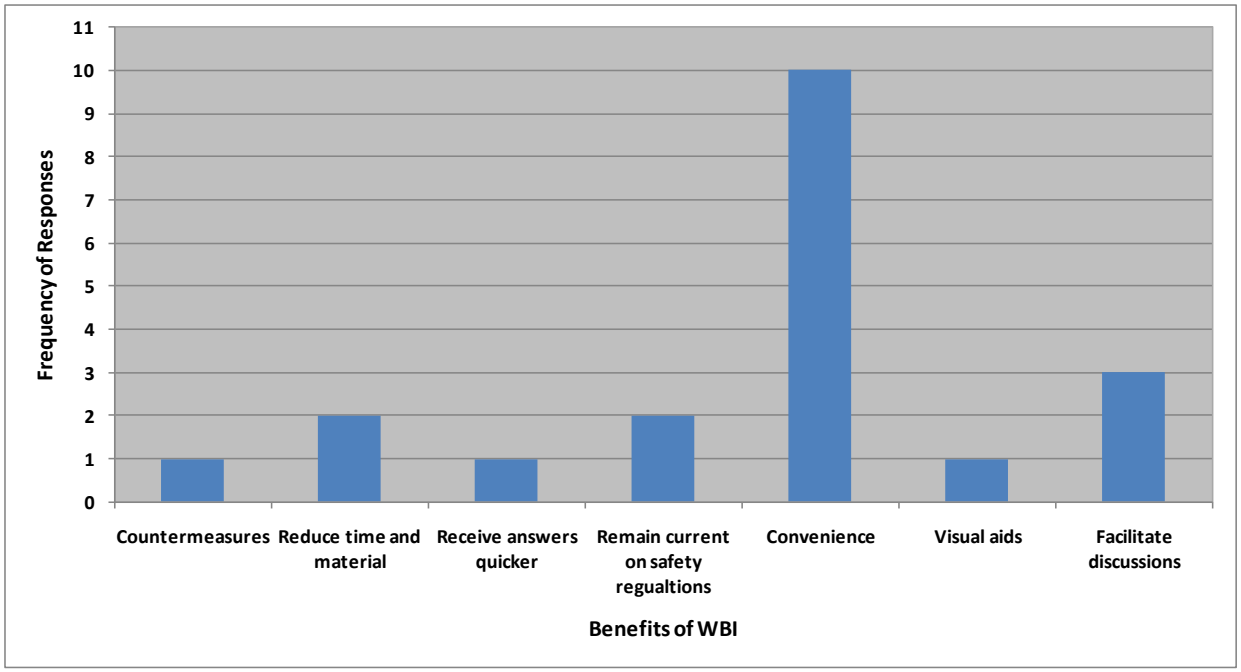

Figure 26. Frequency of Fleet Safety Manager Comments Regarding the Benefits of WBI

Figure 27 illustrates a content analysis of fleet safety manager comments regarding why WBI has not been employed in their fleets. As shown, most respondents were unaware of the availability of WBI and cited this as a primary issue (n = 12). For example, one respondent indicated, "We did not know it was available until now." This was supported by another respondent, "[We were]

not aware of availability except for high cost programs." Respondents also indicated that the costs associated with implementing WBI were an issue in their fleet (n = 10). For example, one respondent indicated, "It's not cost-effective. Our drivers are inconsistently able to access the Internet. We'd have to place dedicated computers at the terminal for the drivers to utilize WBI." Moreover, another respondent stated, "[Our] fleet is not big enough to warrant [WBI]." Other reasons for not implementing WBI included training was completed in the field, classroom training was easier (and possibly more effective for groups), and older drivers may lack computer proficiency.

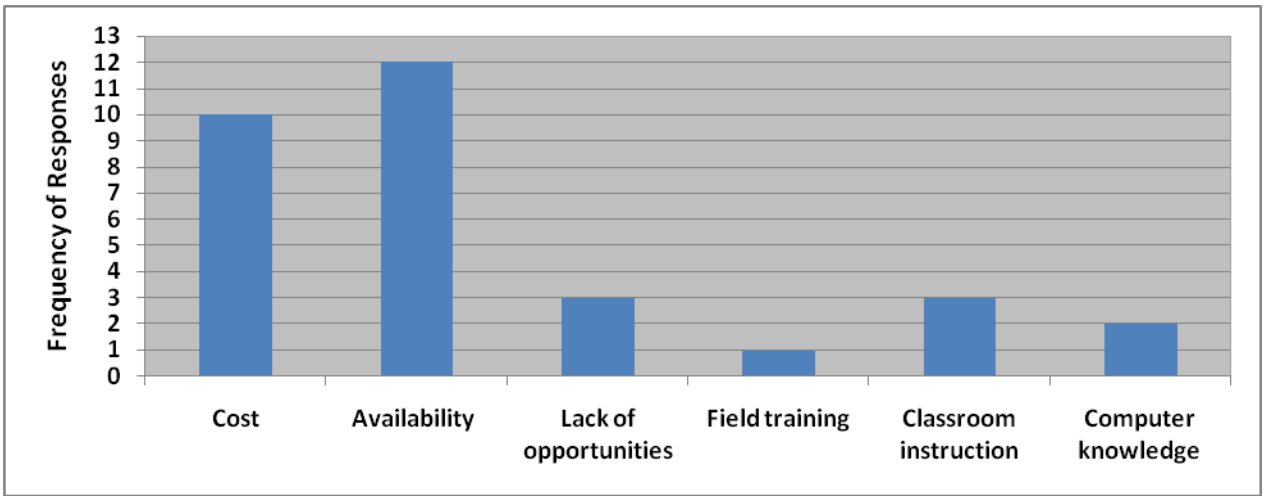

Figure 27. Frequency of Fleet Safety Manager Comments Regarding Barriers to Implementing WBI in their Fleet

3.3.3 Barriers to Implementing WBI

All survey respondents were asked to respond to three questions, including identifying barriers in implementing WBI in CMV fleets, likes regarding WBI in CMV fleets, and dislikes regarding WBI in CMV fleets. Figure 28 illustrates a content analysis of fleet safety manager respondents' barriers in implementing WBI in CMV fleets. As shown, most respondents (n = 12) indicated a lack of accessibility for drivers as a barrier to implementing WBI in the CMV industry. For example, one respondent indicated that the primary barrier was, "The mobility of drivers, since they're always away from the terminal." Another respondent suggested that it was, "Not having the PC's readily available for use." Also, respondents indicated WBI may be too costly to implement and that drivers may not possess the necessary computer proficiency to complete WBI. One respondent made the following comment, "Cost, or more accurately, perceived cost. The initial outlay can be expensive, and many fleet managers don't see the long-term benefit, the return-on-investment." Another respondent said, "I manage a small commercial vehicle operation. Some Web-based programs are costly." A third respondent indicated, "Acceptance by upper management of potential non-tangible cost savings through additional non-involvement of drivers in accidents." Concerning drivers lacking the computer proficiency to complete WBI, one respondent indicated, "User abilities, e.g., some drivers are unfamiliar with computer applications, etc." Similarly, other respondents indicated, "Some people do not know how to use a computer," and "Age and training of computer use and knowledge."

Other possible barriers included overcoming driver resistance and unwillingness to complete WBI, the driver's inability to ask questions, and security issues associated with WBI.

