National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: October 21, 2010

In reply refer to: H-10-8 through -11 and
H-08-13 and -14
(Reiteration)

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On June 26, 2009, a multivehicle accident occurred on Interstate 44 (I-44) near Miami, Oklahoma, shortly after a minor accident in the same vicinity occurred. The minor accident took place about 1:13 p.m., when a 2001 Ford Focus traveling eastbound at milepost 321.7 on I-44 drifted into a truck-tractor semitrailer parked on the right shoulder. After the Focus sideswiped the semitrailer, the car's driver overcorrected to the left, lost control, and struck the concrete center median barrier. The Focus came to rest in the roadway, blocking the left eastbound lane. As the trailing traffic began to slow and stop, it formed a queue. Several motorists exited their vehicles and began to push the disabled Focus to the right shoulder. The queue of stopped vehicles and approaching but slowing vehicles extended back from the accident site approximately 1,500 feet to about milepost 321.5.

Meanwhile, about 1:19 p.m., a 76-year-old truck driver operating a 2008 Volvo truck-tractor in combination with an empty 2009 Great Dane refrigerated semitrailer was traveling eastbound in the outside (right) lane of I-44 at approximately 69 mph. (The posted speed limit was 75 mph.) The truck driver did not react to the queue of slowing and stopped vehicles and collided with the rear of a 2003 Land Rover sport utility vehicle (SUV). As both vehicles moved forward, the Land Rover struck a 2003 Hyundai Sonata and then departed the right lane and shoulder, coming to rest off the roadway. The Volvo continued forward, struck and overrode the Hyundai Sonata, struck and overrode a 2004 Kia Spectra, and then struck the rear of a 2000 Ford Windstar minivan. The Volvo overrode a portion of the Windstar while pushing it into the rear of a livestock trailer being towed by a 2004 Ford F350 pickup truck. The Ford pickup truck was pushed forward and struck a 2008 Chevrolet Tahoe SUV. The Volvo combination unit came to rest approximately 270 feet past the point where it initially struck the Land Rover. As a result of the Volvo combination unit's striking the slowed and stopped vehicle

queue on I-44, 10 passenger vehicle occupants died, 5 received minor-to-serious injuries, and the driver of the Volvo combination unit was seriously injured.[1]

The National Transportation Safety Board determined that the probable cause of this accident was the Volvo truck driver's fatigue, caused by the combined effects of acute sleep loss, circadian disruption associated with his shift work schedule, and mild sleep apnea, which resulted in the driver's failure to react to slowing and stopped traffic ahead by applying the brakes or performing any evasive maneuver to avoid colliding with the traffic queue. Contributing to the severity of the accident were the Volvo truck-tractor combination unit's high impact speed and its structural incompatibility with the passenger vehicles.

Among the issues discussed in the National Transportation Safety Board (NTSB) accident report are the need for updated and comprehensive fatigue education materials and fatigue management programs, and the lack of Federal requirements for video event recorders on heavy commercial vehicles.

Fatigue Education and Information

The NTSB has long been concerned about how fatigue affects all transportation operators, including commercial truck and bus drivers. In 1990, the NTSB completed a study of 182 heavy truck accidents that were fatal to the truck driver.[2] The NTSB's primary purpose in investigating fatal-to-the-truck-driver accidents was to assess the role of alcohol and other drugs in these accidents. The study found, however, that the most frequently cited probable cause in such accidents was fatigue. In a subsequent safety study that focused on fatigue's role in heavy truck accidents,[3] the NTSB recommended that the Federal Highway Administration (FHWA), in cooperation with the American Trucking Associations, Inc. (ATA), the Professional Truck Driver Institute, the Commercial Vehicle Safety Alliance (CVSA), and the National Private Truck Council, take the following action:

> Develop and disseminate, in consultation with the U.S. Department of Transportation Human Factors Coordinating Committee, a training and education module to inform truck drivers of the hazards of driving while fatigued. It should include information about the need for an adequate amount of quality sleep, strategies for avoiding sleep loss such as strategic napping, consideration of the behavioral and physiological consequences of sleepiness, and an awareness that sleep can occur suddenly and without warning to all drivers regardless of their age or experience. (H-95-5)

The FHWA Office of Motor Carriers distributed pamphlets; worked with the Owner-Operator Independent Drivers Association, the CVSA, and the National Private Truck

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[1] For additional information, see *Truck-Tractor Semitrailer Rear-End Collision Into Passenger Vehicles on Interstate 44, Near Miami, Oklahoma, June 26, 2009*, Highway Accident Report NTSB/HAR-10/02 (Washington, DC: National Transportation Safety Board, 2010), which is available on the NTSB website at <http://www.ntsb.gov/publictn/2010/HAR1002.pdf>.

