Testimony of Henry Jasny, Vice President and General Counsel

Advocates for Highway and Auto Safety

On

The Price of Uncertainty:
How Much Could DOT's Proposed Billion Dollar Service Rule
Cost Consumers this Holiday Season?

Before

The House Committee on Oversight and Government Reform

Subcommittee on Regulatory Affairs, Stimulus Oversight and Government Spending

November 30, 2011

Reform of the Truck Driver Hours of Service Rule Is Essential for Highway Safety

Chairman Jordan, ranking member Kucinich, and Members of the Subcommittee on Regulatory Affairs, Stimulus Oversight and Government Spending of the House Committee on Oversight and Government Reform, thank you for inviting me to testify before you today. I am Henry Jasny, Vice President and General Counsel of Advocates for Highway and Auto Safety (Advocates), a non-profit organization that promotes safety on our roads and highways by advocating for laws and regulations that reduce traffic crashes, fatalities and injuries. Advocates is a coalition of public health, safety, and consumer organizations, and insurers and insurer agents that advances highway safety through the adoption of safety policies and regulations, and the enactment of state and federal traffic safety laws. Advocates is a unique coalition dedicated to improving traffic safety by addressing motor vehicle crashes as a public health issue.

Introduction

Advocates has been involved in the issue of motor carrier safety and truck driver Hours of Service (HOS) regulations for over 20 years. Truck crashes are a serious and deadly problem. Until recently, about 4,000 people died and another 100,000 were injured in truck crashes each year. Despite the decline in recent years, large truck fatalities still took a toll of 3,380 lives and caused 73,000 injuries in 2009.[1] This is equivalent to a major airplane crash every other week of the year. The annual cost to society remains over $40 billion.[2] Truck driving continues to be identified as one of the most dangerous occupations in the United States with 529 drivers dying in crashes in 2009.[3] Recent decreases in truck crash deaths and injuries are welcomed by Advocates. However, as discussed later in this testimony, the decline in truck crashes and fatalities is not related to the current HOS rule as suggested by some in the industry.

During the past 20 years, Advocates has participated in the 1995 National Truck and Bus Safety Summit[4] of experts and stakeholders that identified driver fatigue was the number one safety issue in the trucking industry, filed numerous, detailed and well-documented comments on the HOS rule at every step in the regulatory process since 1997, litigated the scientific validity and legality of the current HOS rule in federal court, and served as an invited party participant in this year's National Transportation Safety Board (NTSB) Truck and Bus Safety Forum.

When an air traffic controller fell asleep on the job earlier this year at Reagan National Airport, and in 2009 when two pilots flew past their destination because they were dozing, the public, the media and Members of Congress were justifiably outraged over these transgressions and the Secretary of Transportation took immediate action to rectify the problems. Yet, the current HOS rule for truck drivers promotes driver fatigue while tired truckers fall asleep behind the wheel across the country on a regular basis, leading to hundreds of crashes and fatalities every year. Several family members and survivors of crashes caused by weary truck drivers who fell asleep while driving are in attendance at this hearing today including Ed Slattery whose wife was killed and two

sons were injured including Matthew who suffers serious, costly and lifelong disabling injuries in a crash involving a truck driver who fell asleep at the wheel.

Studies have found that, since the current HOS rule went into effect, large numbers of truck drivers admit to falling asleep behind the wheel while operating commercial motor vehicles that may weigh 80,000 pounds or more. The Federal Motor Carrier Safety Administration (FMCSA) estimates that crashes involving truck driver fatigue kill as many as 500 people a year, a conservative estimate that actually may be twice that number or more.

Background

Driver fatigue was a major safety concern under the HOS rule that was in place for nearly 70 years, from 1937 until 2003. Even though that rule limited drivers to just 10 consecutive hours of driving without a rest break, and did not permit a "reset" or "restart" during the week, driver fatigue and driving while tired were recognized as serious safety problems that led to both fatal and injury crashes. The 1995 National Truck and Bus Safety Summit, sponsored by the U.S. Department of Transportation (DOT), convened experts and stakeholders to discuss all aspects of truck operations and safety issues. The participants, including truck drivers, representatives of motor carriers, researchers, members of the safety community, victims and survivors of truck crashes and government officials, concluded that "driver fatigue" was the number one safety problem in the trucking industry. In response, Congress enacted section 408 of the Interstate Commerce Commission Termination Act (ICCTA)[5] which required DOT to deal with fatigue-related issues and adopt necessary "countermeasures for reducing fatigue-related incidents and increasing driver alertness[]."

Despite this congressional directive to reduce fatigue and improve driver alertness, the FMCSA, in 2003, adopted a final rule that increased the maximum limit on consecutive hours from 10 to 11 hours and instituted the 34-hour restart that effectively reduces the end-of-week rest and recovery period for drivers who use up their maximum weekly hours before the end of the week. Both of these changes to the original rule exacerbate driver fatigue by dramatically extending driving tours of duty later into the day and by adding to cumulative fatigue or sleep debt that drivers suffer from when driving on short sleep from shift-to-shift and from week-to-week.

In addition, in its analysis accompanying the 2003 HOS final rule, FMCSA failed to consider the impact that allowing longer driving hours and less rest would have on individual drivers and the driver population as a whole. Federal law, enacted in 1984,[6] requires the Secretary of Transportation to take into account the impact of regulations on the health and physical condition of truck drivers. This congressional mandate was completely ignored by the agency when proposing the significant increases in driving and working hours of truck drivers.

Because the 2003 FMCSA final rule contradicted both the scientific evidence and research regarding fatigue and the agency's own findings of fact, and neglected to analyze the effect of the rule on driver health, Advocates joined with other health and

safety groups to litigate these issues in federal court. In 2004, the U.S. Court of Appeals for the District of Columbia Circuit ruled against the agency and remanded the HOS rule for necessary revisions.[7] The Court ruled that, by ignoring the mandatory issue of driver health, the HOS final rule violated federal law and had to be vacated. The Court went on to state that there were serious problems with the agency's rationale for extending the longstanding 10 hour consecutive driving limit to 11 hours and for failing to address the inherent problem of cumulative fatigue in allowing drivers to take as few as 34 hours off-duty to rest between weekly driving tours of duty. The Court stated that "the agency's failure to address [the increase in the number of weekly driving hours] . . . makes this aspect of the rule's rationality questionable."[8]

The reintroduction of those same flawed provisions in the subsequent 2005 and 2008 versions of the HOS final rule remain at odds with the scientific research, the agency's findings of fact, and the legal criticism voiced by the Court of Appeals. After filing a third lawsuit in 2009,[9] the parties reached a settlement agreement with DOT in order to avoid prolonged litigation and to provide an opportunity to revise the HOS rule to conform to the overwhelming body of safety research and the deficiencies identified in the 2004 decision of the Court of Appeals.

The proposed HOS reform rule was issued by DOT on December 29, 2010,[10] and a final rule is now under review at the Office of Management and Budget (OMB).

Needed Reforms

The current, unsafe and illegal HOS rule adopted in 2003 substantially increased maximum daily and weekly driving and working hours for truckers in two ways.

First, driving time allowed for each shift was increased from the traditional, long standing, limit of 10 consecutive hours of driving per shift to 11 consecutive hours. By extending the limit to 11 hours, the current HOS rule increases the time drivers are on the road when they are most tired, at the end of their shift. More important, historical data clearly shows that crash risk among truck drivers increases exponentially after eight hours of driving, and is at high danger levels during the 10th and 11th hours of driving. Nevertheless, the agency tacked the additional hour onto the maximum driving limit, permitting another hour of exposure at the end of the driving shift – when crash risk is at its highest. This action not only contradicted the scientific data and research but also, as the Court of Appeals pointed out, called into question the legality of the rule since it exposes drivers and the public to an unreasonable risk of crash involvement. The Court of Appeals 3-judge panel stated that "[w]e have our doubts about whether [the agency's] two justifications [for the 11-hour limit] are legally sufficient."[11]

In addition, the 11 hours of driving can take place any time within an overall 14 hour work day, so that drivers who perform 3 hours of other work during the work day, such as loading and unloading a truck, can still operate large trucks late in the day, 10 or more hours after first reporting for duty. Research in the agency record makes it abundantly clear that fatigue is enhanced when a driver operates a truck late in the 14-hour driving window. Concern for driver fatigue reaches critical levels when drivers

operate vehicles more than 10 hours after reporting for duty – during their 11th, 12th, 13th and 14th hours after starting work – and even later from the time they awoke.

Second, the danger posed by these provisions to the health and safety of truck drivers and the motoring public are made even worse by the 34-hour "restart" provision. The restart undermines what was previously a "hard number" 60-hour weekly driving cap (or 70 hours for drivers on an 8-day schedule). Instead, the current rule permits drivers to reset their accumulated weekly driving hours to zero and start a new driving week, at any point during the work week they choose, after taking only a 34-hour off–duty break, merely one day and 10 hours off. This permits drivers who use the restart provision to cram an extra 17 hours of driving into a 7-day schedule, actually operating their trucks for up to a total of 77 hours in seven calendar days instead of the stated limit of 60 hours. Drivers operating on an 8-day schedule can drive an extra 18 hours in 8 days for a total of up to 88 driving hours instead of the legal limit of 70-hours. These hours of working and driving, week after week, month after month, are dangerous and deadly compared to the typical 40 hour work week of most Americans.

The restart permits truckers to drive and work excessive hours which promote driver fatigue. Instead of having a full weekend of 48 to 72 hours off-duty for rest and recovery, as was required under the previous HOS rule, the 34-hour restart permits drivers to trade rest time for extra driving hours in order to accommodate freight scheduling. Fewer hours of rest and more hours of driving and work dramatically increase truck driver crash risk exposure.

The FMCSA acknowledges that sleep research shows that humans need at least seven (7) to eight (8) hours of sleep each night to perform well and avoid sleep deprivation.[12] Studies conducted since the current HOS rule went into effect show that drivers are actually getting *less* than six (6) hours of sleep, on average on work days and only slightly more than six (6) hours on days off.[13] This means that under the current HOS rule drivers are frequently driving even though sleep deprived resulting in high rates of tired, fatigued drivers behind the wheel of trucks that weigh up to 80,000 pounds.

Beyond this, the current HOS rule did not take into consideration the impact it would have on the health of truck drivers. In 2003, FMCSA completely ignored the issue and the Court of Appeals held that doing so violated federal law and the Court remanded the rule to the agency. The next time around, FMCSA analyzed the driver health issues and, despite finding that the HOS regulations have an impact on numerous diseases and ailments common among truck drivers, including heart disease, hypertension, sleep disorders, back problems, etc., the agency refused to include in its regulatory analysis any costs associated with allowing drivers to operate trucks for more hours every shift, each week, from month-to-month, year-in and year-out. Although the Court of Appeals vacated and remanded this second version of the HOS rule due to the agency's failure to disclose its analysis of crash risk during the 11th hour of driving, the Court reiterated its admonitions on the other safety issues in the case, including the effects on driver health. This flaw in the agency's cost-benefit analysis for the current rule is another reason it was necessary for the FMCSA to revise the HOS rule and its accompanying analysis.

Scientific Evidence and Research

Over the past 20 years, scientific research has documented the adverse effects of long working hours, especially in industries involving shift work. Advocates has highlighted the numerous research studies and scientific findings which conclude that there is an increased risk of crashes associated with more driving and working hours among commercial drivers.[14] Advocates' bibliography of relevant scientific studies and sleep research is attached to my testimony as **Appendix A**. Among the findings and conclusions in the scientific evidence are the following:

- Crash risk increases geometrically after the eighth (8^{th}) consecutive hour of driving;
- Under the current HOS rule drivers are not getting sufficient sleep, obtaining, on average, less than six (6) hours of sleep on work nights;
- Because humans have a biological diurnal schedule that normally requires nighttime sleep, attempts to sleep during daytime result in shorter and less restful sleep periods as compared to nighttime sleep;
- Lack of sufficient sleep from day-to-day and week-to-week results in cumulative sleep deprivation, or sleep debt, that can only be overcome through extended periods of off-duty time for rest and recovery.

