

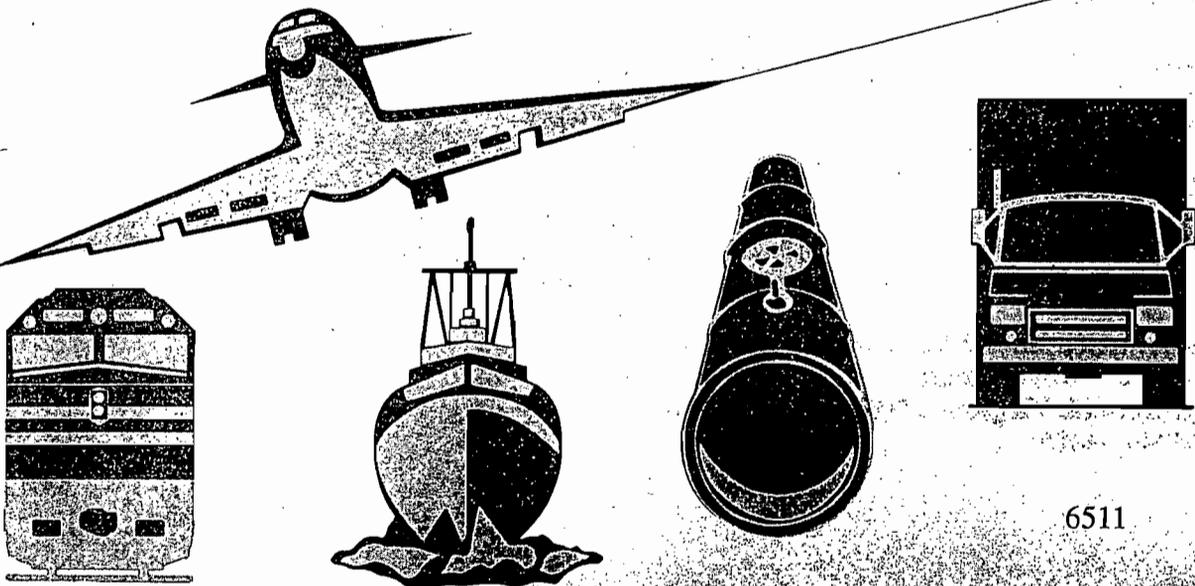
NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

SAFETY STUDY

FACTORS THAT AFFECT FATIGUE
IN HEAVY TRUCK ACCIDENTS

VOLUME 2: CASE SUMMARIES



National Transportation Safety Board. 1995. Factors that affect fatigue in heavy truck accidents. Volume 2: Case summaries. Safety Study NTSB/SS-95/02. Washington, DC.

Because of the significant number of heavy truck-related fatalities and the significant role of fatigue in such accidents, the Board initiated this study of single-vehicle heavy truck accidents to examine the role of specific factors, such as drivers' patterns of duty and sleep, in fatigue-related heavy truck accidents and to determine potential remedial actions. The purpose of the Board's study was to examine the factors that affect driver fatigue and not the statistical incidence of fatigue. The study analyzes data from 107 single-vehicle heavy truck accidents in which the driver survived. Volume 1 of the study contains the Board's analysis of the data and its conclusions and recommendations. Volume 2 of the study contains the summaries of the 107 accidents. The safety issues discussed in the report are (a) the factors that affect fatigue-related accidents; (b) the adequacy of the Federal Highway Administration's hours-of-service regulations; and (c) the adequacy of truckdrivers' understanding of the factors affecting fatigue. Safety recommendations concerning these issues were made to the Federal Highway Administration, the Professional Truck Driver Institute of America, the American Trucking Associations, Inc., the Commercial Vehicle Safety Alliance, the National Private Truck Council, the Independent Truck Owner Operators, the Owner-Operator Independent Driver's Association, the International Brotherhood of Teamsters, and the National Industrial Transportation League.

The National Transportation Safety Board is an independent Federal agency dedicated to promoting aviation, railroad, highway, marine, pipeline, and hazardous materials safety. Established in 1967, the agency is mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The Safety Board makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

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**FACTORS THAT AFFECT FATIGUE
IN HEAVY TRUCK ACCIDENTS**

VOLUME 2: CASE SUMMARIES

Safety Study

Safety Study NTSB/SS-95/02
Notation 6511

National Transportation
Safety Board



Washington, D.C.
January 1995

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Executive Summary

The Safety Board analysis of Fatal Accident Reporting System (FARS) data indicates that in 1993 there were 3,311 heavy trucks involved in 3,169 fatal accidents, in which 3,783 persons died (432 were occupants of the heavy trucks). Fatigue was coded as a related factor for at least one truckdriver in 1.67 percent (53 of 3,169) of these fatal heavy truck accidents. The Safety Board believes, however, that the incidence of driver fatigue is underrepresented in FARS in general and in FARS specifically with regard to truckdrivers. Research has suggested that truckdriver fatigue is a contributing factor in 30 to 40 percent of all heavy truck accidents. In 1990, the Safety Board completed a study of 182 heavy truck accidents that were fatal to the truckdriver. These 182 accidents were a census of the heavy truck accidents that were fatal to the driver in the eight participating States. The primary purpose in investigating fatal-to-the-driver heavy truck accidents was to assess the role of alcohol and other drugs in these accidents. The study found, however, that the most frequently cited probable cause was fatigue. The Board believes that the 31 percent incidence of fatigue in fatal-to-the-truckdriver accidents found in the 1990 study represents a valid estimate of the incidence of fatigue in these most serious of heavy truck accidents.

Because of the significant number of heavy truck-related fatalities and the significant role of fatigue in such accidents, the Board initiated this study of single-vehicle heavy truck accidents to examine the role of specific factors, such as drivers' patterns of duty and sleep, in fatigue-related heavy truck accidents and to determine potential remedial actions. The purpose of the Board's study was to examine the factors that affect driver fatigue and not the statistical incidence of fatigue. Therefore, the Board specifically selected truck accidents that were likely to include fatigue-related accidents; that is, single-vehicle accidents that tend to occur at night. The Board desired to obtain approximately an equal number of fatigue-related and nonfatigue-related accidents through its notification process.

The Board was specifically interested in obtaining accurate information regarding the truckdrivers' duty and sleep patterns for the 96 hours preceding the accident; therefore, the Board limited the accidents to those in which the driver survived and was available to be interviewed by the Board's investigators to reconstruct the previous 96 hours.

The Safety Board investigated 113 single-vehicle heavy truck accidents in which the driver survived. However, because the 96-hour duty/sleep history that was required for the study was not available for 6 drivers, the 6 accidents in which these drivers were involved (Case Nos. 42, 54, 56, 67, 83, and 104) were not included in the study. The study, therefore, analyzes data from 107 single-vehicle heavy truck accidents.

This volume (volume 2, NTSB/SS-95/02) of the report contains case summaries of the 107 accidents that provided the data analyzed in the Safety Board's study. Volume 1 (NTSB/SS-95/01) of the report contains the Board's analysis of the data, its conclusions, and recommendations issued to improve heavy truck safety.

Measures of drivers' schedules as used in the accident briefs

Measure	Rule
Duty/sleep pattern:	
Irregular duty hours	A driver's duty hours were classified as irregular if the start times of two consecutive duty periods varied by 2 or more hours at least twice during the period considered (96-hour period). In cases where the 96-hour break-off occurred within a duty or sleep period, the start time of that duty or sleep period was the starting point of the data.
Irregular sleep hours	A driver's sleep hours were classified as irregular if the start times of two consecutive rest periods varied by 2 or more hours at least twice during the period considered (96-hour period). In cases where the 96-hour break-off occurred within a duty or sleep period, the start time of that duty or sleep period was the starting point of the data.
Irregular duty/sleep hours	A driver's duty/sleep hours were classified as irregular if the start times of two consecutive duty periods and the start times of two consecutive sleep periods both varied by 2 or more hours at least twice during the period considered (96-hour period).
Regular duty/sleep hours	A driver's duty/sleep hours were classified as regular if none of the above three categories were applicable.
Regular sleep with nonclassifiable duty hours	A driver's duty/sleep hours were placed in this category if the sleep hours were regular, but there were not enough consecutive duty shifts to classify duty hours.
Other schedule-related measures:	
Inverted duty/sleep	The times slept and on duty were reversed from one 24-hour period to the next. That is, the driver's accident occurred at a time when on the previous day the driver had been sleeping.
Split sleep pattern	If the duration of each of the driver's multiple sleep periods in the 96-hour history was consistently less than 6 hours.
Exceeded hours-of-service limits	If the driver exceeded the 10-hour driving rule or the 15-hour on-duty rule at any time during the 96-hour history.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 1

Investigation No:	SRH-93-T-HF01
Type of Accident:	Overturn
Accident Location:	Cartersville, Georgia
Date and Time:	September 27, 1992, at 12:45 p.m. e.d.t.
Ambient Conditions:	Daylight, cloudy and dry
Vehicle(s) Involved:	1988 Freightliner tractor in combination with a loaded van semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	6 hours
Number of hours since last slept:	6.25 hours
Number of hours on duty since last slept:	6.25 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination unit was traveling eastbound on a tangent section of State Route 20 with a 3-percent downgrade. As the unit approached the exit ramp to State Route 3, another company driver who was following a short distance behind noticed that the driver of the accident unit was not slowing to exit on the ramp. He attempted to contact the driver of the unit ahead on the Citizens Band (CB) radio but was not successful. As the unit approached the gore point of the ramp, the driver suddenly attempted to steer right and onto the ramp.

The ramp was 18 feet wide, constructed with a raised curb on both sides. It had a reverse curve; both sections had a radius of 300 feet. The posted speed limit was 55 mph. The unit was about 150 feet into the right section of the reverse curve when the unit rolled onto its left side. The unit came to rest on its left side in the grassy area of the east side of the ramp. The truckdriver sustained minor injuries.

In his statement to the investigating police officer, the 26-year-old driver said that he must have fallen asleep. The last thing he could remember before attempting to enter the exit ramp was passing an exit sign about 1 mile before the ramp.

The driver reported that he had been on the road for 9 days before the day of the accident and had worked on 8 of those days. Five days before his accident (Tuesday) he was off duty for 24 hours in a motel in Ontario, California. The following table outlines his duty/sleep pattern for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
WED	0300	10	Before 0000	3+
	2200	3.5	1300	9
THU	--	--	0130	5.5
	0700	10	1700	10
FRI	0300	6.5	0930	4.5
	2100	6	--	--
SAT	--	--	0300	10
	1300	6	1900	5
SUN	0000	.5	0030	6
	--	--		
	0630	6.25 at time of accident		

On the day before his accident, Saturday, September 26, 1992, he arrived in York, Alabama, at 7:00 p.m. He slept in the sleeper berth until 12:00 midnight at which time he drove to a girlfriend's home in York, Alabama. Although the driver claims that he slept for 11 hours the night before the accident, his sleep was split and his last sleep period could have been no longer than 6 hours (after arrival at his girlfriend's house). He departed York, Alabama, at 7:00 a.m. He had been driving about 5 hours at the time of the accident.

The driver's reported duty/sleep information indicated an irregular duty/sleep pattern for the 4 days preceding the accident and a split sleep pattern the night before his accident. These factors, coupled with his failure to respond to the CB radio, suggest that he was in a state of drowsiness and support his statement that he must have fallen asleep.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to negotiate the curve because he fell asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 2

Investigation No:	SRH-93-T-HF02
Type of Accident:	Run Off Road, Collision With Fixed Object
Accident Location:	Bainbridge, Georgia
Date and Time:	September 29, 1992 at 5:45 a.m. e.d.t.
Ambient Conditions:	Cloudy and dry; darkness
Vehicle(s) Involved:	1988 Mack tractor in combination with an unloaded van semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	6 hours
Number of hours since last sleep:	1.25 hours
Number of hours on duty since last slept:	1.25 hours
Duty/sleep pattern:	Irregular duty hours

Description of the Accident:

The combination unit was traveling northbound on a straight and level section of State Route 97 when it ran off the left side of the roadway at an 8-degree angle. The unit then continued ahead with no evidence of steering or braking input for some 370 feet and crashed into three large trees. The truckdriver sustained minor injuries.

The 27-year-old truckdriver said that after a southbound vehicle crossed the center line and entered his lane he steered his vehicle to the left to avoid a head-on collision. This other vehicle was not identified, and no evidence to corroborate the truckdriver's version of the accident was found.

The driver reported that he had worked the day before this accident and was off duty for 1 day before that. The following table outlines his duty/sleep pattern for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
FRI	0800	8	Before 0000 2300	8+ 9
SAT	0800	7	2200	12
SUN	Off duty	--	2300	8
MON	0700 1800	1 4.5	-- 2230	-- 6
TUE	0430	1.25 at time of accident		

On the day before his accident, Monday, September 28, 1992, he worked for 1 hour in the morning beginning at 7 a.m. The truckdriver said that he was off duty, active and "running around" until 6 p.m. He went on duty at 6 p.m. and worked until 10:30 p.m.

The truckdriver said that he had slept for 6 hours in the sleeper berth before beginning to drive at 4:30 a.m. He started work about 3 hours earlier than his usual start time, and got 2 hours less sleep than the 8 hours he reported he normally obtains. He also said he needed at least 7 hours of sleep to feel completely rested and his normal duty hours occurred during the daytime. Based on his duty start times on Monday and Tuesday, his duty hours are classified as irregular.

The vehicle's 8-degree departure angle from the roadway is not suggestive of an evasive steering maneuver to avoid a collision, but rather is suggestive of lack of steering input for some period, most probably due to reduced alertness.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
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CASE NO. 3

Investigation No:	SRH-93-T-HF03
Type of Accident:	Run Off Road, Overturn
Accident Location	Near Roanoke, Alabama
Date and Time:	October 6, 1992 at 5:15 a.m. c.d.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1989 Mack tractor in combination with a loaded van semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	7.25 hours
Number of hours since last slept:	21.25 hours
Number of hours on duty since last slept:	11 hours
Duty/sleep pattern:	Inverted duty/sleep Regular sleep Duty hours could not be classified

Description of the Accident:

The combination unit was traveling northbound on U.S. Route 431 about 9 miles south of Roanoke, Alabama, where the roadway makes a 1,146-foot radius curve to the left. The unit ran off the right side of the roadway, crossed the right shoulder, traveled down a 4-foot embankment, and came to final rest after overturning onto its right side. The truckdriver sustained minor injuries.

The 40-year-old truckdriver said that he was "blinded" by bright headlights from a southbound vehicle as he entered the curve. He said that he closed his eyes momentarily to adjust to the conditions, lost control of his vehicle, and ran off the the roadway.

Although the driver had slept 7.25 hours on Sunday night, at the time of the accident, the driver had only 2.75 hours of sleep in the past 24 hours. Examination of the driver's duty status records for the past 30 days indicated that he tended to work the same shift for several days in a row and then the start time shifted by as much as 12+ hours, causing his duty/sleep pattern to be inverted. On the night of the accident, he started work 2 hours later than the previous night. Also, the driver was in bed by 0045 the previous night. Therefore, the driver was working at the same time he was sleeping the previous night which is an inversion of his duty/sleep

pattern. The following table outlines the truckdriver's duty/sleep pattern for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
THU	0230	12.25	Before 0000 2000	2.5+ 8.75
FRI	0445 1030	4 4.75	2300	10
SAT	Off duty		2330	8.5
SUN	1615	8.5	0045	7.25
MON	-- 1815	-- 11 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain the vehicle on the roadway due to his sleep deprived condition.

**NATIONAL TRANSPORTATION SAFETY BOARD
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CASE NO. 4

Investigation No:	WRH-93-T-HF01	
Type of Accident:	Run Off Road, Overturn	
Accident Location:	Riverside, California	
Date and Time:	October 8, 1992 at 2:15 a.m. P.d.t.	
Ambient Conditions:	Clear and dry; darkness	
Vehicle(s) Involved:	1989 White/GMC tractor in combination with a semitrailer loaded with sewage	
Occupants:	1	
Injuries:	Minor	
Duty/Sleep Information:		
Duration of most recent sleep period:	2 hours	
Number of hours since last slept:	4.25 hours	
Number of hours on duty since last slept:	3.75 hours	
Duty/Sleep Pattern:	Irregular sleep hours	Exceeded hours-of-service limits

Description of the Accident:

As the combination was rounding a right curve on the connecting road from State Route 91 to Interstate 215 at a driver reported speed of 45 to 50 mph, it ran off the left side of the roadway, overturned onto its left side, slid about 100 feet across the three southbound traffic lanes of I-215, and came to rest on its left side facing south with the rear of the trailer against the concrete median barrier and the tractor in the center of the southbound lanes of traffic. The truckdriver sustained minor injuries.

The 42-year-old truckdriver, who had successfully completed a 9-week professional truckdriving school, had a total of 28 months truckdriving experience, most of which was in a straight truck. He was hired by the carrier about 1 month before the accident. Other than truckdriving school, he had only 1 month experience in driving combination vehicles.

The driver stated that he had been following an empty flatbed trailer for 5 to 6 miles, up to the point where he overturned. The driver may have gauged his speed around the curve according to the speed of the flatbed.

Although this accident occurred at 2:15 a.m. and the driver's sleep hours were irregular, he had just come on duty at 10:30 p.m. after a 2-hour nap and related that he was not sleepy. On Monday, 4 days before the accident day, the driver was in

violation of the hours-of-service (HOS) 10-hour and 15-hour rules because he did not take the required 8-hour break before going back on duty at 11 p.m. The following table outlines his duty/sleep pattern for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SUN	-- --	-- --	Before 0000 2000	7 6.5
MON	0700 2300	9.25 10 excessive	0430 1900	2 3.5
TUE	-- -- -- 2230	-- -- -- 10.25	0930 1330 2000	2 4.5 2
WED	-- -- 2230	-- -- 3.75 at time of accident	1015 2000	6.75 2

There were approximately 200 feet of tire yaw marks leading to the point of overturn that were attributed to the left tires of the combination unit. These tire marks indicated that the tires were sideslipping and that, therefore, the vehicle was rounding the curve at an unsafe speed for the given load configuration.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of control on the curved exit ramp due to the incompatibility of the vehicle speed and the curve geometry. Contributing to this accident was the driver's inexperience with driving articulated vehicles with liquid cargo.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 5

Investigation No:	SRH-93-T-HF04
Type of Accident:	Run Off Road, Overturn
Accident Location:	Commerce, Georgia
Date and Time:	October 8, 1992 at 5 a.m. e.d.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1990 Freightliner tractor in combination with a loaded van semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	7 hours
Number of hours since last slept:	14 hours
Number of hours on duty since last slept:	11 hours
Duty/sleep pattern:	Irregular duty hours

Description of the Accident:

The combination unit was traveling southbound in the right lane on Interstate 85 when it braked, turned sharply to the left, and ran off the road into the median. After traveling 182 feet in the median, the driver attempted to reenter the roadway, but as the tractor reentered the roadway the combination unit overturned onto its left side. The truckdriver sustained minor injuries.

The 60-year-old truckdriver said that he had dozed off and that when he awoke, he observed a slower-moving lighted truck immediately ahead and abruptly steered to the left to avoid contacting it.

The truckdriver was on a routine scheduled run, terminal to terminal, for an interstate LTL (less than truck load) carrier. His on-duty hours were irregular for the 4 days preceding his accident. He normally worked during nighttime hours, and about the maximum number of hours allowed by regulations. His duty start times had shifted by at least 3 hours on a daily basis and for one work shift the start time was almost 7 hours later than the previous day. The truckdriver had been awake for 14 hours, had been on duty 11 hours, and driving 8.5 hours when the accident occurred. The following table outlines his duty/sleep pattern for the 4 days before the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SUN	-- 1115	-- 12.75	Before 0000	7+
MON	-- 1800	-- 13	0000	8
TUE	-- 2100	-- 8.5	0800 ---	6.5 --
WED	-- 1800	-- 11 at time of accident	0800	7

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to perceive the slow moving truck ahead and to make a safe and timely evasive maneuver because he fell asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 6

Investigation No:	CRH-93-T-HF01
Type of Accident:	Run Off Road, Overturn
Accident Location:	Near Agua Dulce, Texas
Date and Time:	October 10, 1992, at 5:30 a.m. c.d.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1988 Kenworth tractor in combination with a loaded tank semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	4.75 hours
Number of hours since last slept:	11.00 hours
Number of hours on duty since last slept:	6.75 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination unit was traveling westbound on a level portion of State Route 44 when it left the roadway at an angle of about 4 degrees. The vehicle continued ahead about 250 feet with no evidence of steering before the truckdriver applied the brakes. After traveling an additional 150 feet, the right side tires of the vehicle struck a low concrete abutment, and then fell about 4 feet into a dry bottomed concrete drainage area. The truck overturned clockwise and came to rest. At final rest, the truck was some 490 feet from the point where it left the roadway. A small amount of the cargo of hydrochloric acid leaked onto the ground. The truckdriver sustained minor injuries.

The 28-year-old truckdriver told the investigating officer, his employer, and the Safety Board investigator that he had fallen asleep prior to leaving the roadway. An examination of the driver's duty status records (daily logs) indicated that on a typical trip he would begin the trip during the late evening or early morning hours and drive to his destination. If he arrived at his destination before his scheduled unloading time, he would sleep in the truck's sleeper berth until delivery could be made. After making his delivery, which was usually scheduled to occur before 8 a.m., he would return to his home terminal, normally by midday, and then go off duty.

While off duty, the truckdriver's afternoon and evening hours were divided between sleep and family duties, and he reported the usual afternoon sleep period was often made difficult by oppressive midday temperatures, daytime noises, and

telephone calls. The following table outlines his duty/sleep pattern for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
TUE	-- 2045	-- 4.25	0000 --	9.5 --
WED	-- 0500	-- 5.5	0100 2000	4 12
THU	0800 1330 2230	4 1.5 7	1900 --	3.25 --
FRI	-- 0800 2245	-- 5.75 6.75 at time of accident	0515 1345	2.75 4.75

On the day before the accident, the driver's sleep was interrupted after less than 5 hours by a telephone call from his employer's dispatcher advising him of his driving assignment for that evening. The driver did not go back to sleep after receiving his dispatch.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep.

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

CASE NO. 7

Investigation No: SRH-93-T-HF05
Type of Accident: Run Off Road, Collision With Fixed Object
Accident Location: Hartselle, Alabama
Date and Time: October 15, 1992; at 7:45 a.m. c.d.t.
Ambient Conditions: Clear and dry; daylight
Vehicle(s) Involved: 1983 International tractor combination with a partially loaded van semitrailer
Occupants: 1
Injuries: Minor
Duty/Sleep Information:
Duration of most recent sleep period: 8.00 hours
Number of hours since last slept: 7.75 hours
Number of hours on duty since last slept: 6.75 hours
Duty/sleep pattern: Regular duty/sleep hours

Description of the Accident:

The combination unit was traveling southbound on a straight and level section of State Route 65 when the vehicle ran off the right side of the roadway and across the shoulder, which was covered with rumble strips, at a 6-degree angle. The unit continued straight ahead along an 18-percent grade grassy embankment for 460 feet with no braking or steering input. The unit then struck several trees and continued another 110 feet before coming to rest. The truckdriver sustained minor injuries.