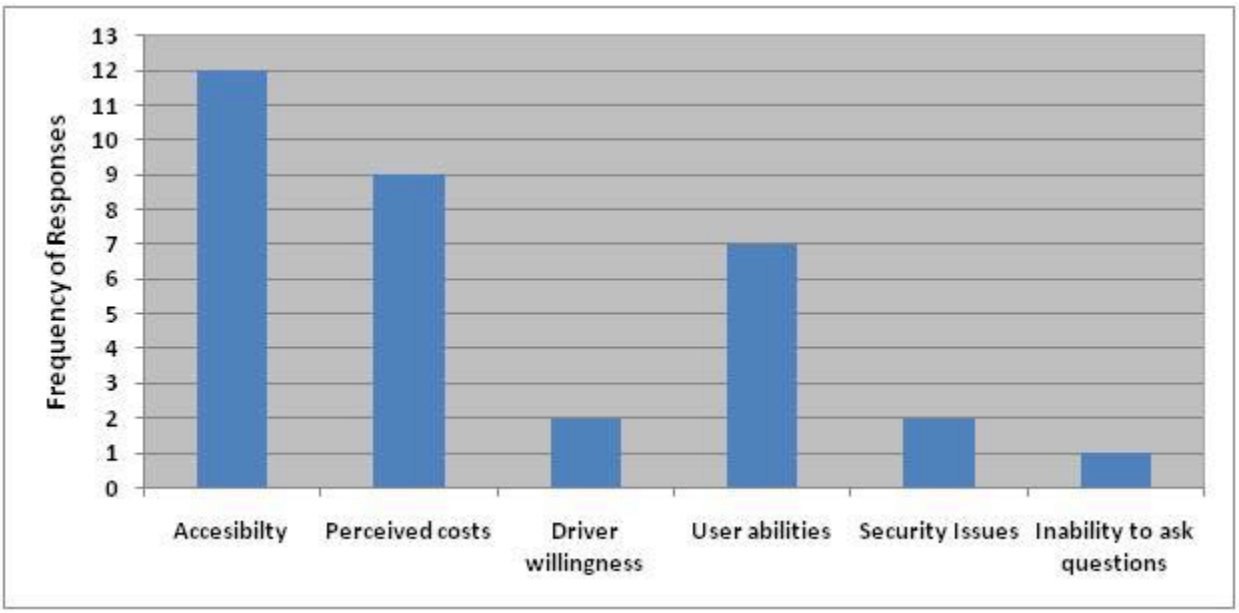

Figure 28. Frequency of Fleet Safety Manager Comments Regarding Barriers in Implementing WBI

Despite these barriers in implementing WBI, 55 percent of respondents indicated there were positive aspects of WBI in CMV operations. Figure 29 illustrates a content analysis regarding fleet safety manager respondents' comments on the positive aspects of WBI in CMV operations. Most respondents (n = 16) indicated that convenience was a positive aspect of WBI. For example, one respondent appreciated "The ability to do it when I wanted to and not in a classroom setting." Another respondent liked "The ease of doing this from any computer anywhere, either a home option or at the place of work." Respondents also noted the ability to personalize instructional materials as positive aspect of WBI. One respondent stated, "I can do it at my own speed, do not have to worry about getting ahead or behind someone else. More time for me to go over what I want to again and again to ensure I understand it." Another respondent wrote, "The ability to personalize (the material) to the users' line of business." Other comments included: the ability to standardize training across participants ("[WBI provides a] consistent message and standard grading"), quick updates to training in response to new legislation and/or rule changes, the ability to track training ("I think the biggest advantage is being able to track which drivers have completed courses online and taking that information comparing accident statistics between those drivers who have completed training and those who have not"), cost, the ability to provide additional training to drivers ("To walk away with a knowledge of knowing that we as a company are doing the most training as possible for our drivers"), and the ability to incorporate interactive components into the development of WBI ("It provides interactivity, keeps interest up").

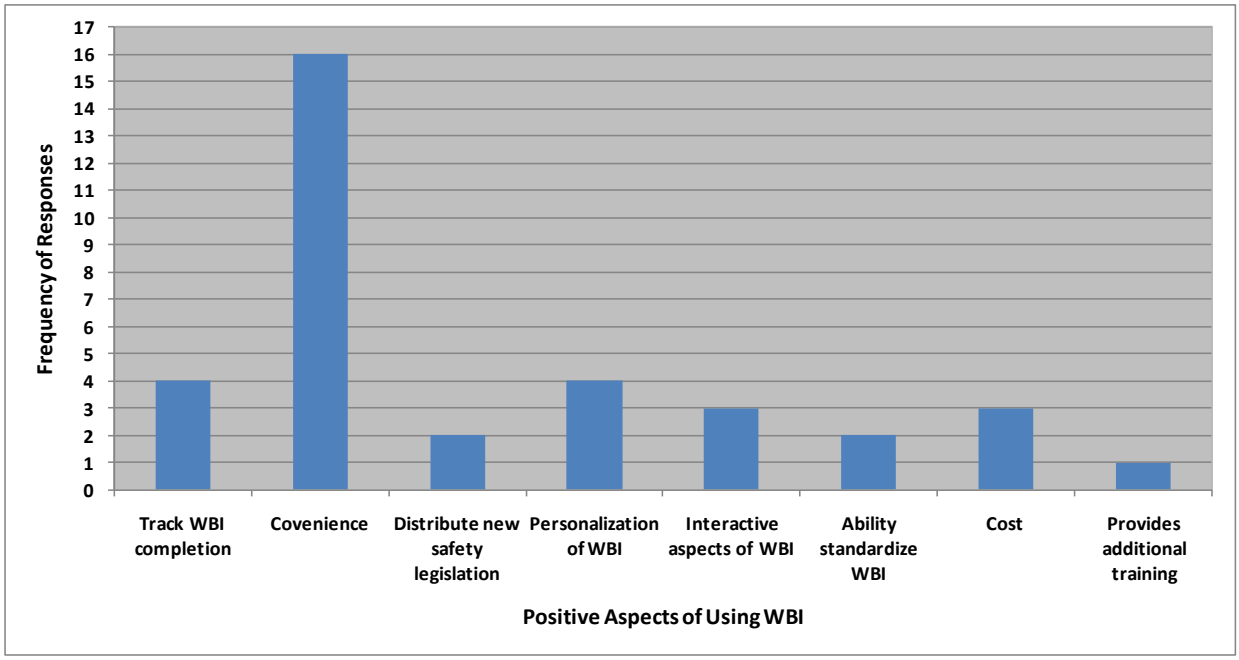

Figure 29. Frequency of Fleet Safety Manager Comments Regarding the Positive Aspects of Using WBI in CMV Operations

Figure 30 illustrates a content analysis of fleet safety manager comments regarding their dislikes in using WBI in CMV operations. Most respondents (n = 11) indicated WBI lacked some of the benefits associated with traditional classroom instruction, such as group discussions, limited interaction between trainees and instructors, and limited ability to receive and answer questions. Respondents also indicated a computer must be used to complete WBI. For example, one respondent pointed out that WBI "Forces your attention in front of a screen. I frequently print out the material and read at another time." Another respondent indicated, "Having a computer available for drivers 24–7." Other negative comments mentioned included, WBI was likely to be prone to technical issues ("Not being able to download videos"), difficulty keeping information current ("If it wasn't kept current, it could turn into the same old-same old"), the time necessary to complete training ("Time consumption. In the trucking industry, time is money. Drivers don't necessarily want to take the time to complete online courses because that would mean downtime"), and WBI could potentially be boring ("Coming away with a feeling of wasted time"). To address these concerns, WBI should include discussion groups and message boards to increase rapport between trainees and instructors as well as be responsive to trainees' questions.

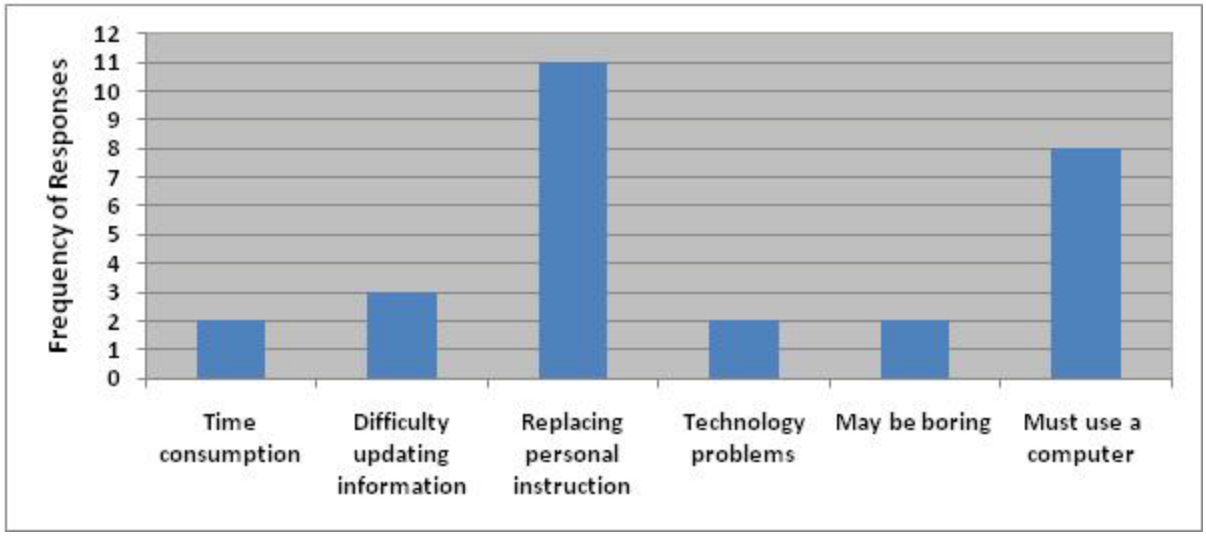

Figure 30. Frequency of Fleet Safety Manager Comments Regarding the Negative Aspects of WBI in CMV Operations