Despite unfounded assertions that the current HOS rule is working well and contributing to safety, fatigue is still a major problem that drivers readily acknowledge. Studies have found that a substantial percentage of truck drivers admit to high levels of fatigued driving and actually falling asleep behind the wheel. FMCSA-sponsored studies revealed that nearly *48 percent* of drivers admitted that they had fallen asleep while driving in the previous year. About 45 percent of the drivers said they sometimes or often had trouble staying awake while driving and about 13 percent reported that they often or sometimes fell asleep while driving. Nearly two-thirds of drivers, 65 percent, reported that they often or sometimes felt drowsy while driving. A third of the drivers reported that they became fatigued on a half or more of their trips.[15] These statistics, acquired after the current HOS rule went into effect, are a clear indicator that driver fatigue remains a major safety problem that needs to be addressed by reform of the HOS rule.

The Court Decisions

In two separate unanimous decisions, in 2004 and again in 2007, the U.S. Court of Appeals vacated the current HOS rule and remanded the rule to the agency for changes consistent with the Court's rulings. In each case, the Court questioned the basis for the agency's decision-making in allowing longer driving hours despite the safety threat, adverse health effects and the increased crash risk posed by the rule, indicating that the current HOS rule was not based on sound reasoning.[16]

In the 2004 decision, the Court held the HOS rule invalid because of the FMCSA's failure to address the impact of the rule on driver health, a statutorily mandated concern. The Court, however, went on to point out, issue by issue, the many

deficiencies in the agency's reasoning and the problems in logic and law that the Court perceived the agency would need to address in order to correct the flaws in the HOS rule.

The Court's 2007 decision turned on a critical point of administrative law, the agency's failure to make its statistical analysis available to the public for comment. However, the Court reiterated its previous statements from the prior decision regarding the safety issues that were still pending. Attached to my testimony **as Appendix B** is a document that quotes excerpts from the Court decisions regarding each of the safety issues.[17]

Despite back-to-back judicial decisions overturning the rule in each case, FMCSA refused to make changes to the maximum daily and weekly driving and work hours allowed by the current HOS rule.

In response to the latest re-issuance of the current, flawed HOS final rule in 2008, Advocates, Public Citizen, the Truck Safety Coalition and the International Brotherhood of Teamsters filed a third lawsuit challenging the rule in 2009.[18] In an effort to expedite the issuance of what safety advocates, truck crash victims and survivors and the Teamsters hope will be a new, safer HOS rule, and to allow the DOT an opportunity to revise the HOS rule to comport with the scientific evidence and the prior Court decisions, the safety and labor litigants negotiated a settlement agreement[19] under which the FMCSA agreed to develop a revised HOS rule. That is the rule that is currently under review at OMB's Office of Information and Regulatory Analysis (OIRA).

Cost/Benefit Analysis

Although the pending proposed HOS reform rule has been widely publicized as costing nearly one billion dollars, this is only one side of the scales and does not reflect the benefits that would flow to society from adoption of the rule. The financial benefits to the public will be substantial and will outweigh the estimated cost. According to the agency's Regulatory Impact Analysis (RIA), the overall net benefit of the proposed rule with a 10-hour daily driving limit (Option 2) would range from $380 million to $1.17 billion annually under the assumptions that drivers are currently obtaining low or medium amounts of sleep.[20] The gross benefits from Option 2 alone, assuming 13 percent of crashes due to fatigue, would range from $1.41 billion to $2.21 billion under the medium and low sleep assumptions accordingly.[21] Truck crashes currently cost the nation over $40 billion.[22]

Moreover, the previous FMCSA regulatory analyses of the HOS rule were flawed because they did not take into account the health issues and related costs associated with allowing truck drivers to drive more and work longer hours. In response to the agency's publication of the Interim Final Rule (IFR) in 2007[23] (the third and current version of the HOS rule), Dr. Michael Belzer, a professor of economics at Wayne State University and a recognized expert and author on motor carrier economic and labor issues, submitted comments on FMCSA's RIA.[24] In his comments Dr. Belzer identified a number of economic factors which the 2007 RIA failed to include among them was truck driver health.[25] Dr. Belzer concluded that "the policy that extends daily driving time to 11 hours

and extends weekly labor time to as many as 84 hours may cost the economy more than $17 billion in premature death alone. This does not even count the additional cost of premature illness."[26] Dr. Belzer reinforced his argument for the calculation of the significant health effects of the current rule when he noted that "[t]he U.S. Court of Appeals for the District of Columbia Circuit threw out the FMCSA's original truck driver HOS regulation because the regulatory evaluation failed [to] consider the effects of the rule on truck driver health, an important consideration when implementing a regulation that substantially changed the number of hours during which a truck driver could work legally."[27]

Indeed, Congress mandated that the FMCSA must take the health of drivers into consideration when proposing new regulations. Since the agency did not do this in the 2003 final rule, the Court of Appeals held that the agency had violated the law and sent the rule back to the agency. In the next two versions of the current HOS rule the agency acknowledged that an increase in driving and working hours has an impact on driver health and medical status. However, the agency irrationally refused to quantify the costs associated with the longer driving and working hours allowed under the current HOS rule. The failure to include reasonable costs of health-related effects in previous RIA cost-benefit analyses is not just merely illogical, and unsound from an economic standpoint, it is an inherent legal flaw that is indicative of arbitrary and capricious rulemaking.

The current HOS reform proposal seeks to cure that legal problem by including, at last, a reasonable estimate of all of the benefits, including driver health, that are attributable to potential changes in the HOS regulation. A regulatory analysis that excludes a quantification of the reasonable costs or benefits of the health effects on drivers from changes to the HOS rule would again leave the agency regulation open to legal challenge for violating federal law and failing to provide a comprehensive cost-benefit analysis of the rule change.

Job Creation

The proposed HOS reform rule not only will advance safety and save lives but it will also create new jobs for truck drivers. The FMCSA RIA indicates that the proposed rule with a 10-hour daily driving limit (Option 2) would create 38,636 positions for new drivers.[28] By reducing the overall hours that drivers can operate trucks to a safe, less-fatiguing limit, the rule would create opportunities for the hiring of new drivers, especially those who left the industry as a result of recent economic conditions or as a result of the reduction in workforce created by the current HOS rule.

In fact, the rule change would actually restore some of the driving jobs that were eliminated when the current HOS rule was adopted. It was the 2003 final rule that actually eliminated 48,000 trucking jobs by allowing the current longer maximum driving hours.[29] *The 2002 RIA made it abundantly clear that the nearly $1 billion in benefits to the trucking industry that resulted from the adoption of the 2003 final rule was a direct result of the elimination of more than 48,000 trucking jobs.*[30]

"Junk Science" Claims Link The HOS Rule To Fewer Truck Crashes and Deaths

Opponents of the proposed HOS reforms have attempted to draw the erroneous conclusion that because there have been recent reductions in overall truck crashes and fatalities, there is no reason to change the current HOS rule. The claims appear to link safety improvements to the HOS rule despite the FMCSA's clear statement to the contrary. According to the agency, "The recent decline in crashes is welcome; but it cannot be attributed to any single factor affecting crashes, including implementation of the 2003 rule."[31] There is, in fact, no study that shows that fatigue-related truck crashes have declined or that the current HOS rule is responsible for any improvement in truck crash statistics.

In a presentation entitled "2009: Historic Truck Crash Declines,"[32] the head of the FMCSA's Analysis Division, Ralph Craft, Ph. D., in explaining the improvement in truck crash and fatality data, highlighted the correlation between recessions and periods of fatality declines, specifically noting that the there were "recessions in each of the three periods of 10 or more quarters of fatality declines" and "the economy now is recovering from the worst recession since 1975, and longest period of consecutive quarterly fatality declines."[33] In addition to citing economic influences, the presentation also noted that the decline in freight transportation coupled with an increase in overall transportation safety and enforcement efforts could have contributed to the recent declines.[34] An excerpt from Dr. Craft's analysis is attached to this testimony, as **Appendix C**.

In addition to the FMCSA analysis, historical data from the Trucks in Fatal Accidents (TIFA)[35] database from 2003 through 2008 indicate that the percentage of truck drivers in fatal crashes officially reported as drowsy or asleep has remained constant with almost exactly the same percentage reported in 2008 as was recorded in 2003. Even though the TIFA data greatly underestimates fatigue involvement in truck crashes, that database should reflect year-to-year crash trends. In fact, the TIFA database shows that, over the last six years (for which data is available), a consistent percentage of collisions are identified as involving a driver who was drowsy or asleep. This indicates that, despite the decline in overall truck crashes and fatalities, the current HOS rule has done nothing to reduce the relative occurrence of fatigue in truck crash involvement.

Moreover, passenger vehicle crashes, fatalities and injuries have also experienced reductions of a similar magnitude to those that have occurred in commercial vehicles over the same time period.[36] Yet, the HOS rule has no application whatsoever to driver fatigue and safety in passenger vehicles. This shows that factors other than the HOS rule, that are common to both passenger and commercial vehicle operation, such as the economy and possibly safety equipment such as seat belts and air bags, must be driving the downturn in crashes and fatalities and *not* the current HOS regulation.

The fact remains that recent reductions in fatalities have not been shown to be directly correlated with implementation of the current HOS rule. The FMCSA has clearly stated as much and suggested that factors such as the economy have played a major role in driving down truck crash statistics. Furthermore, results from data analyses indicate that there has been no relative decline in the involvement of fatigue in fatal truck crashes

during the implementation of the current rule. Combined, these facts provide strong support for arguments against any link between declines in truck related fatalities and the current HOS rule. Repeated claims that the current HOS rule has increased truck safety are junk science and are not credible.

In conclusion, the reformed HOS rule will have a positive impact on safety and the economy. The current HOS rule has been struck down two times by the Court of Appeals and truck driver fatigue remains a serious problem that is killing and injuring too many motorists and truck drivers. It is time that Congress and the Executive Branch provide the same, high level of safety that the American public and the airline industry have come to expect, and indeed realize, in the aviation industry. During this past Thanksgiving week there were no commercial airplane crashes, yet nearly an estimated 100 people died, and over 1,400 more were injured in truck crashes. Chronic worker fatigue, falling asleep on the job and threats to health and safety would never be tolerated in any other sector of the transportation industry and neither should it be tolerated in the trucking industry where thousands are killed annually.

Thank you for the opportunity to testify before the Subcommittee and I would be pleased to respond to any questions you may have.

Endnotes.

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[1] *Motor Carrier Safety Progress Report (as of December 31, 2010)*, FMCSA last accessed on Nov. 27, 2011 from http://www.fmcsa.dot.gov/facts-research/art-safety-progress-report.htm.

[2] *Large Truck and Bus Crash Facts 2009*, FMCSA-RRA-11-025, FMCSA, page 69, Table 71 (Oct. 2011).

[3] *Id.*, page 4.

[4] 68 FR 22456 (Apr. 28, 2003), reissued in substantially the same form at 73 FR 69567 *et seq*. (Nov. 19, 2008).

[5] Interstate Commerce Commission Termination Act, Pub. L. 104-88, § 408 (Dec. 29, 1995).

[6] The Motor Carrier Safety Act of 1984, Pub. L. 98-554, Title II, 98 Stat. 2832 (Oct. 30, 1984) *codified at* 49 U.S.C. § 31136(a), requires that regulations prescribing minimum safety standards for commercial motor vehicles shall, at a minimum, ensure that:

> (1) commercial motor vehicles are maintained, equipped, loaded, and operated safely;
> (2) the responsibilities imposed on operators of commercial motor vehicles do not impair their ability to operate the vehicles safely;
> (3) the physical condition of operators of commercial motor vehicles is adequate to enable them to operate the vehicles safely; and,
> (4) the operation of commercial motor vehicles does not have a deleterious effect on the physical condition of the operators.

[7] *Public Citizen, et al., v. FMCSA*, 374 F.3d 1209 (D.C. Cir. 2004).

[8] *Id*., page 12**23**.

[9] *Public Citizen et al., v. FMCSA*, No. 09-1094 (D.C. Cir. 2009).

[10] Hours of Service of Drivers, Proposed Rule, 75 FR 82170 (Dec. 29, 2010).

[11] *Public Citizen v. FMCSA*, 374 F.3d 1218.

[12] 75 FR 82176.

[13] *Id.*, citing Hanowski, et al., "The Sleep of Commercial Vehicle Drivers Under the 2003 Hours-of-Service Regulations," *Accident Analysis and Prevention*, Vol. 39, No. 6, pp. 1140-1145, Nov. 2007. The study documents that between work shifts drivers are currently getting only 5.6 hours of sleep a night, only just slightly more than five (5) and one-half hours each night.