The 45-year-old truckdriver stated that some papers and booklets fell from an interior overhead compartment onto his right leg and the floor, and that when he reached down to recover the items his truck veered off the roadway. He said that after he was on the embankment he had steering control but intentionally did not steer to his left or brake because he thought to do so would cause his vehicle to overturn. The truckdriver was very familiar with the highway, and the unit had only a partial load, 450 pounds of clothing.

The truck would have traveled over the rumble strips for approximately 1.8 seconds or about 150 feet at 55 to 60 mph. Sufficient auditory warning would have been produced to alert an awake but distracted driver that his truck was traveling off the road and that action was needed. With only a 3.8-percent slope of the shoulder, the driver should have been able to redirect his vehicle onto the road if he had been alert.

The truckdriver routinely worked between midnight and 10 a.m. On the morning of the accident, the truckdriver went on duty at 1 a.m., and had been on duty 6.75 hours and driving 5.75 hours when the accident occurred. Although not excessive, the early morning hours extending into daylight are when drivers are most vulnerable to drowsiness. Given the likely circumstances had the driver taken evasive action, it is reasonable to conclude that the accident occurred because the truckdriver momentarily fell asleep.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 8

Investigation No:	SRH-93-T-HF06
Type of Accident:	Jackknife
Accident Location:	Athens, Alabama
Date and Time:	October 16, 1992; at 8:30 a.m. c.d.t.
Ambient Conditions:	Rainy and wet; daylight
Vehicle(s) Involved:	1992 Freightliner tractor in combination with an empty van semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	3 hours (2.5 actual)
Number of hours since last slept:	1 hour
Number of hours on duty since last slept:	1 hour
Duty/sleep pattern:	Irregular duty/sleep hours Exceeded hours-of-service limits

Description of the Accident:

The combination unit traveling in rain turned onto an off ramp that transitions from westbound Interstate 565 to Interstate 65 southbound. As the unit was entering Interstate 65, it skidded off the left side of the roadway and came to rest in the median. The truckdriver received minor injuries.

The 27-year-old truckdriver stated that he was driving about 60 mph when his truck began skidding as he entered Interstate 65 southbound. The truckdriver admitted that he failed to reduce his speed for safe travel through the interchange on the wet roadway.

Three days before the accident, the truckdriver was on duty 19.5 hours of which he drove a unit 16 hours, exceding the hours-of-service 10-hour and 15-hour rules. The next day, he went on duty at 5:30 a.m. for 1 hour and again at 1 p.m. for 4 hours. The following day he went on duty at 7 a.m., drove for 12 hours, and once again exceeded the 10-hour rule. After 4 hours off duty and 5.5 hours on duty not driving, the truckdriver logged 3 hours of sleep from 4:30 a.m. to 7:30 a.m. He began driving again at 7:30 a.m. and had been driving for 1 hour when the accident occurred. According to his logs, the truckdriver had only 3 hours of sleep during the 26.5-hour period before the accident. The following table outlines his duty/sleep pattern for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
MON	-- 1200	-- 4	0000 2200	7 8.5
TUE	0630	19.5 excessive		
WED	-- 0530 1300	-- 1 4	0200 0630 2200	3.5 6.5 8
THU	0700 2300	12 excessive 5.5 excessive		
FRI	-- 0730	-- 1 at time of accident	0430	3

The truckdriver's failure to respond to the wet roadway surface and reduce speed on the curve is indicative of a reduced level of alertness resulting from exceeding hours-of-service limits and insufficient sleep.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the driver to drive at a speed safe for conditions and maintain control of his vehicle due to a reduced level of alertness caused by exceeding hours-of-service limits and insufficient sleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 9

Investigation No:	WRH-93-T-HF02
Type of Accident:	Collision—Other
Accident Location:	Redding, California
Date and Time:	October 20, 1992, at 2:30 p.m. P.d.t.
Ambient Conditions:	Raining and wet
Vehicle(s) Involved:	1983 Peterbilt tractor in combination with an empty flatbed semitrailer and an empty flatbed full trailer.
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	8.25 hours
Number of hours since last slept:	8.75 hours
Number of hours on duty since last slept:	8.75 hours
Duty/sleep pattern:	Regular duty/sleep hours Duty hours could not be classified

Description of the Accident:

The combination vehicle was southbound on Interstate 5 in the outside lane traveling about 60 mph. It was raining heavily and the pavement was covered with standing water. While the vehicle was negotiating a right curve on a 3-percent upgrade, it jackknifed to the right. The jackknife caused the vehicle to rotate across both southbound lanes and into the median, where it struck a 5-foot-high dirt embankment. This impact caused the tractor to swing back in front of the trailers. The combination then continued southbound in the median for 187 feet before coming to rest facing south. The 26-year-old driver was not injured.

A review of the truckdriver's daily logs indicated he almost always returned home at the end of his work day. This accident occurred on the driver's first day back to work after having been off duty, at home, for 3 days. The driver did not have any other employment. Fatigue does not appear to be a factor in this accident. The physical evidence supports the driver's account that he lost control of the vehicle when the vehicle lost traction on the wet pavement and jackknifed.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to negotiate the curve at a speed safe for the prevailing conditions.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 10

Investigation No:	WRH-93-T-HF04
Type of Accident:	Run Off Road, Overturn
Accident Location:	Canby, California
Date and Time:	October 21, 1992, at 6:45 a.m. P.d.t.
Ambient Conditions:	Clear and dry; dawn
Vehicle(s) Involved:	1980 Peterbilt straight truck in combination with a logging dolly loaded with logs
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	7.00 hours
Number of hours since last slept:	2.75 hours
Number of hours on duty since last slept:	2.25 hours
Duty/sleep pattern:	Regular duty/sleep hours Duty hours could not be classified

Description of the Accident:

The combination unit was eastbound on a straight and level section of State Route 299. The driver stated he was sleepy and looking for a place to pull off the roadway. He saw a wide area by the side of the road but was unable to slow sufficiently to pull into it before passing it. He then continued traveling east, accelerating to a speed of about 45 mph as the vehicle was approaching a gradual right curve. At this point, the driver, by his own admission, fell asleep.

Because the driver was asleep, the vehicle, rather than following the right curve, crossed over the westbound lane and traveled onto the unpaved north shoulder. The vehicle then left the pavement at about a 10-degree angle. The vehicle's departure from the pavement startled the driver, who abruptly steered first right, then left. These abrupt steering inputs caused the vehicle to roll over onto its right side. The vehicle came to rest about 10 feet off the south edge of the roadway and about 490 feet from the point where it initially left the pavement. The driver sustained minor injuries.

The 32-year-old driver, who owned the combination unit, had been driving heavy combination units for about 4 years. The driver related that he went to bed at 9 p.m. the previous evening, got up at 4 a.m., and then departed his residence in the loaded truck about 4:30 a.m. He had driven approximately 100 miles when the accident occurred. Prior to this trip, which was on Tuesday, the driver had been off

duty the previous Saturday and Sunday and drove 9 hours on Monday. The driver related that he had slept well the night before and was unable to offer any explanation for falling asleep while driving.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 11

Investigation No:	WRH-93-T-HF03
Type of Accident:	Run Off Road
Accident Location:	Redding, California
Date and Time:	October 20, 1992 at 9:15 p.m. P.d.t.
Ambient Conditions:	Darkness, raining
Vehicle(s) Involved:	1981 Freightliner tractor in combination with a van semitrailer
Occupants:	2
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	11.00 hours
Number of hours since last slept:	12.25 hours
Number of hours on duty since last slept:	6.25 hours
Duty/sleep pattern:	Irregular duty hours

Description of the Accident:

The combination vehicle was traveling southbound on Interstate 5 on a 6-percent downgrade when it ran off the right side of the roadway at a point where the roadway curves to the left. It was raining and there was an advisory speed limit sign of 50 mph at the entrance of the curve. After the vehicle left the roadway, the right side of the vehicle scraped along a hillside. The truckdriver and his passenger were not injured.

The truckdriver stated he was traveling about 55 to 60 mph on the downgrade approaching the left curve when he felt the trailer begin to sway back and forth. Physical evidence at the accident site consisted of a 10-foot-long tire mark on the asphalt shoulder leading to tire rut marks in the soft dirt. The tire marks indicated the vehicle's wheels were not rotating when it entered the shoulder. The evidence indicated that the driver braked sharply in an attempt to negotiate the curve, but because of the speed of the vehicle and the wet pavement conditions, he was unable to stop the vehicle before it ran off the pavement. The combination unit jackknifed when it left the pavement and came to rest on the dirt shoulder.

The 43-year-old driver of the combination vehicle was a full-time employee of an interstate carrier and had been employed by the carrier for 3 months before the accident. He had a total of 6 years of truckdriving experience. On the day before the accident, he received 11 hours of sleep and was well rested at the time of the

accident. The following table outlines his duty/sleep pattern for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
FRI	--	--	Before 0000	5
	0630 1700	7.5 .5	-- 2200	-- 10.5
SAT	Off duty	--	2200	12
SUN	Off duty	--	2200	7
MON	0600	10.5	2200	11
TUE	1330 1630	1.5 4.75 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of control on the curved section of the roadway due to the incompatibility of the wet roadway, the road curvature, and the speed of the vehicle.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 12

Investigation No:	CRH-93-T-HF02
Type of Accident:	Run Off Road, Overturn
Accident Location:	Henrietta, Texas
Date and Time:	October 21, 1992, at 1:15 a.m. c.d.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1985 Peterbilt tractor in combination with a loaded flatbed semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	6.5 hours
Number of hours since last slept:	18.5 hours
Number of hours on duty since last slept:	9.25 hours
Duty/sleep pattern:	Irregular duty hours Inverted duty/sleep

Description of the Accident:

The combination unit was southbound on U.S. Route 287 on a 2.5-percent downgrade when it ran off the left side of the roadway at a 6-degree angle where the roadway curves to the right. After traveling into the earthen median, the vehicle continued ahead about 180 feet before the truckdriver steered to his right, a maneuver evidenced by furrows in the median. There was no evidence of braking. The truck overturned and came to rest on its left side 395 feet from where it first left the roadway. The truckdriver received minor injuries.

The 66-year-old truckdriver told investigating police that he thought he had a tire failure, causing him to lose control and run off the roadway. There was no evidence to support this scenario.

Daily logs maintained by the truckdriver for the 30-day period before the accident showed that he rarely was on duty driving after 11:30 p.m. The accident occurred at a time when the truckdriver was normally asleep. Further, the truckdriver was rarely on the road over night more than 1 day per week. While away from home, he usually slept in the sleeper berth. Even though the truckdriver began this trip at 10:30 p.m and was driving during his normal sleeping hours, he did not recall being overly fatigued at the beginning or during the trip. The following table outlines his duty/sleep pattern for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	-- Off duty	-- --	Before 0000 2130	8+ 11.5
SUN	1600	5.5	2130	9.5
MON	0800	10	--	--
TUE	-- 0800 1830 2230	-- 6.0 .5 2.75 at time of accident	0000	6.5

Considering that the driver had been awake for 18.5 hours before the accident, it is likely that he momentarily fell asleep. The contributing factors to the truckdriver's fatigue were his irregular duty hours, his inverted duty/sleep and lack of adequate rest before the accident trip.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 13

Investigation No:	SRH-93-T-HF07
Type of Accident:	Run Off Road, Overturn
Accident Location:	Tuscaloosa, Alabama
Date and Time:	October 21, 1992, at 6:00 a.m. c.d.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1990 International tractor in combination with a loaded flatbed semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	5.25 hours
Number of hours since last slept:	2.50 hours
Number of hours on duty since last slept:	2.50 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination unit was traveling northbound on Interstate 59 on a tangent 2.6-percent downgrade when it crossed the left rumble-stripped shoulder at a 4-degree angle and entered the grassy median. It continued ahead about 320 feet before the truckdriver steered to his right, a maneuver evidenced by furrows in the median. The combination unit overturned counterclockwise and came to rest in the median about 550 feet south of where it first left the roadway. The truckdriver sustained minor injuries.

The 29-year-old truckdriver told the investigating police that he "was passing a car and got into the soft part and overturned." In a later comment, the truckdriver said that when passing a car he perceived that the left front of his truck "gave way," and he thought that something had hit the wheels. There was no evidence to support the truckdriver's explanation, and no evidence of a pre-accident mechanical defect on the combination unit.

Daily logs maintained by the truckdriver for 30 days showed that there was considerable variation in the time of day that the long-haul truckdriver went on duty. He routinely drove the maximum number of hours allowed by regulation and was on the road for several days at a time. His sleep periods were usually no more than 4 hours and always taken in the sleeper berth. The following table outlines his duty/sleep pattern for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	-- Off duty	-- --	Before 0000 2200	7+ 8
SUN	Off duty	--	2100	3
MON	0000 0900 1900 2345	5 4.5 1 4.25	0500 1330 2000	4 5.5 3.75
TUE	-- 0800 1400 2000	-- 2.75 1.5 2.25	0400 -- 1530 2215	4 -- 4.5 5.25
WED	0330	2.5 at time of accident		

The truckdriver would not respond specifically when asked if he became inattentive because of fatigue and consequently ran off the roadway. However, given the physical evidence and his irregular duty/sleep, it is reasonable that he was fatigued and momentarily fell asleep.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 14

Investigation No:	WRH-93-T-HF05
Type of Accident:	Overturn
Accident Location:	Bieber, California
Date and Time:	October 22, 1992, at 11:45 a.m. P.d.t.
Ambient Conditions:	Clear and dry; daylight
Vehicle(s) Involved:	1989 Peterbilt straight tank truck in combination with a tank full trailer, both loaded with jet fuel
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	9.5 hours
Number of hours since last slept:	5.75 hours
Number of hours on duty since last slept:	3.75 hours
Duty/sleep pattern:	Regular duty/sleep hours Duty hours could not be classified

Description of the Accident:

The combination unit was traveling westbound on County Road A-2 at a driver stated speed of 50 to 55 mph. While rounding a left curve, the vehicle traveled onto the right gravel shoulder, then came back on the roadway, and the tank trailer overturned onto its right side. The tank truck then traveled 300 feet forward on the roadway, pulling the overturned trailer behind it. The trailer was punctured and its cargo of 8,000 gallons of jet fuel spilled. The truck came to rest upright in the eastbound lane facing west 500 feet from the point where it first left the roadway, with the overturned trailer still in tow. The truckdriver was not injured.

The truckdriver stated that just before the accident, he looked into the rearview mirror and noticed a tour bus following him. He thought this may have distracted his attention from the driving task. The driver then "felt something" and looked into his mirror and saw the tanker trailer off the road and going sideways. He stated that he then steered to the left and brought the truck to a stop on the roadway.

The 48-year-old driver had 22 years of experience driving heavy combination vehicles, of which 4 years were driving tanker trucks. The driver had been off duty 2 days before the accident. On the morning of the accident, he got up at 6 a.m. and arrived for work at 7:30 a.m. After loading the tankers, he departed Sparks, Nevada, at 8:30 a.m. He had driven about 155 miles when the accident occurred.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's inattention to the driving task and his inability to recover after drifting off the roadway.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 15

Investigation No:	SRH-93-T-HF08
Type of Accident:	Run Off Road, Overturn
Accident Location:	Brunswick, Georgia
Date and Time:	October 23, 1992, at 5:15 a.m. e.d.t.
Ambient Conditions:	Dark; clear and dry
Vehicle(s) Involved:	1977 Peterbilt tractor in combination with a loaded semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	11 hours
Number of hours since last slept:	20.25 hours
Number of hours on duty since last slept:	8.25 hours
Duty/sleep pattern:	Inverted duty/sleep Irregular duty hours

Description of the Accident:

The combination unit was traveling southbound on a straight and level section of Interstate 95, when the unit ran off the right side of the roadway. The unit continued to travel away from the roadway for 335 feet at about a 10-degree angle. As the vehicle was slowing to a stop, it overturned onto its right side and came to final rest against some trees. The truckdriver sustained minor injuries.

Although the 33-year-old truckdriver stated that at the time of the accident he was reaching for a piece of candy from a bag that had fallen out of the seat, the available evidence indicated that he may have been operating at a reduced level of alertness. The work schedule of the driver varied considerably during the week preceding the accident. He had only 3.75 hours of sleep in the 24 hours before the accident, and he had inverted his work and rest periods by going to work at the time he normally goes to sleep. Therefore, the accident occurred at a time when he was normally off duty and asleep. The following table outlines his duty/sleep pattern for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SUN	-- Off duty	-- --	Before 0000 2000	7+ 11
MON	0700	6.5	2000	11
TUE	0930	6.5	2100	11
WED	0930 1500	3.5 3	-- 2200	-- 11
THU	2100	8.25 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 16

Investigation No:	WRH-93-T-HF08
Type of Accident:	Non-Collision
Accident Location:	Valencia, California
Date and Time:	October 23, 1992, at 6 p.m. P.d.t.
Ambient Conditions:	Cloudy, daylight
Vehicle(s) Involved:	1977 Kenworth COE tractor in combination with a van semitrailer and a full trailer, loaded with cotton seeds
Occupants:	1
Injuries:	Moderate
Duty/Sleep Information:	
Duration of most recent sleep period:	5 hours
Number of hours since last slept:	16 hours
Number of hours on duty since last slept:	15 hours
Duty/sleep pattern:	Regular duty/sleep hours ¹ Exceeded hours-of-service limits

Description of the Accident:

The combination unit had just left southbound Interstate 5 and was traveling on a one-way, two-lane, truck bypass road when it entered a 500-foot-long tunnel which curved to the left. It had been raining and the roadway was wet. "Slippery When Wet" warning signs were posted ahead of the tunnel entrance. After the vehicle entered the tunnel, the tractor slid into the left lane and began scraping the tunnel wall. The vehicle traveled an additional 300 feet before it came to rest in a lefthand jackknifed position with the tractor facing east in the left lane, the first trailer facing southwest in the left lane, and the second trailer facing south and straddling the left lane and paved shoulder. The driver sustained moderate injuries.

According to the 28-year-old truckdriver, he was traveling 35 to 40 mph when he lost control. The driver does not remember much about the accident other than sliding and striking the tunnel wall. He does not remember for sure if he applied his brakes.

¹ The criteria used by the Safety Board to determine if the driver's sleep hours were irregular would dictate that this driver had irregular sleep because of a 2-hour nap on Wednesday which resulted in two consecutive sleep period start times varying by more than 2 hours. However, because his main sleep period always began between 9 and 9:30 p.m. and the duration was consistent, this case shall be an exception to the rules and his sleep hours are classified as regular.

A witness who was following the accident vehicle told the police that the accident involved truck was negotiating the curve when brakes were applied. According to the witness, the vehicle began to jackknife and then veered into the wall.

The driver had a total of 6 months of experience in heavy combination vehicles and had worked for the employing motor carrier for 2 weeks. The truckdriver exceeded the hours-of-service 10-hour driving rule on the day before his accident, and he was close to exceeding the 15-hour rule at the time of his accident as he had been on duty 15 hours. The driver averaged between 4 and 5 hours of sleep per night; however, in his interview, he said he requires between 6 and 8 hours to feel fully rested. The following table outlines the driver's duty/sleep pattern for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
MON	--	--	2100	4.5
TUE	0300	15	2130	5
WED	0230	11.5	1600 2130	2 4
THU	0300	14 excessive	2100	5
FRI	0300	15 at time of accident		

The driver's excessive duty hours combined with his insufficient rest caused him to be in a state of reduced alertness which contributed to his responses during the accident sequence. Further, the driver said he does not remember the details of the accident which is also an indication that his alertness was reduced.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of vehicle control due to braking on a wet, slippery roadway. Contributing to this accident was the driver's reduced alertness and inexperience.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 17

Investigation No:	SRH-93-T-HF10
Type of Accident:	Run Off Road, Overturn
Accident Location:	Northport, Alabama
Date and Time:	October 27, 1992 at 3:30 a.m. c.s.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1984 Peterbilt tractor in combination with a loaded van semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	3 hours
Number of hours since last sleep:	1.5 hours
Number of hours on duty since last sleep:	1.5 hours
Duty/sleep pattern:	Irregular duty/sleep hours Exceeded hours-of-service limits

Description of the Accident:

As the combination unit was traveling east on U.S. Route 82, its left wheels dropped off the edge of the roadway and entered the median area. Furrows in the median indicated that the vehicle left the pavement at a 5-degree departure angle and traveled about 600 feet before the driver attempted to steer the vehicle back onto the roadway. During this maneuver, he lost control of the unit, which traveled off the right side of the roadway for about 200 feet, overturned onto its right side, and struck several trees. The truckdriver sustained minor injuries.

The accident site on U.S. 82 is in a transition area where the divided four-lane roadway changes to a two-lane, two-way roadway. The 26-year-old truckdriver said that a vehicle passed him on the right and forced him to travel off the left side of the roadway. The furrows in the median did not indicate an abrupt steering maneuver to the left. Such movement would have supported the driver's contention that a vehicle passing on the right forced him off the road to the left. There was no evidence to confirm the driver's explanation that he was avoiding a collision.

The truckdriver had left Greenville, Mississippi at 3:30 p.m. on Monday en route to Sylacauga, Alabama with about 45,000 pounds of baled cotton. He reported he had stopped at a truck stop located about 100 miles west of the accident site and had taken a 3-hour nap in the sleeper berth from 11 p.m. to 2 a.m. before continuing his trip. The accident occurred 1 1/2 hours later at 3:30 a.m.

The truckdriver had recently moved from Texas to Mississippi to look for work. He was not a regular employee for the carrier. The driver's father was a friend of the owner who needed a driver for this particular trip. It was the first trip for the driver in the combination unit.