[2] *Fatigue, Alcohol, Other Drugs, and Medical Factors in Fatal-To-The-Driver Heavy Truck Crashes (Volume 1)*, Safety Study NTSB/SS-90/01 (Washington, DC: National Transportation Safety Board, 1990).

[3] *Factors That Affect Fatigue in Heavy Truck Accidents, Volume 1: Analysis*, Safety Study NTSB/SS-95/01 (Washington, DC: National Transportation Safety Board, 1995).

Council on this issue; and sponsored the U.S. Department of Transportation (DOT) 1995 Truck and Bus Summit. It also funded the ATA to adapt the sleep education and training module developed by the National Aeronautics and Space Administration to the motor carrier industry and to identify, evaluate, and select recommended management practices for determining which drivers are at higher risk of accidents and safety violations and for developing means of appropriately modifying driver behavior. The development and distribution of brochures, manuals, and videotapes, such as "The Alert Driver: A Trucker's Guide to Sleep, Fatigue, and Rest in Our 24-Hour Society," "Awake at the Wheel," "Fatigue and the Truck Driver," and "Dealing with Truck Driver Fatigue," publicized the importance of the issue of fatigue. The FHWA stated that it would continue its educational activities and that the strategic plan for its Office of Motor Carriers would include educational and informational approaches. Safety Recommendation H-95-5 was classified "Closed—Acceptable Action" on July 7, 1998, due to the agency's work with various organizations to educate drivers about the dangers of drowsy driving.

When NTSB investigators reviewed the training material that the motor carrier in this case, Associated Wholesale Grocers, Inc. (AWG), provided its drivers on fatigue, they found only the VHS videotape "The Alert Driver: A Trucker's Guide to Sleep, Fatigue, and Rest in Our 24-Hour Society," which was released in 1996 by the ATA, in partnership with the FHWA Office of Motor Carriers. Although the video provides valuable guidelines for truck drivers regarding the importance of sleep, the cognitive effects of sleepiness, and the best strategies to reduce fatigue related to shift work, some of the information provided is outdated, and the video does not include vital fatigue-related facts and guidance. For example, the video references obsolete hours-of-service (HOS) regulations; the Federal Motor Carrier Safety Administration (FMCSA) significantly revised these regulations in April 2003, limiting driving to 11 hours within a 14-hour, nonextendable period after coming on duty following 10 consecutive hours off duty (known as the 11-hour rule).[4] The video also does not mention the risk factors for obstructive sleep apnea (OSA), which is a significant omission, given the prevalence of these factors among commercial drivers.[5] Further, the driver fatigue video does not mention the importance of maintaining one's health and diet to reduce fatigue.[6] Research has revealed how a health and wellness regimen can reduce the risk factors that may lead to fatigue and drowsiness.[7] A booklet that accompanies the video includes some information on health maintenance and OSA risk

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[4] Although the rules concerning weekly limits for on-duty time remained unchanged, drivers were allowed to restart the weekly limit calculation after they took 34 consecutive hours off duty (known as the 34-hour restart provision). The rule also extended the requisite off-duty time from 8 to 10 hours, providing drivers more time for restorative rest.

[5] (a) R. Stoohs and others, "Sleep and Sleep-Disordered Breathing in Commercial Long-Haul Truck Drivers," *Chest*, vol. 107, no. 5 (1995), pp. 1275–1282. (b) H. Häkkänen and H. Summal, "Sleepiness at Work Among Commercial Truck Drivers," *Sleep*, vol. 23, no. 1 (2000), pp. 49–57.