[14] *See* Research Reports and Studies Showing The Adverse Health and Safety Effects of Longer Working Hours and Inadequate Rest Time, Advocates for Highway and Auto Safety (2011).

[15] 75 FR 82177 citing Dinges, D.F. and Maislin, G., ''Truck Driver Fatigue Management Survey,'' May 2006 (FMCSA–2004–19608–3968).

[16] *Owner-Operator Independent Drivers Ass'n v. FMCSA*, 494 F.3d 188 (D.C. Cir. 2007); *Public Citizen v. FMCSA*, 374 F.3d 1209 (D.C. Cir. 2004).

[17] Truck Driver Hours of Service (HOS) Rule Overturned Twice by Unanimous Decisions, Advocates for Highway and Auto Safety (Dec. 2010).

[18] *Public Citizen et al., v. FMCSA*, No. 09-1094 (D.C. Cir.).

[19] *Id.*, *see* Settlement Agreement dated Oct. 26, 2009 and Order dated March 3, 2010.

[20] 2010-2011 Hours of Service Rule, Regulatory Impact Analysis (2010 RIA), FMCSA, page 6-12, Exhibit 6-23 (Dec. 20, 2010).

[21] *Id.*, Exhibit 6-22.

[22] *Large Truck and Bus Crash Facts 2009*, *op cit*.

[23] Interim Final Rule, 72 FR 71247 (Dec. 17, 2007).

[24] Regulatory Impact Analysis for Hours of Service Options (2007 RIA), prepared by FMCSA & ICF International, Inc. (Dec. 7, 2007).

[25] Comments of Michael H. Belzer, Ph.D., Sound Science, Inc., dated March 28, 2008, filed in docket FMCSA-2004-19608-3475.

[26] *Id*. page 12.

[27] *Id.* page 13.

[28] 2010 RIA, page 6-17, Exhibit 6-26.

[29] Regulatory Impact Analysis and Small Business Analysis for Hours of Service Options (2002 RIA), FMCSA, page 5, Exhibit ES-2 (Dec. 2002) (The 2002 RIA actually estimated the loss of 58,500 positions in the long-haul sector but that 10,500 positions would be offset by the creation of new positions in other sectors).

[30] 2002 RIA, page 7, Exhibit ES-6. (95% of the $1.133 billion "net benefit" of the rule came from the $1.073 billion saved by eliminating the more than 48,000 trucking jobs).

[31] 75 FR 82176.

[32] Available at http://www.fmcsa.dot.gov/facts-research/art-webinars-desc.aspx?webID=49.

[33] *Id*. page 13.

[34] *Id*. page 12.

[35] The Trucks in Fatal Accidents database, maintained by the University of Michigan Transportation Research Institute (UMTRI), http://www.umtri.umich.edu/project.php?wipID=64.

[36] *Traffic Safety Facts 2009*, Early Edition, page 14 (Figure 1- fatal crashes; Table 2 - crash severity), and Page 15 (Table 2 – persons killed and fatality rate; person injured and injury rate), DOT HS 811 402 NHTSA available at http://www-nrd.nhtsa.dot.gov/pubs/811402ee.pdf.

APPENDIX A

ADVOCATES for Highway & Auto Safety

RESEARCH REPORTS AND STUDIES SHOWING THE ADVERSE HEALTH AND SAFETY EFFECTS OF LONGER WORKING HOURS AND INADEQUATE REST TIME

Jovanis, P., Wu, K., Chen, C.; ***Hours of Service and Driver Fatigue: Driver Characteristics Research*****, FMCSA, May 2011:**

◊ Examined the patterns of driving and work in the week before a crash.
◊ "There is a consistent increase in crash odd as driving time increases."
◊ "LTL drivers experienced increased crash odds after the 6th hour of driving."
◊ "Breaks from driving reduced crash odds."
◊ "There was an increase in crash odds associated with the return to work after a recovery period of 34 hours or more."
◊ TL drivers who drive during the day have increased odds of a crash with long driving hours.
◊ LTL drivers:
- Driving time substantially associated with crash odds.
- Highest odds in the 11th hour.
- Consistent increase in odds after the 5th through the 11th hours.

◊ Decrease in odds of a crash were significant for two breaks (sleeper or off duty).
◊ Using all of the data the crash exposure ratio gradually increases, especially after the 6th hour of driving.

Blanco, M., Hanowski, R., Olson, R., Morgan, J., Soccolich, S., Wu, S., Guo, F.; ***The Impact of Driving, Non-Driving Work, and Rest Breaks on Driving Performance in Commercial motor Vehicle Operations*****, FMCSA, May 2011:**

◊ Studies 100 drivers, 4 companies, naturalistic data collection over 4 weeks for each driver.
◊ Analyses of driving hours/safety-critical event (SCE) risk found a time-on-task effect across hours.
◊ Analysis on work hours found an increase risk of SCE as work hours increased.
◊ SCE risk increased with driving late into the 14-hour workday.
◊ Breaks from driving were effective to counteract the negative effects of time on task.
◊ SCE rate in the 11th hour was statistically significantly higher than in hours 8, 9, or 10.
◊ No statistically significant difference between SCE rate in 11th and 10th.
◊ As work hour increases from beginning to end, there is a statistically significant increase in SCE rate.
◊ Rest breaks of at least 30 minutes were shown to decrease the SCE rate in the hour after the break compared to the hour before.
◊ Off duty break provided the greatest benefit.
◊ *Analysis of all of the data indicated increase in SCE risk with increasing driving time.*

APPENDIX A

Sando, T., Mtoi, E., Moses, R.; ***Potential Causes of Driver Fatigue: A Study on Transit Bus Operators in Florida,*** **Transportation Research Board 2011 Annual Meeting, Nov. 2010:**

◊ Studied data from transit agencies in Florida.
◊ "Scientifically and average person needs eight hours sleep every 24-hours cycle."
◊ "Most of the accidents (56.69%) occur when the operators are exposed to red fatigue conditions" ("red fatigue" is a highly fatigued state identified by the software utilized in the study, the Fatigue Audit Interdynamics (FAID) program).
◊ "The survey also revealed that the minimum off duty period of eight hours might not be adequate. It is likely that this could be another cause of fatigue among operators because it leads to inadequate rest and sleep."
◊ A fatiguing work schedule includes: split schedules, less sleep, long driving hours and early starting – late ending schedule patterns.
◊ Fatigue is cumulative, "after the accumulation of fatigue, the operator needs enough off duty period to recover from critical fatigue condition. To start with a green fatigue condition (full recovery) in a weekly schedule the operator needs at least two days off duty."
◊ "there is a statistically strong association between fatigue condition and crash occurrence."

Sando, T., Angel, M., Mtoi, E., Moses, R.; ***Analysis of the Relationship Between Operator Cumulative Driving Hours and Involvement in Preventable Collisions,*** **Transportation Research Board 2011 Annual Meeting, Nov. 2010:**

◊ Studies four transit agencies from the state of Florida.
◊ "The results show a discernable pattern of an increased propensity of collision involvement with an increase in driving hours. . . According to the findings of this study, it is clear that the present regulation that limits driver's on-duty time to a maximum of seventy hours per week should be revisited."
◊ Bus driver with straight schedules in preventable collisions drove an average of 49.8 hours in the week before the collision (95% confidence interval).
◊ Bus driver with split schedules in preventable collisions drove an average of 53.7 hours in the week before the collision (95% confidence interval).
◊ On average, drivers who were involved in preventable collisions drove over six hours more per week than that of the general population of drivers.
◊ Preventable collisions are more prevalent as the length of the driving period increases.

Park, S., P.P., Jovanis., ***Hours of Service and Truck Crash Risk: Findings from 3 national U.S. Carriers during 2004.*****Presented at 89th Annual Meeting of the Transportation Research Board, Washington, D.C., 2010.**

◊ "The study reported a non-linear increase in crash odds after the 6th hour of driving. According to the study, the odds ratios increase from 50% to 200% in the 10th and 11th hour."

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F. Saccomano, M. Yu, and J. Shortread, Effect of Driver Fatigue On Truck Accident Rates, *Urban Transport and the Environment For the Twenty-First Century* (ed. L.J. Sucharov), Computational Mechanics Publications, Southhampton, U.K., 1995, 439-446; and,
F. Saccomano and J. Shortread, "Truck Safety: Perceptions and Reality, *The Institute for Risk Research*, Ontario, 1996, 157-174.

◊ Found a significant increase in crash rates for truck driving shifts of more than 9 hours.
◊ The strong relationship between single-vehicle truck crashes and length of continuous driving time held regardless of the time of day.
◊ Findings confirmed earlier Federal Highway Administration research.

T. Lin, P. Jovanis, and C. Yang, Modeling the Effect of Driver Service Hours On Motor Carrier Accident Risk Using Time Dependent Logistic Regression, 72nd Annual Meeting of the Transportation Research Board, Washington, DC, 1993; and,
T. Lin, P. Jovanis, and C. Yang, Time of Day Models of Motor Carrier Accident Risk, *Transportation Research Record* 1467: 1-8, Transportation Research Board, National Academy of Sciences, 1994.

◊ Found a consistent elevation of crash risk from about the 8th to the 9th hour of driving.
◊ Found a dramatically increased risk if driving exceeded 9 continuous hours.
◊ Confirmed earlier Federal Highway Administration research.

T. Kaneko and P. Jovanis, *Multiday Driving Patterns and Motor Carrier Accident Risk: A Disaggregate Analysis*, U. of CA at Davis, Research Report UCD-TRG-90-9, April 1990.

◊ Driving patterns over the previous 7 days significantly affected crash risk on the 8th day.
◊ Consecutive driving hours have a consistent crash risk relationship.

T. Kaneko and P. Jovanis, Multiday Driving Patterns and Motor Carrier Accident Risk: A Disaggregate Analysis, *Accident Analysis and Prevention*, 25:5, 1992, 437-456.

◊ Consecutive hours of driving were the most significant predictor of accident risk.

I. Jones and H. Stein, *Effect of Driver Hours of Service on Tractor-Trailer Crash Involvement*, Insurance Institute for Highway Safety, Arlington, VA, 1987; and,
I. Jones and H. Stein, Defective Equipment and Tractor-Trailer Crash Involvement, *Accident Analysis and Prevention*, 21: 469-481.

◊ Study used case-control design (3 matching controls for each case), controlled for time of day.
◊ Widely regarded as one of the most rigorous in-depth studies of fatigue ever conducted (*e.g.*, Haworth, Triggs, and Grey (1988)).
◊ Found a substantial increase in crash risk if drivers exceeded 8 continuous hours of driving.
◊ Crash risk for drivers whose reported driving time exceeded 8 hours was almost twice that for drivers who had driven fewer hours.
◊ Crash risk estimates conservative because number of driving hours based on driver self-reporting.

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W. Frith, A Case-Control Study of Heavy Vehicle Drivers Working Time and Safety, *Proceedings of the 17th Australian Road Research Board Conference*, 1994, 17(5): 17-30.

◊ Case-control methodology, matched-pairs.
◊ Crash risk substantially increased for drivers with greater than 8 hours of driving but less than 9 hours.
◊ Crash risk rose even higher if driving exceeded 9 hours.
◊ Emphasized that his findings confirmed the 1987 research of Jones and Stein, and the 1993 research of Lin, Jovanis, and Yang.

S. Folkard, Time On Shift Effects In Safety: A Mini-Review, Abstract in the *Shiftwork International Newsletter*, May 1995, 12:1, Timothy Monk, ed., presentations from the 12th International Symposium On Night- and Shiftwork, Ledyard, CN, June 13-18, 1995.

◊ Major meta-analysis of relative risk of performance lapses over the course of various shift durations.
◊ Increase in relative risk of crashes over time was exponential.
◊ Risk was approximately doubled after 12 hours of work and trebled after 14 hours of work.
◊ Found that safest work duration is 6 to 9 hour long shifts.

P. Krauth, et al., "Systematic Selection of Shift Plans for Continuous Production With the Aid of Work-Physiological Criteria, *Applied Ergonomics*, 1979, 10:1, 9-15.