3.4 SUMMARY AND CONCLUSIONS FROM BOTH SURVEYS

These results suggest that WBI can be a powerful training tool in CMV operations when properly developed. The Driving Tips Web site was included in this assessment to provide each respondent with an opportunity to use WBI. The results indicate the Driving Tips Web site may be considered an effective WBI application. For example, fleet safety managers perceived the Driving Tips Web site was well organized and used specific, real-world video to support each driving tip (as well as links to literature). Moreover, respondents indicated the information gleaned from the Driving Tips Web site was applicable to their everyday job activities as a fleet safety manager. Of critical importance was fleet safety managers' opinion that the Driving Tips Web site was more engaging and interesting than receiving the same information via traditional classroom instruction or by reading a book.

Based on the results from fleet safety manager respondents, an effective WBI program should be designed to complement traditional classroom instruction. Discussion or message boards should be integrated into WBI to build rapport between trainers and trainees as well as provide trainees with the opportunity to ask questions (and receive prompt answers to these questions). Despite these weaknesses and barriers in implementing WBI, the questionnaire results suggest the convenience; the ability to customize training materials, and update training materials with new information was viewed as a significant advantage of WBI compared to traditional classroom lectures.

3.4.1 Strengths of WBI for Training on FMCSRs

Although most survey respondents had not implemented WBI in their fleets, all respondents believed WBI would be beneficial in safety training. Those respondents who indicated WBI had been implemented in their fleets believed WBI was an effective training tool. The convenience of scheduling training at the trainee's discretion was frequently indicated as a strong point for WBI. Specifically concerning the training of motor carrier regulations, WBI would provide the

opportunity to easily update training materials and information with current safety regulations and legislation. This would save valuable time and resources developing new training courses. Moreover, given the distributed operations of FMCSA across the U.S., the ability to train employees at decentralized locations is seen as a significant advantage. WBI also provides trainees personalized training. That is, training can be tailored to address the individual needs of each trainee. Finally, the ability of WBI to standardize training would ensure consistent safety regulation training across employees. This is likely to increase the frequency and promptness in which FMCSA employees receive training on FMCSRs.

3.4.2 Weaknesses of WBI for Training on FMCSRs

Despite the previously mentioned strengths of WBI, respondents did mention a number of weaknesses pertaining to the use of WBI to provide training on FMCSRs. Many safety managers indicated concern about replacing classroom instruction with WBI. More specifically, these respondents believed classroom instruction provided trainees with an opportunity to actively participate in group discussions, ask questions, provide feedback, and interact with other trainees and the instructor. Thus, many respondents believed classroom instruction should not be replaced; however, if WBI could address these issues (via discussion or message boards and the ability to ask questions) it would complement traditional classroom instruction. Another weakness of WBI for training motor carrier safety regulations would be providing Internet access for FMCSA employees in the field (though this is viewed as a trivial limitation as it's likely these employees have Internet access). Lastly, WBI is subject to technical problems. It's possible that links, videos, audio, etc. could fail or work improperly. Thus, it is critical these elements are monitored frequently to ensure all components are working properly.

3.4.3 Benefits of WBI for Training on FMCSRs

The greatest benefit in using WBI to train drivers on FMCSRs is the convenience of delivering instruction via the Internet. Trainees would no longer need to meet in a physical location to participate in training. More specifically, trainees could simply login to a secure Web site to complete training. Though initial start-up costs are associated with implementing WBI, the costs to maintain and revise an existing WBI training program are likely to reduce long-term costs compared to traditional classroom lectures. As WBI is delivered via the Internet, recurrent costs associated with instruction and materials are minimized. Additionally, costs associated with updating training would be substantially less. Lastly, using WBI to train drivers on FMCSRs affords FMCSA the ability easily track, monitor, and store information on training and testing. This can also provide valuable information in tracking those who have completed WBI versus those who have not completed training (and are in need of training).

3.4.4 Barriers to Implementing WBI for Training on FMCSRs

Initial start-up costs were indicated by fleet safety managers as one barrier to implementing WBI. Despite the significant start-up costs required to develop an interactive and effective WBI application, the future cost savings justify using WBI over traditional classroom instruction. Security issues should also be addressed prior to implementing WBI application on FMCSRs. As personal information would need to be submitted to track progress, it would be critical to ensure the trainees' privacy. One barrier indicated by fleet safety managers was the computer proficiency of their drivers. This is unlikely to be an issue with FMCSA employees as basic computer proficiency is required as part of their job duties. Lastly, some individuals may be

hesitant to complete the WBI. Developing an interactive, enjoyable, useful, and secure WBI application is likely to alleviate some of these concerns.

3.5 FMCSA STRUCTURED INTERVIEWS

In addition to gathering feedback from constituents, the project team gathered information from FMCSA staff members within who have experience with internal WBI initiatives. Members of the project team interviewed five members of FMCSA (four in person, one by teleconference) about their experiences with and insights into WBI and the challenges facing FMCSA in this area. In addition to gathering feedback from participants, the project team interviewed five FMCSA employees about their experiences with WBI and the challenges facing FMCSA in adopting this training method. The interviewees came from a variety of areas within FMCSA: strategic planning, policy, outreach, analysis, research, technology, and training.

Prior to the interviews, the project team developed a brief interview guide for internal use. The guide was not shared with the interviewees, but contained questions to launch discussion in a number of areas. Because the interviewees came from a cross-section of FMCSA, it was never intended that all interviewees would be able to speak to all detailed topics; during the interviews, the authors focused on the areas most suitable for the particular interviewee.

Although the actual discussions tended to move freely from topic to topic, four key themes emerged.

3.5.1 Theme 1: Involvement

In this theme, the authors sought to elicit information on these topics:

- What were the stakeholders' interactions with WBI development and deployment by FMCSA?
- Was the stakeholder more familiar with the less structured training such as webinars, or was there involvement with a more detailed curriculum?
- What types of end users were being targeted (i.e., drivers, company safety managers, Agency staff, etc.), and what were the methods used?
- Were these programs designed to surround mandatory events, or geared towards optional and constituent-initiated learning?
- How were these programs organized within FMCSA?

Our findings were that the interviewees came from a wide range of programs. Some interviewees had a very loose definition of WBI, including virtually any activity where a constituent could learn from an FMCSA Web site, live webinar, or recorded webinar or podcast. Other interviewees had exposure to formal courseware development using structured design methodologies. Most programs were supporting optional activities, and more programs were geared to drivers than to company safety managers or internal Agency staff. In general, there was not cross-comprehension of initiatives: if we asked interviewee #2 about interviewee #1's WBI

program, very little was known. There was not a well-defined central clearinghouse for WBI activities, although some interviewees had ideas on how such a mechanism might work.

3.5.2 Theme 2: Defining and Measuring Success

In this theme, the authors explored how interviewees defined a successful program. For example, what methods did people use, versus what methods would people *like* to use if given more resources. Much of this discussion directly informed the Experimental Design Framework development (section 4). Interviewees were asked about what negative events would be expected to be reduced through participation in WBI, how interviewees gathered feedback from participants, and how interviewees preferred to learn about the backgrounds and existing aptitude of the participants.

One of the interesting outcomes was that interviewees stated that long-term comprehension and retention were not being measured by FMCSA in its WBI initiatives. Interviewees, however, were sharply divided as to the relevance of measuring long-term retention. A minority of the interviewees stated that measurement of retention was not appropriate or useful, and that simply measuring participation was a sufficient metric of success.