[6] (a) J. Brock and others, *Commercial Truck and Bus Safety Synthesis 7: Motorcoach Industry Hours of Service and Fatigue Management Techniques* (Washington, DC: Transportation Research Board, 2005). (b) *Fatigue Survey of BC Truck Drivers* (WorkSafeBC, December 2005), <http://www2.worksafebc.com/pdfs/forestry/truck_driver_fatigue_survey_final.pdf> (accessed June 8, 2010). (c) D. Wiegand, R. Hanowski, and S. McDonald, *Commercial Motor Vehicle Health and Fatigue Study Final Report*, 09-UF-002 (Blacksburg, Virginia: National Surface Transportation Safety Center for Excellence, February 11, 2009).

[7] (a) R. Stoohs and others. (b) H. Häkkänen and H. Summal. (c) *Fatigue Survey of BC Truck Drivers*.

factors; however, because the video is the primary mode of information dissemination, the relegation of this information to a supplementary booklet makes it less likely that it will be seen and heeded by truck drivers.

In addition, the 1996 video provides questionable strategies for truck drivers to follow in combating sleepiness, such as chewing gum, eating sunflower seeds, turning on the radio, and rolling down the window.[8] However, on its website, the FMCSA has discouraged the use of such "alertness tricks," stating that they are not "real cures for drowsiness and may give you a false sense of security."[9]

The NTSB concludes that the provision of new and updated information on sleep, fatigue, and alertness by the FMCSA, based on contemporary scientific research, is essential to ensuring that commercial drivers have the necessary guidance to enable them to be alert and well rested when operating their vehicles. Updating the information being provided to truck drivers on fatigue and fatigue countermeasures, HOS, and OSA may help to reduce accidents caused by fatigue; therefore, the NTSB recommends that the FMCSA create educational materials that provide current information on fatigue and fatigue countermeasures and make the materials available in different formats, including updating and redistributing its truck-driver-focused driver fatigue video. Further, the FMCSA should make the video available electronically for quicker dissemination, and it should implement a plan to regularly update the educational materials and the video with the latest scientific information and to regularly redistribute them.

Fatigue Management Programs

Although employee education concerning fatigue is extremely valuable, the provision of information alone is insufficient to constitute an adequate fatigue management program, which should involve all aspects of a carrier's operation. A fatigue management program is a system[10] designed to take a comprehensive, tailored approach to the issue of fatigue within an industry or a workplace and to address the problem of fatigue in an operational environment. Commonly, a fatigue management program would incorporate individual program-focused efforts to help manage fatigue (for example, policies and practices addressing scheduling;[11] attendance; employee education, medical screening, and treatment; personal responsibility during nonwork periods; task/workload issues; rest environments; and commuting and/or napping) as well as an overall organizational strategy for implementing, supervising, and evaluating the plan. Many motor carriers have developed and put into action their own fatigue management programs, although the extent and nature of the plans vary widely.

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[8] A witness stated that the Volvo cab's driver-side window was rolled down at the accident scene, despite the temperature being above 100 °F. This was confirmed in postaccident scene photos. However, it is not known whether the window was opened before or immediately following the accident.

[9] See <http://www.fmcsa.dot.gov/about/outreach/education/driverTips/Driver-fatigue.htm> (accessed November 3, 2009).

[10] Fatigue management systems can also be referred to as fatigue management plans, fatigue risk management programs, fatigue management schemes, fatigue countermeasures programs, and alertness management programs. For the purposes of this letter, the term "fatigue management program" will be used when referring generically to such systems.

[11] Scheduling policies and practices could include written policies and/or the use of fatigue-modeling software tools to assist in roster development.

AWG operates around the clock and its drivers work on shift schedules, yet the NTSB found no evidence that the carrier had taken any companywide action to minimize the occurrence of fatigued driving. Apart from including the outdated "Alert Driver" video in its training library, AWG did not have any program in place to prepare and educate its dispatchers, managers, and drivers to deal with the fatigue-related consequences of its shift work operations. The NTSB concludes that AWG did not have a meaningful fatigue management program in place at the time of the accident.