The precrash activity of the truckdriver could not be verified through his logbook; it was reportedly lost in the accident. The driver's verbal account of his activities on the days before his accident indicated that he exceeded the hours-of-service 10-hour driving rule. Further, he had only had 6 hours of split sleep (he slept for two 3-hour time periods) in the 24 hours preceding his accident. The wrecker driver stated that the truckdriver slept in the cab of the wrecker while recovery operations were performed. The following table outlines his duty/sleep pattern for the 6 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
THU	Before 0000	3+	0300	5
	0800	1	0900	4
	1600	13	--	--
FRI	Off duty	--	0200	7
SAT	--	--	0000	6
	Off duty	--	2200	12
SUN	Off duty	--	1800	3
	--	--	2130	2.5
MON	--	--	0400	3
	0700	4.5	--	--
	1530	6 excessive	2300	3
TUE	0200	1.5 at time of accident, excessive		

The available evidence, particularly the excessive duty hours and irregular duty/sleep, suggests that the driver's level of alertness was substantially reduced and that he momentarily fell asleep.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 18

Investigation No: SRH-93-T-HF09
Type of Accident: Overturn
Accident Location: U.S. 84 and U.S. 31, Evergreen, Alabama
Date and Time: October 27, 1992, at 5:45 a.m. c.s.t.
Ambient Conditions: Fog and dry, dawn
Vehicle(s) Involved: 1992 International tractor in combination
with a loaded van semitrailer
Occupants: 1
Injuries: None
Duty/Sleep Information:
Duration of most recent sleep period: 10.50 hours
Number of hours since last slept: 2.25 hours
Number of hours on duty since last slept: 1.75 hours
Duty/sleep pattern: Irregular duty/sleep hours

Description of the Accident:

The combination unit was traveling eastbound in dense fog on a level winding section of U.S. 84. As the unit approached the highway's intersection with U.S. 31, the driver intended to make a left turn to proceed north on U.S. 31 at a "T" intersection that was controlled by a stop sign. Tiremarks showed that the right tires of the unit made contact with and traveled over a traffic island at the intersection, and the unit came to rest overturned on its right side some 173 feet from the stop line on U.S. 84. The truckdriver was not injured. According to the police report, visibility was 0 to 50 feet at the time of the accident because of the dense fog.

According to the 23-year-old driver, he had not driven through this intersection prior to the morning of the accident. The driver stated that he was in his left turn onto U.S. 31, when he observed a vehicle coming toward him from the north. Sensing the approaching vehicle as a hazard, the driver said that he accelerated the unit to clear the intersection.

The physical evidence indicated that the unit was driven through the stop sign without stopping. The unit could not have been accelerated to overturn speed in 173 feet, which would have been the case if the unit had stopped. Therefore, the driver must have been traveling at a speed too fast for the visibility conditions.

The driver of the unit had 11 months of experience in operating combination units. He had been driving for 2 hours before the accident after 10.5 hours of off-duty

time. Although the times at which the driver began to sleep were irregular, it appears he was obtaining a sufficient amount of sleep. The following table outlines his duty/sleep pattern for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
FRI	-- 1200	-- 5.5	Before 0000 --	9.5 --
SAT	Off duty	--	0400	7
SUN	-- 0800	-- 7.25	0000 2100	7 9
MON	0700	10	1700	10.5
TUE	0330	1.75 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the driver to drive at a speed safe for existing weather conditions. Contributing to the accident was the driver's unfamiliarity with the route.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 19

Investigation No:	WRH-93-T-HF07	
Type of Accident:	Fixed Object Collision	
Accident Location:	Redding, California	
Date and Time:	October 28, 1992, at 9:20 p.m. P.s.t.	
Ambient Conditions:	Raining, wet, and darkness	
Vehicle(s) Involved:	1992 White tractor in combination with a van semitrailer, and a van full trailer, both partially loaded	
Occupants:	2	
Injuries:	2 Minor	
Duty/Sleep Information:		
Duration of most recent sleep period:	12.0 hours	
Number of hours since last slept:	2.25 hours	
Number of hours on duty since last slept:	1.25 hours	
Duty/sleep pattern:	Irregular duty/sleep hours	

Description of the Accident:

The combination vehicle was traveling about 50 to 55 mph northbound on Interstate 5 in heavy rain around a right curve on a 3-percent upgrade when the tractor began to jackknife. The vehicle then crossed the left lane and crashed into the left guardrail. The full trailer then slid along the guardrail for 105 feet before flipping over onto its top, pulling the tractor and semitrailer over onto their left sides. After overturning, the combination unit came to rest diagonally across the northbound lanes. The truckdriver and his passenger sustained minor injuries.

The 29-year-old truckdriver had 19 months of truckdriving experience. He stated that he was able to straighten the tractor and semitrailer out of the jackknife, but could not control the full trailer. Given that it was raining hard at the time and there was standing water on the roadway, a speed of 50 to 55 mph was too fast for these roadway conditions.

Daily logs maintained by the truckdriver for 30 days showed that there was some variation in the time of day that he went on duty, but the majority of his on-duty time was during the evening and night hours. During the week, the driver normally worked nights and slept during the day. On the weekends and days off, he shifted to a daytime awake schedule and slept at night. The driver's account of his time for the 5 days preceding his accident indicated that the times he began sleeping varied but that the duration of his sleep periods appeared to be sufficient. His logs

showed that he had logged 12 hours in the sleeper berth up to about 2.25 hours before the accident. The time since awakening consisted of 1 hour of waiting while the truck was loaded and 1 hour and 20 minutes of driving time. The following table outlines his duty/sleep pattern for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	--	--	0000	10
	Off duty	--	2300	10
SUN	Off duty	--	2200	2
MON	0800	.5	0830	10.5
	1900	10	--	--
TUE	--	--	0500	13.5
WED	0630 2000	.5 1.25 at time of accident	0700	12

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to negotiate the curve at a speed safe for the prevailing conditions.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 20

Investigation No:	WRH-93-T-HF09
Type of Accident:	Overturn
Accident Location:	San Diego, California
Date and Time:	October 28, 1992, at 10:15 p.m. P.s.t.
Ambient Conditions:	Raining, wet, and darkness
Vehicle(s) Involved:	1992 Freightliner tractor in combination with a loaded van semitrailer and an empty van full trailer.
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	8 hours
Number of hours since last slept:	11.25 hours
Number of hours on duty since last slept:	6.75 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination vehicle was traveling around a right curve from westbound Interstate 8 to northbound Interstate 15 when the trailers began to sway back and forth. The vehicle swerved sharply to the right, crossed the traffic lanes, and ran off the right side of the roadway where it struck a light pole. It then veered left, reentered the roadway, and overturned onto its right side. The trailers remained attached to the tractor.

At the time of the accident, it was raining heavily and the pavement was covered with standing water. A witness traveling behind the combination stated that the vehicle was traveling between 45 and 50 mph when it went out of control. At the beginning of the transition curve, there were two "right turn arrow/45 mph" advisory warning signs.

The 60-year-old truckdriver stated that a passenger car on his left cut in front of him, causing him to jam on his brakes and swerve to the right. The statement of the witness traveling behind the truck and the physical evidence on the roadway did not support the truckdriver's story.

A review of the truckdriver's daily logs showed that he had a scheduled route and that he went on duty about the same time each day. The route not only allowed him to return home at the end of his work day, but gave him weekends off. His basic

work schedule was Monday through Friday from 11 a.m. to 11 p.m. The driver's normal sleeping pattern was from midnight to 9 a.m. each day. The driver did not have any other employment.

The investigation revealed that the accident driver was making deliveries normally assigned to another driver's route, and he was running about 2 hours late. Several consignees had called the carrier complaining about the late deliveries. These circumstances probably contributed to truckdriver's traveling at a speed faster than warranted by the wet conditions on the roadway.

Fatigue did not appear to be a factor in this accident. There was no evidence to indicate that the mechanical condition of the vehicle or roadway design deficiencies were factors in this accident. The wet roadway conditions and the speed of the vehicle contributed to the vehicle's instability.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to negotiate the transition curve at a speed safe for the prevailing conditions.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 21

Investigation No: WRH-93-T-HF06
Type of Accident: Run Off Road, Collision With Fixed Object
Accident Location: Pixley, California
Date and Time: October 28, 1992, at 11:15 p.m. P.s.t.
Ambient Conditions: Clear and dry; darkness
Vehicle(s) Involved: 1982 Kenworth tractor in combination with
a loaded van semitrailer and a loaded van full
trailer
Occupants: 1
Injuries: None
Duty/Sleep Information:
Duration of most recent sleep period: 5.50 hours
Number of hours since last slept: 4.75 hours
Number of hours on duty since last slept: 4.75 hours
Duty/sleep pattern: Irregular duty/sleep hours

Description of the Accident:

The combination vehicle was traveling northbound on Interstate 5 on a straight, level section of roadway when it left the roadway to the right at a 6-degree angle. After traveling 150 feet with no evidence of braking or steering input and uprooting an 8- to 10-inch-diameter tree, the full trailer separated from the rest of the combination and overturned. The tractor and semitrailer continued forward, destroying 150 feet of barbed wire fence before coming to a stop. The truckdriver was uninjured.

The 30-year-old driver had been employed by the carrier for only 27 days before the accident. He had been driving heavy trucks for only 6 months, and during part of that time he attended a professional truckdriving school. He told investigators the reason the accident occurred was because he fell asleep while driving. He said that he was having marital problems and had not been getting adequate sleep. He had stopped and had a cup of coffee about 1/2 hour before the accident.

The driver stated that during the days before the accident, he was working a new split shift; he would start work around 7 p.m., drive for about 4 hours, be off duty until around 7 a.m., and then drive another 4 hours. A review of his hours on the days before his accident revealed that he actually began work about 6:30 p.m. for the first shift, was off duty for 4 to 6 hours, and then began the second shift as early as 1:30 a.m. The driver said that he had not adjusted to working the late night and

early morning hours. His schedule resulted in irregular duty/sleep, split sleep patterns, and inadequate sleep. The following table outlines his duty/sleep pattern for the 3 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
MON	1830	5.75	--	--
TUE	-- 0600 1830	-- 4.75 3.0	0015 1300 2130	5.75 3.5 4
WED	0130 0530 1830	1.50 5.0 4.75 at time of accident	-- -- 1300	-- -- 5.5

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 22

Investigation No:	SRH-93-T-HF11
Type of Accident:	Run Off Road, Collision With Fixed Object
Accident Location:	Opelika, Alabama
Date and Time:	October 30, 1992; at 12:00 p.m. c.s.t.
Ambient Conditions:	Cloudy and dry; daylight
Vehicle(s) Involved:	1989 Freightliner tractor in combination with a loaded van semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	3 hours
Number of hours since last slept:	3.5 hours
Number of hours on duty since last slept:	3.5 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination unit was traveling northbound on a straight section of Interstate 85 when it traveled to the left and ran off the roadway at a 5-degree angle. After traveling 505 feet across the earthen median and the southbound roadway lanes, it struck the W-beam guardrail on the west side of the southbound lanes. The unit then traveled north along the right southbound shoulder for an additional 195 feet before overturning onto the guardrail. The truckdriver sustained minor injuries.

The 45-year-old truckdriver said that his last recollection before the accident was that he was northbound in the left travel lane and was beginning to travel up a slight upgrade. He said that his next perception was after his unit was in the median. At that time, he attempted to regain control of the vehicle. The truckdriver said that, although it had never happened before, he could not remember running off the road, and he admitted that he "must have gone to sleep." The truckdriver further indicated that he was probably awakened as his vehicle angled across the rumble strips on the left shoulder.

Daily logs revealed that 5 days before the accident the truckdriver departed home and went on duty at 2 p.m., and that at the time of the accident, he had logged 55.25 on-duty hours; 52.5 hours of which were driving. Using data contained in logs, it was determined that during this period the truckdriver drove 3,624 miles. The following table outlines his duty/sleep pattern for the 6 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SUN	1400	6.25	2015	8.75
MON	0500	10	1700	7
TUE	0000 0700	3 7	-- 1600	-- 8
WED	0000 0700	2.5 8.25	0230 1515	4.5 9.25
THU	0030	10.25	1600	8
FRI	0000 0830	5.5 3.5 at time of accident	0530	3

Driving 3,624 miles in 52.5 hours would require an average speed of 69 mph, an average speed not likely for a combination unit. Prior to the accident, the truckdriver's logs showed 5.5 hours driving for a distance of 219 miles, an average speed of 39.8 miles per hour. At that more reasonable average speed, it would have taken him about 90 hours to drive the 3,624 miles. Therefore, of the hours that the truckdriver logged as off duty and sleep time, about 38 hours (90 - 52 = 38) were probably devoted to driving. Therefore, it is reasonable that the truckdriver was well in excess of allowed duty hours and short on rest hours. The available evidence suggests that the truckdriver's level of alertness was probably substantially diminished, that he was fatigued, and that he momentarily fell asleep.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 23

Investigation No:	CRH-93-T-HF05
Type of Accident:	Run Off Road, Overturn
Accident Location:	Lindale, Texas
Date and Time:	November 1, 1992, at 2:00 a.m. c.s.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1988 Peterbilt tractor in combination with a loaded livestock semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	8.5 hours
Number of hours since last slept:	20.5 hours
Number of hours on duty since last slept:	11.75 hours
Duty/sleep pattern:	Irregular duty hours Inverted duty/sleep

Description of the Accident:

The combination unit was westbound on a straight section of Interstate 20 on a 3-percent downgrade when it ran off the roadway into the median at a 3-degree angle. The vehicle continued ahead about 170 feet before the truckdriver steered to his right, a maneuver evidenced by furrows in the median. As the tractor reentered the roadway with the semitrailer continuing to offtrack in the median, the combination overturned, slid another 172 feet, and came to rest on its left side 507 feet west of where it first left the roadway. The truckdriver sustained minor injuries.

The 31-year-old truckdriver told investigating police that he had fallen asleep. The shallow angle of departure from the roadway supports the truckdriver's statement.

The investigation revealed that during the 30-day period prior to the accident there was considerable variation in the time of day that the long-haul truckdriver went on duty. He routinely drove the maximum number of hours allowed by regulation and was on the road several days at a time. His sleep periods while on the road varied and were always taken in the sleeper berth. The following table outlines his duty/sleep pattern for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
TUE	-- 0930	-- 8.5	0100 2300	8 10
WED	Off duty	--	2300	10
THU	Off duty	--	2300	8.5
FRI	0930	8.5	2100	8.5
SAT	0530 1930	5.25 6.5 at time of accident	--	--

The driver began the accident shift shortly before his usual bedtime and was driving through the hours he usually slept. At the time of his accident, he had driven exactly 10 hours which means he was about to violate the hours-of-service 10-hour rule. As a result of the irregular duty hours and inverted duty/sleep, the driver was fatigued and, as he admitted, fell asleep.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 24

Investigation No:	SRH-93-T-HF14
Type of Accident:	Overturn
Accident Location:	Ethelsville, Alabama
Date and Time:	December 3, 1992, 7:15 a.m. c.s.t.
Ambient Conditions:	Clear and dry; daylight
Vehicle(s) Involved:	1984 International tractor in combination with a loaded tank semitrailer
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	6.75 hours
Number of hours since last slept:	2.50 hours
Number of hours on duty since last slept:	1.75 hours
Duty/sleep pattern:	Irregular duty hours

Description of the Accident:

The combination vehicle was traveling westbound on U.S. 82 exiting a lefthand curve on a 2-percent downgrade when the truckdriver stated he observed an automobile and combination unit ahead slowing to a stop for a schoolbus loading students. After braking and realizing that he would be unable to stop before colliding with the vehicles ahead, the truckdriver steered off the roadway to the right. After traveling along the shoulder for 50 feet, the vehicle overturned onto its right side. The 47-year-old truckdriver was not injured.

Records indicated that the driver had worked 11 consecutive days without a day off. However, a 30-day review of the driver's daily logs did not reveal any hours-of-service violations. The driver stated that although he went on duty at various times and often worked split shifts, his work schedule allowed him to return home every evening and receive adequate rest. The following table outlines his duty/sleep pattern for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	-- 0815	-- 5	Before 0000 2300	6+ 6.5
SUN	0630	4	2200	10
MON	1000 1745	4.75 4.5	-- 2330	-- 4.25
TUE	0445 1045	3.75 4	-- 2200	-- 7.75
WED	0630 1115 1445	3.25 1.75 4.5	-- -- 2200	-- -- 6.75
THU	0530	1.75 at time of accident		

There was no evidence to indicate that the mechanical condition of the vehicle, the roadway, the weather, or driver fatigue were factors in this accident.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the inability of the driver to stop his vehicle without leaving the roadway in an effort to avoid hitting stopped traffic.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 25

Investigation No:	SRH-93-T-HF12
Type of Accident:	Run Off Road, Collision With Fixed Object
Accident Location	Somerville, Alabama
Date and Time:	November 5, 1992 at 4:30 a.m. c.s.t.
Ambient Conditions:	Rainy and wet; foggy and dark
Vehicle(s) Involved:	1986 International tractor in combination with a loaded van semitrailer
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	5 hours
Number of hours since last slept:	2.50 hours
Number of hours on duty since last slept:	2.50 hours
Duty/sleep pattern:	Irregular duty hours Exceeded hours-of-service limits

Description of the Accident:

As the combination unit was traveling northbound on State Route 67, the vehicle ran off the right side of the roadway at about a 10-degree angle, traveled about 500 feet forward, and struck a concrete culvert. The vehicle then continued forward another 300 feet, traveled down an embankment, and came to rest in an upright position. The truckdriver was not injured.

The 45-year-old truckdriver reported that it was foggy and he was having trouble seeing the roadway. He said that when the unit's wheels dropped off the edge of the pavement, he attempted to steer it back but was unsuccessful because of the soft shoulder.

The truckdriver said that he had stopped in Gadsden on Wednesday evening, slept for about 5 hours in the cab of the tractor, which was not equipped with a sleeper berth, and left Gadsden about 2 a.m. the morning of the accident. He also indicated that he had slept in the cab on other occasions as well, and he rated the quality of this sleep as poor. The following table outlines his duty/sleep pattern for the 5 days before his accident.

Day	Began Driving	Hours Driving	Began Sleep	Hours Slept
SUN	--	--	Before 0000	8+
	1400	5.5	--	--
	2045	3.25	--	--
MON	--	--	0000	8
	Off duty	--	2100	4
TUE	0100 0900	6 3.25	2100	7
WED	0400	16 excessive	2100	5
THU	0200	2.5 at time of accident, excessive		

The driver did not comply with the hours-of-service 15-hour rule on Wednesday and continued in non-compliance when he began driving at 2 a.m. on the day of the accident. He was in non-compliance of the 10-hour rule at 3 a.m., 1.5 hours before the accident occurred.

The physical evidence and the driver's duty/sleep pattern and lack of proper rest suggests that the truckdriver likely fell asleep momentarily before leaving the roadway.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 26

Investigation No:	WRH-93-T-HF10
Type of Accident:	Overturn
Accident Location:	Newberry Springs, California
Date and Time:	November 6, 1992, at 12:30 p.m. P.s.t.
Ambient Conditions:	Clear and dry; daylight
Vehicle(s) Involved:	1992 International tractor in combination with a flatbed semitrailer loaded with lumber
Occupants:	2
Injuries:	2 Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	9 hours
Number of hours since last slept:	7.5 hours
Number of hours on duty since last slept:	7.5 hours
Duty/sleep pattern:	Irregular duty hours Exceeded hours-of-service limits

Description of the Accident:

The driver reported that as the combination unit was traveling eastbound in the right lane of Interstate 40, he began feeling hot and faint. He stated he rolled down his window and was steering onto the paved shoulder when he "blacked out." The driver's wife, who was sitting in the passenger seat, noticed that her husband had passed out, and she attempted to steer the vehicle onto the shoulder. After striking a curb, the unit left the roadway, went down an embankment, and overturned onto its right side. Both occupants sustained minor injuries.

After the 53-year-old driver was admitted to a nearby hospital, it was determined that he had a cardiac-related ailment and a pacemaker was implanted. The driver had received his most recent Department of Transportation physical examination on May 13, 1991, at which time he reported no previous medical history of cardiovascular disease or seizures, fits, convulsions, or fainting.

The driver had been on the road for 40 days, and for the 5 days preceding his accident, his duty hours were irregular. On the day before his accident, he had exceeded the hours-of-service 10-hour rule. He stated that on the night before the accident he slept about 9 hours in the "sleeper berth" and then got up at 5 a.m. He described the quality of his rest in the sleeper berth, where he usually obtained his rest while on a trip, as "fair." He drove nonstop for 240 miles before stopping at a truck stop where they refueled and ate a snack. The accident occurred about

30 minutes after departing the truck stop. The following table outlines his duty/sleep pattern for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
MON	--	--	2000	11
TUE	1000 1800	6 3.5	-- 2130	-- 8.5
WED	0600 1530	1 5	-- 2100	-- 9
THU	0600	14 excessive	2000	9
FRI	0500	7.5 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver running off the roadway after fainting due to a cardiac-related ailment.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 27

Investigation No:	CRH-93-T-HF06
Type of Accident:	Run Off Road, Overturn
Accident Location:	Near Pecos, Texas
Date and Time:	November 11, 1992, at 2:15 a.m. c.s.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1991 Peterbilt tractor in combination with loaded van semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	4.00 hours
Number of hours since last slept:	3.25 hours
Number of hours on duty since last slept:	3.25 hours
Duty/sleep pattern:	Irregular duty hours Exceeded hours-of-service limits

Description of the Accident:

The combination unit was eastbound on Interstate 20 when the left-side tires ran off the paved shoulder onto the grass median at a 4-degree angle. After traveling about 86 feet with the left tires off the pavement, the truckdriver began braking the vehicle, based on skid marks on the pavement that were attributed to the right drive axles' tires. After traveling another 214 feet, the left tires returned to the pavement. The vehicle then overturned onto its left side and slid another 300 feet before coming to rest blocking both travel lanes. The truckdriver sustained minor injuries.

When first interviewed, the 47-year-old truckdriver stated that he was traveling in the right lane at 55 to 60 mph when he attempted to reach across the dashboard for a can of snuff. As he did so, the vehicle wandered into the median, where he lost control. When asked how he could drift across two traffic lanes and the shoulder in the time it took to grasp a can of snuff, the driver then stated that he was in the left lane, attempting to avoid rough pavement, rather than the right lane as he first related. The truckdriver denied having fallen asleep at the wheel.

At the time of the accident, the driver was within 420 miles of completing a 3,000 plus mile roundtrip in 5 days. He stated he had not exceeded the hours of service at the time of the accident, but would have within the last 200 miles of the trip. The truckdriver did not respond to Safety Board requests for his driver's logs

for the 2 days before the accident. His employer also claimed that the driver would not respond to a request for logs.

The truckdriver alleged that his employer caused him to drive in excess of the maximum number of hours allowed by regulation in transporting perishable produce from California to northeast Texas. He said, "They just push us too hard." The truckdriver admitted that he routinely falsified his log book to cover hours-of-service violations. He stated that in the event that he might be stopped by police and his log book checked, he would rather be cited for failing to complete his log than for violating the hours-of-service regulations. The financial and other penalties for incomplete logs were less than those for an hours-of-service violation.

Analysis of the distances traveled, first skidding, then sliding and overturning, indicated that at the time the vehicle first left the roadway it was traveling in excess of 68 mph. The high speed of the accident vehicle when considered in combination with the rapid reaction of the driver in applying the brakes and steering to the right just 86 feet after leaving the roadway, suggest that the driver had not fallen asleep at the time of the accident.