In general, participants were not pre-tested, but in many of the situations using informal methods such as webinars, pre-qualification is not a particular goal. Several interviewees were concerned that attempting to tie WBI participation to specific events such as crash reduction was too tenuous a link, while others stated that in remedial situations (for example, a driver who has been cited for the same offense on multiple occasions), tying participation to reductions in negative events was critical.

Participant impressions were measured in some situations. One simple metric was the return visit which assumed that return visitors could be expected to have enjoyed and learned from their previous WBI experiences. Other interviewees indicated that more formal survey approaches were desirable.

3.5.3 Theme 3: Setting Up Controls

In this theme, the project team was asked about their experience in setting up control groups for comparison to WBI participants. There was near unanimity on this topic. Three key points were consistently made:

- There was minimal experience within FMCSA at setting up control groups for WBI programs.
- Control groups were less relevant for “inexpensive” programs such as webinars than for programs with substantial investment in courseware.
- Existing FMCSA datasets could theoretically be used to craft control groups, if the measures of success of an initiative could be framed around data measured by, or reported to, FMCSA.

3.5.4 Theme 4: Cost-Effectiveness

In this theme, interviewees were asked about costs associated with WBI initiatives, and whether interviewees viewed WBI as cost-effective. One question was, "If costs needed to be controlled, how could trade-offs be established with respect to constituent performance and/or comprehension?" A second question was, "What were the additional requirements (if any) on FMCSA for programs where constituents would have a substantial cost for participation?"

In general, the response was that the WBI programs had the potential to be cost effective, but that in some cases it had been difficult to properly quantify the benefit. It was viewed that the less expensive methods provided a sufficient return on the Agency's investment, and that the Agency should consider how to use emerging technologies. One point raised in several interviews was that training geared towards drivers had to be cognizant of the driver's mobile situation, and needed to have shorter modules that a driver could study during a break period at a rest stop or at a company facility.

The significance of these findings will be discussed in the Overall Summary and Conclusions.

4. EXPERIMENTAL DESIGN FRAMEWORK

The literature review, surveys, and interviews form the basis for a benchmark approach to WBI evaluation. The framework will provide a structure for sponsors to use when creating WBI initiatives and will be suitable for presentation to key decision-makers and sponsors. However, the wide variety of initiatives under the WBI umbrella is not suitable to a totally prescriptive approach. Research suggests that consideration of the framework will require judgment based upon specific contexts. The real discussion begins by outlining the framework's key design principles and describing the potential success criteria for various types of WBI initiatives and then leads to an outline of several key quantitative considerations and approaches. To conclude, we consider how the framework might be used in two hypothetical examples.

4.1 DESIGN PRINCIPLES

The Experimental Design Framework (EDF) for Web-based instruction is based on four generally accepted experimental design principles. The authors find nothing in the surveys or in the interviews of either Agency employees or end users of current or potential FMCSA WBI offerings to suggest that these principles are not appropriate for this discussion.

The principles are:

- Formal Hypothesis Testing: For even the smallest instruction programs, it is important to ask the question, "How will we know that this program works before beginning the implementation process?"
- Proportional Design: One of the potential pitfalls of a design framework is that it can evolve into a "one-size-fits-all" model due to over-specification. There is no single "right" way to design an evaluation experiment, but in general, our goal is to scale the evaluation framework to the size and criticality of the training.
- Multiple Options for Defining Success: Our interviews with FMCSA staff reinforced our belief that the objectives of a WBI program should dictate the definition of success.
- Integrated Evaluation. One of the benefits to considering evaluation design at the beginning of a WBI initiative is the ability to integrate evaluation techniques into the infrastructure as part of the deployment. "Integration" in this case may range from designing specific screens of an interactive WBI session to ensuring an appropriate follow-up campaign for FMCSA-sponsored webinars.

4.1.1 Defining Success: The Recommended Dependant Variables for FMCSA WBI Initiatives

Our interviews with the various FMCSA professionals, as earlier described, offer three potential metrics of success for current and future FMCSA WBI programs:

- Participation: For the simplest programs, the most important metric is that the target community actually sees and participates in the instruction. Participation is the most appropriate measure when considering wider broadcast-style instruction, regardless of

medium. In these types of initiatives, there is rarely formal testing of participants, and the instruction is often geared to fit into a limited amount of time. For Web-based instructions, this metric is often reported as number of hits.

- Attitude: For intermediate programs with interactive components, the participants' attitudes towards the instruction can be measured. In these situations, a questionnaire format is appropriate for gathering a participant's attitudes and preferences regarding the instruction. The depth and style of questioning can vary based on the amount of instruction provided and the amount of interaction available with the participant.
- Comprehension: For more complex programs with specific testing objectives, comprehension remains the most relevant performance metric. The goal of such instruction is to prepare participants for specific activities, and the value of the instruction is related to its ability to properly measure attendees' performance.

4.1.2 Selecting the Right Performance Measure

Determining how to measure a particular WBI system should be part of the initial design. A participation, or "hits" metric, is suitable when the WBI includes materials distributed via the Internet for consumption in short bursts of time, as well as instruction delivered through online webinars where the time frame may limit formal interaction with the instructor. At this level of measurement, it is assumed that the participants found some value in the instruction, and relative changes in participation can be assumed to be generally correlated with the value of the instruction.

By comparison, the other metric options require the calculation of value. In an attitude-based approach, we allow the participants to define their own version of successful instruction. In a comprehension-based approach, the WBI designers develop the definition using testing mechanisms.

We propose that WBI developers and sponsors consider the following "yes/no" questions when contemplating a deployment. If a preponderance of questions can be answered "yes," then it is more likely that a measure of participation is not, by itself, a sufficient metric for evaluation.

- Will the participant have to register for the instruction?
- Will the participant have their own "user profile" or "contact details"?
- Will there be access to ask questions of a live instructor (either in real-time or via email)?
- Will the participant be able to work through the instruction at his/her own pace?
- Will the participant answer questions through a browser interface during the instruction?
- Is the participant taking the instruction as part of a formal certification or aptitude-testing process?
- Is the participant taking the instruction as part of a remedial program (for either the driver or the motor carrier)?

4.1.3 Use of Multiple Performance Measures

It is appropriate to consider using two or even all three of the metrics for a single WBI program. But if multiple types of metrics are to be used, the WBI sponsor should articulate the rationale for using each type of metric, and the relative importance among them. Multiple metrics should not be used simply to provide multiple options for (re)defining success after the instruction has been completed.

4.1.4 Evaluation Hypothesis for Each Performance Measure

Each of the performance measures defined above has a specific corresponding research hypothesis. In scientific research, the hypothesis is framed as the negative of what we are expecting. Known as the null hypothesis, experimentation is approached as a study to see if the hypothesis can be statistically rejected.

For each WBI program, the sponsor and development team should define specific objectives to reflect the nature and mission of the program. These specific objectives will describe the success of the program.

Examples of these types of objectives are:

- Staff from agencies in at least 30 States will listen to any particular week's webinar;
- At least 60 percent of participants would recommend the WBI to a colleague.
- Participants in the WBI passed the subsequent formal examination at a rate five percentage points higher than those not participating in the WBI, everything else being equal.
- Three quarters of participants in the WBI who scored under 50 percent in the pretest improved their comprehension to more than 70 percent in the post-WBI test.
- Participants in the WBI showed a significant reduction in out-of-service violations.

4.1.5 Temporal Aspects

One of the interesting aspects of many WBI programs is the ability to measure the performance of the instruction over an extended period of time. Any WBI program should have the ability to measure this temporal aspect of the program. Examples of how to design temporal aspects into an evaluation framework include:

- Record webinars, including question-and-answer sessions, and track return visits from participants or their organizations.
- Design the user registration system to integrate with a mailing list program, and send newsletters about related WBI programs to participants.
- Use the same newsletter to ask participants to complete attitudinal surveys "six months later" and "one year later" to measure how the participant's perception has changed after real-world usage of the knowledge gained from the program.

- Offer a "refresher" course version of a module after an elapsed period of time, and have participants take a pre-test before the refresher course. Compare the participant's refresher pre-test results to both their initial pre-test and post-instruction results.