◊ Working times of more than 8 hours must be avoided because of long-term deleterious effects on worker health.
◊ Longer shift times found to reduce effective daily recuperation, produce adverse impacts on sleep length and quality [*e.g.*, see Smiley and Heslegrave (1997], and reduce desirable leisure activities.
◊ Showed that research literature consistently demonstrates that only in exceptional cases have 12 hours shifts, in particular, proved successful without measurable deterioration in safety, sleep quality, and worker health.
◊ Cites corroborative research findings, such as Rutenfranz (1973); Knauth and Rutenfranz (1972); Rutenfranz et al. (1974).

C. Abrams, T. Shultz, and C. Wylie, *Commercial Motor Vehicle Driver Fatigue, Alertness, and Countermeasures Survey*, Report FHWA-MC-99-067, Federal Highway Administration, U.S. Department of Transportation, August 1997.

◊ Survey of 511 commercial motor vehicle drivers undertaken concurrently with the 1997 Driver Fatigue and Alertness Study.
◊ Twenty-eight (28) percent of surveyed drivers admitted falling asleep at the wheel during the previous month.
◊ One-third of these fall-asleep drivers admitted falling asleep at the wheel from 3 to 6 times in the prior month.
◊ The majority of drivers who fell asleep at the wheel reported that they sometimes or always are aware of the danger of falling asleep, but nevertheless continue to drive.
◊ Nearly 47 percent of surveyed drivers stated that they sometimes cut their sleep short to make delivery schedules.

◊ Drivers often begin trips already fatigued, *e.g.*, more than 38 percent have already been awake for 6 to 12 hours before beginning to drive.
◊ More than a third of drivers surveyed said that loading/unloading contributed to their fatigue and lowered their alertness.
◊ Ninety-one (91) percent of surveyed drivers slept in tractor sleeper berths, 6.7 percent in motels.
◊ About one-quarter of sleeper berth drivers split their sleeping time and overall slept fewer hours than drivers who rested in one period.
◊ Most drivers use breaks for other than napping purposes, *e.g.*, eating, fueling, restroom use, *etc.*
◊ Authors conclude that fatigue, drowsiness, difficulty of preventing falling asleep at the wheel may be more prevalent in the driver community than previously thought.

J. Rutenfranz and P. Knauth, Hours of Work and Shiftwork, *Ergonomics*, 19:3, 1976, 331-340.
◊ Found that the primary protection afforded workers against undue health risks were achieved by limitation of working hours as a direct means of curtailing risk exposure.
◊ A daily working time limit of 8 hours is shown to be optimal.

Simon Folkard, Black Times: Temporal Determinants of Transport Safety, *Accident Analysis and Prevention*, 29:4, 1997, 417-430.
◊ Showed that circadian rhythms are insufficient to account for the variation in crash risk over the 24-hour day.
◊ Deleterious effects of time on task overarch those derived from circadian effects (time of day).
◊ Safest continuous task duration, except for very short duty periods of about 2.5 hours, is about 8 to 10 hours of maximum shift length.

E. Grandjean, *Fitting the Task to the Man: An Ergonomic Approach*, London 1982.
◊ Shows that many studies have demonstrated that shortening the work day actually raises worker efficiency.
◊ Making the working day longer causes worker hourly efficiency to decline.
◊ Shows that many studies of actual workplace productivity demonstrate that increasing daily working hours beyond 10 hours actually results in a decline in productivity as a natural product of increasing fatigue which more than offsets the increased working hours.
◊ Found that working time of 8 hours per day cannot be increased to 9 hours or more without ill effects.

D. Linklater, Fatigue and Long Distance Truck Drivers, *Australian Road Research Board Proceedings*, 10:4, 193-201, 1980.
◊ Interviewed drivers of all types of vehicles at roadside restaurants and found that relative crash rates of truck drivers increased when weekly driving time exceeded 55 hours.
◊ Cites U.S. Bureau of Motor Carrier Safety finding in 1969 that 30 percent of single-vehicle truck crashes involved commercial drivers asleep at the wheel with 13 percent of those drivers verified to have exceeded maximum permitted hours of driving.
◊ New South Wales commercial drivers limited to a maximum of 72 hours driving per week, yet the crash risk of drivers has already begun to rise before this limit is reached.

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Mark Rosekind, et al., From Laboratory to Flightdeck: Promoting Operational Alertness.
◊ All estimates of fatigue-related accidents in transportation are underestimated.
◊ Many shiftwork studies have found reductions in performance, lowered alertness, and increased proneness to error and injuries for 12 hour shifts.
◊ Cite many supporting research studies such as Rosa (1991); Rosa and Bonnet (1993); Rosa (1995).
◊ Authors point out that in Rosa (1995), analysis of a national occupational-injury database showed a constant accident/injury rate through 9 hours of work, but then a rapid and progressive increase to three times the rate at the end of 16 hours of work.

Raymond Fuller*, Prolonged Heavy Vehicle Driving Performance: Effects of Unpredictable Shift Onset and Duration, and Convoy vs. Independent Driving Conditions*, U.S. Army Research Institute for the Behavioral and Social Sciences, Tech. Report 585, Sept. 1983.
◊ Found that symptoms of fatigue were most typical near the end of the driving shift, becoming evident from about the 9th hour of driving.
◊ Asserts that his research shows that prudence dictates a driving regime of no more than 8 or 9 hours long.

Gunther Hildebrandt, "12 & 24 H Rhythms In Error Frequency of Locomotive Drivers and the Influence of Tiredness, *International Journal of Chronobiology*, Vol. 2, 175-180 (1974).
◊ Tiredness was shown to play an important role in error frequency by train engineers, especially in the afternoon.
◊ Found that the increase in error frequency was linearly related to the number of hours previously worked.

Federal Highway Administration Report to Congress On Commercial Driver Hours of Service, November 1990.
◊ Openly endorses research findings showing the adverse effects of longer continuous driving times and of cumulative fatigue resulting from several consecutive days of driving.
◊ Asserts at the outset that the risk of crashes increases with the number of hours driven.
◊ Supports the 10-hour maximum regulatory restriction on continuous driving time because it is consistent with research showing that the potential for crashes rises as the hours of driving increase due to increasing driver fatigue.
◊ Favorably cites the Jones and Stein (1987) study by the Insurance Institute for Highway Safety that driving in excess of 8 hours may be associated with a significantly increased risk of crash involvement.
◊ Asserts that this increase in relative risk with increasing time of driving also confirms the 1978 FHWA study of Mackie and Miller.
◊ States that research has shown a cumulative fatigue effect after several successive days of driving.
◊ States that research indicates that time spent on-duty may be a more important factor in driver loss of alertness.

◊ These statements repeat previous assertions to the same effect made in 1980 (45 FR 82284, 82286, 82288, 82290).
◊ FHWA in 1987 again endorsed the findings that both increased consecutive driving hours and consecutive days of driving directly contribute to driver errors and crashes (52 FR 45215).
◊ Assertions to the same effect were made by FHWA in its November 29-30, 1988, Proceedings of the Federal Highway Administration Symposium On Truck and Bus Driver Fatigue.

W. Harris and R. Mackie, *A Study of the Relationships Among Fatigue, Hours of Service, and Safety of Operations of Truck and Bus Drivers*, Bureau of Motor Carrier Safety, Federal Highway Administration, BMCS-RP0-71-Z, June 1971-November 1972; and,
R. Mackie and J. Miller, *Effects of Hours of Service Regularity of Schedules and Cargo Loading On Truck and Bus Driver Fatigue*, Federal Highway Administration, DOT-HS-803-799, May 1975-October 1978.
◊ Classic federal studies funded through the Federal Highway Administration whose findings have been sustained by numerous later studies.
◊ Found that drivers suffered increased risk of crashes whether they were on regular or irregular driving schedules.
◊ Even on regular daytime schedules, adverse safety effects were clearly seen after about 8.5 hours of driving.
◊ Significant increases in driver errors and significant decreases in driver level of alertness began to show as early as the 4th hour of driving time on irregular schedules in particular (at about 8 hours on regular schedules) and increased throughout the trip.
◊ Frequency of crashes increased disproportionately after 7 hours of driving and remained significantly higher than expected for all driving times longer than 7 hours.
◊ Amount of driver recovery declined with each successive rest break; drivers taking a third rest break, after about 9 hours, showed no recovery and an actual further decline in alertness [See Lisper, Laurell, and VanLoon (1986): taking breaks had no lasting effects on reducing sleepiness among drivers].
◊ About twice as many crashes per mile traveled occurred in the second half of the trip as in the first half.
◊ Significant increases in driver errors and decreases in alertness occurred within the current 10-hour consecutive driving limit.
◊ Cumulative effects of fatigue appeared after the first 4 consecutive days on duty.
◊ Later U.S. Department of Transportation study (J.P. Eicher (1982)) relies heavily on the findings of these two studies.
◊ These findings further evaluated and relied on by the Office of Technology Assessment of the United States Congress in its September 1988 report (OTA-SET-382).

Benjamin F. Jones, et al., *Fatigue and Hours of Service of Interstate Truck Drivers*, U.S. Public Health Service, Public Health Bulletin No. 265, Washington, DC, 1941.
◊ Tests conducted showed lowered functional efficiency with increasing hours of work per week.

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EEC Council Regulation No. 3820/85 (December 1985); EEC Council Regulation No. 98/0319SYN Amending Reg. 3820/85 and Directive 93/104/EC.

◊ Regulations establishing the European Economic Community policy on worker hours as based on extensive research and consensus agreements among member states.
◊ Regulations curtail weekly driving time to an average of no more than 48 hours per week as averaged over 4 months, with some derogations permitted (48 hours a week averaged over 6 months, 39 hours a week over 9 months, and 35 hours averaged over 12 months).
◊ Another EEC publication of November 18, 1999, emphasizes that 18 percent of fatal crashes in the European Union involve trucks or motor coaches, with 45,000 people killed each year.

F. van Ouwerkerk, Sub-Topic 4: Quality of Life and Social Costs - c) Working Conditions, *Resources For Tomorrow's Transport: Introductory Reports and Summary of Discussions*, ECMT, Brussels, September 12-14, 1988.

◊ Found serious, adverse health and social impacts from truck driver hours of service demands.
◊ High percentages of drivers admit to falling asleep or almost falling asleep at the wheel.
◊ Sixty (60) percent of drivers report anxiety, chronic heart problems, and hypertension.
◊ Relies heavily on B. Jansen (1987) study which showed that shiftwork produces pervasive problems of fatigue, sleep deprivation, gastrointestinal complaints, low family contact time, no community life, personal isolation, inability to pursue education, inadequate access to commonly available public facilities and activities such as public transportation/schools/sports, etc.
◊ Drivers have little leisure time and are disengaged from common social activities.
◊ More than one-quarter of drivers are not home on one of two weekend days.
◊ Drivers cannot schedule reasonable social time because much of their weekends are spent recovering from fatigue and sleep deprivation accrued from previous week's driving.
◊ Drivers report adverse impacts on spouses and households where the net effect of international driving is a one-parent home.
◊ Nearly half of all drivers have high rates of domestic discord with spouses and children.
◊ Drivers have more problems and more severe problems than the general population.
◊ Relatively high percentage of drivers reporting crash involvement due to falling asleep at the wheel of a moving truck probably a considerably low estimate because many drivers fell asleep and died in the crashes.

Torbjorn Akerstedt, Readily Available Countermeasures Against Operator Fatigue, *Managing Fatigue In Transportation: International Conference Proceedings*, April 29-30, 1997, 105-117.

◊ Valuable review of research literature on shift work, sleep/fatigue, and related risk.
◊ Allowing the same minimum off-duty or layover time for driver recovery following successive nights of driving are not equivalent to the restorative effects of the same amount of time allowed for recovery from the fatigue of daytime driving.
◊ Stresses other major research findings on the effects of extended shiftwork hours (Kurumatani (1994): very high correlation between length of free time between shifts and proportional sleep duration; Hamelin (1987): fast rise in crashes beginning before the 11th hour of driving).
◊ Emphasizes that all studies since 1971 show rest breaks induce only very short-lived increases in alertness with a return to sleepiness and error proneness almost immediately afterwards.

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C.D. Wylie et al., *Commercial Motor Vehicle Driver Fatigue and Alertness Study,* FHWA Report No. MC-97-001, U.S. Department of Transportation, 1997; and,
C.D. Wylie et al., *Commercial Motor Vehicle Driver Rest Periods and Recovery of Performance,* Transportation Research Centre, TP 12850E, Transport Canada, Montreal, Canada, 1997.