The small 4-degree angle of departure from the left lane of the roadway onto the grass median is consistent with a decreased state of alertness, possibly as a result of drowsiness or a distraction inside the vehicle. Although the driver claimed that he did not "fall asleep," his duty/sleep hours indicated that he was probably fatigued at the time of the accident. Further, the driver claims he was not in excess of the hours-of-service rules, but his account of time shows that he drove for 7.5 hours, was off duty for only 5.5 hours, and then drove an additional 3.25 hours to the accident site. At that time, he was in non-compliance by 0.75 hours of driving. The following table outlines his duty/sleep pattern for the 2 days before his accident, based on the truckdriver's verbal account of the 2 days.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
MON	Before 0000 1030	2.5+ 9.5	0230 2030	8 11.5
TUE	1000 2300	7.5 3.25 at time of accident, excessive	1900	4

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain proper control of his vehicle due to inattention. Contributing to this accident was the driver's long and irregular duty hours and the excessive speed of the vehicle at the time of the accident.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.****CASE NO. 28**

Investigation No.: WRH-93-T-HF11
Type of Accident: Overturn
Accident Location: Blythe, California
Date and Time: November 12, 1992, at 2:30 a.m. P.s.t.
Ambient Conditions: Clear and dry, darkness
Vehicle(s) Involved: 1987 Freightliner COE tractor in combination
with a 1987 Trailmobile refrigerator van
semitrailer
Occupants: 1
Injuries: Minor
Duty/Sleep Information:
Duration of most recent sleep period: 8.5 hours
Number of hours since last slept: 17.5 hours
Number of hours on duty since last slept: 6.0 hours
Duty/sleep pattern: Irregular duty/sleep hours
Inverted duty/sleep

Description of the Accident:

The combination vehicle was eastbound on Interstate 10 in the left lane traveling approximately 55 mph en route from Pasadena, California to Phoenix, Arizona. The vehicle ran off the left side of the roadway at about a 10-degree angle into the center median. After traveling in the median for 500 feet, the truck reentered the highway at a sharp angle, jackknifed, and overturned. After overturning, the vehicle slid 150 feet and came to rest facing north and blocking both lanes of travel. The truckdriver received minor contusions.

The 30-year-old truckdriver said that there were two vehicles stopped along the right shoulder with their lights off and that, suddenly, both vehicles moved into his travel lane. He stated that he steered sharply to the left to avoid a collision. He related that he did not believe he left the roadway. When he swerved back into his lane of travel, the vehicle overturned. He stated that the two other vehicles did not stop.

The driver had been employed by the carrier for 3 years and had been driving heavy trucks during that period. His driving responsibilities included making two nighttime round trips to Phoenix each week along this same route. A typical one-way trip required about 10 hours to complete.

The following table outlines the driver's duty/sleep pattern for the 4 days before his accident. This trip was the beginning of the second round trip of the week. Although he had been off duty for 20.5 hours, he had been awake for 17.5 hours at the time of the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SUN	-- 1100	-- 10	Before 0000 2100	9+ 10
MON	-- 2200	-- 8.75	1800 --	4 --
TUE	-- 1445	-- 9.75	0645 --	8 --
WED	-- 2030	-- 6 at time of accident	0030	8.5

The driver's version of the accident sequence was not corroborated by the physical evidence. The physical evidence indicated that the vehicle departed the roadway at a shallow angle and traveled in the median for about 500 feet before the driver took any action. This physical evidence, the early morning hour when the accident occurred (2:30 a.m.), and the fact that the driver had been awake for 17.5 hours, had inverted his duty/sleep hours, and had been working for 6 hours at the time of the accident indicated that the driver probably fell asleep.

Probable Cause:

The National Transportation Safety Board determines the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 29

Investigation No:	WRH-T-HF12
Type of Accident:	Overturn
Accident Location:	Weed, California
Date And Time:	November 17, 1992, at 3:30 a.m. P.s.t.
Ambient Conditions:	Cloudy, cold, wet roadway, darkness
Vehicle(s) Involved:	1988 Peterbilt, conventional tractor in combination with a loaded 1989 Western flatbed semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	2 hours
Number of hours since last slept:	11 hours
Number of hours on duty since last slept:	6.5 hours
Duty/sleep pattern:	Inverted duty/sleep Irregular sleep hours Duty hours could not be classified

Description of the Accident:

The combination vehicle was southbound on Interstate 5 in a mountainous, rural area in northern California. The driver was familiar with the route, as he drove it frequently, and knew that he was approximately 2 miles from the nearest off-ramp on a 4-percent upgrade. The driver reported that at this point he felt the load of rolled paper shift to the right. He stated that he crested the top of the hill about 45 mph and took the off-ramp to the City of Weed. He reported that he attempted to gain control of the load by accelerating. The vehicle overturned onto its right side near the bottom of the ramp and slid across an intersection. The vehicle came to rest in the dirt field on the southwest corner of the intersection. The rolls of paper came off the truck and were scattered in the dirt field. The truckdriver received minor injuries.

The 49-year-old truckdriver said that the vehicle had been loaded with 8 rolls of paper at a paper mill in southern Oregon for delivery to the City of Industry in southern California. The paper rolls were loaded vertically (on end) by the employees of the paper mill and secured by 4-inch-wide synthetic webbing binders across the top of each roll. The adequacy of the load securement devices could not be determined.

The 1,450-foot-long off-ramp is on a 5-percent downgrade and is relatively level (no superelevation). At the foot of the off-ramp is the intersection with North Weed

Boulevard; the ramp then continues back onto the highway. The weather was cloudy and the roadway was wet, although it was not raining at the time of the accident. There were no street lights in the area.

The driver's daily log book indicated he was on the first day of his first trip of the week. The following table outlines the driver's duty/sleep pattern for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
FRI	--	--	Before 0000	6.75+
	0645	5.25	1200	3
	1500	2.75	1745	1.75
	1930	2.75	2215	9
SAT	0715	8.25	2130	9
SUN	Off duty	--	1200	1
	--	--	2130	9
MON	-- 2100	-- 6.5 at time of accident	1430	2

His rest hours were classified as irregular and he had inverted his duty/sleep pattern on the accident day. Although the driver had 9 hours of sleep on Sunday night, he had only 5 hours of sleep in the past 24 hours. He had been awake for 11 hours and driving 6 hours at the time of his accident.

If the driver felt his load shift at the point he reported, his decision to continue driving for 2 miles with a shifting load would not be prudent, even though he was apparently aware of an exit ramp 2 miles ahead. More importantly, however, his decision to accelerate his vehicle to correct for the shifting load would not be proper corrective action. Although the truckdriver's explanation of the accident sequence cannot be disputed based on the physical evidence, Safety Board investigators believe that equally plausible, given the driver's duty/sleep pattern and his inadequate amount of rest, is that the driver's reduced state of alertness caused him to misjudge the exit speed and not slow for the stop sign. An excessive exit speed may have caused the vehicle to overturn and dump its load of paper rolls. The truckdriver may have recognized that it was time to exit the roadway despite a reduced state of alertness but failed to exit the ramp at a speed safe for the prevailing conditions.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of control of the vehicle due to either an improper maneuver to correct a load shift or the driver's reduced state of alertness.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 30

Investigation No.	WRH-93-T-HF13	
Type of Accident:	Non-Collision	
Accident Location:	Woodland, California	
Date and Time:	November 19, 1993, at 10:15 a.m. P.s.t.	
Ambient Conditions:	Cloudy and raining; daylight	
Vehicle(s) Involved:	1975 White Freightliner, 2 axle COE tractor, in combination with two 1981 Titan, 24-foot empty "bin trailers"	
Occupants:	1	
Injuries:	Minor	
Duty/Sleep Information:		
Duration of most recent sleep period:	5 hours	
Number of hours since last slept:	6.25 hours	
Number of hours on duty since last slept:	5 hours	
Duty/sleep pattern:	Regular sleep hours	Duty hours could not be classified

Description of the Accident:

The combination unit was traveling northbound on a flat straight section of County Road 102. It was raining and the roadway was slippery. While traveling at a speed of 45 to 50 mph, the driver felt the drive wheels spinning and he let off of the accelerator. After resuming acceleration, the wheels started to spin again. He again let off of the accelerator and began to slide. As the driver attempted to steer the tractor straight, the entire combination unit slid to the left, crossed over the southbound lane, and went onto the earthen shoulder. It came to rest in a righthand jackknifed position with the tractor facing northwest and the trailers facing south. The tractor received moderate damage, the first trailer minor damage, and the second trailer was undamaged. The driver sustained only minor injuries.

The 54-year-old driver had about 30 years of experience driving combination units with double trailers, all of which were with the same carrier. The driver's experience consisted mainly of hauling produce from the fields to large produce distributors in central California.

The tractor was equipped with a Jacobs Engine Brake, which was found to be in the "off" position during the postaccident examination. The driver related that it was "off" during the time of the occurrence and that he knew not to use it on slippery

roads. The driver also related that when the tow truck came to the scene, it slid past the accident site when attempting to stop.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of control of the vehicle on the wet and slippery roadway.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 31

Investigation No:	CRH-93-T-HF07
Type of Accident:	Non-Collision
Accident Location:	Near Benavides, Texas
Date and Time:	November 21, 1992, at 12:30 p.m. c.s.t.
Ambient Conditions:	Clear and dry; daylight
Vehicle(s) Involved:	1987 Mack conventional tractor in combination with a loaded tanker semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	8.5 hours
Number of hours since last slept:	7.5 hours
Number of hours on duty since last slept:	5.75 hours
Duty/sleep pattern:	Regular duty/sleep hours ²

Description of the Accident:

The combination unit was traveling westbound on State Route 359 in a rural area. Evidence at the scene indicated that the combination unit began to skid while in the traveled portion of the westbound lane, jackknifed with the tractor rotating clockwise, and then skidded to a stop along the north side of the roadway in a total distance of approximately 380 feet; 300 feet of which was on pavement and an additional 80 feet along the dirt and grass shoulder. Tiremarks along the paved surface of the roadway indicated that the tractor drive wheels (#2 and #3 axles) both left visible bounce skidmarks on the roadway. The #5 axle of the trailer left a visible skidmark on the pavement. The steer axle of the tractor and #4 trailer axle left no visible skidmarks.

The 20-year-old driver stated that he had been operating his vehicle westbound at 54 to 55 mph when the brakes suddenly applied without warning. The vehicle began to skid and he lost control. After the vehicle skidded to a stop, the engine was still running and the driver turned off the key.

² Based on the classification rules for this study, the driver's duty hour start times are irregular. However, the irregularity is based on one extra 2.25-hour shift that was worked 3 days before the accident day beginning at 9:15 p.m. and was within the hours-of-service regulations. All other work start times were consistently between the hours of 6:30-8 a.m. His sleep start times were regular based on the classification rules for this study.

During the postaccident vehicle examination, the air brake system to the trailer was fully pressurized and found to be free of mechanical defect. However, the #4 axle brakes were badly out of adjustment and incapable of providing sufficient braking force to cause the tires to skid. Both the #4 and #5 axles of the trailer were equipped with spring brakes, but only the #2 axle of the tractor was so equipped. Therefore, in order for the #3 axle to have locked and skidded during the accident sequence, the foot brake had to have been applied by the driver, and the clutch had to have been depressed so as to allow the engine to continue to run while the drive wheels were locked and skidding. The driver had 3 years of experience operating heavy trucks and 2 months of experience in this particular rig.

The driver denied having applied the foot brake. However, the circumstances of this accident strongly suggest that the driver attempted to stop his truck-tractor and empty semitrailer quickly in order to render aid at an accident scene. An abandoned/wrecked passenger vehicle was located in a field just south of the roadway, lying on its top. Police had investigated this accident 8 days before; the path of the vehicle off the roadway and through the field was still clearly visible.

The driver denied any knowledge of the abandoned/wrecked passenger vehicle. However, the skidmarks from the combination unit began at a point consistent with the driver's first opportunity to have seen the vehicle at rest.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of control of the vehicle due to an inappropriate brake application.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 32

Investigation No:	SRH-93-T-HF13
Type of Accident:	Overturn
Accident Location:	Cordele, Georgia
Date and Time:	November 23, 1992, at 11:15 p.m. c.s.t.
Ambient Conditions:	Clear and dry, dark
Vehicle(s) Involved:	1992 Freightliner COE tractor, in combination with a loaded 1990 Great Dane van semitrailer
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	10 hours
Number of hours since last slept:	16.25 hours
Number of hours on duty since last slept:	11.75 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The truckdriver stated that he was traveling about 55 mph in the right lane of the two northbound lanes of Interstate 75 when he saw an object in his travel lane and swerved to the right to avoid striking it. The truckdriver stated that there was a vehicle to his left and that he could not move to the left and applied the brakes while steering to the right. The right wheels of the unit entered a ditch, and moved along a steep slope parallel with the roadway. The combination unit traveled about 100 feet in the ditch and rolled onto its right side before coming to rest. The 48-year-old driver was not injured. The investigating police officer found parts of a fiberglass box on the roadway.

The driver's record of duty status indicated that he was awake and active for 16 hours immediately prior to the accident; during 11.75 of these 16 hours, he was either on duty driving or on duty not driving. The following table outlines the driver's duty/sleep schedule for the 6 days before his accident. Even though the driver was active for an extended period of time and his duty/sleep cycles were irregular, he was not engaged in any heavy labor and driver fatigue did not appear to be a factor in the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
WED	-- 0600	-- 9.25	Before 0000 2200	6+ 9
THU	0900	2	2200	10
FRI	-- 2300	-- 4.25	1400 --	5 --
SAT	-- 0715 1400	-- 4.75 3.25	0315 -- 2200	4 -- 9
SUN	0715	9.25	-- 2100	-- 10
MON	0700 1430	3 8.75 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain control of the vehicle after striking an object in the roadway.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 33

Investigation No:	CRH-93-T-HF08
Type of Accident:	Collision Vehicle
Accident Location:	Mineral Wells, Texas
Date and Time:	November 24, 1992, 10:45 a.m., c.s.t.
Ambient Conditions:	Clear and dry; daylight
Vehicle(s) Involved:	1986 White conventional tractor in combination with a loaded van semitrailer, a 1989 Dodge 150 pickup and a 1984 Chevrolet C-60 truck
Occupants:	1
Injuries:	Minor (driver), Fatal (pedestrian)
Duty/Sleep Information:	
Duration of most recent sleep period:	3 hours
Number of hours since last slept:	11.5 hours
Number of hours on duty since last slept:	8.75 hours
Duty/sleep pattern:	Irregular duty/sleep hours Inverted duty/sleep

Description of the Accident:

About 10:45 a.m., a three-man work crew from the Texas Department of Transportation (TDOT) began a pothole patching operation on the shoulder lane of Interstate 20, approximately 592 feet east of Exit 386. Two men were patching the pavement, and a Dodge 150 pickup with an arrowboard trailer was positioned approximately 119 feet in advance of the workers. There was a Chevrolet C-60 truck loaded with asphalt on the shoulder adjacent to the pothole. The Dodge pickup and arrowboard trailer were parked astraddle the traffic lane and the shoulder edgeline. There was a flagman positioned in the center of the right-hand lane, approximately 127 feet in advance of the arrowboard. Warning signs were not posted in advance of the flagman. There was no speed reduction in effect for the work zone.

Shortly after the patching operation began, the loaded combination unit was traveling eastbound when it skidded into the rear of the arrowboard trailer and pickup. The combination unit skidded 234 feet before coming to rest. At impact, the right front of the truck tractor contacted the left rear of the arrowboard trailer and the pickup, pushing them forward and to the right. The tractor jackknifed to the right and continued skidding forward to where it sideswiped the Chevy C-60 truck and came to rest. Postaccident examination of the physical evidence at the scene indicated that the combination unit was traveling about 63 mph before it began skidding.

When the combination unit first began skidding, the workers started running toward the south roadside. From the initial impact area, the pickup was moved forward and to the right where it struck and killed one of the TDOT employees. This impact occurred approximately 25 feet south of the roadway. The combination unit, the pickup, and the arrowboard and trailer sustained substantial damage. The Chevy C-60 truck had minor damage. The truckdriver received minor injuries.

The truckdriver made conflicting statements concerning the accident. He stated to the flagman and to the first police officer on the scene that he had been reaching for a cigarette and never saw the flashing arrowboard. He later told the investigating trooper and Safety Board investigators that his vision was obstructed by another truck that was changing lanes.

Evaluation of the truckdriver's statements and duty records showed that he had approximately 3 hours of sleep in the last 24-hour period. On the day of the accident, the driver began his shift in the early morning hours, which was inverted from the day before when he slept until 11:30 a.m. The following table outlines the driver's duty/sleep schedule for the 4 days before his accident. He had driven 547 miles in the last 8.25 hours and had been on duty for 8.75 hours when the accident occurred. The truckdriver had been on duty for 153 hours in the 19 days that he worked during November. He had driven 7,991 miles in the 147 hours that he was on duty driving.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SUN	0630	2	0830	8
	1630	8.5	--	--
MON	-- off duty	-- --	0100	8
TUE	--	--	0000	9.5
WED	--	--	0000	7.5
	0730	.5	0800	3.5
	1830	1	2015	3
THU	0000 0930	7.5 1.25 at time of accident		

The 51-year-old truckdriver had 18 years of experience driving heavy trucks and had been working for the carrier since 1990. In the last 5-year period, the truckdriver had been involved in two other commercial vehicle accidents. In one of the accidents, he was cited for making an unsafe lane change.

The arrowboard had a pulse rate of 31 flashes per minute. An electron scanning microscopic (ESM) evaluation of the arrowboard lamp filaments showed that the arrowboard was flashing at the time of the accident, and a sight distance evaluation of the terrain showed that the view of the arrowboard was not obstructed by any changes in roadway alignment or elevation. Additionally, the flagman stated that there were no other trucks around when the accident combination unit skidded into the work zone and struck the arrowboard and pickup.

The Manual on Uniform Traffic Control Devices (MUTCD) indicated that arrowboards should be positioned on the shoulder or in the case of narrow shoulders in the traffic lane behind channelizing devices. However, the Texas Manual on Uniform Traffic Control Devices (TMUTCD) indicated that shadow vehicles with arrowboards may provide a taper by parking astraddle the shoulder and lane. This can create confusion for motorists because arrowboards are almost always positioned on the shoulder of the road.

As a result of similar accidents, the Safety Board recommended to the Federal Highway Administration (FHWA) to make changes to the MUTCD indicating that use of arrowboards astraddle the shoulder and lane as a channelizing device was undesirable. The FHWA agreed and removed figures from the MUTCD that showed arrowboards positioned astraddle the shoulder and traffic lane.

Also, in this accident the shadow truck was not equipped with a truck-mounted crash attenuator (TMA). The TDOT policy required the use of TMAs on striping operations, raised pavement marker installations, and any maintenance activity that the responsible engineer judges to present a significant hazard to department personnel or the traveling public. Moreover, the policy required the use of a 24,000-pound shadow vehicle. In this accident, the shadow truck weighed only 4,000 pounds.

The truckdriver failed to respond to the hazard in the roadway in a timely manner. This performance error could not be attributed to any physical problems or drug impairment. Because the postaccident investigation determined that the arrowboard was working and that the truckdriver's visibility was not restricted by the roadway geometry or other traffic, it is apparent that the truckdriver was not alert and attentive to the driving task. Moreover, because the truckdriver had been awake for 21 of the last 24 hours, had been on duty for 8.75 hours, and had driven 547 miles in the preceding 8.25 hours, the reduced level of alertness or inattentiveness was probably caused by insufficient sleep.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to respond to work zone warning devices on the highway due to a reduced level of alertness caused by insufficient sleep. Contributing to the severity of the collision was the use of an inappropriate channelizing device and an improper size shadow vehicle by the Texas Department of Transportation.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 34

Investigation No:	CRH-93-T-HF09
Type of Accident:	Fixed Object Collision
Accident Location:	Henrietta, Texas
Date and Time:	December 16, 1992, at 5:15 a.m. c.s.t.
Ambient Conditions:	Cloudy and dry; dark
Vehicle(s) Involved:	1984 Freightliner COE tractor in combination with a loaded refrigerated semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	6.5 hours
Number of hours since last slept:	1.25 hours
Number of hours on duty since last slept:	1.25 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination unit was northbound on U.S. Highway 287 in a rural area. The unit had traversed a straight 2-percent upgrade and traveled about 355 feet into a 3-degree right curve when it departed the left side of the roadway. The truck crossed the shoulder at a 7-degree angle and entered the median and traveled about 430 feet before striking a drainage berm. There was no evidence of any steering input. After hitting the drainage berm, the truck vaulted 21 feet at a 2.7-degree take-off angle and then traveled an additional 350 feet before coming to rest in the median.

The 38-year-old truckdriver had 12 years of heavy truckdriving experience but had only worked 1 day for this carrier. Consequently, 30 days of daily logs were not available for this truckdriver. However, the driver did not work on Sunday, and on Monday only drove 1 hour (from 6 p.m. to 7 p.m.) to transport the truck from the carrier to his home. He went on duty at 4:30 a.m. on Tuesday and remained on duty for 12.5 hours. He drove for 7 of the 12 hours on duty. The driver said that he had slept at home for 6.5 hours before going on duty the morning of the accident. The accident occurred shortly after the truckdriver went on duty and began driving. The truckdriver told investigating officers that he was not paying attention while pouring himself a cup of coffee and that while doing this he passed over a low spot in the roadway that pulled his vehicle to the left and into the median. However, the postaccident examination of the area revealed that the only evidence of a low spot in the roadway was at a location 25 feet beyond where the vehicle departed the

roadway. Given the driver's new schedule and the early morning hours, it is possible that the driver's circadian rhythms were disrupted.

Probable Cause:

The probable cause of this accident was the driver's failure to maintain his vehicle on the roadway due to inattention and reduced alertness.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 35

Investigation No:	WRH-93-T-HF15
Type of Accident:	Collision—Other
Accident Location:	Leggett, California
Date and Time:	December 17, 1992, at 5:30 a.m. P.s.t.
Ambient Conditions:	Snowing, wet, and darkness
Vehicle(s) Involved:	1978 Freightliner COE in combination with a 1973 Brown flatbed semitrailer, empty and a 1951 Trailmobile flatbed pull-trailer, empty
Occupants:	1
Injuries:	Serious
Duty/Sleep Information:	
Duration of most recent sleep period:	7 hours
Number of hours since last slept:	2 hours
Number of hours on duty since last slept:	1 hour
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination vehicle was traveling northbound on U.S. Highway 101 in the outside lane at a driver-reported speed of 45 to 50 mph. The driver was exiting a right curve on a 5-percent downgrade when he encountered a large boulder in the middle of the travel lane. He did not have time to brake. The driver swerved to the left but was unable to avoid hitting the boulder. The impact with the boulder ripped off the right front wheel and destroyed the vehicle's steering and brakes. The vehicle turned towards the left, crossed the southbound lanes at a 75-degree angle for a distance of 541 feet and dropped into a deep canyon. It came to rest at the bottom of the canyon facing in a northwesterly direction 320 feet below the roadway. The tractor landed on its left side with the front trailer upright, smashed against the back of the cab. The rear trailer came to rest on its wheels 87 feet beyond the tractor and partially in the river. The 31-year-old driver was pinned in the cab for about 4 hours before being rescued and was seriously injured.

