



Loss Control Department
Technical Information Paper Series

Fatigue:
*Its Impact On Motor
Vehicle Accidents*

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Fatigue

Its Impact On Motor Vehicle Accidents

Driver fatigue is a significant responsible condition of motor vehicle accidents. This paper addresses the regulations pertaining to permissible hours of service, some of the factors that are responsible for fatigue in drivers, and the controls that management can implement to counteract these negative conditions.

Introduction

Driver fatigue is a significant safety issue for drivers of Commercial Motor Vehicles (CMV). Regulations governing the hours that interstate drivers may work (on-duty hours) and drive were developed by the Interstate Commerce Commission in 1935, and have remained essentially unchanged. Under the current Hours of Service (HOS) regulations (as specified in Title 49, Code of Federal Regulations, Part 395), a CMV driver operating in interstate commerce may *drive* up to 10 hours after a mandatory 8-hour off-duty period and may *work* no more than 15 hours. Drivers may not drive after having been on-duty for 60 hours during any seven consecutive days, or 70 hours in eight days (for carriers having operations every day of the week).

Time spent in a sleeper berth must be of at least two hours duration to be considered as “off-duty” sleeping time. In the case of adverse weather conditions, drivers may continue to drive for up to two additional hours in order to complete their run, or in order to reach a place offering safety and security for the vehicle, occupants, and cargo.

Many CMV drivers drive at night, and often have irregular and unpredictable work schedules. These conditions can lead to inadequate or poor-quality sleep periods. For these drivers, the high mileage of CMV operations presents a greater exposure to accidents in general, and fatigue-related accidents in particular. Driver fatigue has been, and continues to be, a major concern for those in CMV transportation. Over the years, many studies have been conducted to determine if a correlation exists between fatigue and hours of service. Driver drowsiness or fatigue has become the dominant human factors research issue relating to CMV transportation.

Sleep Disorders

The risk of having a sleep-related accident varies, due to several factors. Fatigue-related crashes occur at times of typical maximal sleep (i.e., during the night and mid-afternoon “siesta” time). People who have undiagnosed sleep disorders (e.g., apnea, chronic insomnia, or narcolepsy, i.e., brief attacks of deep sleep) and those who are knowingly sleep-deprived, have a higher likelihood of experiencing this type of crash. Among drivers, sleep disorders are more common than diabetes, seizure disorders, or alcoholism.

Sleep apnea results in frequent awakenings (as many as 600 during a night sleep) causing poor quality sleep. Sleep apnea occurs in 4-9% of males and 2-4% of females between the ages of 30 and 60, yet fewer than 5% of these drivers are aware of their condition. Sleep apnea is found most often in men who snore and have a size 17 or larger shirt collar.

One study suggests that people who have these problems can perform as poorly as legally intoxicated drivers.

Certain segments of the population are more likely to have accidents associated with falling asleep:

- Males have a two to three times greater likelihood of being involved in this type of accident.
- Younger drivers (those under the age of 30) are involved in four times the number of fatigue-related accidents.
- Shift workers are often sleep-deprived, due to the difficulty of their sleeping during the day, or due to their having to work rotating work shifts.

Driver Fatigue and Alertness Study

The Federal Highway Administration's Office of Motor Carriers, in cooperation with Transport Canada and the Trucking Research Institute, conducted a study to evaluate driver fatigue, alertness, and physiological and subjective states of drivers as they perform in real-life, revenue-generating trips. Eighty (80) male tractor trailer drivers were studied in four groups with different driving conditions. The study investigated the following work-related factors:

- the amount of time spent driving during a work period
- the number of consecutive days of driving
- the time of day when driving took place
- the number of hours spent in principal sleep periods
- schedule regularity

Study Results

- The strongest and most consistent factor influencing driver fatigue and alertness was time of day. Drowsiness was markedly greater during night driving than during daytime driving. Peak drowsiness occurred during the eight hours from late evening until dawn. The body has two "down" times: between 2 a.m. and 6 a.m. and between 1 p.m. and 5 p.m. Most people are programmed to sleep during periods of darkness. Those who attempt to do otherwise experience poor quality sleep and a reduced level of performance.
- Time of day was a much better predictor of decreased driving performance than hours of driving or the cumulative number of trips made. Hours of driving was not a strong or consistent predictor of observed fatigue.
- Cumulative number of trips was neither a strong or consistent predictor of fatigue.
- The quantity of sleep obtained by the drivers during their principal sleep periods was low. Drivers obtained an average of two hours less sleep than their daily "ideal" requirements. The quality of their sleep period was high, probably due to their lack of sufficient time in bed. Laboratory tests show that a sleep loss of as little as two hours can affect alertness and performance. Affected performance can include: reduced judgment, slowed reaction time, lack of concentration, fixation, and a poor mood or attitude.
- Drivers were detected driving while drowsy about 5% of the time. Fourteen (14) percent of the drivers accounted for 54% of all observed drowsiness episodes.