◊ Major study effort conducted over 5 years by the Trucking Research Institute of the American Trucking Associations in cooperation with Transport Canada.
◊ Prospective cohort study of commercial operators driving different schedules, truck equipment, time of year, and routes in U.S. and Canada.
◊ Severe methodological deficiencies, including threshold errors in sample size and subject selection, also unrecorded sleep and unmonitored naps.
◊ Many data gathering inadequacies, including acquisition of data from intermittent vigilance tests of drivers, *e.g.*, authors failed to acknowledge the well-known phenomenon resulting from use of secondary task techniques which provide extratask stimulus (alerting effect) offsetting effects of fatigue on alertness and capacity (see, *e.g.*, Brown (1978); Brown, Simmonds, and Tickner (1967); Brown, Tickner, and Simmonds (1966); Home and Wilkinson (1985); Haworth, Triggs, and Grey (1988); Dinges and Kribbs in Monk (ed.) (1991)).
◊ Study adversely criticized by peer review panels and in peer review journals for study design.
◊ *Post hoc* statement by researchers of hypothesis of interest, *viz.*, whether time of day of driving (circadian effect) overarches driving duration or time-on-task.
◊ Evidence of drowsiness in drivers not found in physiological testing but through visual interpretation of drivers' faces recorded on camera; drowsiness judgments uncorroborated in research community because face videos protected from disclosure.
◊ Primary reliance on judgments made from face videos confuses drowsiness indicators with fatigue -- drivers can be fatigued, *i.e.*, increasingly unable to perform a task well or safely, without appearing drowsy because of, *e.g.*, drooping eyelids.
◊ Due to lack of adequate data and multiple research design failures, study could not demonstrate a dominant circadian effect in comparison with performance and alertness deficits associated with duration of time-on-task.
◊ The follow-up study by Wylie et al. for Transport Canada studied 25 of the original 40 Canadian drivers participating in the DFAS, but statistical power of the follow-up is quite low (primarily from small sample size), especially as regards the study premise of whether adequate driver recovery from fatigue and sleep debt following 60 hours of driving within a seven-day period occurs after no (actually a nominal 12 hours), one (actually a nominal 36 hours), or two workdays (nominally 48 hours) of off-duty time.
◊ The follow-up study also relied on EEG, face video interpretation, vehicle lane tracking, and surrogate performance testing data as collected for the DFAS, all of which had various major deficiencies as described above.
◊ Use of these drivers during the layover days during the DFAS study further confounded the findings of both the DFAS and the follow-up study, and constitute a major research design failure.

◊ However, the initial study and its follow-up produced corollary information which is nevertheless highly suggestive:

(1) No objective evidence that drivers could sufficiently recover from consecutive days of driving with a 36-hour or even a 48-hour off-duty period [*e.g.*, see Smiley and Heslegrave (1997)];

(2) All driver cohorts, whether driving 10-hour or 13-hour shifts, suffered severe and chronic sleep deprivation throughout the length of the study.

A. Smiley and R. Heslegrave, *A 36-Hour Recovery Period for Truck Drivers: Synopsis of Current Scientific Knowledge*, Transportation Development Centre, Transport Canada, 1997.

◊ Excellent literature review of studies specifically relating to driver recovery time needs.
◊ Evaluation of known research (*e.g.*, Lille (1967)) indicates serious concerns over the sufficiency of a 36-hour driver clock reset provision after several consecutive days of driving – drivers still fatigued and carrying unresolved sleep debt, resulting in quickly deteriorating performance when resuming work.
◊ Thirty-six- (36) hour layover especially inadequate following night shift work.
◊ Several studies strongly indicate inadequacy of even 48 hours off for full performance recovery (*e.g.*, Hildebrandt, Rohmert, and Rutenfranz (1975); Mallette (1994)).
◊ Authors conclude that commercial drivers need minimum of 48 hours off after several consecutive days of driving, but this still does not secure full performance and alertness recovery -- 72 hours or more are needed.
◊ Research literature also consistently shows that long work shifts result in accumulation of sleep debts.
◊ Concludes that Wylie study strongly indicates that even four 13-hour consecutive driving shifts results in significant performance deterioration.
◊ Long work shifts and associated inadequate sleep/recovery results in family and social dysfunction, increased substance abuse and health problems.

Roger Rosa and Michael Colligan, Extended Workdays: Effects of 8-Hour and 12-Hour Rotating Shift Schedules On Performance, Subjective Alertness, Sleep Patterns, and Psychological Variables, *Work and Stress*, 1989, 3:1, 21-32.

◊ Demonstrated the lower performance and alertness produced by an extra 4 hours added to shifts which result in more sleep reduction, disruption of personal activities, and increased self-reported stress.
◊ Use of a 12-hour rather than an 8-hour shift caused an increasing accumulation of unresolved sleep debt, as shown by substantial diminishment of sleep latency.
◊ None of these adverse effects was found on an 8-hour shift.
◊ Shift workers make inroads on sleeping time to perform normal personal activities within less off-duty time.

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Roger Rosa, Performance, Alertness, and Sleep After 3-5 Years of 12 H Shifts: A Follow-Up Study, *Work and Stress*, 1991, 5:2, 107-116.

◊ Confirmed findings of earlier study.
◊ Also showed the adverse health effects of 12-hour versus 8-hour work shifts.

Roger Rosa and Michael Bonnet, Performance and Alertness On 8 H and 12 H Rotating Shifts At a Natural Gas Utility, *Ergonomics*, 1993, 36:10, 1177-1193.

◊ A review of the data of the 1991 study confirming the lowered performance, decreased alertness, reduced quality of social life, and increased health complaints associated with 12-hour shifts.

Ivan Brown, Driver Fatigue, *Human Factors*, June 1994, 36:2, 298-314.

◊ Drivers may be fatigued, yet sustain performance effectiveness, but at an increasing cost of experienced fatigue until performance begins to collapse.
◊ Long work shifts produce reactive inhibition in which the human brain becomes disinclined to continue producing the same repeated response to the same environmental stimuli.
◊ Typical 8-hour shift has no adverse implications for drivers.
◊However, research has long established that extended work periods both impair task performance and increase sickness absence and injuries (*e.g.*, Vernon (1921)).
◊ Daily hours and weekly hours must be balanced to avoid fatigue and performance degradation (*e.g.*, Rosa et al. (1985) showed that a 12 hour/4-day week more detrimental to performance and produces more self-reports of drowsiness and fatigue than 8-hour/6-day week).
◊ The longer the duty period, more stressful the task, and more hazardous the working conditions, the more restitutive sleep a driver will be obliged to take.
◊ Performance deterioration more severe in performance of tasks which are long, familiar, monotonous, and complex such as driving.

T. Sanquist, et al., *Fatigue and Alertness In Merchant Marine Personnel: A Field Study of Work and Rest Sleep Patterns*, U.S. Coast Guard Report No. CG-D-06-97, June 1996.

◊ One hundred forty-one (141) mariners in commercial maritime industry studied for their work and sleep patterns on shipboard duty.
◊ Major fatigue/sleep deprivation problem in commercial maritime industry.
◊ Mariners averaged 6.6 hours of sleep in each 24 hours and quickly accumulated large sleep debts with pervasive symptoms of fatigue, including critically low alertness levels and extremely short sleep latencies.
◊ Response of Congress to sleep deprivation of watch mate prior to grounding of Exxon Valdez was enactment of legislation limiting tank vessel personnel to 15 hours duty time in each 24 hour period, 36 hours duty in 72 hour period.
◊ This statutory regime promotes sleep deprivation and accumulated sleep debt coupled with deteriorating performance over consecutive days.
◊ Minimum off-duty period of 9 hours provides insufficient opportunity for enough sleep by mariners.
◊ Once diurnal alertness is achieved, even with some accumulated sleep debt, mariners avoid afternoon naps in particular because of high sleep inertia following them.

◊ Conversely, mariners often report poor sleep following duty periods because of work inertia, resulting in insufficient sleep even with enough time available to secure needed sleep.
◊ Cites numerous research findings that fragmenting sleep into shorter, intermittent periods [*e.g.*, in truck sleeper berths] results quickly in sleep deprivation, reduced alertness, and lowered performance, a practice explicitly avoided for flight crew in commercial aviation because FAA regulations require 9 consecutive hours of rest following a flight of 8 hours or less.
◊ Cites research (*e.g.*, Kecklund and Akerstedt (1995)) showing that at least 16 hours between work shifts in necessary to consistently achieve sleep durations of 7-8 hours.

A. Fletcher and D. Dawson, Cabin Safety and Hours of Work: Developing a General Risk-Control Model for Fatigue, *Journal of Centre for Sleep Research*, 2: 9-26, 1997.
◊ Surveys research literature showing that the longer a work period, the more fatiguing it is likely to be.
◊ Fatigue impact of longer working hours is compounded by also abbreviating the available time for rest and restorative sleep.
◊ Confirms previous studies that laboratory-based studies such as those showing no differences in performance between shifts of varying lengths are unreliable for making generalizations applying to specific workplaces.
◊ Experimental studies typically oversimplify the complex psycho-social context in which shiftwork occurs and fail to model real-world shift schedules.
◊ Stresses that many organizations view financial and service imperatives as overriding determinants of shift schedules.
◊ Without reliable empirical tools to accurately quantify actual relationships between fatigue and organizational costs, there is little incentive to implement coherent hours of work schedules.
◊ In developing fatigue policies, organizations will ignore objective scientific information not suiting their economic goals.

Patrick Hamelin, Lorry Driver s Time Habits In Work and Their Involvement In Traffic Accidents, *Ergonomics*, 1987, 30:9, 1323-1333.
◊ Cites MacDonald (1984) and concludes that, based on a comparison with exposure to risk, both long hours of work and driving at night are associated with a much higher rate of accidents than shorter hours and daytime driving.
◊ The accident rate in the second half of driving trips is twice as high as in the first half.
◊ Risk rate linked to work span duration is probably underestimated.
◊ Points out that several authors (*e.g.*, Pokorny et al. (1981)) have show the existence of a slight excess-risk rate immediately after work resumption following a break.

James C. Miller, *Fundamentals of Shift Work Scheduling*, 2nd ed., c1992.
◊ Manual sets forth quantitatively-based recommendations for shift work scheduling, including shift rotations.
◊ Most current work schedules are not based on worker efficiency and health needs, but on productivity goals which have been abstracted from the workers' needs.
◊ Stresses that real-world policy investigations of shiftwork impacts have clearly shown that 12 hour shifts are not appropriate for continuous operations (citing P.M. Lewis, *Recommendations*

for NRC Policy On Shift Scheduling and Overtime At Nuclear Plants, U.S. Nuclear Regulatory Commission, NUREG/CR-4248, PNL-5435, 1985).

◊ Also cites J.T. Mets, "Adverse Effects of Working 12-Hour Shifts, *Proceedings of the 2nd Annual Conference of the Ergonomics Society of Southern Africa,* Cape Town, April 14-15, 1986, who showed the increased injury rates for workers in auto manufacturing plants when management changed plant policy from 9 to 12 hour shift lengths.

◊ Also cites Gardner and B.D. Dagnall, "The Effect of 12-Hour Shift Working On Absence Attributed to Sickness, *British Journal of Industrial Medicine*, 1977, 34, 148-150, who showed the consistent increase in work absence rates for sicknesses among process workers in an oil refining/petrochemical plant as a direct consequence of switching from 8 hour to 12 hour shifts.

P.M. Lewis, *Shift Scheduling and Overtime: A Critical Review of the Literature*, Nuclear Regulatory Commission Contract DE-AC06-76-RLO, 1985; and,
P.M. Lewis, *Recommendations for NRC Policy On Shift Scheduling and Overtime At Nuclear Power Plants*, Division of Human Factors Safety, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC, 1985.

◊ Found that the number of hours worked in a 7-day period must be limited.

◊ Basis of recommendations was a comparison of findings from studies of work/risk relationships in other industries.

◊ Relied on federal regulations limiting airline pilots and flight crew to 30 hours aloft in 7-day period.

◊ Cites Nicholson's (1972) findings of total duty time of 55 hours in 7 days and Mohler's (1976) physiological index for pilots and crew indicating that 56 hours/7days is a high work load and that 84 hours in 7 days is far too much.