A mud slide on the hillside next to the roadway had caused some rocks and large boulders to dislodge and come to rest on the roadway. The weather conditions (snowing and wet), the time of day (darkness), and the position of the boulder in the curve contributed to the driver's inability to detect it until it was too late to avoid the collision.

The driver's logs indicated that his duty/sleep hours were regular. On the day of the accident, he departed his residence after receiving 8 hours of sleep. He had been driving for approximately 40 miles when he struck the boulder.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the inability of the driver to avoid hitting a boulder in the roadway because of the limited sight distance due to the curvature of the roadway, the weather, and the lighting conditions.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 36

Investigation No.:	WRH-93-T-HF16
Type of Accident:	Overturn
Accident Location:	Placerville, California
Date and Time:	December 18, 1992, at 11:30 a.m. P.s.t.
Ambient Conditions:	Clear, daylight, and about 25 degrees Fahrenheit
Vehicle(s) Involved:	1983 Kenworth COE tractor pulling two 1979 Utility, 24 foot flatbed trailers, loaded with lumber
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	2 + 8 hours (disrupted)
Number of hours since last slept:	4.5 hours
Number of hours on duty since last slept:	3.5 hours
Duty/sleep pattern:	Irregular duty hours

Description of the Accident:

The combination unit had just departed a lumber mill and was traveling westbound on Carson Road descending a grade of about 5 percent on an icy asphalt covered roadway. According to the driver, he was in third gear and traveling at about 15 mph when the tractor began to jackknife. While attempting to steer out of the jackknife, the tractor struck a dry spot on the pavement and the tractor and first trailer rolled onto their left sides. The tractor and first trailer came to rest diagonally across the roadway facing northwest. The second trailer remained upright and was facing west. The accident occurred about 1/4 mile after the driver departed the lumber mill. The tractor received moderate damage to the left side, the first trailer was undamaged, and the second trailer had damage to the drawbar. The driver sustained minor bruising.

Although the tractor was equipped with an engine retarder, the driver related that it was off, and it was found in the "off" position. He stated that he was trained not to use it on slippery roadways. The driver also stated that he was not using his air brakes, but relied solely on the engine for braking.

The 37-year-old driver had about 13 months of experience driving combination vehicles, all of which were with this carrier. Prior to this employment, he had driven a heavy straight truck for 7 years. He successfully completed a professional truckdriving school in 1991. According to a carrier spokesman, the driver was not specifically trained to drive in this type of situation (descending an icy hill).

According to the driver's logs, his duty hours were irregular; he began work as early as 3 a.m. and would work as late as 5:30 p.m. The following table outlines his duty/sleep schedule for the 4 days before his accident. Even though his work start times vary from day to day and throughout any given day, the driver always went to sleep at the same time and received about the same amount of sleep each night. On the morning of the accident, he awoke at 4 a.m., worked from 4:30 to 5 a.m., and went back to sleep from 5 until 7 a.m. He started working again at 8 a.m. and had worked 3.5 hours (2.25 driving) at the time of the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
TUE	0300 1430	10 .5	-- 2000	-- 6.5
WED	0300 0800 1230 1600	3.5 2.5 1 1.5	-- -- -- 2000	-- -- -- 9.5
THU	0530	9.5	2000	8
FRI	0430 0800	.5 3.5 at time of accident	0500	2

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of vehicle control on an icy downgrade because of the driver's inexperience and lack of training in driving on icy roadways.

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

CASE NO. 37

Investigation No: SRH-93-T-HF15
Type of Accident: Overturn
Accident Location: Courtland, Alabama
Date and Time: January 11, 1993; at 5:30 a.m. c.s.t.
Ambient Conditions: Foggy; darkness
Vehicle(s) Involved: 1992 Freightliner tractor in combination
with a 1989 Great Dane cargo van semitrailer
Occupants: 2
Injuries: None
Duty/Sleep Information:
Duration of most recent sleep period: 3.5 hours
Number of hours since last slept: 2 hours
Number of hours on duty since last slept: 1.5 hours
Duty/sleep pattern: Irregular duty/sleep hours

Description of the Accident:

The combination unit was traveling eastbound along a straight and level section of State Route 20 when it ran off the right side of the four-lane, divided, roadway. The vehicle departed the roadway at a 3-degree angle and continued straight ahead on the 5.5-foot-wide gravel shoulder for 130 feet. At that location, the right wheels of the combination unit left the edge of the shoulder and entered a 3-foot-deep ditch. Recent maintenance on the shoulder caused its outer edge to be soft and it gave way under the weight of the combination unit. The combination unit continued forward with its right wheels in the ditch for 218 feet before coming to rest. At rest, the truck tractor remained upright and the semitrailer was overturned onto its right side. The tractor sustained minor damage and the semitrailer sustained substantial damage. Neither the truckdriver nor his passenger was injured. Visibility was estimated to be between 300 and 400 feet with fog throughout the area.

The 35-year-old truckdriver stated that he was traveling about 50 mph in the restricted visibility condition when he observed an automobile at a crossover some 200 feet ahead. The headlights of the automobile indicated that it was facing southwest when it moved into a left turn and entered the eastbound roadway. It then moved across the left lane and into the right lane, a maneuver that caused the truckdriver to steer to the right and brake his vehicle. The combination unit avoided contact with the automobile and entered the shoulder about 50 feet east of the crossover. The passenger in the combination unit verified the truckdriver's statement.

Although the automobile left the scene, it was chased to no avail by a following combination unit, the driver of which witnessed the accident sequence. The truckdriver of the following combination unit returned to the scene and verified the driver's statement.

Although the driver's duty/sleep cycles were irregular, his hours of service did not exceed the limits. At the time of the accident, he had been driving for 1 hour after 3.5 hours in the sleeper berth. The following table outlines his duty/sleep schedule for the 5 days before his accident.

Day	Began Driving	Hours Driving	Began Sleep	Hours Slept
FRI	-- Off duty	-- --	Before 0000 1300	10+ 2
SAT	-- Off duty	-- --	0300 2200	9 15
SUN	2000	6	--	--
MON	-- 1200 1530	-- 1.5 8.5	0200 1330	10 2
TUE	-- 0400	- 1.5 at time of accident	0000	3.5

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's evasive maneuver to avoid an encroaching vehicle. Contributing to the accident was the soft shoulder of the highway.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 38

Investigation No:	CRH-93-T-HF11
Type of Accident:	Overturn
Accident Location:	Interstate on-ramp to I-10, near Ozona, Texas
Date and Time:	December 28, 1992, at 6:30 a.m. c.s.t.
Ambient Conditions:	Clear and dry; dark
Vehicle(s) Involved:	1992 Mack conventional tractor in combination with a partially loaded tanker semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	10 hours
Number of hours since last slept:	0.5 hour
Number of hours on duty since last slept:	0.5 hour
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination unit exited a truck stop and proceeded southbound on a secondary highway bridge spanning Interstate 10 (I-10). The vehicle then turned east, entering an access roadway paralleling the interstate roadway. About 400 feet before the intersection of the access road and the I-10 on-ramp, the vehicle passed an advanced route turn sign indicating that a turn to the left was necessary in order to access "I-10." The vehicle then entered a sharp "S" curve at a moderate speed of about 25 mph, first turning left and then right. One-hundred and ten feet from the end of the second curve, the driver came upon a "T" intersection and a route marker advising drivers to turn left approximately 60 degrees in order to access the I-10 on-ramp. The driver applied his brakes and turned sharply left, which caused the partially filled tanker to overturn. The vehicle rolled clockwise, struck the pavement, and slid to a final rest position in a distance of 30 feet.

The 62-year-old truckdriver stated that when he entered the access road about 0.25 mile before the accident scene, he was under the impression that he was already traveling on the on-ramp to I-10 eastbound. He thought the advanced route marker posted 400 feet prior to the "T" intersection of the access road and the on-ramp was simply a warning of the "S" curve he was approaching. When he began to accelerate out of the "S" curve, he was surprised by the "T" intersection and the route marker advising him to turn left. He turned without full consideration of his speed and the performance limitations of the partially filled tanker semitrailer. In the predawn darkness, he also failed to perceive the near 90-degree nature of the turning

movement, having relied upon the inaccurate route marker that indicated the curve was approximately 60 degrees.

The following table outlines the driver's duty/sleep schedule for the 5 days before his accident. Although his duty/sleep cycles were irregular, they do not appear to be a factor in the accident. The driver usually worked a split shift; the first shift began between 5:15 and 6:45 a.m., and the second shorter shift began around 5 or 6 p.m. Further, the account of his time showed he was receiving a sufficient amount of sleep each night as well as added rest between his split shifts.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
THU	0545 1030	2.25 6.75	Before 0000 2200	5.75+ 8
FRI	off duty	--	2300	8.25
SAT	0645 1700	5.25 4	1200 2100	4 8.25
SUN	0515 1800	8.75 2	1400 2000	4 10
MON	0600	.5 at time of accident		

An examination of the physical evidence at the accident site and the driver's statements concerning his duty/sleep hours indicate that fatigue was not a factor in this accident.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain proper control of his vehicle due to a combination of its speed, center of gravity (liquid cargo), and turning radius. Contributing to this accident was the poor location of and inaccuracy of roadway signing and the roadway geometry.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 39

Investigation No:	WRH-93-T-HF17
Type of Accident :	Non-Collision
Accident Location:	Encinitas, California
Date and Time:	December 29, 1992, at 12:45 p.m. P.s.t.
Ambient Conditions:	Cloudy, raining, slippery roadway
Vehicle(s) Involved:	1988 Hino COE tractor in combination with a 1988 Fruehauf enclosed van semitrailer (loaded)
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	7 hours
Number of hours since last slept:	8.75 hours
Number of hours on duty since last slept:	8 hours
Duty/sleep pattern:	Regular sleep hours ³ Duty hours could not be classified

Description of the Accident:

The combination vehicle was northbound on Interstate 5 in a suburban area. The vehicle had descended a 2-percent downgrade and was in a level area approaching a 2-percent upgrade. It was raining heavily and there were pools of standing water along the outside edges of the roadway. The vehicle was in the #4 (outside lane) and was lightly loaded with 3,000 pounds of general freight. As the driver accelerated from 60 mph to about 65 mph to ascend the hill, the vehicle passed through a pool of water. The tractor lost traction, jackknifed, and slid off the right side of the roadway. It struck an embankment and came back onto the roadway blocking the #3 and #4 lanes of traffic. The driver was not injured.

A California Highway Patrol Officer was following behind the truck and verified the driver's story of the accident.

The 29-year-old driver had 10 years of experience driving heavy trucks and had been employed by the carrier for 4 months. His regular duties included transporting

³ The rules that are used to determine if a driver's sleep hours are regular or irregular would dictate that this driver had irregular sleep. However, this classification would be based on the fact that he had gone to bed 2.5 hours later one night and then shifted back to sleeping earlier the next night. Because his sleep period duration was consistent, this case shall be an exception to the rules and his sleep hours are classified as regular.

general freight from Los Angeles to San Diego using Interstate 5 as his normal route. He worked 5 consecutive days each week and then had 2 days off. His work shift began at 5 a.m. and ended around 3 to 4 p.m. The accident occurred on the third day of his work week. He was not required to maintain a log book because his driving duties did not meet the distance or time requirements. A check of the delivery time sheets in the carrier's records verified the driver's work schedule and did not indicate any duty hours that exceeded the hours-of-service limits.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of control of the vehicle due to an unsafe speed for the wet slippery roadway. Contributing to the instability of the vehicle on the wet roadway was the light load on the semitrailer.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 40

Investigation No:	SRH-93-T-HF16
Type of Accident:	Fixed Object Collision
Accident Location:	Uniontown, Alabama
Date and Time:	January 4, 1993 at 8:45 p.m. c.s.t.
Ambient Conditions:	Cloudy and wet; darkness
Vehicle(s) Involved:	1992 Kenworth conventional tractor in combination with an unloaded 1988 Great Dane van semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	8 hours
Number of hours since last slept:	13.75 hours
Number of hours on duty since last slept:	3 hours
Duty/sleep pattern:	Irregular duty hours

Description of the Accident:

The combination unit was traveling westbound on U.S. 80 in Morengo County about 2 miles west of Uniontown, Alabama. As the combination unit traveled on a tangent section of the roadway, it moved off the pavement on the right side of the westbound lane. It then traveled forward on the shoulder for about 325 feet before striking an 80-foot blocked out "W" beam metal guardrail which was anchored to a concrete bridge rail. The combination unit mounted the bridge rail and slid 100 feet before it came to final rest still on top of the rail. The combination unit's fuel tank was ruptured in the collision; a fire ensued and destroyed the unit's tractor. The truckdriver sustained minor injuries.

The 32-year-old driver of the combination unit said that he had developed a sinus cold on this trip and notified his company of his condition. He said that he requested but was denied permission to layover a few days to get over his illness. There was no record at the motor carrier to verify or dispute the driver's statement. The driver said that he continued his trip after taking two Tylenol sinus pills. He said that he took two more pills about 1 hour later and began to feel sleepy. The driver further stated that several times before the accident he had run off the road but had recovered. Sinus Tylenol is an over-the-counter medication; its label cautions on limited dosage and the effects of the medication (drowsiness). The driver should have discontinued his trip after experiencing the effects of the medication.

The following table outlines the driver's duty/sleep schedule for the 5 days before his accident. His duty hours were irregular and his rest hours were regular.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
THU	-- Off duty	-- --	Before 0000 2300	7+ 8
FRI	Off duty	--	2230	8.5
SAT	1200 1800	2.5 5	-- 2300	-- 9.75
SUN	0845 1700	3 6	-- 2300	-- 8
MON	1615 1815	.5 2.5 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep. Contributing to the driver's condition were his illness and the medication he took.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.****CASE NO. 41**

Investigation No: WRH-93-T-HF18
Type of Accident: Fixed Object Collision
Accident Location: Chula Vista, California
Date and Time: January 6, 1993, at 11:10 p.m. P.s.t.
Ambient Conditions: Cloudy, raining, wet road, dark
Vehicle(s) Involved: 1985 Peterbilt, COE Tractor in combination
with a 1984 Brown chassis semitrailer
(freight container on chassis, empty)

Occupants: 1
Injuries: Minor

Duty/Sleep Information:

Duration of most recent sleep period:	7 hours
Number of hours since last slept:	11.25 hours
Number of hours on duty since last slept:	8.25 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination vehicle was traveling in the #3 lane northbound on Interstate 805 on a 2-percent downgrade in the suburban area of Chula Vista, California. The driver was en route from San Diego to the Port of Los Angeles, returning an empty freight container. It was raining heavily and the roadway was wet and slippery. During the descent of the downgrade, the vehicle jackknifed to the right, slid across the gore point of an on-ramp and the on-ramp lane, went off the pavement, struck a guardrail, and went down a steep embankment. At the base of the embankment, the vehicle struck a chain link fence and stopped. The driver received minor injuries.

The driver indicated he was traveling about 55 mph in the #3 lane when another vehicle moved suddenly into his lane from the right. The driver stated that he braked and swerved to the left to avoid the vehicle and that in doing so he lost control of the truck. However, the driver of a vehicle following the truck indicated there were no other vehicles in the immediate area when the truck suddenly jackknifed and went out of control. The witness believed the truck "hydroplaned," which caused it to slide off the roadway. He said both vehicles were traveling about 55 to 60 mph when the accident occurred. Based on this witness information, a lightly loaded vehicle, heavy rains, a slippery roadway, and the speed of the vehicle, it appears that the conditions were sufficient to cause the vehicle to lose traction and go out of control.

The 66-year-old driver had 6 years of heavy truckdriving experience and had been employed by the carrier for 3 years. His duties included making two or three round trips from San Diego to the Port of Los Angeles each night. His duty/sleep hours were irregular and his work periods were about 12 hours long, 5 days each week. The accident occurred on the fourth work day of his work week. Although his sleep start times were irregular, he had slept 7 hours before he started the accident trip. The following table outlines his duty/sleep hours for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SUN	0445 0900	2.75 2.75	Before 0000 2000	4.75+ 11
MON	1145	11.5	2315	9.75
TUE	1645	12.25	--	--
WED	-- 1500	-- 8.25 at time of accident	0500	7

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of control of the vehicle due to incompatibility of his speed and the wet slippery roadway.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 43

Investigation No:	SRH-93-T-HF17
Type of Accident:	Overturn
Accident Location:	Montgomery, Alabama
Date and Time:	January 11, 1993; at 9:30 p.m. c.s.t.
Ambient Conditions:	Rainy and wet; dark
Vehicle(s) Involved:	1989 Freightliner tractor in combination with a 1990 Utility refrigerated van semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	9.5 hours
Number of hours since last slept:	7.5 hours
Number of hours on duty since last slept:	7.25 hours
Duty/sleep pattern:	Irregular duty/sleep hours Inverted duty/sleep

Description of the Accident:

The combination vehicle was traveling northbound on State Route 231 south of Montgomery, Alabama on a 3-percent downgrade when it ran off the left side of the straight roadway. It departed the left lane at a 5-degree angle, crossed the shoulder, and continued down the 20-percent sloped median. The combination unit overturned on its left side and traveled an additional 170 feet for a total distance of 220 feet. The tractor sustained moderate damage and the semitrailer sustained minor damage. The truckdriver received minor injuries.

At the time of the accident, it was raining and the pavement was wet. The 33-year-old truckdriver said that he steered abruptly to the left to avoid a deer running across the roadway and "lost control" of his vehicle. Some blood splatters and probable deer hair were found on the front license tag of the truck tractor; however, neither the blood nor the hair appeared to be fresh and may have been on the plate for some time. No deer carcass or other evidence was found during a search of the accident site.

After 2 days at home in Montgomery, the truckdriver left at 10:15 a.m. on Sunday for a trip to Florida. The following table outlines his duty/sleep hours for the 5 days before his accident. The truckdriver stated that on the day of the accident he worked from midnight until 4:30 a.m. and then logged 9.5 hours in the sleeper berth. His duty/sleep hours on the day of the accident were inverted from the previous day.

He departed Auburndale at 2 p.m. on Monday. Except for a 15-minute rest stop in Madison, he drove straight through to the accident site. The trip of 460 miles in 7.25 hours calculated to an average speed of 62 mph. A review of 30 days of daily logs also revealed irregularities in his duty/sleep hours. It is reasonable to conclude that the truckdriver's irregular duty/sleep hours resulted in a diminished level of alertness causing him to leave the roadway.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
THU	-- 0500	-- 11	Before 0000 1700	5 7
FRI	0000	5	2200	9
SAT	Off duty	--	2200	10
SUN	1000	5	1800	6
MON	0000 1400	4.5 7.5 at time of accident	0430	9.5

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because of his diminished level of alertness.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 44

Investigation No:	SRH-93-T-HF18
Type of Accident:	Fixed Object Collision
Accident Location:	Butler, Alabama
Date and Time:	January 12, 1993 at 4:45 a.m. c.s.t.
Ambient Conditions:	Cloudy and wet; dark
Vehicle(s) Involved:	1980 Kenworth cab-over-engine tractor in combination with a loaded 1982 Great Dane, van semitrailer
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	4 + 2.5 hours (interrupted)
Number of hours since last slept:	7.25 hours
Number of hours on duty since last slept:	3.75 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination unit was traveling southbound on State Route 17 in a rural area. As the driver was negotiating a 2,300-foot-radius lefthand curve, the combination unit ran off the right side of the roadway at a 4-degree angle. The combination unit traveled about 390 feet on the grassy shoulder before it impacted and overrode an earthen private drive. It continued forward another 140 feet, struck two mailboxes mounted on wooden posts, remained upright, and jackknifed before coming to final rest. The truckdriver was not injured.

The 27-year-old driver said that when he entered the curve he observed an oncoming vehicle that he perceived to be over the center line. He said that he moved his truck to the right to avoid a collision and lost control. There were no witnesses or physical evidence to support the driver's statement of an oncoming vehicle on the wrong side of the road. The driver said that after 2 days off duty he was on the second day of his scheduled work week when the accident occurred. The driver reported that he was hunting from 3 a.m. to 10 p.m. on each of his 2 days off.

A review of the driver's daily logbook revealed that he reported for work at 1 a.m. on Monday with only 1 hour of rest. The night before he had only 4 hours of sleep. The following table outlines his duty/sleep hours for the 5 days before his accident. On the day before his accident, he drove 8.5 hours which was interrupted with a 2.5-hour break. The driver then recorded 10.25 hours of off-duty time before

departing on the accident trip at 11 p.m. on the same day. He said that during the 10.25 hours of off-duty time he had slept 4 hours, was awake for 1 hour, and then slept another 2.5 hours. The driver recorded the other 2.75 hours as active time. The accident occurred at a time when the driver would normally be sleeping. In combination, the driver's off-duty outdoor activities and inadequate rest, his active schedule on Monday with very little rest, and a segmented sleep schedule likely caused him to momentarily fall asleep while driving.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
FRI	-- 0600	-- 5.5	Before 0000 2200	6+ 5
SAT	Off duty	--	2300	4
SUN	Off duty	--	2300	1
MON	0100 0800 -- 2245	4.5 4.5 -- 3	-- 1400 1900 --	-- 4 2.5 --
TUE	0400	.75 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 45

Investigation No:	SRH-93-T-HF19
Type of Accident:	Overturn
Accident Location:	Catherine, Alabama
Date and Time:	January 12, 1993, at 7:15 a.m. c.s.t.
Ambient Conditions:	Cloudy and dry, daylight with fog
Vehicle(s) Involved:	1987 Freightliner C-112 conventional tractor in combination with a loaded 1987 pole trailer
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	6 hours
Number of hours since last slept:	5.25 hours
Number of hours on duty since last slept:	4.25 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination unit was traveling northbound on State Route 5 on a straight section of road when the combination unit departed the right edge of the roadway at a 7-degree angle. After leaving the 4-foot-wide earthen shoulder, the unit continued forward on an 8-foot-wide, 15-degree embankment for a distance of 450 feet. The physical evidence indicated that at that location the driver attempted to steer the unit back toward the roadway. The right side wheels dug into the soft embankment, and the combination unit rolled onto its right side. The driver was not injured.

Although the 22-year-old truckdriver's duty/sleep hours was usually regular, on the day of the accident, he started work 1.5 hours earlier than the previous night. He awoke at 2 a.m. and went on duty at 3 a.m. The accident occurred about 4.25 hours later.