4.1.6 Statistical Analysis Techniques

The Research Team envisions that up to three levels of statistical analysis techniques will be utilized in a typical evaluation of a WBI initiative.

- Descriptive Statistics do not attempt to refute a hypothesis with statistical significance, but instead are showing general trends and potential patterns in data. These statistics are the most common: means and medians, scatter-grams and histograms, fits to various typical distributions, calculations of variance.
- Regression Analyses attempt to isolate the variance in data by creating a formulaic model. The most common models are linear in nature. The goal is to identify which variables can be added to an equation to reduce the total variance of the data from what its "expected" value could be from the curve.
- Choice Models are used in attitudinal analysis to predict future behavior. When we have access to attitudinal data, we can use choice models to forecast potential adoption of WBI initiatives by a broader population than that initially exposed to the instruction, and inform marketing efforts by identifying attributes of potential adopters.

4.1.7 Establishing Baselines and Controls

A WBI initiative is designed to improve knowledge in a constituency compared to before and after their participation. In order to properly evaluate the hypotheses described above, it is generally necessary to answer two questions:

- "Improve knowledge" before when?
- "Improve knowledge" compared to whom?

These two questions can be framed into a matrix, as shown in Table 10. The matrix has time on the horizontal axis (before vs. after), and participation on the vertical access (participants vs. similar non-participants).

Table 10. Structuring Baseline Events and Control Groups to Support Hypothesis Testing

	Before Instruction	After Instruction
Test Group (Participants)	Performance-BT	Performance-AT
Control Group (Others)	Performance-BC	Performance-AC

The cells of the table contain the relative performance specified earlier based on the initiative of each group at each point in time. Since the test group undertook the instruction, and the control group did not, one can expect that the following measurements will hold true:

- Performance-AT is significantly better than Performance-BT (since they took the instruction).

- Performance-AC is not significantly different than Performance-BD (since they did not take the instruction).

If we allow membership in either group without screening, we can make no assertions about the relative strength of Performance-BT versus Performance-BC. But if we add restrictions to the participation in the control group, we can create a control group with similar characteristics to the participation group. At that point, we can assert that Performance-BT should equal Performance-BC; all things being equal, the two groups should be interchangeable in the pre-instruction performance.

4.1.8 Defining a Control Group

A control group is appropriate when the primary performance measure is attitudinal or comprehension-based, and the instruction is not supporting a remedial or otherwise prescribed activity. In the latter case, the control group is inappropriate because assignment to the control group denies those potential participants access to the information for a period of time, and it is generally desirable to instruct all participants in these situations.

In WBI initiatives where only participation could be measured, a control group is overkill for measurement as the hypotheses are not sufficiently complex to warrant such a group. A control group is appropriate, however, to evaluate the promotion of a participation-measured WBI initiative, such as performing structured evaluations of a marketing campaign.

As described above, a control group is designed as the "all things being equal" shadow of the participant group. The definition of "equal" or "similar" is highly dependent on the specific WBI initiative, the target audience, and the attributes of the participants. The WBI initiative sponsor should define how to articulate the "similarity" of two potential participants, and use this approach to define the control group as needed.

The size of a control group is typically equal to the size of the participant group, but this is not always the case. Two scenarios are quite common:

- The participants' similarity can be defined through demographic means, and large datasets can be queried after the fact to find an "oversample" of multiple control group candidates for each actual participant.
- Conversely, the cost to identify or exclude "similar" participants is high, and therefore a proportionally smaller control group is appropriate.

The remedial course scenario above is an extreme example of the latter: while participants may be easily identified, they cannot be excluded without an implied high cost.

4.1.8.1 Control via Other Instruction Methods

One potential area where a large control set may be available is for WBI programs that are derivatives of more established techniques of instruction, such as classroom instruction. In these situations, it is very possible to have a much larger control group than the actual test group. But care must be taken to ensure that the "everything else being equal" nature between test and control is in fact true. For example, if the WBI course is being offered for free, but the classroom

instruction costs $400/day (a typical cost for privately-operated classroom instruction programs), then care must be taken to identify whether the WBI participants have the financial means to participate in the classroom instruction.

4.1.9 Guidelines for Participant and Control Sample Sizes

A key design factor is identifying the minimum number of participants, and thus the corresponding number of control subjects, to be considered statistically significant for the analysis to be performed:

- Proportional design to the task at hand.
- The cost of participation.
- The detail of the hypotheses to be tested.

In general, the smallest practical size for measurement is 30 observations; 50–75 observations would be considered marginal. This sample size, if from a relatively homogenous set of participants, could evaluate a simple yes/no type of hypothesis. As the complexity of the experiment expands, the appropriate size grows in a non-linear manner. For example, stratifying by five age groups for the same question might bring the minimum sample size up to 150 observations, while stratifying by five age groups and two genders would bring the size up to 300.

The more complex the hypothesis, the greater is the sample size requirement. For the 10-strata example in the last paragraph, a hypothesis which requires simultaneous comparison of a number of factors might drive the desired number of participants to 1,200 or even 3,000.

A point of reference is campaign polling. In the 2008 presidential campaign, many national polling companies conducted opinion polls using between 300 and 700 respondents, for questions with three or four discrete potential answers.

In general, attitude-based evaluation will need the highest number of responses, because the evaluation device must ask a broad enough set of questions, and then stratify the results based on the corresponding sets of questions. Consider a survey to CMV drivers executed a year after instruction, where, before asking about the value of the course, typical questions might be:

- What is your level of experience driving a commercial motor vehicle (four answers)?
- Do you drive on a regular or irregular pattern of trips over a typical month (three answers)?
- In the last year since you participated in the course, have you encountered situations as described in the instruction (five yes/no parts corresponding to various modules)?

Given a target of an average of 30 responses for each cell, we can foresee that a sample size of 1,800 responses ($30 \times 4 \times 3 \times 5$) would be appropriate.

4.1.9.1 The Reality of Most WBI Programs

In many WBI situations, the participant group is going to be whatever part of the community the Agency can get to participate. The framework should not limit participation, but it should manage expectations of what can be accomplished statistically with small sample sizes, particularly under 300. In these cases, the results may often be "trend analyses" or "descriptive statistics," but may lack the sample size for a full statistical evaluation.

4.2 IMPLEMENTING EVALUATION MEASUREMENT TOOLS INTO THE WBI REQUIREMENTS PROCESS

In this section, we will outline the key evaluation tools which WBI sponsors should integrate as requirements when designing a WBI initiative. Since the specific technical implementation of these components will often depend on the particular systems and platforms used to develop the WBI materials, a description of functional requirements is more appropriate at this framework level.

Not all requirements will be necessary for all WBI initiatives; the specific requirements that are appropriate will be dependent on the design choices made in the earlier sections. Folowing are requirements in the context of two hypothetical WBI initiatives.

Scenario 1: A Web-based seminar series geared towards safety managers of carriers with fleets of more than 20 vehicles. The seminar series is presented via a webinar, typically each month, and is available for replay for those unable to attend. A moderated forum has been set up for participants to discuss the series over time, and speakers answer questions in the forum for a week after their seminar.

The primary performance measures in this scenario are likely to be participation and attitudes (either implicit or explicit) towards the program. The discussion forum lends itself to a potential enlightening amount of insight from participants, but the insight will be mostly qualitative.

For the sake of argument, we will establish five performance measurements:

- A target of 200 company safety managers who participate in at least one seminar (Participation).
- At least 50 percent of participants will participate in at least three seminars (Participation).
- At least 30 percent of participants will participate in the discussion forum, either by asking a question or by commenting on an ongoing discussion (Participation).
- At least 20 percent of participants will be referred to the series by an existing participant (Attitude).
- Participants both find the series valuable enough on an annual basis to fill out a survey, and find 80 percent of the individual speaker sessions valuable (Attitude).

The discussion forum attached to the seminar series provides an opportunity to establish a dialogue mechanism with participants that previously would have required a relatively expensive panel survey approach. It also allows the ability to use "analytics" tools, typically used in e-commerce marketing, to track the relationship between various events on the WBI platform. Examples include:

- Everybody has an account enabling us to tie the login to participation in particular webinars (either in real time or on demand).
- We can establish polling threads where we can ask questions of participants both before and after particular speakers.
- We can track the popularity of specific topics.
- We can identify which participants return to the site and participate in and initiate discussions (what is often referred to as the "stickiness" of the site).