David Dinges and Nancy Kribbs, Performing While Sleepy: Effects of Experimentally-Induced Sleepiness, *Sleep, Sleepiness, and Performance*, Timothy H. Monk, ed., John Wiley and Sons, Ltd., c1991, 97-128.

◊ Inadequate sleep is endemic in industrialized societies that prize irregular hours and view sleep as a potential source of additional work time.

◊ More attention has been paid to the physiological, neurological, and psychopathological effects of sleep loss than to performance effects.

◊ The most powerful determinant of lapsing [on tasks] and decreased performance in a sleepy person is the required task duration -- the longer the task duration, the greater likelihood that performance will show evidence of impairment early on during sleep deprivation.

◊ Cites several studies to support this conclusion, including Williams, Kearney, and Goodnow (1959) who consistently found that reaction time was an increasing monotonic function of task duration.

◊ Even providing enough time for gaining off-duty sleep cannot by itself offset the increased risk from longer exposure to high-risk tasks such as driving a commercial motor vehicle because many drivers will still get inadequate sleep.

◊ Research literature consistently shows that increased exposure time will correspondingly produce more performance lapses (failures), especially if workers get inadequate sleep.

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Gregory Belenky, The Effects of Restricted Sleep On Performance and Subsequent Recovery: Implications for Managing Sleep to Sustain Performance, *Fourth International Conference On Fatigue In Transportation*, Freemantle, Australia, Mary 19-22, 2000.

◊ Reviews studies conducted by the U.S. Army and Walter Reed Hospital showing that anything less than eight to nine hours of sleep per night leads to degraded work performance over time.

◊ The longer a person suffers from restricted sleep, the longer it takes them to recover even when given optimal conditions for sleep.

T. Balkin *et al., Effects of Sleep Schedules on Commercial Motor Vehicle Driver Performance,* Walter Reed Army Institute of Research, Report No. DOT-MC-00-133, Federal Motor Carrier Administration, U.S. Department of Transportation, May 2000.

◊ Study comprised two separate research efforts, one a field study using wrist actigraphy to determine sleep duration and timing in long- and short-haul commercial drivers over 20 consecutive days, the other a sleep dose/response laboratory study on commercial drivers to determine the effects on performance of differing times spent in bed each night (3, 5, 7, 9 hours) over 7 consecutive days.

◊ Overall purpose of the study was the attempt to quantify the relationship between different amounts of sleep and subsequent performance during wakefulness.

◊ Field portion of the study showed that daily sleep duration was strongly correlated with the amount of off-duty time.

◊ In the field portion, long- and short-haul drivers averaged about 7.5 hours of sleep.

◊ Long-haul drivers obtained almost half of their daily sleep during work shift hours principally in sleeper berths which suggests that they spend a significant portion of the work shift in a state of partial sleep deprivation.

◊ Even for small reductions in average nighttime sleep duration to about 6.3 hours in the 7-hours of sleep group, there was measurable performance decrements on several tests, including the psychomotor vigilance test.

◊ The performance deterioration for even small amounts of sleep restriction was maintained over the entire 7 consecutive days of sleep restriction suggesting that there is no compensatory or adaptive response to even mild amounts of sleep loss.

◊ For more severe sleep restriction, it was found that recovery of performance is not complete even after three consecutive nights of attempted recovery sleep based on 8 consecutive hours of time in bed each night, showing that expunging substantial sleep debt takes extended periods of recovery sleep over several days.

◊ These findings also suggest that the extant level of daytime alertness and performance capability is a function not only of an individual's circadian rhythm, amount of time since his/her last sleep period, and the duration of that sleep period, but is also a product of that person's long-term sleep history extending back several days.

◊ Temporal concordance between electroencephalograph defined lapses in alertness and performance on simulated driving was low, indicating that sleepiness-induced performance reductions most often occur in the absence of visually observed electrophysiological evidence of impaired alertness.

N. Haworth, T. Triggs, and E. Grey, *Driver Fatigue: Concepts, Measurement and Crash Countermeasures*, Australia Transport and Communications, Federal Office of Road Safety, Report CR72, June 1988.

◊ Massive, detailed evaluation of prior research and speculation on nature, origin, effects, and measurement of fatigue.

◊ Precise estimation of contribution of fatigue to road crashes in Australia cannot be made, but there are strong indications that the effects are far greater than hitherto believed, with 5 - 10 percent in all crashes, 20 - 30 percent in casualty crashes, 25 - 35 percent in fatal crashes, and perhaps up to 50 percent in single-vehicle tractor-semi-trailer fatal crashes.

◊ Authors' review of prior research shows that drivers' relative risk of crashes increase with increasing work duration and is compounded by drivers taking more risks as fatigue increases.

◊ In-depth studies of fatigue effects, even as rigorous as the Jones and Stein (1987) study, may still underestimate the contribution of fatigue to crash causation.

◊ Probable that most fatigue-related crashes are unidentified because they do not result in serious injuries or deaths, therefore are unreported and/or disregarded for investigation (see, *e.g.*, Hampson, *Contributing Factors In Road Crashes*, Working Document No. WD78, Federal Office of Road Safety, Australia).

◊ Cites studies showing the poor relationship between breaks or naps and recovery of alertness, *e.g.*, Lisper, Laurell, and van Loon (1986) (drivers fell asleep again soon after a five-minute walk break); Lisper and Eriksson (1980) (no difference in recovery of alertness after one, two, or five rest pauses as compared with control who had no pause); Lisper et al. (1979) (no difference between breaks of 15 and of 60 minutes for restoration of alertness).

◊ Discusses repeated findings that commercial drivers, including U.S. truck drivers, widely use amphetamines to increase alertness and performance to offset the fatiguing effects of long driving hours, which use, however, also measurably increases risktaking behavior (*e.g.*, Guinn (1983); Baumler (1975) in Seppala et al. (1979)) and increases crash rates (*e.g.*, Smart, Schmidt, and Bateman (1969)).

◊ Prolonged hours of service, including both driving and non-driving duty time, is an important cause of fatigued commercial drivers and reduction of excessive driving hours is an effective countermeasure.

J. Stutts, J. Wilkins, and B. Vaughn, *Why Do People Have Drowsy Driving Crashes?: Input From Drivers Who Just Did,* AAA Foundation for Traffic Safety, Wash., DC, Nov. 1999.

◊ Case-control study of drowsy driving crashes, with a very large sample size of over 1,400 cases and controls.

◊ Cases were drivers involved in police-reported crashes in North Carolina whose condition following the crash was explicitly characterized as asleep or fatigued, two control cohorts of non-sleepy crash-involved drivers and non-crash-involved drivers.

◊ Both cases and controls interviewed by telephone (interviewers blinded to case or control status of each interviewed driver) with survey results analyzed descriptively and through multiple logistic regression models.

◊ Very high percentages of both cases and controls interviewed regard drowsiness in driving to be a major cause of motor vehicle crashes, second in importance only to alcohol consumption.

◊ Study importantly recognizes distinction between sleepiness and fatigue: the former is the inclination to sleep, the latter a disinclination or inability to continue performing a task.
◊ Drivers in sleep- and fatigue-related crashes were behind the wheel significantly longer prior to the crash, were awake for longer the day of their crashes, and had slept fewer hours the night before (both asleep and fatigued crash-involved drivers averaged about 6.5 hours of sleep per day).
◊ Twenty-seven (27) percent of the asleep crash-involved drivers and 20.6 percent of the fatigued crash-involved drivers work more than 60 hours each week; 43.4 percent asleep drivers and 37.3 percent fatigued drivers 50 or more hours per week; and 88 percent asleep drivers and 83.3 percent fatigued drivers 40 or more hours per week.
◊ Working more than 60 hours a week increased the odds of having a crash by 40 percent.
◊ More than half of all asleep crash-involved drivers and almost half of all fatigued crash-involved drivers have regular daytime work schedules.
◊ Half of the fatigued and asleep drivers reported feeling only slightly drowsy or not at all drowsy prior to their crashes.
◊ There was evidence that fatigue-related crashes are underreported, as well as drivers unable or unwilling to recognize the influence of drowsiness or fatigue in their crashes.

***The National Highway Traffic Safety Administration and National Center On Sleep Disorders Research Program to Combat Drowsy Driving: Report to the House and Senate Appropriations Committees Describing Collaboration Between the National Highway Traffic Safety Administration and the National Center on Sleep Disorders Research, National Heart, Lung and Blood Institute, National Institutes of Health, March 15, 1999; and, Drowsy Driving and Automobile Crashes,* NCDSR/NHTSA Expert Panel Report on Driver Fatigue and Sleepiness, DOT HS 808 707, April 1998.**

◊ Report jointly authored by NHTSA and NCSDR to comply with the mandates of the Fiscal Year 1996 and Fiscal Year 1997 Senate Appropriations Committee Conference Reports which stated that police statistics on fatigue-related crashes represent underreporting of the prevalence of these crashes, as well as a failure to identify driver inattention problems leading to crashes.
◊ The FY96 Report asserted that NHTSA has not devoted sufficient resources to understanding and addressing driver fatigue, sleep disorders, and driver inattention.
◊ The FY97 conference agreement supplied $1,000,000.00 to NHTSA to analyze the role of driver fatigue, sleep disorders, and inattention in cooperation with NCSDR.
◊ One of the risk factors identified by the Expert Panel was shift workers accruing long daily working hours, including drivers driving long hours each day.
◊ The Panel emphasized that periods of work longer than 8 hours have been shown to impair performance and increase crashes (*e.g.*, performance is worse on 12 hours per day work schedules than 8 hours per day (Ivan Brown (1994)).
◊ The Panel explicitly distinguished from fatigue, recognizing that fatigue is a disinclination to continue performing a task at hand whereas sleepiness is a neurobiological drive or need to sleep.
◊ The Panel found that sleepiness can contribute to fatigue- and inattention-related crashes, but that fatigue-related crashes do not necessarily involve sleepiness [See Stutts, Wilkins, Vaughn (1999)].

APPENDIX A

T. Dingus, *et al.*, *Impact of Sleeper Berth Usage on Driver Fatigue: Final Project Report*, Virginia Tech Transportation Institute, Federal Motor Carrier Safety Administration Contract DTFH61-96-C-00068, USDOT, July 2002.

◊ Prospective study of 56 commercial drivers in 13 team cabs and 30 solo drivers working for 4 for-hire, over-the-road trucking firms, using Class 8 tractors with semi-trailers.

◊ Multiple data acquisition systems including PERCLOS (videoed driver face drowsiness interpretation as percentage of eye closure), steering movements, lane maintenance and departures, braking, automated piezo-electric sleep-monitoring system, subjective driver sleep self-ratings, Karolinska Sleepiness Scale (trained observer interpretative use), sleeper berth data noise/vibration/temperature.

◊ Study preceded by 10 focus group interview sessions in 1997-1998 comprising 74 drivers.

◊ Several drivers in focus groups admitted to illegal conduct related to their commercial driving.

◊ The focus group driver admissions of violations were confirmed later in the study participants: there were a significant number of cases where study drivers, even though they knew they were being observed, violated hours of service regulations by driving in excess of 10 consecutive hours without taking the required minimum 8 hours off-duty rest period.

◊ Excessive (illegal) consecutive hours of driving ranged from 11 hours to 15 hours, and most violations were committed by solo drivers.

◊ However, the 5 percent of the shifts that illegally exceeded 10 consecutive hours of driving had very few recorded critical incidents, and although there were 22 cases where a drive drove over 14 hours in a single shift, there were no occurrences of a critical incident or driver error in any of these cases, according to the authors.

◊ Study authors could only verify whether violations of driving hours were committed because logbooks and truck data collection systems cannot verify on-duty not-driving time.

◊ Drivers in the focus groups are required to stay awake while waiting in line for long periods of time to load/unload and would like to sleep, but don't for fear of losing their place in the loading/unloading queue.

◊ Drivers in the focus groups mentioned that they often cannot load/unload within schedules, and if schedules are not adhered to, they would like to be able to sleep.

◊ Drivers in every focus group claimed that carrier dispatchers coerce them to continue driving even when the drivers feel they need to rest.

◊ Drivers in the focus groups complained that trucking companies do not give them enough anticipation of a driving tour of duty to enable the drivers to get sufficient sleep before going on the road.