The shallow departure angle from the roadway in conjunction with the fact that the driver did not attempt to steer back onto the roadway for 450 feet are indicative of a driver that has reduced alertness and fallen asleep.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 46

Investigation No:	WRH-93-T-HF20	
Type of Accident:	Overturn	
Accident Location:	Los Angeles, California	
Date and Time:	January 13, 1993, at 2:30 a.m. P.s.t.	
Ambient Conditions:	Raining, wet, and dark	
Vehicle(s) Involved:	1991 International COE tractor in combination with a 1988 Lufkin dry van semitrailer, loaded	
Occupants:	1	
Injuries:	Minor	
Duty/Sleep Information:		
Duration of most recent sleep period:	5.5 hours	
Number of hours since last slept:	2.5 hours	
Number of hours on duty since last slept:	2.5 hours	
Duty/sleep pattern:	Irregular duty/sleep hours	
	Exceeded hours-of-service limits	

Description of the Accident:

The combination vehicle was negotiating a sharp left spiral transition curve (400-foot inside radius) from westbound Interstate 10 to southbound Interstate 5. According to the driver, the vehicle entered the curve in the inside lane at a speed of 54 mph. At the time, it was raining and the pavement was covered with a layer of water. The roadway was on a 2- to 3-percent upgrade with a left sloping superelevation that varied from 7 to 10 percent. When the truck was in the middle of the curve, the driver stated it began sliding toward the right. It slid across the right lane, overturned onto its right side, and slid 97 feet along the shoulder destroying the metal guardrail. The combination came to rest on its right side facing south just short of a concrete wall. The truckdriver received minor injuries.

The physical evidence at the scene supported the truckdriver's story. A postaccident test drive was conducted around the curve in the outside lane (424-foot radius) using a California Highway Patrol full size Ford patrol car traveling at 50 mph on dry pavement. As the car negotiated the curve, the car's weight shifted towards the right and the tires emitted a light squealing sound as they scrubbed on the pavement. The California Department of Transportation's highway engineering plans indicated that the "comfortable speed" for the curve in a passenger car was 40 mph. The curve was not posted for any certain speed or advisory speed limit.

The truckdriver's logs were legal but did not match the driver's statement about his trip hours. The driver's statement and cash receipts indicated that the driver made the 800-mile trip in less than 20 hours in a truck that was governed at 58 mph. The company stated that the trip normally takes 24 to 25 hours to complete, which includes 16 to 17 hours of driving time and the required 8-hour rest period. These time differences indicated that the driver drove during his rest/sleep period in order to complete the trip in less than 20 hours and therefore exceeded the hours-of-service 10-hour driving rule. On the day of the accident, the driver began his shift at a time when he normally was sleeping. Considering the driver's duty/sleep hours and the time of the accident, it appears that the driver was fatigued. The following table outlines the driver's account of his duty/sleep hours for the 6 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
FRI	0000	11 excessive	2100	13
SAT	Off duty	--	2300	7
SUN	0700 0900	.25 .25	-- 2000	-- 10.5
MON	0745 1300 1545	.25 .25 .25	0800 -- 1800	2 -- 6
TUE	0830	10	1830	5.5
WED	0000	2.5 at time of accident, excessive		

The 25-year-old truckdriver had only 6 months of truckdriving experience. This lack of experience may have affected the driver's judgment to negotiate the curve at a speed safe for the prevailing adverse weather conditions.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of control on the curved section of the roadway due to the incompatibility of the wet roadway, the road curvature, and the speed of the vehicle. Contributing to this accident was the lack of advance warning signs and the driver's poor judgment due to inexperience and fatigue.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 47

Investigation No:	WRH-93-T-HF19
Type of Accident:	Overturn
Accident Location:	Blythe, California
Date and Time:	January 13, 1993, at 3:00 a.m. P.s.t.
Ambient Conditions:	Cloudy, cold, wet roadway
Vehicle(s) Involved:	1992 Freightliner, conventional tractor in combination with a 1991 Utility enclosed van semitrailer (loaded)
Occupants:	2
Injuries:	None
Duty/Sleep Schedule:	
Duration of most recent sleep period:	6.5 hours
Number of hours since last slept:	7.5 hours
Number of hours on duty since last slept:	7.5 hours
Duty/sleep pattern:	Irregular sleep hours Exceeded hours-of-service limits

Description of the Accident:

The combination vehicle was traveling eastbound in the #2 (outside) lane of Interstate 10 in a rural desert area 41 miles west of Blythe, California. The vehicle swerved to the left and the left front wheel left the pavement. The vehicle then swerved back across the highway at a sharp angle and went off the pavement on the right side of the roadway. The dirt embankment on the right side of the roadway sloped down to a point 2 feet below the roadway surface. The vehicle traveled 70 feet on the dirt embankment parallel to the roadway before rolling over onto its right side. Neither the driver nor the co-driver was injured.

The 45-year-old truckdriver told investigators that he experienced a coughing attack while driving, which caused him to unintentionally steer the vehicle to the left. When the left front wheel went off the roadway, he steered sharply back to the right. He lost control of the vehicle and the vehicle went off the roadway and overturned. Due to recent rains, very little of the vehicle's marks remained on the highway, except the ruts in the dirt where the vehicle overturned. His claim of a coughing attack could not be verified by the co-driver who was asleep at the time the accident occurred.

The driver indicated that he often logged time spent not driving while seated in the passenger's seat as "sleeper berth" time to avoid hours-of-service violations.

When his hours-of-service time was adjusted to reflect his actual activity time, the record indicated that the driver exceeded the 15-hour on-duty rule every day since his last off-duty time and that on the day of the accident, he exceeded the 15-hour on-duty rule and the 10-hour driving rule. Considering the irregular rest hours and duty hours that exceeded the hours-of-service limits, it is reasonable to believe that the driver was fatigued at the time of the accident. The following table outlines the driver's account of his duty/sleep hours for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	-- Off duty	-- --	Before 0000 2300	5.5+ 6.5
SUN	-- 2030	-- 15.5 excessive	1600 --	3 --
MON	-- 2100	-- 16 excessive	1200 --	8.5 --
TUE	-- 1930	-- 7.55 at time of accident, excessive	1300	6.5

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because of his diminished level of alertness.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 48

Investigation No:	SRH-93-T-HF20
Type of Accident:	Overturn
Accident Location:	Greensboro, Alabama
Date and Time:	January 14, 1993, at 2:30 a.m. c.s.t.
Ambient Conditions:	Clear and dry, dark unlighted
Vehicle(s) Involved:	1983 International COE, in combination with a loaded 1987 Trimble flatbed semitrailer
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	5 hours
Number of hours since last slept:	2.5 hours
Number of hours on duty since last slept:	1.5 hour
Duty/sleep pattern:	Irregular sleep hours Duty hours could not be classified

Description of the Accident:

The combination unit was traveling southbound on State Route 69 when the driver perceived what he thought was a mechanical problem in the drive train of the tractor. He slowed and made a right turn onto a country road where it joins Route 69 at an angle of 56 degrees in the northeast quadrant of the intersection. The driver stopped and then backed the unit across Route 69 to turn around and return to the company shop. As the driver pulled back onto Route 69 northbound, the axles of the 45-foot-long semitrailer cut across the corner of the intersection. The trailer axles disengaged and slid about 3 feet to the right into a concrete drain catch basin before coming to rest. The driver was not injured.

The 40-year-old driver had been off duty at home for 31.5 hours immediately preceding this trip. He had been on the road about 1.5 hours at the time of the accident. Although his rest hours are classified as irregular, it is reasonable to conclude that fatigue was not a factor in this accident. The driver made an error in his turning maneuver that caused the semitrailer axles to disengage. The following table outlines the driver's duty/sleep hours for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SUN	-- Off duty	-- --	Before 0000 1900	9+ 11.5
MON	1400 2000	1 2.5	2230	7.5
TUE	0730	10	2200	10
WED	Off duty	--	1900	5
THU	0100	1.5 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure (due to misjudgment) to keep his vehicle on the roadway while making a turn at an intersection.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 49

Investigation No:	CRH-93-T-HF12
Type of Accident:	Overturn
Accident Location:	Big Lake, Texas
Date and Time:	January 20, 1993, at 7:15 a.m. c.s.t.
Ambient Conditions:	Clear, wet and icy; daylight
Vehicle(s) Involved:	1992 Navistar conventional single unit straight truck with a loaded tank body
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	9.5 hours
Number of hours since last slept:	1 hour
Number of hours on duty since last slept:	1 hour
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The loaded truck was southbound on State Highway 137 in a rural area traveling along a straight 1-percent downgrade. While the truckdriver was attempting to turn left into a driveway, the truck rotated 180 degrees counterclockwise, left the roadway, overturned onto its right side, and came to rest on its roof. At the time, the roadway was wet and icy.

The truckdriver told investigating police that he thought he had a tire blowout. There was no evidence to support this, nor was there any evidence of a precollision mechanical defect on the truck.

The truckdriver's daily scheduled routes for his 12 days of employment prior to the accident showed that his on-duty time varied very little. He routinely drove to about 30 drop-sites per day on each route with an average daily driving distance of 110 miles. The truckdriver stated that he did not feel tired or fatigued at the time of the accident. Based on the truckdriver's work and sleep cycles, there was no evidence to indicate that he was fatigued.

The 24-year-old truckdriver did not have a valid commercial driver license nor any prior experience driving heavy trucks. The driver's lack of experience operating heavy trucks was probably a factor in his inability to control the vehicle on the wet and icy roadway.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to keep his vehicle on the roadway while making a turn on a wet and icy roadway because of the driver's inexperience with heavy truck driving.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 50

Investigation No:	CRH-93-T-HF14
Type of Accident:	Overturn
Accident Location:	Selma, Alabama
Date and Time:	January 21, 1993, at 11:30 a.m. c.s.t.
Ambient Conditions:	Clear, dry; daylight
Vehicle(s) Involved:	1982 International COE tractor in combination with a loaded pole semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	9.5 hours
Number of hours since last slept:	4.5 hours
Number of hours on duty since last slept:	3.5 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination unit was traveling westbound on a straight, 5-percent upgrade on State Highway 22 in a rural area. The truckdriver attempted to make a left turn onto County Road 39 when the truck overturned onto its left side. The truck came to rest off the roadway with its cargo of timber dislodged and scattered over a wide area.

The 29-year-old truckdriver told investigating police that "the trailer was not loaded properly and he was traveling too fast as he made the left turn." The evidence indicated that the larger diameter logs that were usually placed on the bottom of the load had been placed on top causing a higher than usual center of gravity.

The truckdriver's daily scheduled routes indicated that his on-duty time varied very little. He routinely drove the maximum number of hours allowed by regulation and averaged about 700 miles per day. The truckdriver stated that he did not feel tired or fatigued at the time of the accident. The truckdriver's duty and sleep cycles were regular.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain control of his vehicle due to a combination of its speed, high center of gravity, and turning radius.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 51

Investigation No:	WRH-93-T-HF21
Type of Accident:	Overturn
Accident Location:	Niland, California
Date and Time:	January 22, 1993, at 6:45 a.m. P.s.t.
Ambient Conditions:	Clear and dry, daylight, about 60 degrees Fahrenheit
Vehicle(s) Involved:	1970 Peterbilt, 3-axle conventional dump truck, pulling an empty 1970 Superior "transfer bin" dump trailer
Occupants:	1
Injuries:	None
Duty/sleep Information:	
Duration of most recent sleep period:	6.5 hours (actually slept only about 2 hours)
Number of hours since last slept:	2.25 hours
Number of hours on duty since last slept:	1.25 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination unit was traveling northbound on a straight and level section of State Route 111. The driver admitted that he fell asleep. The truck then drifted off the right side of the roadway at about a 5-degree angle and onto a downward sloping earthen shoulder. After being startled, the driver overcorrected to the left. As the unit came back onto the roadway, the dump trailer overturned onto its right side. The combination unit then crossed over the southbound lane and went off the left side of the roadway. It came to rest on an earthen area about 25 feet west of the roadway with the truck upright and facing north and the dump trailer on its right side. The combination unit had traveled about 500 feet from the point where it initially went off the right side of the roadway to the final resting position. The truck was undamaged, but the trailer received heavy damage. The truckdriver was not injured.

The 33-year-old driver had 15 years of experience driving combination vehicles and had worked for this carrier driving dump truck combination units and transit concrete mixers. He had driven this particular unit for the previous 2 months and was very familiar with the roadway. The driver normally worked about 40 hours a week and nearly all of his driving was within a 50-mile radius of the carrier's terminal. He normally worked 5 days a week and was off on Saturday and Sunday.

During the week of the accident, he had driven a total of 34.5 hours, from Monday to Thursday, mostly in daylight hours. According to the driver, on the day of the accident he got up at 4:30 a.m. and reported to the carrier's terminal at 5:30 a.m. He departed about 5:45 a.m., and the accident occurred about 1 hour later.

The driver related that during the past several weeks he was having domestic conflicts with his live-in girlfriend. He also related that he had not eaten a meal for 3 days prior to the accident. On the night before the accident, he went to bed about 9 a.m., but due to problems with his live-in girl friend, he slept only 1 or 2 hours.

At 3:30 p.m. on the day of the accident, the driver gave a urine sample for the purpose of being screened for drugs. This sample was found to be positive for amphetamines and methamphetamines, above the level of 500 NG/ML and 1,000 NG/ML, respectively. When confronted with these results, he denied using any drugs and gave a second urine sample 5 days later. This sample was negative.

The driver attributed the initial positive readings to either Tylenol Cold Medicine, which he was taking every 4 hours, or Lodine (an anti-inflammatory drug) or Propacet (a pain reliever). He had taken both Lodine and Propacet about 12 hours before the accident. The driver related that he was treating problems with his knee and back. Medical research revealed that none of these substances ingested by the driver would have resulted in a false reading of amphetamines or methamphetamines.

The carrier has a "Drug/Alcohol Abuse Policy" which prohibits the use or possession of alcohol or drugs while on duty or reporting to work under the influence of drugs or alcohol. According to this policy, any violation of these rules will result in discipline, to include termination. The carrier has recently established a drug testing program which requires testing for reasonable cause and/or accident involvement. After this accident, it was the carrier who requested that the driver submit a urine sample for a drug screen.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep. Contributing to the driver's inability to obtain adequate rest was the driver's domestic conflict and his use of amphetamines and/or methamphetamines.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 52

Investigation No:	WRH-93-T-HF22
Type of Accident:	Overturn
Accident Location:	Gold Run, California
Date and Time:	January 27, 1993, at 6:00 a.m. P.s.t.
Ambient Conditions:	Clear and dry; dark; no street lights
Vehicle(s) Involved:	1985 Peterbilt, COE flatbed motor truck in combination with a 1974 Brown flatbed pull trailer (loaded)
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	4.5 hours
Number of hours since last slept:	1 hour
Number of hours on duty since last slept:	1 hour
Duty/sleep pattern:	Irregular rest hours Exceeded hours-of-service limits

Description of the Accident:

The combination vehicle loaded with bales of hay was westbound in the right lane on Interstate 80 in a mountainous area. As the vehicle negotiated a moderate right curve, one of the bales of hay fell off the right side of the vehicle, which caused the rest of the bales to shift to the right side of the trailer. As a result, the vehicle began to lean to the right and about 1/4 mile later on a 3-percent downgrade, the trailer rolled to the right and then overturned, spilling the remaining load. The 37-year-old truckdriver was not injured.

The vehicle's cargo of baled hay had been loaded on the vehicle the day before in rainy weather. The rain caused the bales of hay to start to come apart, making the load insecure. The truckdriver's driving record indicated two citations in the past 3 years for violations of loading regulations pertaining to baled hay.

A review of the driver's log book indicated that he exceeded the intrastate driving regulation by 2 hours at the time of the accident. He had stopped at a local truck stop the night before but had not received sufficient rest because he had visited with friends until late at night. The following table outlines the driver's duty/sleep hours for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	-- 0100	-- 6	Before 0000 1600	.5+ 8
SUN	0000 --	6 --	1000 2230	8 10
MON	Off duty	--	1900	10.5
TUE	0700	16 excessive	2330	4.5
WED	0500	1 at time of accident, still excessive		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the shifting of an improperly secured load.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 53

Investigation No:	CRH-93-T-HF15
Type of Accident:	Fixed Object Collision
Accident Location:	Arlington, Texas
Date and Time:	January 27, 1993, 2:37 p.m. c.s.t.
Ambient Conditions:	Clear and dry; daylight
Vehicle(s) Involved:	1985 GMC conventional tractor in combination with a loaded tanker semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	8.5 hours
Number of hours since last slept:	8.25 hours
Number of hours on duty since last slept:	6.75 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination vehicle was traveling westbound on Interstate 20 at a driver-reported speed of 55 mph. The tanker was loaded with 2,800 gallons of liquified petroleum gas (LPG). As the truck approached the Matlock Road overpass, it drifted to the right approximately 5 degrees out of the travel lane and collided with a temporary guardrail in the construction zone. From this impact, the truck was redirected approximately 10 degrees to the left from the guardrail. It veered across the four westbound lanes traveling 160 feet to where it collided with a temporary concrete "New Jersey" barrier. The combination unit displaced a 40-foot section of the barrier, overturned, and came to rest in the median area.

After the unit came to rest, a small engine compartment fire ensued. A passing motorist was able to extinguish the fire before it spread to the LPG in the tanker. The tractor was destroyed, but the tanker sustained only minor damage, and none of the LPG escaped from the tanker. The truckdriver received minor injuries.

A witness stated that the combination unit had drifted onto the shoulder four times in the last several miles before the accident. At first, the truckdriver stated he may have had a problem with his steering, but later he indicated that he may have fallen asleep.

A review of the truckdriver's qualification file indicated that he had 14 years of experience as a heavy truckdriver. He had been transporting LPG for the last 8 years.

The truckdriver appeared to be extremely drowsy and fell asleep numerous times when he was interviewed at the hospital on the day following the accident. The nurse in charge stated that the truckdriver was not taking any medication that would make him drowsy. Later in the interview, he admitted that he was suffering from sleep apnea which was diagnosed in 1991. Symptoms of sleep apnea include sudden nodding off at inappropriate times, discontinued breathing during sleep periods, and loud snoring. He related that he had alertness problems when he was a teenager but they were diagnosed as thyroid problems. As he grew older and became overweight, his problems continued to worsen. The truckdriver also had high blood pressure, diabetes, and kidney disease.

In September of 1991, he had surgery to correct the sleep apnea. At that time, the motor carrier was aware that the driver had a breathing problem, but they were unaware that it could result in extreme daytime drowsiness. The driver stated that the surgery corrected his loud snoring, but he continued to stop breathing during sleep periods and his extreme daytime drowsiness also continued. He stated that he always slept poorly and was often found sleepwalking. His wife stated that he never slept and that he suffered from extremely painful headaches.

In October 1992, when the truckdriver had his U.S. Department of Transportation required biannual medical exam, he was certified as physically qualified to drive a commercial vehicle. However, he did not inform the examining physician that he had sleep apnea and was experiencing extreme daytime drowsiness.

In November of 1992, a customer reported to the motor carrier that the truckdriver had fallen asleep standing up while unloading LPG from his tanker. The driver blamed his drowsiness on some high blood pressure medicine he was taking. He was placed on probation as a result of the incident, but company management did not make a vigilant effort to determine the extent of the truckdriver's illness. A sleep disorder evaluation performed in 1993 after the driver's accident showed that the driver had a severe case of obstructive sleep apnea.

Based on the combination unit's gradual departure from the travel lane, witness statements that the unit departed the travel lane several times before the accident, the driver's admission that he may have fallen asleep, and finally the driver's lengthy history of obstructive sleep apnea, which according to sleep researchers prevents restful sleep, it can be concluded that he did fall asleep.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep due to chronic fatigue. The chronic fatigue resulted from the driver's sleep illness.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 55

Investigation No:	SRH-93-T-HF21
Type of Accident:	Overturn
Accident Location:	Atlanta, Georgia
Date and Time:	February 2, 1993 at 9:45 a.m. e.s.t.
Ambient Conditions:	Clear and dry; daylight
Vehicles Involved:	1989 Peterbilt conventional tractor in combination with a loaded 1988 Great Dane, van semitrailer
Occupants:	3
Injuries:	Minor (driver), Serious (two passengers)
Duty/Sleep Information:	
Duration of most recent sleep period:	8 hours
Number of hours since last slept:	1.75 hours
Number of hours on duty since last slept:	1 hour
Duty/sleep pattern:	Irregular duty/sleep hours Exceeded hours-of-service limits

Description of the Accident:

The combination unit was traveling eastbound on the Interstate 20 off-ramp to northbound Interstate 75/85 in downtown Atlanta, Georgia. As the combination unit traveled in the left lane at a driver-estimated speed of 50 mph, he attempted to negotiate a 477-foot-radius left curve on a 6.5-percent downgrade. The combination unit overturned onto its right side. It then slid forward and to the right across the right lane and onto the shoulder for about 150 feet before striking a 3-foot-high concrete barrier and coming to rest. A left arrow curve sign, left chevron road alignment signs, and a 30-mph speed advisory sign were located in advance of the roadway curvature. The truckdriver sustained minor injuries and his two unauthorized passengers were seriously injured. The unauthorized passengers had accompanied the driver for several days.

The 31-year-old driver said that when his truck was loaded he noticed that the load was not properly secured. When he questioned the load securement, the driver was told that the cargo would ride with no problems. Based on the driver's own estimated speed of 50 mph and his knowledge of the improperly secured cargo, it is reasonable to believe that the rollover was caused by both the excessive speed and the improperly secured load.

The following table outlines the driver's duty/sleep hours for the 5 days before his accident. Although his duty/sleep hours were irregular and he had exceeded the

hours of service 10-hour rule twice during the 5 days, fatigue did not appear to be a factor in this accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
FRI	-- 0800	-- 11 excessive	0000 2000	8 8
SAT	0400 1200 1600	3 2 5	-- -- 2100	-- -- 6.5
SUN	0330 2130	8.5 2.5	-- --	-- --
MON	-- 1100	-- 13 excessive	0000 --	6 --
TUE	-- 0845	-- 1 at time of accident	0000	8

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to negotiate the transition curve at a safe speed.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 57

Investigation No:	WRH-93-T-HF23
Type of Accident:	Overturn
Accident Location:	Susanville, California
Date and Time:	February 6, 1993, at 3:00 a.m. P.s.t.
Ambient Conditions:	Foggy, road wet and icy in spots, dark
Vehicle(s) Involved:	1991 Peterbilt conventional tractor combined with a 1991 Reinke flatbed semitrailer, loaded
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	3 hours
Number of hours since last slept:	1.5 hours
Number of hours on duty since last slept:	1.5 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination vehicle was eastbound on State Route 44 at 50 mph. The vehicle's three-stage engine retarder was fully engaged. The roadway conditions ranged from wet to icy. The vehicle had completed a left curve and entered a straight section of roadway on a 5-percent downgrade when it encountered a large patch of black ice. The vehicle's tires lost traction and began spinning which caused the combination to slide sideways to the right. As the driver attempted to regain control, the vehicle slid back towards the left and overturned onto its left side. It came to rest on its left side facing east and blocking the westbound lane. The cargo of processed lumber was scattered along the westbound lane and shoulder. The physical evidence and a witness traveling behind the truck verified the truckdriver's statement regarding the sequence of events. The 41-year-old truckdriver was not injured.