In terms of a control set, the user account approach allows us to capture key carrier identifying information, as well as demographic information perhaps not typically stored in Federal datasets. With this information, we can create an oversample in one of two ways:

- Statistically generate 30 candidate-"similar" companies (either by performance or demographics) and distribute a survey to those companies assuming a 2–3 percent response rate.
- Work with industry sector groups to identify focus groups of similar companies.

With the likely participant size, formal hypothesis testing may not be feasible beyond some basic information such as comparing participation levels. But trend analyses of participants, including stratification by either participation level or demographics (although it is likely that there will not be enough respondents to stratify both simultaneously and still obtain meaningful results) will provide useful information when combined with the qualitative review of comments over time from the discussion forum.

Scenario 2: A Web-based "refresher course" to be taken each year by drivers as part of the requirements to maintain an exemption from Federal medical requirements for vision deficiencies. Approximately 1,100 drivers would take this course each year they are in the program.

This is a very different scenario from its predecessor. In this situation, participation would be made compulsory. We will have a larger number of participants (better for formal hypothesis testing), but no control set (due to the required nature).

In this situation, we would establish some different types of measurements:

- At least 5 percent of the drivers would participate more frequently than once every 12 months (Attitude—they implicitly see added value in repetitive usage).

- Year after year, drivers as a whole perform "better" in the course, both in the pre-test as well as, in the number of wrong answers when completing various modules (Comprehension).
- Year after year, the number of drivers who are removed from the program due to items covered in the refresher course diminishes (Comprehension).

To track mandatory participation, user accounts would be required for each driver. From that information, we can track frequency of participation. The curriculum would have to have a pretest with a deep enough question and data storage bank to withstand 4–**5** years of usage.

We would be able to link the drivers' test results to existing (non-WBI) information about why the driver is in the program as well as the driver's demographic information. A set of 1,100 drivers would allow us to do some complex three-level stratifications (example: reason for inclusion, age, current eyesight level) and still have enough data for a reasonably rigorous statistical analysis of variance of response rates.

4.2.1 Linking WBI to Federal Datasets

Both of the above discussions had references to other Federally held data, either about drivers or motor carriers. When designing a WBI initiative where a participant will be identified in a way that will link them to an existing dataset, a sponsor should consider which datasets are available and appropriate for augmenting the information about the participant. This augmentation can occur during both the control definition and the analysis processes of the overall evaluation.

4.3 SECTION SUMMARY

The objective in this section is to introduce typical quantitative techniques for evaluation, often utilized by authors of literature reviewed in this project, into a context appropriate for implementation as part of FMCSA WBI initiatives. Our approach is not directly prescriptive, but contains elements which over time may become prescriptive for subsets of the WBI spectrum.

The concepts presented are valuable to potential sponsors of specific WBI initiatives. As the concepts of new initiatives are adopted, FMCSA will have an approach towards identifying efficacy which becomes increasingly data-driven, while recognizing the limitations of a full quantitative analysis for every single initiative.

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5. OVERALL SUMMARY AND CONCLUSIONS

5.1 LITERATURE REVIEW

WBI, if well-designed, has been shown to be effective in a wide variety of settings, both inside and outside the Government. The literature review concludes that WBI provides a delivery method where costs and time can be significantly reduced as personnel can access training materials online (Cornford & Pollock, 2003) and new information can be updated easily and efficiently (Rosenberg, 2001). Evidence also suggests that technology-based instruction, including WBI, is less costly and potentially more effective than traditional instructional methods when developed by staff experienced in the design of online training (Bartley and Golek, 2004).

Furthermore, the benefits of WBI increase when instructional equipment (e.g., computers, projectors, televisions, and software) is incorporated and a large number of personnel are involved (Dodds and Fletcher, 2004). Dodds and Fletcher (2004) identified a "rule of thirds" from their assessment of the benefits of technology-based instructional methods (including WBI). The researchers found that technology-based instruction reduced the costs by approximately 33 percent, reduced the instruction time by approximately 33 percent, and increased learning by approximately 33 percent. WBI can be especially useful in organizations and Government agencies that train personnel across a distributed geographic area, especially those agencies with personnel in isolated locations (Taylor, 2002). WBI provides these individuals the opportunity to learn from their current location without the need to travel to a central location. This is particularly advantageous for the motor carrier industry as drivers, fleet safety managers, or other field personnel can complete training as long as they have a computer and access to the Internet.

While many regulatory agencies and organizations provide WBI to their employees, WBI is not frequently used by the Government to disseminate information to the motor carrier industry. There are some examples of private transportation training schools that use WBI (e.g., ProTek Group, Carriers Edge, and Safetek), and some businesses that use WBI for driver training (e.g., General Electric, Schneider Trucking, UPS, Smithway Motor, Ryder, and Frito Lay). However, few State and Federal Government agencies have used WBI to train motor carrier vehicle drivers. The literature review did identify some specific FMCSA applications of WBI. USDOT's TSI is discussed in detail.

Other State and Federal regulatory agencies also use WBI as a training tool. These agencies include the Office of Regulatory Affairs, the National Oceanic and Atmospheric Administration the Department of Health and Human Services, the U.S. Department of the Interior, the Federal Emergency Management Administration, and the Nuclear Regulatory Commission. Despite the existence of these programs, many do not have published data evaluating the effectiveness of their in-house programs. The literature review describes several of these programs in detail.

To gauge the current level of use of WBI that is provided by private sector businesses and organizations to motor carriers, the Research Team conducted a scan of online training options provided by industry stakeholders. The results of this scan indicated that there are a significant

number of Web-based training products and services available to motor carriers, which provides some evidence that such programs are both utilized and effective. The Research Team analyzed the information by placing trucking industry WBI users into two categories: managers and drivers. The review describes the content and technologies of several key WBI programs.

5.2 SURVEYS

Two surveys were conducted as part of this effort. The first offered general questions related to WBI to trucking company safety managers. The second asked respondents to answer questions related to FMCSA Web pages named Driving Tips.

In the first survey, the 37 safety managers that elected to take the survey were generally familiar and comfortable with Web-based instruction as a tool to teach safety concepts to drivers and managers. Of those that did not currently use WBI as part of training, there was a willingness to identify and test WBI-based safety courses.

However, carriers face issues: technology limitations, WBI product costs, driver access, and questions of the effectiveness of this type of distance learning were raised. In the cases where concerns were assessed, it is important to consider that the respondents were all familiar enough with the Internet enough to have taken the survey online. If survey takers had not been familiar enough to take the survey in an electronic, Internet format, it is likely that the general level of comfort would have been lower, and that insurmountable barriers would have emerged more often and with greater detail.

The respondents that currently use WBI indicated, in general, that this technology was effectively employed to teach safety concepts. The advantages of WBI were, generally speaking, that a remote work force could use the training product at any given time and at a lower cost than traditional training programs. Measuring the effectiveness of WBI does not appear to be a simple task, however, and was listed as a disadvantage by some respondents. Driver acceptance and feedback, as well as the implementation process, were listed as evaluation criteria; there appears, however, to be a dearth of outcome-based metrics to evaluate WBI in training drivers (though such metrics are mentioned in general terms by a small number of respondents). Effective and credible outcome based evaluation criteria, therefore, while quite difficult to pinpoint, may be the most useful selling point for WBI in training safety concepts and regulations to commercial vehicle operators.

These results from both surveys suggest that WBI can be a powerful training tool in CMV operations when properly developed. The Driving Tips Web site was included in this assessment to provide each respondent with an opportunity to use WBI. The results indicated that the Driving Tips Web site should be considered an effective WBI application. One important finding was that the fleet safety managers identified the Driving Tips Web site as more engaging and interesting than receiving the same information via traditional classroom instruction or by reading a book.

Despite the strengths of WBI, respondents did mention a number of weaknesses pertaining to the use of WBI to provide training about FMCSRs. Many safety managers indicated concern over replacing classroom instruction with WBI. More specifically, these respondents believed

classroom instruction provided trainees with an opportunity to actively participate in group discussions and ask questions (and receive prompt answers), provide feedback, and interact with other trainees and the instructor. Thus, many respondents believed classroom instruction should not be replaced; however, if WBI could address these issues (e.g., via discussion or message boards and the ability to ask questions) it would complement traditional classroom instruction.