◊ Drivers in the focus groups emphasized that they were paid by the mile, were not paid for any time when their trucks were immobile (*e.g.*, during waiting to load/unload), and that this practice impelled them to violate hours of service requirements and to speed.

◊ Authors suggest that this industry practice leads drivers to falsify their logbook entries to conceal violations.

◊ Low study participant (driver) interaction with data collection systems, but drivers had to don Nightcap sleep monitoring system and attach piezoelectric film to one eyelid.

◊ One study participating driver subverted the data collection systems by placing opaque tape over the cab-mounted video camera.

◊ Critical incident recordation protocol (video and computer storage) governing indications of fatigue, performance lapses, safety-related events, potentially hazardous driving behavior.
◊ Solo drivers were found to be greatly affected by drowsiness which compromises their ability to safely operate large trucks.
◊ Solo drivers were greatly affected by their level of drowsiness which translated into dangerous driving behavior.
◊ Solo drivers had many more critical incidents at all levels of severity as compared with team drivers and the differences were large at all trigger severity levels.
◊ The ratio of critical incidents to timed triggers in the extremely drowsy category for solo drivers was far greater than expected and hypothesized.
◊ Solo drivers were found to be extremely drowsy in almost 2.5 times as many incidents as hypothesized.
◊ Solo drivers were involved in 4 times the instances of very/extremely drowsy observer ratings than were team drivers (20 occurrences solo drivers, 3 occurrences team drivers).
◊ Six (6) of the extreme fatigue occurrences took place when drivers had <5 hours sleep in previous 24 hours.
◊ Authors note that only 9 of the extreme drowsiness drivers had more than 7 hours of sleep in the previous 24 hours.
◊ However, only 3 of the extremely drowsy drivers had rated themselves subjectively for prior quality of sleep as worse than Level 4 (slept fairly well) [Note GAD: a finding that accords with several studies over the years showing that drivers cannot accurately judge or predict how drowsy they are or will be while driving].
◊ Solo drivers were more alert in the morning and gradually became fatigued as the day progressed.
◊ Solo drivers experienced high rate of extreme drowsiness after the second or third bout (authors use the term shift) of driving after the first day of several days of consecutive driving.
◊ The authors believe that this high rate of extreme drowsiness is the combination of long consecutive driving hours and multiple days of consecutive driving, and several measures indicate that this extreme drowsiness is the product of cumulative fatigue.
◊ The impact of drowsiness on single drivers increased as the days of a duty tour accumulated.
◊ Solo drivers in the extremely drowsy category were involved in over 20 times as many abrupt steering incidents than hypothesized, a result that was much larger than expected by the authors.
◊ The authors believe the combination of long driving shifts over multiple days creates a high potential for significant drowsiness for commercial drivers, especially in the final days of several consecutive days of driving.
◊ Quality and depth of sleep during a tour of duty were worse than home sleep, especially for team drivers who had difficulty especially sleeping in sleeper berths while trucks were moving.
◊ Team drivers got more sleep during the study than solo drivers, but the sleep was overall of poorer quality.
◊ Both solo and team drivers reported having a harder time falling asleep in sleeper berths than at home.
◊ Both solo and team drivers slept more deeply during a tour of duty as the days of consecutive driving elapsed due perhaps to the presence of a growing, cumulative sleep debt.

◊ Solo drivers, unlike team drivers, continued to push their driving when very tired and judged to be extremely drowsy.
◊ Solo drivers on average reported one hour less sleep per day than team drivers during a tour of duty.

B. Wright and E. Fogel, *On-Board Recorders: Literature and Technology Review*, Cambridge Systematics, Inc., FMCSA Contract No. DTFH61-99-Z-00083, July 2002.
◊ Literature review of 4 studies:

- Deborah Freund, *Agency Working Paper: On-Board Automated Recording for Commercial Vehicle Driver's Hours-of-service Compliance: The European Experience.*
- Federal Highway Administration Global Positioning System Pilot Program 1998 (unpublished materials reviewed by authors), derived from GPS Technology Notice of Interpretation with Request for Participation in Pilot Demonstration Program, 65 FR 16697 (April 6, 1998).
- K. Campbell and S. Lang, *Electronic Recorder Study: Final Report*, University of Michigan Transportation Research Institute, Federal Highway Administration, June 1998.
- *Field-Testing of On-Board Recorder, Smart Card, and Digital Signature Technology: Phase I*, Public Works and Government Services Canada Western Quebec Region and TECSULT, September 2001.

◊ Technologies include digital tachographs, engine control modules (widely used and installed by engine manufacturers, GPS, and wireless communication system.
◊ Technologies need to record number of hours driver has rested, number of hours driver has been awake and the time s/he awoke, number of hours driver on duty but not driving.
◊ About 4.2 million commercial drivers subject to logbooks.
◊ Authors note early on concerns regarding sufficiency of relying exclusively on GPS data for determining RODS and hours-of-service compliance.
◊ Authors recommend that RODS and compliance need to be governed by effective combinations of technologies, not just one type.
◊ 49 CFR Pt. 395.15, adopted in 1988, cannot be fulfilled by GPS because reg specifically requires any non-logbook technology to be integrally synchronized with specific vehicle operations, therefore must record engine use, road speed, miles driven, date, and time of day.
◊ Special pilot program necessary in 1998 because GPS does not use engine data to create RODS reports.
◊ Clear from GPS pilot program that technologies chosen must protect the regulatory interests of the federal government.

◊ **Deborah Freund agency working paper review**: European Union has made advances in promoting use of on-board recordation technologies along with defining their requirements for monitoring compliance with hours-of-service requirements.
◊ EU specifies that buses carrying more than 9 passengers and trucks weighing more than 7,700 lbs. must have automatic recording devices for distance traveled, speed, driving times, non-driving work time, and rest time.
◊ EU reg. Annex 1 prescribes requirements for development, testing, installation, and periodic inspection of the recording devices (includes design specs even for cable types and insulation).

◊ Digital tachographs poised to replace tamper-prone mechanical tachographs in near future.
◊ Digital tach uses electronic recording on a smart card, and permits printouts of daily, weekly, monthly info of date, time, names of drivers and inspectors, driving times, breaks, rest periods, standby times, start-finish times of all transportation-related activities.
◊ Authors concluded that few on-board technologies are available in the market designed specifically to capture Record of Duty Status (RODS) because they cannot record activity of driver while not in a driving mode, cannot distinguish between on-duty/not-driving and off-duty activities.
◊ Some European interest groups opposed to use (International Road Transport Union).

◊ **GPS pilot program** conducted 1995-1998, 2000 drivers, written logbooks used alongside GPS.
◊ System calculates driving time by determining time and distance between truck location updates not direct recordation of driving time.
◊ GPS operates on several algorithmic default assumptions – if vehicle idle >2 hours, system codes sleeper berth; if vehicle idle for <2 hours, driver status coded off-duty; no driving time recorded if truck and trailer travels <15 miles or tractor alone travels <25 miles; if driver fails to record how long on-duty not-driving, GPS automatically records default of 15 minutes for loading/unloading.
◊ Inspection and enforcement personnel can examine either display or printed hard copy of RODS.
◊ No FMCSA claims either supporting or opposing company claims about value or accuracy of RODS with GPS.
◊ However, Cambridge Systematics interviewed several FMCSA personnel about GPS pilot program.
◊ FMCSA personnel said that technology needed because commercial driver so not always accurately log on-duty times per regs and provide other economic/administrative benefits.
◊ FMCSA do not believe that there has been any documented improvements in compliance or safety due to GPS use in the pilot program.
◊ FMCSA personnel observed that 40% of HOS OOS citations were for no log or log not up to date, not falsified entries.
◊ FMCSA personnel cautioned that default assumptions governing GPS in pilot program could lead to an inaccurate picture of a driver's working time and total distance traveled.
◊ One FMCSA staffer questions accuracy of sleeper berth default judgment (two hours motionless vehicle).
◊ FMCSA personnel think GPS not enough, need use with other engine-related EOBRs.
◊Some GPS pilot program drivers found ways to tamper with data, compromise safety.
◊ FMCSA personnel admitted that some carriers don't want EOBRs because they regularly violated HOS limits, want to avoid enforcement.
◊ FMCSA personnel do not believe an EOBR mandate is imminent because, among other things, current Administration is pro-business.

◊ **UMTRI electronic recorder study** conducted 1998 on benefits/costs of EOBRs by interviewing major trucking organizations and independent owner-operators.
◊ Low response rate (1,200 responses of 10,000 distributed survey forms).

◊ Of respondents, only 175 use EOBRs.
◊ Multiple purposes of EOBR use, not just regulatory.
◊Larger firms = more common use.
◊ Private fleets use more than for-hire.
◊ 57 percent have HOS function for EOBRs.
◊ Only 37 fleets of 1,200 use EOBRs for HOS compliance and RODS tracking.
◊ But no for-hire and owner-operators used EOBRs for HOS compliance.
◊ EOBR buy/install $2,000 or less, <$200 annual operating costs.
◊ Fleets cite driver paperwork timesaving, better fleet management.
◊ Most carriers don't want them, won't get them.
◊ UMTRI authors concluded no economic benefits to EOBR use.

◊ **Transport Canada October 2001 Study EOBRs, Smart Cards, Digital Signatures** Phase 1 conducted with several national and provincial transportation agencies and one motor carrier.
◊ 16 companies providing EOBRs, smart cards, and digsigs evaluated.
◊ No company could prove that its technology could meet regulatory requirements.
◊ But part of problem is the lack of clear legal framework to tailor technical specs.
◊ Study (Phases 2-4) will proceed to other phases of actual in-service testing, specification of actual processes for recordation.

APPENDIX B

TRUCK DRIVER HOURS OF SERVICE (HOS) RULE OVERTURNED TWICE BY UNANIMOUS DECISIONS

U.S. COURT OF APPEALS HAS VACATED KEY ASPECTS OF HOS RULE IN TWO PREVIOUS DECISIONS AND HELD THIRD CASE IN ABEYANCE PENDING OUTCOME OF NEW RULEMAKING

The U.S. Court of Appeals for the District of Columbia Circuit (Washington, D.C.) has twice ruled that prior versions of the Hours of Service (HOS) rule issued by the Federal Motor Carrier Safety Administration (FMCSA) were adopted in violation of federal law.

In the first case, a unanimous 3-judge panel of the appellate Court held in a 2004 decision that the FMCSA failed to consider the effect of longer driving and work hours permitted by the HOS rule on the health of truck drivers. Federal law required the agency to examine the impact of regulations on driver health. The Court went on to analyze and criticize every other aspect of the HOS rule including:

- increasing in the limit on consecutive driving hours from 10 to 11 hours of driving, even though data shows that crash risk increases geometrically after 8 hours of driving;
- allowing drivers to restart their maximum weekly driving hours after only 34-hours off duty, even though the agency found that drivers need two nights of sleep in order to be fresh and alert for driving;
- permitting a continuation of split sleeper berth off-duty time, where drivers can take two five hour breaks instead of one 10-hour off duty period, even though data shows that drivers cannot get a full night sleep or adequate rest in shorter off duty periods;
- failing to address the need to require automatic on-board recorders (EOBR) that accurately collect information on truck engine operation and driver on and off duty compliance.

The Court stated that the FMCSA had not provided reasoned explanations for the increases in maximum driving and on-duty time, casting doubt on the safety of the 11-hour daily driving limit and the 34-hour restart requirements. The Court remanded the rule to the FMCSA which began a separate rulemaking process for the EOBR issue.

In 2005, the FMCSA reissued nearly the identical rule except that the revised rule required drivers using sleeper berths to take at least 8 hours off-duty in a single rest period, allowing an 8/2 split of the 10 hour off duty period but no shorter split sleeper berth rest periods.

In the second lawsuit, another unanimous 3-judge panel of the Court, in a 2007 decision, ruled that the 11 hour limit on consecutive driving hours and the 34-hour restart provision must be sent back to FMCSE because the agency had acted illegally in failing to disclose during the public comment period critical information in its cost-benefit analysis and by failing to explain the assumptions and methodology used by FMCSA in arriving at the statistical models on which the HOS rule cost-benefit analysis relied. The HOS rule was, once again, returned to the agency for further action and, once again, FMCSA issued the same, exact rule in 2008.