The FMCSA is currently collaborating with Transport Canada and others on the development of the North American Fatigue Management Program (NAFMP), which will provide companywide guidelines for the management of fatigue in a motor carrier operating environment. The NAFMP guidelines are envisioned to promote the following elements: (1) corporate change processes, including the involvement and support of management, (2) modifications to scheduling policies and practices, (3) companywide fatigue management training, (4) sleep disorder screening and treatment for drivers, and (5) fatigue-monitoring technologies and alertness strategies. The NAFMP fatigue management guidelines are anticipated to be available within the next 2 years; they will be applicable to all motor carrier operations, industrywide, regardless of size.

Because of the complex nature of the factors that contribute to fatigue, not only has the NTSB issued safety recommendations regarding fatigue in all modes, but it has also supported industry initiatives led by the DOT to develop practical fatigue management tools for the transportation industry.[12] For example, in the late 1990s, the DOT's Human Factors Coordinating Committee, a group consisting of representatives from the Federal Aviation Administration (FAA) and other transportation modal administrations, sponsored an Operator Fatigue Management (OFM) Program.[13] The program resulted in several products, including a practical guide addressing fatigue management and countermeasure usage[14] and work schedule representation and analysis software to aid managers and schedulers in evaluating and designing work schedules and procedures for validating the output of fatigue-modeling tools. In response to Safety Recommendation A-06-11, which the NTSB issued to the FAA in its report on the Kirksville, Missouri, aircraft accident,[15] on April 28, 2006, the FAA issued *Safety Alert for Operators 06004*, which informed aviation operators of the fatigue-related information in the

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[12] (a) *Collision With Trees on Final Approach, Federal Express Flight 1478, Boeing 727-232, N497FE, Tallahassee, Florida, July 26, 2002*, Aircraft Accident Report NTSB/AAR-04/02 (Washington, DC: National Transportation Safety Board, 2004). (b) *Collision with Trees and Crash Short of Runway, Corporate Airlines Flight 5966, British Aerospace BAE-J3201*, N875JX, *Kirksville, Missouri, October 19, 2004*, Aircraft Accident Report NTSB/AAR-06/01 (Washington, DC: National Transportation Safety Board, 2006).

[13] This program was established as part of the "ONEDOT" program to coordinate resources among DOT agencies. One of the goals of the effort was to reduce the number of accidents and injuries related to operator fatigue.

[14] *Commercial Transportation Operator Fatigue Management Reference* (Washington, DC: U.S. Department of Transportation, Research and Special Programs Administration, 2003).

[15] NTSB/AAR-06/01.

DOT OFM program. According to DOT and industry personnel, the Federal Railroad Administration has tested and applied some of the OFM program tools in the railroad industry.[16]

In addition, the Rail Safety Improvement Act of 2008[17] states that the Secretary of Transportation, by regulation, shall require each railroad carrier that is a Class I railroad,[18] a railroad carrier that has inadequate safety performance (as determined by the Secretary), or a railroad carrier that provides intercity rail passenger or commuter rail passenger transportation to develop and update, at least once every 2 years, a fatigue management plan designed to reduce the fatigue experienced by safety-related railroad employees, as well as the likelihood of accidents, incidents, injuries, and fatalities caused by fatigue. Further, the Airline Safety and FAA Extension Act of 2010[19] will require all Part 121 air carriers to submit to the FAA a fatigue risk management plan for its pilots so that the FAA can review and accept it. The plan must include annual fatigue management training for pilots, a work/rest policy to help manage pilot fatigue, and a methodology to assess the effectiveness of the program. Air carriers will also be required to update and resubmit their plans to the FAA every 2 years.

The FMCSA has not yet applied such guidance or requirements concerning fatigue management programs in the motor carrier industry. However, until the FMCSA issues guidance to operators on the best practices to apply in developing a fatigue management program, other resources are available to help motor carriers create comprehensive companywide policies and processes for reducing fatigue-related accidents. For instance, organizations such as the National Institute for Occupational Safety and Health and the National Highway Traffic Safety Administration (NHTSA) provide updated information and pamphlets related to shift work that could be used as a starting point for developing a fatigue management program.[20] In addition, the DOT makes available general fatigue management resources and tools through the efforts of its Human Factors Coordinating Committee.[21]

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[16] *Validation and Calibration of a Fatigue Assessment Tool for Railroad Work Schedules, Summary Report*, DOT-06/21 (Washington, DC: U.S. Department of Transportation, Federal Railroad Administration, 2006).