According to the survey results, the greatest benefit in using WBI to provide training about FMCSRs is the convenience of delivering instruction via the Internet. Trainees would no longer need to meet in a physical location to participate in training. More specifically, trainees could simply login to a secure Web site to complete training. Though initial start-up costs are associated with implementing WBI, the costs to maintain and revise existing WBI training program are likely to reduce long-term costs compared to traditional classroom lectures. As WBI is delivered via the Internet, recurrent costs associated with instruction and materials are minimized. Additionally, costs associated with updating training with new legislation would be substantially less. Lastly, using WBI to train motor carrier regulations affords FMCSA the ability easily track, monitor, and store information on training and testing. This can also provide valuable information in tracking those who have completed WBI versus those who have not completed training (and are in need of training).

Initial start-up costs were indicated by fleet safety managers as one barrier to implementing WBI. Despite the significant start-up costs required to develop an interactive and effective WBI application, the future cost savings justify the using WBI over traditional classroom instruction. Security issues should also be addressed prior to implementing WBI application on motor carrier safety regulations. As personal information would need to be submitted to track progress, it would be critical to ensure the trainees' privacy. One barrier indicated by fleet safety managers was the computer proficiency of their drivers. This is unlikely to be an issue with FMCSA employees as basic computer proficiency is required as part of their job duties. Lastly, some individuals may be hesitant to complete the WBI. Developing an interactive, enjoyable, useful, and secure WBI application is likely to alleviate some of these concerns.

Based on the results from fleet safety manager respondents, an effective WBI program would complement traditional classroom instruction. Discussion or message boards could be integrated into WBI to build rapport between trainers and trainees as well as provide trainees with the opportunity to ask questions (and receive prompt answers to these questions). Despite these weaknesses and barriers in implementing WBI, the questionnaire results suggest the convenience; the ability to customize training materials, and update training materials with new information was viewed as a significant advantage of WBI compared to traditional classroom lectures.

Section two also includes a summary of author interviews with key FMCSA professionals. The two major finding from these interviews is that individual units in FMCSA are moving ahead with WBI applications and that there is little to no coordination among these various FMCSA organizations.

5.3 BEST PRACTICES

The following list of best practices are derived from an analysis of the literature review, the discussions with FMCSA professionals, and the results of the surveys described above. They also reflect the combined knowledge and experiences of the members of the Research Team. Among the literature, interviews and surveys, the team found no instance where all of these practices were in place. Details about these various qualities are in the main body of this report.

- Ideally, WBI provides an interactive learning experience for the user. The WBI program tailors instruction to the individual needs of the trainee. Furthermore, the trainee is able to ask the program questions and seek out advice, feedback, and tips.
- Ideally, the WBI allows each user to enter and exit the training course as desired.
- Ideally, the WBI is easy to use.
- Ideally, the WBI is visually rich.
- Ideally, learning in the WBI is recorded in a common database to document progress and completion. This information may be used to track progress through the program and show proof of completion.
- Ideally, trainees set their own pace throughout the WBI.
- Ideally, WBI includes objective criteria to assess learning.
- Ideally, any one-time events (e.g., webinars) are kept online for a set period of time to allow users to access the event after it has occurred.

5.4 EXPERIMENTAL DESIGN FRAMEWORK

The literature review, surveys, and interviews formed the basis for a benchmark approach to WBI evaluation. The framework will provide a structure for sponsors to use when creating WBI initiatives and will be suitable for presentation to key decision-makers and sponsors. However, the wide variety of initiatives under the WBI umbrella is not suitable to a totally prescriptive approach. Research suggests that consideration of the framework will require judgment based upon specific contexts.

The team's interviews with the various FMCSA professionals offered three potential metrics of success for current and future FMCSA WBI programs: Participation, Attitude and Comprehension. Section 4 describes these terms in details and provides guidelines for when each metric should be used.

The objective of section 4 was to introduce typical quantitative techniques for evaluation, often utilized by authors of literature reviewed in this project, into a context appropriate for implementation as part of FMCSA WBI initiatives. Our approach was not directly prescriptive, but contains elements which over time can become prescriptive for subsets of the WBI spectrum.

The concepts presented are valuable to potential sponsors of specific WBI initiatives. As the concepts of new initiatives are adopted, FMCSA will have an approach towards identifying efficacy that becomes increasingly data-driven, while recognizing the limitations of a full quantitative analysis for every single initiative.

5.5 FMCSA'S NEW WBI INITIATIVES

Beginning in 2009, FMCSA's National Training Center (NTC) completed analyses to identify distance learning opportunities for eighteen in-house Safety training courses to determine their suitability for conversion to distance learning. The courses were evaluated to determine the level of converting background information, definitions, regulations, software user process information, and procedural steps to web-based instruction. The proposed blended curriculum for these courses consisted of webinars, web-based learning modules, and instructor-led classroom training.

In the first quarter of 2009, NTC initiated a new webinar training program that facilitated the quick development and implementation of training on an as-needed basis through distance learning. This initiative provided the agency with the ability to respond quickly to regulatory and policy changes to ensure uniformity and consistency. Since this time, webinar training has been provided in a highly responsive manner prior to policy implementation and regulatory compliance dates to more than 4,000 FMCSA employees and their state and industry partners. NTC received numerous comments on the high quality of the training.

In the last quarter of 2009, the design and redevelopment of the Safety Investigations, Compliance Review, and Enforcement training was initiated by NTC, which is planned for full implementation by the end of 2010. For this effort, the newly developed Safety Investigations and Enforcement in-classroom training will focus on the application of regulations; whereas, the web-based modules will focus on acquiring knowledge about the regulations, how to use the Information Technology systems, and how to access resources.

In conjunction with this course redevelopment effort, NTC has been developing further web-based distance learning training that will allow both new Federal and State motor carrier safety enforcement personnel and industry stakeholders to familiarize themselves with key FMCSA regulations and requirements. The asynchronous learning will address subject areas, such as New Entrant Safety Audits, Compliance Requirements, Driver Operations, Vehicle Operations, Fleet Operations, Hazardous Materials Operations, and Household Goods. The aims of the training will include reaching out to motor carrier industry partners and providing an overview of the regulatory framework with a view to improving motor carrier safety.

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APPENDIX A—ONLINE QUESTIONNAIRE

CMV Web-based Instruction Questionnaire

Directions: Respond to the statements on the questionnaire based on your personal experience with the Driving Tips Web site and Web-based instruction. Web-based instruction can be defined as an Internet or intranet-based instructional program that enhances learning using the features and resources of the World Wide Web. Once you respond to all of the questions please press the submit button. After submitting the questionnaire you will be directed to another Webpage where you can submit your payment information. Your responses are anonymous so please answer each question honestly.

Navigating the Driving Tips Web site

1. The Driving Tips Web site was easy to navigate. (Please select only one category).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

2. I had trouble locating specific driving tips in the Driving Tips Web site (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

3. I had difficulty reading the information displayed (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

4. I was able to understand the specific driving tips presented in the Driving Tips Web site (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

5. The information in the Driving Tips Web site was well organized (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

Usefulness of the Driving Tips Web site

6. The Driving Tips Web site presented information in the context of real-world; commercial vehicle operations (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

7. The Driving Tips Web site provided specific examples of the driving tips discussed (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

8. The Driving Tips Web site did not help to clarify any misconceptions I had concerning safe driving in commercial vehicle operations (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

9. The videos were useful in my understanding of unsafe driving behaviors (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

10. I believe I will be able to apply the information on safe driving behaviors I learned in the Driving Tips Web site to everyday commercial vehicle operations (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

11. The learning objectives in the Driving Tips Web site were not clearly defined (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

12. I believe the Driving Tips Web site should have covered information on other driving issues (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

13. The Driving Tips Web site helped to explain the concepts I previously misunderstood about unsafe driving behaviors in commercial motor vehicle operation (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

14. This Driving Tips Web site was more useful than receiving the same information through classroom instruction (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

15. The Driving Tips Web site was more interesting than receiving the same information through classroom instruction (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

16. The Driving Tips Web site was no different than reading a book (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