- Forty-four (44) percent of the drivers took at least one nap during a duty cycle, in response to self-perceived sleepiness. These naps increased their principal sleep periods an average of 27 minutes, for an 11% increase in average daily sleep time. (Other studies have shown “power naps” of 20-30 minutes to have very important benefits by increasing alertness and reducing fatigue.)
- There was little correlation between drivers’ subjective self-ratings of alertness or sleepiness and concurrent objective performance measures. There was a tendency for drivers to rate themselves as more alert than the performance tests indicated. Drivers had no expectation, vis-à-vis their subjective ratings, that night driving is associated with reduced performance, when, in fact, it is.
- There were large individual differences among drivers in levels of alertness and performance. Thirty-six percent of the drivers were never judged drowsy; 15% were judged drowsy more than 10 times. It could not be determined whether observed individual differences were reflective of driver *traits* or driver *states* (short term differences related to recent sleep, etc.).
- Sleep apnea was identified in 2.5% of the drivers in the test; however, their driving performance was not statistically different from other drivers in the study.
- No significant relationship was found between driver age and fatigue.

National Transportation Safety Board

- A 1995 study by the National Transportation Safety Board showed that 74% of accidents that occurred between 10 p.m. and 8 a.m. were fatigue-related.
- Of the accidents studied, 58% were fatigue-related. The drivers stated that they fell asleep while driving.
- Commercial vehicle driver fatalities were caused by fatigue in 31% of crashes studied.
- Fifteen percent of the accidents studied involved drivers with inverted duty/sleep schedules. Of these, 94% had fatigue-related accidents.

Australian Study

In Australia, where criteria have been developed to identify crashes as likely “fall asleep” accidents, fatigue is estimated to account for 6% of all crashes, 15% of fatal crashes, and 30% of fatal crashes on rural roads.

Warning Signs of Fatigue

- Continuous yawning
- Eyes drooping or closing frequently
- Fixed stare; difficulty maintaining normal eye movements
- Head drooping
- Finding the vehicle wandering
- Experiencing “highway hypnosis” (can’t remember what you just drove past)

Countermeasures

- **Work with the biological clock.** Minimize the amount of scheduled driving during the hours of midnight to 6 a.m., especially at the end of a work shift.
- **Establish regular work schedules.** Avoid scheduling drivers “on a wheel” where they are dispatched out after receiving their minimum required eight hours of rest. Changing sleep cycles can degrade the quality of sleep obtained.
- **Allow time for sufficient sleep.** Maximize the amount of off-duty time between driving tasks. This will permit drivers to obtain the quantity of sleep their body requires. Be especially mindful of those who must travel significant miles after being relieved of duty in order to get to their place of rest.
- **Provide information.** Give training and literature to drivers and their families to make them more aware of causative factors relating to fatigue. Stress their inability to factually determine their own fatigue level. Make them aware of the inherent problems associated with driving between the hours of midnight and 6 a.m. Address the quantity and quality issues associated with sleep and drowsiness. Discuss the biological clock, sleep habits, nutrition, and family relationships.
- **Offer effective sleep strategies.** Encourage drivers to use “power naps” to refresh the mind and body during the trip. Provide sleeping facilities where noise and light can be minimized, to improve the quality of the sleep period. Power naps taken *prior to* work cycles have been found to be beneficial.
- **Help drivers develop good habits.** Drivers can develop habits that can minimize the effects of fatigue, such as:
 - talk (with co-driver or on CB)
 - get good nutrition (avoid heavy meals)
 - set sensible schedules (take a break every 2-3 hours)
 - use medication with care
 - avoid caffeinated beverages before sleep
- **Follow a seven-day schedule.** Maintain the same awake/sleep schedule during days off, this is very beneficial for keeping the body clock in rhythm.

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