[17] For additional information, see <http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_bills&docid=f:h2095enr.txt.pdf> (accessed August 12, 2010).

[18] A Class I railroad is one that has annual carrier operating revenues that meet the threshold amount for Class I carriers as determined by the Surface Transportation Board under 49 *Code of Federal Regulations* 1201.1-1.

[19] For additional information, see <http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_bills&docid=f:h5900rds.txt.pdf> (accessed August 19, 2010).

[20] For additional information, see <http://www.cdc.gov/niosh/topics/workschedules/> and <http://www.nhtsa.gov/people/injury/drowsy_driving1/human/drows_driving/resource/resource.html> (both accessed August 24, 2010).

[21] See <http://hfcc.dot.gov/ofm/index.html> (accessed August 19, 2010).

The goal of a fatigue management program is to mitigate human fatigue, thereby reducing the probability of human-error-caused incidents and accidents. Pilot studies conducted for the NAFMP have shown positive results with respect to driver sleep lengths and reduction in critical driving events.[22] Other modes of transportation—in particular, aviation and rail—have moved toward mandating fatigue management programs for their modal carriers. The NTSB concludes that the use of fatigue management programs by motor carriers has the potential to reduce accidents caused by fatigued commercial drivers.

To be most effective, a fatigue management program should be comprehensive and authoritative. Within the next 2 years, the NAFMP is expected to provide fatigue management program guidelines specifically designed for use in the motor carrier environment. Implementation of these guidelines by every motor carrier would be a major step toward addressing the problem of fatigue among commercial drivers on the nation's highways. But if the NAFMP guidelines remain voluntary—and are used by some carriers but ignored by others—this important safety tool might have only a limited effect in reducing fatigue-related highway accidents. Consequently, the NTSB recommends that the FMCSA require all motor carriers to adopt a fatigue management program based on the NAFMP guidelines for the management of fatigue in a motor carrier operating environment.

The NTSB referenced the NAFMP in its report on an early morning collision between a truck-tractor semitrailer and a motorcoach near Osseo, Wisconsin.[23] Although the NTSB has supported the NAFMP effort to create fatigue management guidelines, in the Osseo report, it also expressed concern that motor carriers have been evaluating their own fatigue management programs without expert oversight. The NTSB considered that the FMCSA, as the Federal agency responsible for motor carrier safety, must also be involved in the evaluation of the fatigue management programs used by carriers to determine whether they successfully mitigate fatigue. The NTSB concluded that for fatigue management programs to be successful, FMCSA oversight is needed; therefore, the NTSB made the following recommendation to the FMCSA:

> Develop and use a methodology that will continually assess the effectiveness of the fatigue management plans implemented by motor carriers, including their ability to improve sleep and alertness, mitigate performance errors, and prevent incidents and accidents. (H-08-14)

Based on the FMCSA's continuing work with the NAFMP, Safety Recommendation H-08-14 is currently classified "Open—Acceptable Response." The NTSB considers that the circumstances of the Miami accident again demonstrate the serious nature of fatigue-related accidents and the need for effective fatigue management programs and oversight of such programs; therefore, the Board reiterates Safety Recommendation H-08-14, and it remains classified "Open—Acceptable Response."

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[22] (a) A. Moscovitch and others, *Development of a North American Fatigue Management Program for Commercial Motor Carriers: Phase II (Pilot Study)*, TP 14828E (Ottawa, Ontario: Transport Canada, January 2006). (b) A. Smiley and others, *Effects of a Fatigue Management Program on Fatigue in the Commercial Motor Carrier Industry: Summary Report*, TP 14921E (Ottawa, Ontario: Transport Canada, September 2009).

[23] *Truck-Tractor Semitrailer Rollover and Motorcoach Collision With Overturned Truck, Interstate Highway 94, Near Osseo, Wisconsin, October 16, 2005*, Highway Accident Report NTSB/HAR-08/02 (Washington, DC: National Transportation Safety Board, 2008).