A review of the truckdriver's daily logs indicated that he had slept in the sleeper berth for 3 hours and had been driving about 1.5 hours at the time of the accident. Although the driver's duty/sleep hours were irregular, they do not appear to be a factor in this accident. The following table outlines the driver's duty/sleep hours for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
TUE	-- 0300 1200	-- 6 4.5	Before 0000 2200	3+ 7
WED	0900	6	1800	8
THU	0200 1800	8 3.5	1000 2130	8 2.5
FRI	0000 1600	7.5 6.5	0730 2230	8.5 3
SAT	0130	1.5 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of control of the vehicle due to a speed that was incompatible for the prevailing roadway conditions.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.****CASE NO. 58**

Investigation No: CRH-93-T-HF17
Type of Accident: Overturn
Accident Location: Near Dennison, Texas
Date and Time: February 7, 1993, at 3:15 a.m. c.s.t.
Ambient Condition: Dry; darkness
Vehicle(s) Involved: Cab-over-engine 1991 Freightliner in combination
with a loaded van trailer
Occupants: 2
Injuries: Minor (driver, passenger)
Duty/Sleep Information:
Duration of most recent sleep period: 3 hours
Number of hours since last slept: 44.25 hours
Number of hours on duty since last slept: 27.5 hours
Duty/sleep pattern: Irregular duty/sleep hours
Exceeded hours-of-service limits

Description of the Accident:

The combination unit was northbound on U.S. Route 75 when the vehicle entered a marked construction zone and passed signs reducing the speed limit from 55 mph to 45 mph. The two northbound lanes were divided by a concrete New Jersey barrier, thus allowing southbound traffic to pass through the construction area on what had been the left lane of northbound Route 75. The driver had traveled about 1/4 mile through the construction zone, having successfully negotiated both a left and right highway curve, when the vehicle entered a 3,500-foot-radius left curve and then departed the right side of the roadway at an angle of 2 degrees.

Tracks in the soft shoulder indicated that the right side wheels of the tractor had traveled nearly parallel to the road edge for a distance of 108 feet when the right side trailer tires began to skid along the shoulder. No skid marks corresponding to the left side trailer tires were visible on the paved concrete surface of the roadway. About 225 feet after the right side tires first departed the road surface, the left side tires exited the pavement. The trailer traveled along the soft shoulder without jackknifing, continuing to track behind the wheels of the tractor, until it reached the steep edge of an embankment. The combination unit then slid sideways down the slope and came to rest on its right side in the deep mud of the gully below. The point of rest was 558 feet from the point where the vehicle first left the highway and about 450 feet from where the driver first applied the brakes. The occupants sustained only minor injuries.

The 30-year-old driver was accompanied by an unauthorized female passenger. Both had been consuming alcoholic beverages. Toxicology tests conducted less than 2 hours after the accident indicated that the driver had a blood alcohol concentration of 0.168.

In the 67 hours before the accident, the driver's log showed a total of 3 hours of sleep. However, the driver also stated that he did not sleep on Friday, Saturday, or Sunday, the day of the accident. The driver's logs were not consistent with his verbal account of this duty/sleep times. According to the driver, he falsified his logs to satisfy the regulations and his employer. The driver appeared to have grossly mismanaged his off-duty time. Although he had exceeded the hours-of-service limits, he did have opportunities to sleep but according to his statements did not do so. The following table outlines the driver's account of his duty/sleep hours for the 6 days before the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
TUE	Before 1600	9+	--	--
WED	--	--	0100	4
	0500	7	--	--
	1500	9 excessive		
THU	--	--	0000	3
	0300	4.25	--	--
FRI	--	--	0400	3
	1600	6	--	--
SAT	0100	21.25 excessive	--	--
SUN	0300	.25 at time of accident		

The driver was interviewed in a jail holding cell approximately 4 hours after the accident. He admitted consuming alcoholic beverages. He claimed that he clearly remembered the moments just prior to losing control and was certain that he did not fall asleep. After some thought, he added that he may have smelled exhaust fumes in the cab of the tractor just before the accident and that the fumes may have contributed to his loss of control.

The driver stated that he was traveling at a speed of 45 mph when, during a period of momentary inattention, the right side wheels of the accident vehicle dropped off the pavement edge onto the shoulder. He tried to steer the vehicle back up onto the roadway but could not. He pumped his brakes in order to maintain control but

did not apply full brake pressure. He had succeeded in slowing the vehicle to a near stop when it slipped off the steep embankment into the mud filled gully below.

The driver's irregular duty/sleep hours, the consumption of alcohol, and the 2-degree vehicle departure angle from the edge of the roadway are consistent with a diminished state of driver alertness.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep. Contributing to the driver's condition was his excessive alcohol consumption.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 59

Investigation No:	WRH-93-T-HF28
Type of Accident:	Collision Fixed object
Accident Location:	Gold Run, California
Date and Time:	February 11, 1993, at 10:30 p.m. P.s.t.
Ambient Condition:	Cold, Clear, Darkness, Snow on Roadway
Vehicle(s) Involved:	1991 Kenworth COE tractor in combination with a 1992 Alloy enclosed van semitrailer (loaded)
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	9.5 hours
Number of hours since last slept:	14.5 hours
Number of hours on duty since last slept:	7.75 hours
Duty/sleep pattern:	Irregular duty hours

Description of the Accident:

The combination vehicle was traveling westbound on Interstate 80 in a rural mountainous area on a 5-percent downgrade. The weather was cold and it had been snowing heavily the previous few weeks. As a result of snow removal activity, there were 10-foot-high snow banks on each side of the roadway, forming hard packed "walls." The roadway also contained patches of hard packed snow and ice. As the vehicle negotiated a left turning curve, it lost traction on the packed snow in the roadway and jackknifed to the left. It slid sideways across both westbound lanes with the tractor striking the snow bank "wall" on the left side of the roadway and the right rear of the semitrailer striking the guardrail on the right side of the roadway. It bounced off the "wall" and came to rest perpendicular to the roadway blocking both westbound lanes. The 44-year-old driver was slightly injured.

A witness following the truck indicated the truck's speed was between 50 and 57 mph. The truckdriver indicated he was traveling about 50 mph. The posted speed limit was 55 mph with an advisory speed limit for trucks of 45 mph. The driver was exceeding the advisory limit by 5 to 12 mph and did not exercise caution given the icy roadway and the darkness. The witness also confirmed that the truck seemed to have jackknifed because it struck a slippery part of the roadway. A review of the driver's logs for the 30 days prior to the accident indicated he had irregular duty hours but appeared to be adequately rested for this trip and had not exceeded the hours-of-service requirements. The following table outlines the driver's duty/sleep hours for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
MON	--	--	0000	9.5
TUE	-- 1100	-- 7.5	0000 --	8 --
WED	-- 1015 2000	-- 8.25 2.5	0000 -- 2230	10.25 -- 9.5
THU	0800 1330 2100	1.75 4.5 1.5		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain vehicle control because he was driving too fast on an icy roadway.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.****CASE NO. 60**

Investigation No: SRH-93-T-HF22
Type of Accident: Overturn
Accident Location: Riverdale, Georgia
Date and Time: February 16, 1993, 12:15 p.m. e.s.t.
Ambient Conditions: Cloudy and dry, daylight with good visibility
Vehicle(s) Involved: 1981 Peterbilt, with a loaded 48-foot Greatdane semitrailer
Occupants: 1
Injuries: Minor
Duty/Sleep Information:
Duration of most recent sleep period: 7 hours
Number of hours of since last slept: 6 hours
Number of hours on duty since last slept: 4.5 hours
Duty/sleep pattern: Regular duty/sleep hours

Description of the Accident:

The combination unit was traveling southbound on a straight and level section of State Route 85 en route to a local store to make a deliver. As the combination unit approached the intersection of Martha Street at a witness estimated speed of about 10 mph, the truckdriver executed a left turn. The driver stated that as he was executing the left turn, he looked in the left rearview mirror and noticed that the left trailer wheels were about 2 feet above the highway surface. As the driver attempted to redirect the vehicle, the combination unit overturned onto its right side and slid for about 10 feet before coming to rest, blocking all northbound lanes of State Route 85.

The 41-year-old driver had 8 years of experience driving combination vehicles. He worked a routine week Monday through Friday. His assignments were primarily short local trips usually within a 100-mile radius of the carrier's terminal; therefore, a record of duty status (log book) was not required.

According to the driver, the freight on the accident trailer had been moved around several times to the extent that it was stacked high in the rear and became progressively lower toward the front of the trailer. With the semitrailer loaded in that configuration, the center of gravity at the rear of the unit would be increased, thus compromising the stability of the vehicle. When the left wheels left the pavement, the driver's steering input to redirect the vehicle caused the unstable trailer to overturn onto its right side.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain control of his vehicle due to the incompatibility of the speed, the load configuration, and the turning radius.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 61

Investigation No.:	WRH-93-T-HF24
Type of Accident:	Fixed Object Collision
Accident Location:	Anaheim, California
Date and Time:	February 17, 1993, at 2:30 a.m. P.s.t.
Ambient Conditions:	Cloudy and Dry, Darkness with Street Lights
Vehicle(s) Involved:	1992 Peterbilt, conventional tractor in combination with a 1987 Monon loaded van semitrailer and a 1989 WABAS loaded van semitrailer
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	8 hours
Number of hours since last slept:	15.5 hours
Number of hours on duty since last slept:	15.5 hours
Duty/sleep pattern:	Irregular duty/sleep hours Exceeded hours-of-service limits

Description of the Accident:

The combination vehicle was westbound on State Highway 91 in the City of Anaheim. The vehicle was negotiating a sweeping level left hand curve in the #4 (outside) lane. The vehicle failed to complete the curve, drifted off the right side of the roadway into a depressed dirt shoulder, and struck a highway "sound" wall. The vehicle did not overturn but did jackknife. The driver was not injured.

The 39-year-old truckdriver indicated that he fell asleep while driving and does not recall the events of the accident. He told investigators that he normally drives with a co-driver, but on this trip his co-driver was ill and could not make the trip. The accident day was the fourth consecutive driving day on this trip from Tennessee to California. A review of his driver's log book indicated that he had slept in the truck's sleeper berth and had taken irregular rest breaks during the trip. He told investigators that he did not sleep well or receive quality rest during these stops. Further, the driver was driving during the nighttime hours when his accident occurred, and the previous night he was going to bed about the same time as the accident. His log entries indicated that 2 days before the accident he had exceeded the driving hours-of-service limit by 2 hours, and that at the time of the accident he had exceeded the limit by 3.75 hours. The following table outlines his duty/sleep hours for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	0515	10	1515	8.75
SUN	0000 0215 2015	.75 10 12.5 excessive	-- 1215 --	-- 8 --
MON	-- 1645 2200	-- 4 5	0845 --	8 --
TUE	-- 1100	-- 15.5 at time of accident, excessive	0300	8

A postaccident drug screen test of the driver, as required by the company, showed positive results for the following drugs: amphetamines, methamphetamines, and cannabinoids (marijuana). The driver had tested positive for marijuana during his pre-employment drug testing with this company.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep. Contributing to the driver's condition was his use of amphetamines and/or methamphetamines and marijuana.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 62

Investigation No:	WRH-93-T-HF25
Type of Accident:	Fixed Object Collision
Accident Location:	Arbuckle, California
Date and Time:	February 17, 1993, at 5:45 a.m. P.s.t.
Ambient Conditions:	Darkness, raining, 50 degrees Fahrenheit
Vehicle(s) Involved:	1990 Ford, 2-axle conventional tractor, pulling a lightly loaded 1989 Road Systems, 28-foot "van" trailer with a converter dolly attached to the rear of the trailer.
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	2 hours
Number of hours since last slept:	13.75 hours
Number of hours on duty since last slept:	11.75 hours
Duty/sleep pattern:	Irregular sleep hours Inverted duty/sleep Duty hours could not be classified

Description of the Accident:

The combination unit was traveling north on Interstate 5 at a witness stated speed of 55 to 60 mph. It was raining and dark. The vehicle was in the right lane and negotiating a sweeping right curve when it gradually crossed into the left lane and went off the left side of the roadway at a 10-degree angle. The unit initially struck a guardrail and then started across a bridge while in contact with the concrete bridge railing. The tractor came to rest facing north and straddling the left bridge railing. The semitrailer, still attached and at a right angle to the tractor, came to rest with the rear wheels resting in a creek bed about 15 feet below the bridge. The converter dolly was still attached to the semitrailer and was also resting in the creek bed. The combination unit traveled about 100 feet from where it initially struck the guardrail to the point of rest. The tractor and trailer were destroyed and the converter dolly was lightly damaged. The truckdriver sustained minor injuries.

A witness, who was also driving a combination unit, had been following the accident vehicle for the previous 5 miles. The witness saw the accident vehicle weaving on the roadway and attempted to call the driver on the Citizens Band Radio, but he did not answer. The witness then flashed his headlights in an attempt to get the driver's attention but did not succeed. When the accident driver was questioned

at the scene by the highway patrol as to whether he fell asleep, his response was "I think so."

When the accident driver was questioned by the Safety Board investigator concerning this accident, he related that he "was not sure what happened." The driver declined to answer questions concerning occurrences 1 hour before the accident and simply related that he did not remember anything.

The 29-year-old driver had 10 years of experience driving combination units, primarily with double trailers. He had been employed by this carrier for 3 years. The driver had been working a steady night shift, starting about 6:30 p.m. and working until 6:30 a.m. About 8 hours of his 12-hour shift were devoted to driving, and the remaining 4 hours were devoted to loading, unloading, and meal or rest breaks. Although he was working his normal shift on the morning of the accident, he had been off duty the previous 3 days. On his off-duty days, he slept at night. On the day of his accident, he had inverted his sleep schedule and was driving at night. The driver related that on the day before the accident, he got up at 8 a.m. and had slept well for 9 hours. He stayed at home that day and then went to bed again at 2 p.m. and slept for 2 hours. He then got up, ate supper, and departed his residence at 6 p.m. The driver's off-duty activities could not be verified. The following table outlines his duty/sleep hours for the 4 days before the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	0030	4.25	0700	6
	--	--	2300	9
SUN	Off duty	--	2300	9
MON	Off duty	--	2300	9
TUE	-- 1800	-- 11.75 at time of accident	1400	2

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 63

Investigation No:	WRH-93-T-HF31
Type of Accident:	Overturn
Accident Location:	Sacramento, California
Date and Time:	February 17, 1993, at 12 noon P.s.t.
Ambient Conditions:	Daylight, cloudy, raining, 60 degrees Fahrenheit
Vehicle(s) Involved:	1982 Ford, Model 9000, 3-axle conventional tractor pulling a 1972 Utility, 32-foot empty flatbed trailer and a 1991 Walton, 16-foot lowboy trailer loaded with a forklift
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	6.75 hours
Number of hours since last slept:	7.25 hours
Number of hours on duty since last slept:	6 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination unit (unit #1) had just entered U.S. 50/Business 80 and was traveling westbound during rain. Unit #1 was in the #4 lane (4th lane from the center median) and traveling at a driver-stated speed of about 50 mph when it was overtaken by unit #2 (another combination unit consisting of a tractor and large "van type" trailer), which was traveling in the #3 lane. After completing the pass, unit #2 pulled in front of unit #1 and then slowed down, apparently because of traffic slowing ahead. As a result, the driver of unit #1 forcefully applied the brakes. Driver #1 then noticed that the second trailer hauling the forklift was jackknifing to the right. He attempted to correct the jackknifing through steering input, but the second trailer overturned onto its left side. There was no collision between the two combination units, and unit #2 did not stop at the accident site. Unit #1 came to rest in the #3 lane facing west with the second trailer on its left side. There was no damage to the tractor, but the pintle hook on the rear of the first trailer was broken. The second trailer and the forklift had minor damage on the left side. The driver was not injured.

The 21-year-old driver had about 6 months of experience driving heavy combination vehicles. He had not attended a professional truckdriving school but had on-the-job training from the carrier. About half of the driver's job duties involved loading and unloading cargo with a forklift.

Driver #1 related that after unit #2 passed and pulled in front of him unit #2 slowed suddenly. Although driver #2 did not stop at the scene, he later called the police and related that after passing and pulling in front of unit #1, he traveled about 1/4 mile before noticing cars slowing in front of him. He stated that he then let off on the accelerator, which activated the Jacobs Engine Brake, thus slowing the vehicle. Although traffic was heavy, there were no other known witnesses to corroborate either version of the occurrence. Because driver #2 decelerated by using his engine retarder rather than by applying the brakes (brake lights were not activated), driver #1 may have had difficulty interpreting the deceleration and may have delayed reacting and then reacted too suddenly to maintain the stability of his configuration, which had the heavy forklift in the rear.

All of the brakes on unit #1 were examined and found to be in good adjustment. There was no evidence to indicate that the mechanical condition of the vehicle was a factor in this accident.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's heavy brake application, which resulted in the loss of stability of the second trailer, and an improper load distribution.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 64

Investigation No:	WRH-93-T-HF26
Type of Accident:	Overturn
Accident Location:	Milford, California
Date and Time:	February 18, 1993, at 9:54 a.m. P.s.t.
Ambient Conditions:	Daylight, foggy (<500 feet visibility) 25 degrees Fahrenheit
Vehicle(s) Involved:	1980 Freightliner, 3-axle COE tractor, pulling a 1978 Trailmobile, 42-foot flatbed trailer loaded with lumber
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	11.5 hours
Number of hours since last slept:	2.5 hours
Number of hours on duty since last slept:	2.5 hour
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination unit was traveling northbound on U.S. 395 at a driver-stated speed of 35 to 40 mph. The road surface was covered with snow, ice, and slush. While on a straight section of roadway, the driver observed a highway patrolman standing on the east edge of the roadway waving his arms. The driver interpreted this to mean stop. (There had been an accident north of this location, and the highway patrolman was attempting to slow traffic in the heavy fog to prepare drivers for an impending stop.) At the same time, a marked highway patrol vehicle was parked about 7 feet off the east edge of the roadway with the emergency lights activated. After observing the patrolman, the truckdriver applied his brakes and began to slide. The trailer swung to the right and struck the left side of the police car and several mailboxes. The combination unit continued forward and overturned onto its right side. It came to rest facing northwest with the tractor in the northbound lane and the trailer off the roadway. The distance from where the combination unit initially departed the roadway to the final resting position was about 200 feet. The tractor received moderate damage, mostly to the left side, and the trailer was lightly damaged. The load of lumber remained on the trailer. The driver sustained minor injuries.

There were two motor-homes stopped on the roadway just north of where the involved combination vehicle came to rest. The first motor-home driver related that

the patrolman was signaling for them to stop. The second motor-home driver believed the patrolman was simply signaling for them to slow down. The patrolman stated that he was signaling for them to slow down.

The 61-year-old truckdriver was an owner/operator who had 9 years of truckdriving experience, all with the same combination unit. He had learned to drive from another truckdriver after he bought his unit.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of control on an icy roadway, due to braking, in an attempt to stop at the ambiguous signaling of a police officer.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 65

Investigation No.:	WRH-93-T-HF29
Type of Accident:	Fixed Object Collision
Accident Location:	Susanville, California
Date and Time:	February 22, 1993, at 11:30 p.m. P.s.t.
Ambient Conditions:	Cold, Cloudy, Dry, Darkness
Vehicle(s) Involved:	1995 Kenworth COE tractor in combination with a 1986 Raven flat-bed semitrailer (loaded)
Occupants:	2
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	4 hours
Number of hours since last slept:	3.75 hours
Number of hours on duty since last slept:	3.75 hours
Duty/sleep pattern:	Irregular sleep hours Duty hours could not be classified ⁴

Description of the Accident:

The combination vehicle was traveling southbound on a straight and level section of U.S. Route 395 approaching a 434-foot-radius left turning curve that was on a 10-percent superelevation. As the roadway curved, it formed one side of a triangle with two intersecting roadways. The interior of the triangle was composed of level dirt, approximately 2 feet below the surface of the roadway. The area was lighted by lights from a country "general store" and three single family residences. The vehicle failed to completely negotiate the curve and drifted off the right side of the roadway near the lower corner of the triangle. The slope of the interior dirt embankment caused the vehicle to overturn on its right side. It slid on its right side in a southwesterly direction a total of 150 feet. While sliding, it struck a phone booth on the opposite side of the roadway, knocking it down before coming to rest in a dirt pile in front of one of the residences. There were no tire marks on the pavement. The driver and co-driver received minor injuries.

The 67-year-old driver said he fell asleep while driving. He had been driving for 2.75 hours after 4 hours of sleep in the sleeper berth. A review of his duty/sleep hours indicates that the driver's sleep start times were irregular and the accident

⁴ According to the classification criteria for this study, the driver's start times are irregular. However, because all three start times occurred during a 12-hour period, the case will be considered nonclassifiable.

occurred at a time when the driver had been 2.5 hours into sleep on each of the previous 3 nights. The driver had been off duty the last 3 days. The following table outlines the driver's duty/sleep hours for the 4 days before his accident. The co-driver was asleep in the sleeper berth at the time of the collision.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
FRI	Off duty --	-- --	0000 2100	6.5+ 9
SAT	Off duty	--	2100	10.5
SUN	Off duty	--	2030	11.25
MON	0745 1130 1945	1 4.25 3.75 at time of accident	0845 1545	2.75 4

An evaluation of the vehicle marks in the dirt and the slide distance indicates that the vehicle was not exceeding a safe speed at the time of the accident.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 66

Investigation No:	SRH-93-T-HF23
Type of Accident:	Fixed Object Collision
Accident Location:	Alexander City, Alabama
Date and Time:	February 25, 1993, 6:45 a.m. c.s.t.
Ambient Conditions:	Clear and dry, darkness/no artificial light
Vehicle(s) Involved:	1990 International conventional, with a loaded 1989 Greatdane 48-foot semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	5.5 hours
Number of hours since last slept:	3 hours
Number of hours on duty since last slept:	3 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination unit was traveling westbound on a four-lane divided section of U.S. 280. As the unit approached the Coosa County line, the road transitioned from a four-lane divided highway to a two-lane, two-way roadway that curved to the left. The left hand curve had a radius of 821 feet. The combination unit failed to negotiate the left curve and traveled straight ahead off of the right edge of the roadway. The unit traveled over the chevron markers, struck a gravel pile, became airborne for 30 feet, came back down still traveling in a westerly direction, and slid 100 feet before coming to rest on its wheels blocking both lanes of U.S. 280. The driver sustained minor injuries.

The driver was on a trip from Brunswick, Georgia to Birmingham, Alabama. Before loading his truck, the driver informed the dispatcher that he was not feeling well, that he had a bad cold, and needed to go home. The driver stated that the dispatcher instructed him to take the trip and then he would see about getting him home.

The 45-year-old driver related that he was taking two 500 mg Tylenol tablets every 2 to 3 hours. He also said that he had slept 8.75 hours in the last 26 hours.