17. Hyperlinks to reference material in the Driving Tips Web site did not provide adequate supplemental information (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

18. The directions concerning how to use the Driving Tips Web site were not helpful (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

19. I had problems accessing the Driving Tips Web site (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

20. I was overwhelmed with the amount of information on driving behaviors presented in the Driving Tips Web site (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

21. The Driving Tips Web site provided me with the opportunity to review the safe and risky driving concepts I learned in the Web site (please select one).

    a) Yes
    b) No

22. Please list any other driving issues you believe the Driving Tips Web site should have covered.

    _____

    _____

    _____

    _____

Information on the Driving Tips Web site

23. Which safe driving tip was NOT discussed in the Driving Tips Web site (please select one)?
    a. Always drive defensively
    b. Review maps and plan your route before driving
    c. Turn off your cell phone while driving
    d. Only check your mirrors when changing lanes, merging, or turning

24. Did the Driving Tips Web site include training exercises for each specific driving behavior (please select one)?
    a. Yes
    b. No

25. What was the purpose for developing the Driving Tips Web site (please select one)?
    a. To train commercial motor vehicle drivers for CDL certification
    b. To provide training on FMCSA regulations
    c. To evaluate the safety record of commercial motor vehicle drivers
    d. To provide defensive driving safety information to commercial motor vehicle drivers

General Web-based Instruction Questions

The following questions are related to your personal experiences with Web-based instruction in the commercial motor vehicle industry. As indicated above, Web-based instruction can be defined as an Internet or intranet-based instructional program that enhances learning with the features and resources of the World Wide Web.

26. How has Web-based instruction been employed in your fleet (please list each application)? If Web-based instruction **has not** been employed in your fleet, please skip to question #31.

    _____

    _____

    _____

    _____

27. How effective were those Web-based instruction applications used in your fleet (please describe the effectiveness of each application)?

    _____

    _____

    _____

    _____

28. What were the advantages of those Web-based instruction applications used in your fleet (please describe)?

    _____

    _____

    _____

    _____

29. What were the weaknesses of those Web-based instruction applications used in your fleet (please describe)?

    _____

    _____

    _____

    _____

30. Do you have any suggestions on how you would improve those Web-based instruction applications used in your fleet (please describe)?

_____

_____

_____

_____

If your fleet **has not** used Web-based instruction, please respond to Questions #31 and #32. If you have used Web-based instruction, skip to question #33.

31. If Web-based instruction has not been employed in your fleet, do you think it could be beneficial (please describe)?

_____

_____

_____

_____

32. Why has your fleet not used Web-based instruction (please describe)?

_____

_____

_____

_____

33. What are the potential barriers to implementing Web-based instruction in the commercial motor vehicle industry (please describe)?

_____

_____

_____

_____

34. What would you like most about completing a Web-based instruction course regarding commercial motor vehicle regulations (please describe)?

_____

_____

_____

_____

35. What would you like least about completing a Web-based instruction course regarding commercial motor vehicle regulations (please describe)?

_____

_____

_____

_____

Computer and Internet Proficiency

36. I do not have any problems operating a computer (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

37. I have difficulty locating information on the Internet (please select one).

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

38. I have a computer in my home (please select one).
    a) Yes
    b) No

39. What type of Internet connection do you use at home (please select one)?
    a) Dial-up Modem (28k)
    b) Dial-up Modem (56k)
    c) Cable Modem
    d) DSL
    e) No Internet Connection
    f) Not Sure
    g) I do not have a computer at home

40. I use a computer at work:
    a) Yes
    b) No

41. What type of Internet connection do you use at work (please select one)?
    a) Dial-up Modem (28k)
    b) Dial-up Modem (56k)
    c) Cable Modem
    d) DSL
    e) No Internet Connection
    f) Not Sure
    g) I do not have a computer at work

42. How often do you use a computer (please select one)?

a) Seldom or never
b) 2 to 4 times a month
c) Weekly
d) Daily

43. How often do you connect to the Internet (please select one)?
    a) Seldom or never
    b) 2 to 4 times a month
    c) Weekly
    d) Daily

Demographic Questions

44. What is your position/job title? _____

45. How many years of experience do you have in commercial motor vehicle operations? _____

46. How many vehicles are in your organization's fleet (please indicate)? _____

47. How would you characterize your fleet's primary operation (please select one)?
    a) For hire: long-haul/truckload
    b) For hire: local/short-haul
    c) Private: long-haul
    d) Private: local/short-haul
    e) Passenger carrier: long-haul
    f) Passenger carrier: local/transit
    g) Other (please specify):_____

48. What is your age (please indicate)? _____

49. What is the highest education level you have achieved (please select one)?
    a) Less than 12 years
    b) High School Diploma
    c) Associate's Degree
    d) Bachelor's Degree
    e) Master's Degree
    f) Doctoral Degree

Thank you for participating in the study! Once you have answered all the questions please press the submit button below. After pressing the submit button you will be taken to another page where you'll be required to enter information for payment for answering our survey. There will be no association made between the questionnaire and the information you submit for payment and your responses will remain anonymous.

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APPENDIX B—INFORMED CONSENT FORM

Informed Consent Form for
Participant of Investigative Projects

1. THE PURPOSE OF THIS RESEARCH

You are invited to participate in a project that will attempt to assess your opinions and perceptions regarding the dissemination of regulatory information through Web-based instruction. Web-based instruction can be defined as an Internet-based instructional program that enhances learning with the features and resources of the World Wide Web. 125 fleet safety managers are being asked to participate in this study.

2. PROCEDURES

You will be asked to complete a brief online questionnaire. In relation to Web-based instruction, you will first be asked to indicate your opinions regarding the Driving Tips Web site. Further, you will be asked to indicate what Web-based instructional programs are currently employed in your fleet, and then asked to rate the effectiveness of those programs. The last section of the survey questionnaire will gather basic descriptive data on your carrier fleet (e.g., years of experience, fleet size, operational type) and your computer and internet use. You will also be given an opportunity to write in other issues and to comment.

3. RISKS & BENEFITS OF THIS PROJECT

No promise or guarantee of benefits has been made to encourage you to participate. We anticipate no more than minimal risks associated with participation in this project. Your participation in this project will help assess the extent to which Web-based instruction is an effective tool in training commercial motor vehicle regulatory information.

4. EXTENT OF THE ANONYMITY AND CONFIDENTIALITY

THE RESULTS OF THIS STUDY WILL BE KEPT STRICTLY CONFIDENTIAL. At no time will the researchers release your responses to anyone other than individuals working on the project without your written consent. The data you provide will not be associated with your payment information.

It is possible that the Institutional Review Board (IRB) may view this study's collected data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research.

5. COMPENSATION

If you choose to complete the questionnaire, you will receive $25.00 via check. You are under no obligation to provide the researcher with your contact information; however, this information is necessary if you desire to receive the compensation.

6. FREEDOM TO WITHDRAW

YOU ARE FREE TO WITHDRAW FROM THIS STUDY AT ANY TIME WITHOUT PENALTY. YOU ARE ALSO FREE TO SKIP ANY QUESTIONS THAT YOU CHOOSE WITHOUT PENALTY.

7. APPROVAL OF RESEARCH

This research has been approved by the Human Subjects Committee of the Department of Psychology and by the Institutional Review Board of Virginia Polytechnic Institute and State University, IRB approval #09-005.

8. PARTICIPANT'S RESPONSIBILITIES

I know of no reason I cannot participate in this study. I have the responsibility to answer the questions as honestly as I can.

9. PARTICIPANT'S PERMISSION

I have read and understand the informed consent form and conditions of this project. I have had all my questions answered. I understand that my voluntary consent will be implied if I submit the questionnaire.

If I participate, I may withdraw at any time without penalty.

Questions about this research, or for an official copy of this informed consent form, contact Matthew Camden, M.A. at 540-231-1503 or Jeffrey Hickman at 540-231-1542.

Any questions about the protection of human research participants regarding this study, should be directed to:

Dr. David Moore,
Chair Virginia Tech Institutional Review Board for the Protection of Human Subjects
Telephone: (540) 231-4991;
Email: moored@vt.edu;
Address: Office of Research Compliance, 2000 Kraft Drive, Suite 2000 (0497), Blacksburg, VA 24060.

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