Also in the Osseo accident report, the NTSB concluded that had the truck-tractor semitrailer been equipped with technologies to detect fatigue, the systems might have prevented or mitigated the severity of the fatigue-related crash. Consequently, the NTSB issued another recommendation regarding fatigue to the FMCSA, as follows:

> Develop and implement a plan to deploy technologies in commercial vehicles to reduce the occurrence of fatigue-related accidents. (H-08-13)

On May 11, 2009, the FMCSA responded to this recommendation and indicated that the development of an advanced Drowsy Driver Warning System was underway and would move into principal research and prototype development in 2009. The FMCSA projected that this phase would last 2 years, after which a commercialization decision would be made. The FMCSA has acknowledged that driver drowsiness poses a major threat to highway safety, given the 24-hour operations, high annual mileages, challenging environmental conditions, and demanding work schedules faced by commercial drivers today.[24] However, in its response to the NTSB, the FMCSA specifically stated that it was unaware of any available technology that could be used by commercial drivers for both day and night driving. The NTSB responded that although the FMCSA was correct that no products were currently available commercially that could be used effectively both day and night, the agency's recently published review[25] of activities underway to develop unobtrusive, in-vehicle, real-time, drowsy driver detection and alertness systems discussed at least five separate systems capable of functioning under a variety of conditions.[26] Therefore, the NTSB classified Safety Recommendation H-08-13 "Open—Unacceptable Response" on October 2, 2009. The NTSB considers that the circumstances of the Miami accident again demonstrate the serious consequences of fatigue-related accidents and the need for in-vehicle technologies to reduce the incidence of such accidents; consequently, the NTSB reiterates Safety Recommendation H-08-13, and the recommendation remains classified "Open—Unacceptable Response."

Video Event Recorders

The data gathered by the NTSB during this investigation strongly indicated that a loss of driver alertness due to fatigue was the most likely cause of this accident. However, given the limited information available, this could not be confirmed with absolute certainty. Thus, driver distraction could not be ruled out.

A 2009 NHTSA report, *An Examination of Driver Distraction as Recorded in NHTSA Databases*, stated that, in 2008, about 5,870 people lost their lives and an estimated 515,000 people were injured in police-reported crashes in which at least one form of driver distraction appeared on the accident report. NHTSA further asserted that, "While these numbers are

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[24] *An Evaluation of Emerging Driver Fatigue Detection Measures and Technologies*, Tech Brief FMCSA-RRR-09-006 (Washington, DC: U.S. Department of Transportation, Federal Motor Carrier Safety Administration, June 2009), p. 4.

[25] L. Barr, S. Popkin, and H. Howarth, *An Evaluation of Emerging Driver Fatigue Detection Measures and Technologies: Final Report*, FMCSA-RRR-09-005 (Washington, DC: U.S. Department of Transportation, Federal Motor Carrier Safety Administration, June 2009).

[26] These five systems are all illumination conditions (from full sunlight to complete darkness), eyeglasses, contact lenses, most sunglasses, and variable subject distances.

significant, they may not state the true size of the problem, since the identification of distraction and its role in the crash by law enforcement can be very difficult."[27] It has been estimated that 80 percent of all crashes and 65 percent of near-crashes involve some type of driver inattention.[28] Distraction is one form of inattention; and, according to NHTSA Fatality Analysis Reporting System data, driver distraction was reported to have been involved in 16 percent of all fatal crashes in 2008. According to NHTSA's General Estimates System information, an estimated 21 percent of injury crashes involve distracted driving.[29]

One possible solution to the problem of driver distraction may be the video event recorder (VER), a device designed to capture video and other parameters related to operator and vehicle performance. A VER may record forward-looking video, interior video, interior audio, lateral acceleration, and longitudinal acceleration. VER systems may be configured to save the video and other data after a triggering event is detected. VER manufacturers offer systems for use in private, public, and commercial vehicles.

For commercial vehicle use, the systems are marketed as tools to reduce operating and insurance costs while increasing safety, by allowing companies to monitor and modify driver behavior. With respect to operating and insurance costs, companies using these systems have reported reduced fuel consumption, fewer collisions, and insurance claims savings.[30] Concerning safety, the companies report reductions in collisions, vehicle damage, and injury/worker's compensation claims.