The third lawsuit was filed in March, 2009, but just as the briefs were due in Court the parties and the government reached a settlement agreement in which FMCSA agreed to issue a new revised HOS rule by the end of July, 2011. The third lawsuit is pending but held in abeyance until the FMCSA issues the new HOS rule. If the HOS rule is essentially the same as the HOS rule issued in 2008 then the Court can reinstate the lawsuit and the briefing would proceed.

APPENDIX B

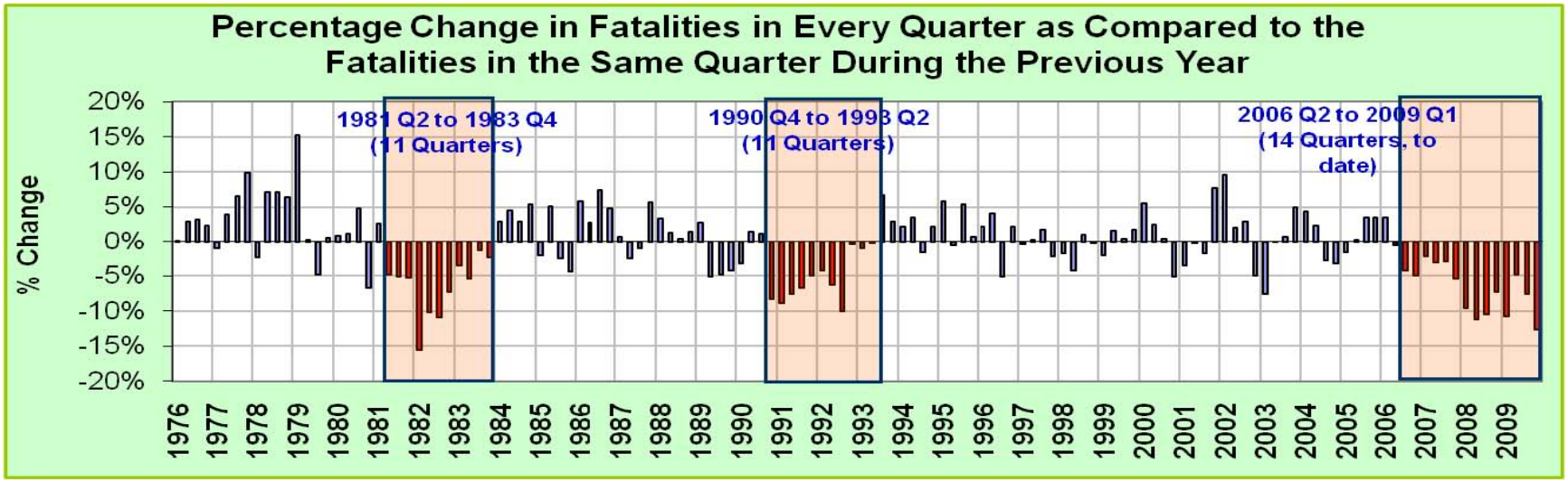
Six federal judges of the appellate court that is directly below the U.S. Supreme Court have found the prior iterations of the HOS rule illegal. Beyond the specific legal holding in each case, the Court in both decisions criticized other shortcomings of a number of critical aspects of the FMCSA HOS rule. The attached side-by-side includes quotations from each Court opinion about the various issues considered by the Court panels in the two cases.

ISSUE	ANALYSIS of July ***2004*** COURT OF APPEALS DECISION	ANALYSIS of July ***2007*** COURT OF APPEALS DECISION
Driver Health	"The FMCSA points to nothing in the agency's extensive deliberations establishing that it considered the statutorily mandated factor of drivers' health in the slightest" "[The FMCSA's] failure to [explain its reasons for not considering the effect of the rule on driver health], standing alone, requires us to vacate the entire rule as arbitrary and capricious, as the agency's failure to consider this factor, to borrow a phrase from the agency's brief, 'permeated the entire rulemaking process.' "	**N/A**
Cost-Benefit Analysis (Operator-Fatigue Model Methodology)	"[T]his analysis assumes, dubiously, that time spent driving is equally fatiguing as time spent resting – that is, that a driver who drives for ten hours has the same risk of crashing as a driver who has been resting for ten hours, then begins to drive. [citation omitted]. In other words, the model disregarded the effects of 'time on task' because, the agency said, it did not have sufficient data on the magnitude of such effects." "The exponential increase in crash risk that comes with driving greater numbers of hours, presumably caused by time-on-task effects, raises eyebrows about the agency's increase in daily driving time. Yet the agency excluded time-on-task effects from the cost-benefit analysis. That analysis, then, assumes away the exact effect that the agency attempted to use it to justify. The agency's reliance on the cost-benefit analysis to justify this increase is therefore circular, and the rationality of that explanation is correspondingly doubtful."	"FMCSA's decision to plot the data point for Hour 13 and beyond at Hour 17 – instead of at Hour 13 (or some other point) – was entirely unexplained in the RIA [regulatory impact analysis] and final rule. This complete lack of explanation of an important step in the agency's analysis was arbitrary and capricious." "Although we apply a deferential standard of review to an agency's use of a statistical model, we cannot uphold a rule based on such a model when an important aspect of its methodology was wholly unexplained." "FMCSA gives no explanation for the failure of its operator-fatigue model to account for cumulative fatigue due to the increased weekly driving and working hours permitted by the 34-hour restart provision. . . . [t]he agency's failure of explanation renders the restart provision arbitrary and capricious."
Increase in Maximum Driving Time from Ten to Eleven Hours	"The exponential increase in crash risk that comes with driving greater numbers of hours . . . raises eyebrows about the agency's increase of daily driving time." "[P]etitioners' challenge raises very real concerns."	"First, we expressed 'very real concerns' about the increase in the daily driving limit from 10 to 11 hours. [cite omitted]. We noted that the 'agency freely concedes that 'studies show [] that performance begins to degrade after the 8th hour on duty and [the

Increase in Maximum Driving Time from Ten to Eleven Hours (Continued)	"We have our doubts about whether [the agency's] two justifications are legally sufficient." "The agency freely concedes that 'studies show[ ] that [driver] performance begins to degrade after the 8th hour on duty and increases geometrically during the 10th and 11th hours' on duty. Despite this finding, the agency cited absolutely no studies in support of its notion that the decrease in daily driving-eligible tour of duty from fifteen to fourteen hours will compensate for these conceded and documented ill effects from the increase [in consecutive driving hours]." "The agency did refer generally to studies, but that generalized reference is of doubtful legal sufficiency." ". . . the effects from the increased weekly driving hours may offset any decrease in fatigue flowing from the fact that drivers have overall [one hour] shorter tours of duty. For these [] reasons, it is unlikely that we would find the agency's first explanation legally sufficient." "The agency's reliance on the cost-benefit analysis to justify this increase [in driving hours] is therefore circular, and the rationality of that explanation is correspondingly doubtful."	degradation] increases geometrically during the 10th and 11th hours'.' " "Second, we also found suspect the agency's claim that the increase in daily driving limit to 11 hours could be justified by 'the cost-benefit analysis it conducted.' "
34-Hour Restart Provision	". . . this provision has the effect of increasing the number of hours drivers can work [i.e., drive] each week." "While the agency's explanation seems sound enough as far as it goes, it does not even acknowledge, much less justify, that the rule . . . dramatically increases the maximum permissible hours drivers may work [i.e., drive] each week." "And the agency's failure to address it [the increase in the number of weekly driving hours] . . . makes this aspect of the rule's rationality questionable."	"[W]e regarded as 'problematic' the fact that FMCSA's justification for the 34-hour restart provision '[did] not even acknowledge, much less justify, that the rule . . . dramatically increases the maximum permissible hours drivers may work [i.e. drive] each week.' [citation omitted]. That increase, we said, 'is likely an important aspect of the problem[,] [a]nd the agency's failure to address it . . . makes this aspect of the [2003] rule's rationality questionable.' "
Electronic On-Board Recorders (EOBRs)	"The agency's justification for not requiring EOBRs to monitor driver compliance is another aspect of the final HOS rule of questionable rationality." "The agency's explanation in all likelihood does not conform to [its] statutory requirement." "The agency concedes that it 'did not test the	**N/A**

	(very few) EOBRs currently available.' The agency offers no excuse for not doing so, and we can think of none that would suffice to fulfill the agency's duty to 'deal [] with' the issue of EOBRs." "We cannot fathom, therefore, why the agency has not even taken the seemingly obvious step of testing existing EOBRs on the road, or why the agency has not attempted to estimate their benefits on imperfect empirical assumptions." "The agency has given no good reason for treating this problem with such passivity."	
Sleeper Berth Exception	"Despite the premise [that each driver should have an opportunity for eight consecutive hours of uninterrupted sleep every day], the agency offered several justifications for nevertheless permitting drivers to obtain the required continuous period of rest in two chunks, all of which are quite weak." "In sum, we have grave doubts about whether the agency's explanation for retaining the sleeper-berth exception would survive arbitrary and capricious review."	**N/A**

Long Term Quarter to Quarter Changes in All Fatalities



- Recessions in each of the three periods of 10 or more quarters of fatality declines
- Economy now is recovering from the worst recession since 1975, and longest period of consecutive quarterly fatality declines

Source: FARS

Excerpted from "2009: Historic Truck Crash Declines," Powerpoint Presentation, Ralph Crafty, Ph.D., FMCSA Office of Analysis, Research and Technology (9/29/2010)

HENRY M. JASNY

Professional Experience:

Advocates for Highway and Auto Safety: Vice president (2011)
General Counsel, (1991- present):

Areas of Responsibility—
Legal analysis of safety issues regarding federal motor vehicle and traffic safety legislation and legal claims involving Department of Transportation (DOT) agencies.
Development and implementation of Advocates' Policy Statements and safety positions on legislative and regulatory issues involving programs and standards administered by the DOT, the National Highway Traffic Safety Administration (NHTSA) and the Federal Motor Carrier Safety Administration (FMCSA).
Supervision of regulatory issues and rulemaking comments and petitions filed by Advocates in over 700 docket submissions to DOT, NHTSA, FMCSA and related federal agency public dockets regarding surface transportation safety issues and programs.
Drafting legislative proposals as well as legal and technical assistance on legislation to congressional offices on motor vehicle safety issues.
Litigation under the Federal Motor Carrier Safety Act, National Highway and Motor Vehicle Safety Act and related safety legislation and open government laws. Served as counsel in successful litigation opposing waiver programs for truck drivers and hours of service requirements issued by the Federal Motor Carrier Safety Administration.

Center for Auto Safety, Staff Attorney (1985-1990):
Lead attorney on Highway Safety Project. Provided oversight on legal issues involving the Federal Highway Administration (FHWA) under the Federal-Aid Highway Act, traffic safety laws and regulation, and open government issues.

Legal Aid Society of New York, Senior Trial Attorney (1976-1984):
Lead attorney in felony trials and criminal investigations for indigent defendants.

Other Experience:
Member, FMCSA Motor Carrier Safety Advisory Committee (2011)
National Transportation Safety Board (NTSB):
Party Representative, 2011 Truck and Bus Safety Forum.
General Services Administration, Instructor (1991-2011):
Instructor for General Services Administration Federal Advisory Committee Act.
Media:
Conducted numerous interviews on highway and truck safety issues with major media.

Education:
Brooklyn Law School (1976);
New York University (1973);
Bronx High School of Science (1969).

Affiliations:
Member of the bar of the U.S. Supreme Court and Federal District Court;
Practice in U.S. Court of Appeals;
Active Member, District of Columbia Bar.

Committee on Oversight and Government Reform
Witness Disclosure Requirement – "Truth in Testimony"
Required by House Rule XI, Clause 2(g)(5)

Name: **Henry Jasny**

1. Please list any federal grants or contracts (including subgrants or subcontracts) you have received since October 1, 2008. Include the source and amount of each grant or contract.

None.

2. Please list any entity you are testifying on behalf of and briefly describe your relationship with these entities.

Vice President, General Counsel, Advocates for Highway and Auto Safety.

3. Please list any federal grants or contracts (including subgrants or subcontracts) received since October 1, 2008, by the entity(ies) you listed above. Include the source and amount of each grant or contract.

None.

I certify that the above information is true and correct.
Signature: Henry Jasny Date: **Nov. 28, 2011**