In January 2008, the NTSB investigated an accident near Mexican Hat, Utah, in which the involved motorcoach was equipped with a VER.[31] The information from the VER allowed investigators to document vehicle motion, use of headlights, driver actions, and passenger statements and reactions. Because of the information recorded by the VER on the Mexican Hat motorcoach, investigators were able to determine that the driver was driving too fast (23 mph above the posted speed limit of 65 mph) and was not distracted or using a cellular telephone. The VER provided verified information unavailable by other means and helped prove that the accident was caused by the driver's diminished alertness.

The FMCSA has evaluated VERs in a driving behavior management system study.[32] VERs were installed in the fleets of two commercial carriers. During the study's evaluation

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[27] *An Examination of Driver Distraction as Recorded in NHTSA Databases*, DOT HS 811 216 (Washington, DC: NHTSA National Center for Statistics and Analysis, September 2009). See <http:www-nrd.nhtsa.dot.gov/Pubs/811216.pdf> (accessed June 7, 2010).

[28] See <http://www.trb.org/Main/Blurbs/100Car_Naturalistic_Driving_Study_155990.aspx> (accessed September 21, 2010).

[29] *An Examination of Driver Distraction as Recorded in NHTSA Databases*, DOT HS 811 216.

[30] See <http://www.roadscan.co.uk/roadscanvideos/index.php> and <http://www.drivecam.com> (both accessed February 3, 2010).

[31] *Motorcoach Rollover Near Mexican Hat, Utah, January 6, 2008*, Highway Accident Report NTSB/HAR-09/01 (Washington, DC: National Transportation Safety Board, 2009).

[32] See <http://www.fmcsa.dot.gov/facts-research/research-technology/tech/FMCSA-RRR-10-032.pdf> (accessed September 23, 2010) and <http://www.fmcsa.dot.gov/facts-research/media/webinar-09-07-22-slides.pdf> (accessed February 3, 2010).

phase, data collected from the VERs were sent to the system provider for review, and safety-related events were forwarded to the carrier management so an "intervention" could be conducted. An intervention consisted of the manager and driver watching the video, discussing the cause, and determining followup steps (training, discipline, reward, etc.) to prevent future issues. The results from the two carriers indicated a reduction in safety-related events per 10,000 miles of over 38 percent at one carrier and over 52 percent at the other. In addition, severe safety-related incidents decreased by more than 59 percent and 44 percent, respectively. Based on the study results, the NTSB concludes that VERs have the potential to increase safe behavior among commercial drivers through structured safety performance monitoring, which may lead to decreases in accidents and injuries.

On March 19, 2009, the FMCSA issued a notice of final disposition and granted a 2-year exemption to Greyhound Lines, Inc., to enable the company to mount VERs on its buses lower in the windshield than is currently permitted by Federal regulations. According to the FMCSA, Greyhound requested the exemption so that the company could use the VERs to increase safety through (1) identification and remediation of risky driving behaviors, such as distracted driving and drowsiness; (2) enhanced monitoring of passenger behavior; and (3) enhanced collision review and analysis. One of the reasons that the FMCSA granted the exemption to Greyhound was that it "believes that the potential safety gains from the use of video event recorders to improve driver behavior will improve the overall level of safety to the motoring public."[33]

As demonstrated by the Mexican Hat accident investigation, VERs can provide information not typically available through other investigative means, potentially allowing a more accurate determination of probable cause. In the case of the Miami accident, a forward-looking video could have provided investigators more information on the actions of the vehicles ahead of the accident truck and their visibility, and an interior video could have allowed investigators to entirely rule out medical incapacitation or distraction and identify periods of reduced vigilance. The NTSB concludes that had the accident truck been equipped with a VER, a more definitive assessment of the driver's precrash condition and behavior would have been possible.

The NTSB has long advocated the use of recording devices as a means of quantifying operator and vehicle behaviors in other modes of transportation.[34] NTSB investigations have benefitted from the presence of data, video, and audio recorders in most modes of transportation, and it is evident from FMCSA-funded research that VER data are being used on a routine basis by transportation safety managers to reduce risky behaviors by their drivers through structured safety-performance-monitoring programs.

Another benefit of using VERs for monitoring operator behavior and providing accident information has been demonstrated in the field operational tests for forward collision warning systems and the research tests of integrated vehicle-based safety systems. Such safety systems rely heavily on driver perception and reaction times to provide the best warning and alerting intervals for accident prevention. Additional information on driver behaviors provided by an

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[33] *Federal Register*, vol. 74, no. 52 (March 19, 2009), pp. 11807–11808.

[34] For example, see NTSB Safety Recommendations R-81-65, R-81-67, R-84-38, R-87-21, R-90-17, M-95-5, M-95-6, H-07-41, A-07-7, A-09-90, R-10-1 and -2, A-10-27, and A-10-29.

increased volume of VER data could be used to help improve these systems. Anecdotal evidence of savings in fuel and insurance costs also suggests that commercial motor vehicle carriers could benefit financially by installing and using VERs throughout their fleets. Drivers, too, could benefit by using the systems to provide evidence of their safe driving behavior.

The Miami accident investigation shows not only the value of having scientific, unbiased data available when investigating and reconstructing highway transportation accidents but also the value of having video-based event data to correlate with analog and digital event data recorder data to establish a driver's condition and state of attention. Heavy commercial vehicle industry members could also realize safety, cost, and other benefits by installing VERs in all their vehicles. Therefore, the NTSB recommends that the FMCSA require all heavy commercial vehicles to be equipped with VERs that capture data in connection with the driver and the outside environment and roadway in the event of a crash or sudden deceleration event. The device should create recordings that are easily accessible for review when conducting efficiency testing and systemwide performance-monitoring programs. Further, the NTSB recommends that the FMCSA require motor carriers to review and use VER information in conjunction with other performance data to verify that driver actions are in accordance with company and regulatory rules and procedures essential to safety.

As a result of the investigation, the National Transportation Safety Board makes the following new recommendations to the Federal Motor Carrier Safety Administration:

> Create educational materials that provide current information on fatigue and fatigue countermeasures and make the materials available in different formats, including updating and redistributing your truck-driver-focused driver fatigue video; make the video available electronically for quicker dissemination; and implement a plan to regularly update the educational materials and the video with the latest scientific information and to regularly redistribute them. (H-10-8)
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> Require all motor carriers to adopt a fatigue management program based on the North American Fatigue Management Program guidelines for the management of fatigue in a motor carrier operating environment. (H-10-9)
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> Require all heavy commercial vehicles to be equipped with video event recorders that capture data in connection with the driver and the outside environment and roadway in the event of a crash or sudden deceleration event. The device should create recordings that are easily accessible for review when conducting efficiency testing and systemwide performance-monitoring programs. (H-10-10)
>
> Require motor carriers to review and use video event recorder information in conjunction with other performance data to verify that driver actions are in accordance with company and regulatory rules and procedures essential to safety. (H-10-11)

Further, the National Transportation Safety Board reiterates its Safety Recommendations H-08-13 and -14 to the Federal Motor Carrier Safety Administration:

Develop and implement a plan to deploy technologies in commercial vehicles to reduce the occurrence of fatigue-related accidents. (H-08-13)

Develop and use a methodology that will continually assess the effectiveness of the fatigue management plans implemented by motor carriers, including their ability to improve sleep and alertness, mitigate performance errors, and prevent incidents and accidents. (H-08-14)

The NTSB also issued safety recommendations to Associated Wholesale Grocers, Inc., and the National Highway Traffic Safety Administration and reiterated recommendations to the U.S. Department of Energy and the National Highway Traffic Safety Administration. In response to the recommendations in this letter, please refer to Safety Recommendations H-10-8 through -11 and H-08-13 and -14. If you would like to submit your response electronically rather than in hard copy, you may send it to the following e-mail address: correspondence@ntsb.gov. If your response includes attachments that exceed 5 megabytes, please e-mail us asking for instructions on how to use our secure mailbox. To avoid confusion, please use only one method of submission (that is, do not submit both an electronic copy and a hard copy of the same response letter).

Chairman HERSMAN, Vice Chairman HART, and Members SUMWALT, WEENER, and ROSEKIND concurred in these recommendations.

[Original Signed]
By: Deborah A.P. Hersman
Chairman