An interview of the company safety director revealed that their dispatchers are assigned a number of trucks and drivers. The dispatchers are paid bonuses if (1) the

drivers assigned to them complete a certain number of miles per month and (2) if not more than two drivers lay off (for whatever reason) each month.

The driver stated that he must have fallen asleep. The driver had irregular duty/sleep hours, and he had less sleep on the night before the accident than he had on the 2 previous nights. Also, he went to work 2 hours earlier than his average start time. The following table outlines his duty/sleep hours for the 7 days before the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
FRI	--	--	2200	8
SAT	0645	2.25	--	--
	1030	3.25	2100	9
SUN	0900	.25	--	--
	1600	.75	2100	8.75
MON	0545	.5	--	--
	0845	2.25		
	1330	4.75		
	2115	2.75		
TUE	--	--	0000	6.75
	0645	8.75	1830	10.75
WED	0515	1	--	--
	0745	2.25	--	--
	1130	.25	--	--
	1300	2.25	1530	3.25
	1845	3.5	2215	5.5
THU	0345	3 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 68

Investigation No:	SRH-93-T-HF28
Type of Accident:	Fixed Object Collision
Accident Location:	Lincoln, Alabama
Date and Time:	March 1, 1993; at 4:15 a.m. c.s.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1983 International conventional tractor in combination with a 1988 Wabash cargo van semitrailer

Occupants:	1
Injuries:	Minor

Duty/Sleep Information:	
Duration of most recent sleep period:	2.5 hours
Number of hours since last slept:	12.25 hours
Number of hours on duty since last slept:	12.25 hours
Duty/sleep pattern:	Irregular duty/sleep hours Exceeded hours-of-service limits

Description of the Accident:

The combination unit was traveling westbound on Interstate 20 near Lincoln, Alabama and entered a construction zone; the eastbound roadway was closed and the westbound roadway was designated for two-lane, two-way traffic. While traveling in the straight and level single lane, the combination unit departed the right side of the roadway, crossed the rumble-stripped shoulder, and at a 5-degree angle continued down the side slope 280 feet to the bottom of the ditch. The unit crossed the ditch and then rotated counterclockwise as it moved along the outer embankment of the ditch for 340 feet before returning to the bottom of the ditch. The unit continued along near the bottom of the ditch another 500 feet before it collided with a concrete culvert head-wall and overturned onto its right side. Vehicle damage was substantial. The truckdriver sustained minor injuries.

The 30-year-old truckdriver told the investigating officer that he was "avoiding a vehicle that swerved into his lane." Several days later the truckdriver stated that he perceived that the oncoming vehicle was moving into his lane but that it did not actually cross the temporary asphalt median. The slight departure angle and 480 feet of travel before any steering input is characteristic of diminished alertness rather than an evasive maneuver.

Examination of the truckdriver's daily logs revealed that during the 4 days before the accident his on-duty and driving hours were irregular and exceeded the hours-of-service limits. The truckdriver logged on duty in Charlotte, North Carolina at 5 p.m. on Friday, and the accident occurred at 5:15 a.m. e.s.t. the following Monday. During this period of 60.25 hours, the driver logged 41.5 hours driving and traveled 2,301 miles, which calculates to an average speed of about 56 mph. Because an average speed of 56 mph would have been difficult to maintain, it is likely that he drove more hours than actually logged. The driver's sleep periods were irregular, and the last 8-hour rest period logged by the truckdriver was on Saturday morning. At 11 p.m. on Saturday, the truckdriver exceeded the hours-of-service regulations of 10 hours driving. He continued to exceed the hours of service regulation until the time of the accident (29.75 hours later) and drove an additional 21.25 hours, logging off duty for a 2-hour and a 3-hour period. Therefore, it is reasonable to conclude that the truckdriver momentarily fell asleep because of excessive on-duty hours and insufficient sleep. The following table outlines his duty/sleep hours for the 4 days before the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
THU	-- Off duty	-- --	Before 0000 --	9+ --
FRI	-- 1700	-- 10.75	0000 --	9 --
SAT	-- 1230	-- 11.25	0345 2330	8.5 3.25
SUN	0245 1300 1700	8.25 1.5 12.25	1100 1430	2 2.5

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 69

Investigation No:	WRH-93-T-HF30
Type of Accident:	Collision—Other
Accident Location:	Emigrant Gap, California
Date and Time:	March 1, 1993, at 3:30 p.m. P.s.t.
Ambient Conditions:	Clear, dry, sunny day
Vehicle(s) Involved:	1986 Peterbilt COE tractor in combination with a 1991 Trailmobile dry van semitrailer, empty
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	12 hours
Number of hours since last slept:	8.5 hours
Number of hours on duty since last slept:	1.5 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The empty combination vehicle was westbound in the mountains on a 2-percent upgrade on Interstate 80. The truck was traveling at a driver-stated speed in excess of 60 mph in the inside (left) lane passing vehicles. Near the top of the grade, the truck exited a left turning curve and encountered other westbound traffic that was progressing very slowly due to a previous accident in the roadway. The truckdriver made a hard brake application and locked the brakes. The combination slid to the right, jackknifed, and then slid back to the left and into a high snowbank that was adjacent to the shoulder. The truckdriver sustained minor injuries.

The 29-year-old male driver stated that he was aggravated with the drivers of westbound passenger cars because they would slow to admire the scenery and then speed up again. He was unable to pass them until the roadway leveled somewhat near the top of the grade. The driver further stated that the reason he became easily aggravated was because of his high stress level generated by his personal problems within the last 4 months. During that time, he suffered a foot injury that caused him to lose 2 weeks of work and income. In addition, he was in the process of a divorce.

The driver's daily logs indicated that this trip originated on Sunday, the day before the accident, in Fontana, California with a load delivered in Reno, Nevada. After spending the night in Reno, he started the second leg of the trip to the company's terminal in Stockton, California. He was 60 miles from the terminal when the accident occurred.

At the terminal, he would have been off-duty for the rest of the day. According to the driver, he had already earned his commission/pay for the trip and, consequently, there was no need for him to be in a hurry.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of vehicle control when he attempted to slow from an excessive speed for other traffic.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 70

Investigation No:	SRH-93-T-HF26
Type of Accident:	Fixed Object Collision
Accident Location:	Comer, Georgia
Date and Time:	March 3, 1993, 2:20 a.m., e.s.t.
Ambient Conditions:	Cloudy and roadway wet; darkness
Vehicle(s) Involved:	1983 Freightliner cab-over-engine tractor in combination with a loaded van semitrailer
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	7.25 hours
Number of hours since last slept:	1.25 hours
Number of hours on duty since last slept:	1 hour
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination unit, loaded with 40,000 pounds of insulation, was traveling eastbound on State Route 72 about 3 miles east of Comer, Georgia en route to Abbeville, South Carolina. The combination unit had exited a 1,000-foot-radius right curve and entered a straight section of highway when it ran off the right side of the roadway at a 5-degree angle. The combination unit continued forward about 360 feet before striking several trees and a utility pole. The unit then continued forward another 290 feet before striking another utility pole and coming to rest in an upright position. The 39-year-old truckdriver was not injured.

The driver of the combination unit said that he misjudged the distance between the right side of his vehicle and the edge of the roadway. He further stated that when the combination unit entered the soft area beyond the paved shoulder, he lost control of the vehicle. The roadway was delineated with pavement markings and the 4-foot paved shoulder was installed with rumble strips.

A review of the last 30 days of entries in the driver's logbook and his activities for 96 hours before the accident did not reveal any information that might suggest the driver was fatigued other than the fact that he started this trip 2 hours earlier than his normal start time. However, the shallow departure angle and the driver's failure to initiate any adequate steering input suggest that the driver's alertness was diminished. The accident occurred during the early morning hours when drivers are most susceptible to a reduced state of alertness and drowsiness.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 71

Investigation No:	SRH-93-T-HF25
Type of Accident:	Fixed Object Collision
Accident Location:	Tuscaloosa, Alabama
Date and Time:	March 3, 1993, 10:15 a.m. c.s.t.
Ambient Conditions:	Cloudy and dry; daylight
Vehicle(s) Involved:	1985 Peterbilt cab-over-engine tractor in combination with an unloaded 1989 Utility flatbed semitrailer
Occupants:	2
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	9 hours
Number of hours since last slept:	3.25 hours
Number of hours on duty since last slept:	0.75 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination unit was traveling northbound in the left lane of Interstate 59 in Tuscaloosa, Alabama, at a driver-estimated speed of 55 mph when the semitrailer brakes suddenly engaged. The vehicle continued forward for about 400 feet before the rear of the semitrailer rotated counterclockwise to an attitude of about 45 degrees. In that configuration, the combination unit moved across the paved shoulder and onto a gradual descending earthen slope. Before coming to final rest, the semitrailer struck a breakaway utility pole that was located about 20 feet from the edge of the paved shoulder. The 40-year-old truckdriver and his wife, the other occupant in the vehicle, were not injured.

The evidence indicated that a disconnection occurred in the brake system between the truck tractor and semitrailer causing a loss of air pressure and subsequent engagement of the semitrailer brakes. The police were unable to determine in the postcrash examination of the combination unit the cause of the disconnection; it was not available for Safety Board inspection. The driver may have overlooked a loose connection during his pre-trip inspection, and the vibration from over-the-road travel could have caused the supply-brake line to disconnect.

Although the driver's duty/sleep hours was irregular, it appeared that he was receiving adequate sleep each day. The following table outlines his duty/sleep hours for the 5 days before the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	-- Off duty	-- --	Before 0000 2200	8+ 2
SUN	0015 1930	11.25 4.5	1130 --	8 --
MON	-- 1230	-- 9.5	0000 2200	6.75 8.75
TUE	0645	10.25	2200	9
WED	0930	.75 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was a loss of vehicle control due to the inadvertent loss of brake air pressure from a disconnection in the air brake line between the truck tractor and semitrailer.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 72

Investigation No:	SRH-93-T-HF29
Type of Accident:	Jackknife
Accident Location:	Cordele, Georgia
Date and Time:	March 3, 1993; at 3:00 p.m. e.s.t.
Ambient Conditions:	Moderate rain, highway wet
Vehicles Involved:	1986 International COE tractor in combination with a 1990 Fruehauf cargo van semitrailer
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	6.5 hours
Number of hours since last slept:	9.5 hours
Number of hours on duty since last slept:	8.5 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination unit was traveling southbound in the right lane on Interstate 75 en route to Douglas, Georgia. The truckdriver said that at some distance ahead he observed a truck stopped on the right shoulder. As he approached the truck, it began moving forward along the shoulder. He said that the truck moved slowly along the shoulder and suddenly turned to the left into his path of travel. Braking his vehicle, the truckdriver perceived that he could not stop clear of the encroaching truck, and vehicles in the left travel lane prevented immediate steering to the left. Subsequently, the left travel lane became clear, and the truckdriver steered sharply to the left and avoided contact with the encroaching truck. The evasive steering maneuver initiated skidding on the wet asphalt, and the combination unit skidded across the left travel lane and entered the median. The unit moved across the median and approached the northbound roadway before the truckdriver was able to regain steering control and turn back into the center of the median. The combination unit came to rest upright and in a jackknifed configuration about 340 feet from where it first entered the median. The encroaching truck did not stop, and neither the vehicle nor its driver was identified. The investigating officer reported that he received witness information to substantiate the truckdriver's statement about the encroaching truck. Damage to the combination unit was minor. The 37-year-old truckdriver was not injured.

The truckdriver had been on the same scheduled run for over a year—a daytime run each weekday with weekends off. The motor carrier utilizes a

"LogAssist" system, which is a computer-assisted system approved by the Office of Motor Carriers. The motor carrier provided 3 months of computerized hours-of-service records on the accident truckdriver. No evidence of hours-of-service irregularities was found.

The wet pavement may have contributed to the truckdriver's loss of vehicle control during the evasive maneuver.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of control of his vehicle during an evasive maneuver to avoid an encroaching vehicle.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.****CASE NO. 73**

Investigation No: WRH-93-T-HF33
Type of Accident: Overturn
Location: Coalinga, California
Date and Time: March 5, 1993, at 6:15 a.m. P.s.t.
Ambient Conditions: Clear and dry, dawn, 60 degrees Fahrenheit
Vehicles Involved: 1991 Peterbilt, 3-axle conventional tractor, pulling
a 1986 Fruehauf, 53-foot "van" semitrailer loaded
with general freight
Occupants: 2
Injuries: Minor (driver, passenger)
Duty/Sleep Information:
Duration of most recent sleep period: 9.25 hours
Number of hours since last slept: 11.25 hours
Number of hours on duty since last slept: 6.75 hours
Duty/sleep pattern: Irregular duty/sleep hours

Description of the Accident:

The combination unit was traveling northbound on Interstate 5 at a driver-stated speed of 56 mph. The combination unit departed the roadway at about a 5-degree angle and then drifted over the rumble strips on the right paved shoulder and onto the gravel berm. The driver, who admitted that he fell asleep, was startled awake by the rumble strips and overcorrected to the left to avoid a bridge support. As a result, the vehicle came back on the roadway and crossed back over both northbound lanes, overturning in the process. The unit came to rest in the 75-foot-wide earthen median on its right side and facing southwest. From its initial departure from the roadway to the final resting position, the combination unit traveled about 500 feet. The tractor was heavily damaged and declared a total loss. There was moderate damage to the right side of the semitrailer. The driver and the co-driver, who was asleep in the sleeper berth, sustained minor injuries.

The 23-year-old driver had about 7 months of experience driving heavy combination vehicles. He had driven the same tractor for the previous 4 months. Before being hired, the driver successfully completed training at a professional truck driving school.

The driver worked with two other drivers in a three man team rotation. The truck was ordinarily on the road 7 days per week and operated between Seattle and Los Angeles, making stops at terminals in Portland and San Francisco. There was

always one driver off duty, and they usually changed drivers in San Francisco about every 10 days. All three driver's resided in central California.

On the day before the accident, the driving team departed San Francisco about 10:30 a.m. with the accident driver in the sleeper berth. After traveling about 400 miles, they arrived in Los Angeles at 7 p.m. The driver stated that he slept very poorly during this trip and blamed it partly on the rough road. He also related that he seldom sleeps well in the sleeper berth. After arriving in Los Angeles, the two drivers walked to a restaurant to eat supper and returned to the truck at about 9 p.m. The accident driver related that he did not go back to sleep. At midnight, he assisted in loading the trailer, and they then departed at about 12:30 a.m. with the accident driver driving and the co-driver in the sleeper berth. The following table outlines his duty/sleep hours for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
MON	--	--	0800	6
TUE	-- 1315 2315	-- .5 4.25	0000 1345	9.5 9.25
WED	0600	3.5	1300	11
THU	0000 1900	9.75 .5	0945	9.25
FRI	0000	6.25 at time of accident		

The driver admitted that he became sleepy shortly after leaving Los Angeles and stated that he drank Coca Cola to help him stay awake. The driver related that about 45 minutes before the accident, he saw a "ghostly looking dog" on the roadway. He realized that this was only an illusion due to fatigue. Because he was sleepy, he intended to pull off the roadway at State Route 33 but fell asleep and passed up the exit. (The accident occurred under the State Route 33 overpass.) The driver had driven 225 miles in about 5.5 hours from the time they departed Los Angeles until the time of the accident.

When questioned as to why he did not pull off earlier, he related that he would have been scolded by the co-driver sleeping in the berth. When the co-driver was questioned about this matter, he related that he probably would have scolded him, but "then it would be over with." The co-driver related that he had previously informed the accident driver if he became sleepy to stop the truck and wake him up. The co-driver also related that the accident driver was in a strained relationship that was affecting his job performance.

A 30-day examination of the driver's daily logs did not reveal any hours-of-service violations. During the 7 days before the accident, the accident driver had driven 2,225 miles in 46.5 hours.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.****CASE NO. 74**

Investigation No: CRH-93-T-HF19
Type of Accident: Overturn
Accident Location: Arlington, Texas
Date and Time: March 5, 1993, at 7 a.m. c.s.t.
Ambient Conditions: Clear and dry; daylight
Vehicle(s) Involved: 1990 Peterbilt conventional tractor in combination
with a loaded van semitrailer
Occupants: 1
Injuries: Minor
Duty/Sleep Information:
Duration of most recent sleep period: 1.5 hours
Number of hours since last slept: 11.5 hours
Number of hours on duty since last slept: 11.5 hours
Duty/sleep pattern: Irregular duty/sleep hours
Exceeded hours-of-service limits

Description of the Accident:

The loaded combination unit was westbound on Interstate 30 in an urban area. The combination had traveled about 880 feet on an exit ramp from the interstate to State Highway 360 when it overturned onto its left side and slid off the left side of the roadway. The exit ramp had a 24-degree right hand curve that was banked with a 6-percent cross-slope. The cargo, a load of new tires, was not damaged. The truckdriver received minor injuries.

The 26-year-old truckdriver told investigating police that he had reduced his speed to 15 mph on the exit ramp. The driver also stated that by the time he realized the trailer was overturning it was too late to take evasive action. The truckdriver stated that he was not familiar with the area. The posted advisory speed for the ramp was 25 mph. Physical evidence at the scene contradicted the driver's statement that he had reduced his speed to 15 mph. The evidence indicated that the truck was traveling between 23 and 25 mph when it overturned. Postaccident calculations indicated that the minimum overturning speed for this combination unit was 23 mph. Consequently, the driver had failed to reduce his speed sufficiently to avoid overturning on the curved exit ramp.

The truckdriver had 7 years of experience driving heavy trucks but had only worked a few weeks for this carrier. Daily logs maintained by the truckdriver for the 10-day period before the accident indicated that there was considerable variation in

the time of day that he went on duty. During this period, he drove the maximum number of hours allowed by regulation. At the time of his accident, however, he had exceeded the hours-of-service 10-hour rule. While he was on the road, his sleep periods were split and irregular and were always taken in the sleeper berth. Even though the truckdriver stated that he was not tired or fatigued at the time of the accident, he had been on duty for 11.5 hours (11 hours of driving). The following table outlines his duty/sleep hours for the 5 days before the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SUN	1900	6	--	--
MON	--	--	0100 ⁵	1
	0200	1	0300	5
	0800	2	1100	7
	1800	10	--	--
TUE	--	--	0400	8
	--	--	2200	2
WED	0000	5.5	0600	3.5
	0930	4.5	1400	4
	--	--	2000	3.5
THU	0000	6	0600	8.5
	1930	11.5	1800	1.5

Considering the truck's excessive speed for the curve and the fact that the driver had been on duty driving for more than 10 hours at the time of the accident, it is likely that he was fatigued and inattentive. Contributing to the truckdriver's fatigue were his irregular duty/sleep hours and lack of adequate rest during the accident trip.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to reduce his speed sufficiently while traversing a curved exit ramp. Contributing to this accident was the drivers' reduced alertness due to excessive continuous driving hours.

⁵ For the purposes of the Safety Board's analysis and classification of duty status, only breaks longer than 1 hour were considered as off-duty status.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 75

Investigation No.:	WRH-93-T-HF32
Type of Accident:	Non-Collision
Accident Location:	Beaumont, California
Date and Time:	March 7, 1993, at 5:00 a.m. P.s.t.
Ambient Conditions:	Clear, cool, dry, darkness
Vehicle(s) Involved:	1984 Peterbilt COE tractor in combination with a 1978 Timpfe enclosed van semitrailer (loaded)
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	1 hour
Number of hours since last slept:	4 hours
Number of hours on duty since last slept:	10 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination vehicle was westbound on State Route 60 approaching a "T" intersection on the north side of the roadway. As the vehicle was completing a 1,250-foot-radius right curve, it drifted off the right side of the roadway at a shallow angle over an 8-inch-high asphalt curb. After leaving the roadway, the vehicle continued straight for about 100 feet at which point it struck a sign. The vehicle continued forward for about 80 feet before coming to a stop. The vehicle remained upright and the driver was not injured.

The 21-year-old truckdriver had 1.5 years of truckdriving experience and had been driving "interstate" for only 3 months. He told investigators that he fell asleep while driving because he was not accustomed to nighttime driving. Five days before this accident, he had been involved in another accident at night in which he had fallen asleep. In that accident, he had drifted off the roadway in much the same manner as he had in this incident. The driver's duty/sleep hours were irregular. He was on duty for 10 hours before the accident occurred. During this time, he had driven 7.5 hours, which were interrupted by a 1-hour nap 4 hours before the accident.⁶ A review of his driver's logs indicated he had exceeded the driving hours-of-service rules by 4.5 hours at the time of this accident because he did not have an adequate number of hours off duty between his driving shifts. A review of

⁶ For the Safety Board's analysis and classification of duty status, only breaks longer than 1 hour were considered as off-duty status.

his driver's logs for the 60 days before the accident indicated he had exceeded the driving hours-of-service regulations on several occasions. The following table outlines his duty/sleep hours for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
WED	0800	.5	Before 0000	8+
	1030	1	--	--
	1430	2	1630 2200	2.5 9
THU	--	--	1500	7
	2200	10	--	--
FRI	--	--	0800	6
	1400	3.5	1730	5
	2230	3.5	--	--
SAT	--	--	0200	2
	0400	4	0800	6
	1400	3.5	1730	1.5
	1900	10	--	--
SUN			0000 ¹	1

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 76

Investigation No:	SRH-93-T-HF27
Type of Accident:	Rollover
Accident Location:	Tuscaloosa, Alabama
Date and Time:	March 8, 1993, at 4:30 a.m. c.s.t.
Ambient Conditions:	Cloudy and dry, darkness
Vehicle(s) Involved:	1990 Freightliner conventional tractor in combination with a 1992 Brenner MC-312 tank semitrailer.
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	5.25 hours
Number of hours since last sleep:	1.75 hours
Number of hours on duty since last sleep:	1.75 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination unit was traveling northbound on a straight and level rural section of Interstate 59 en route to Crossville, Tennessee, when the unit crossed the paved left shoulder, which had rumble strips, departed the left side of the roadway, and entered the grassy median. The unit was then redirected to the right and traveled across both travel lanes. The unit then crossed the paved right shoulder, which had rumble strips, at a 5-degree angle, and departed the right side of the roadway about 1,500 feet north of where it first entered the median. As the truckdriver attempted to steer the combination unit back to the roadway, the unit overturned and came to rest on its right side about 170 feet from where it left the right travel lane. During the overturn, the semitrailer separated from the truck tractor at the fifth wheel. Damage to the combination unit was substantial. The driver sustained minor injuries.

The 29-year-old driver had been employed by this motor carrier for 1.5 years. He had 12 years of experience in vehicles of this type and configuration.

The driver had been driving in a team with his wife until March 2, 1993. He departed on the accident trip by himself at 6:30 a.m., on March 6, 1993, drove to Geismer, Louisiana, loaded the semitrailer and was returning to Crossville, Tennessee, when the accident occurred. The driver's duty/sleep hours was irregular, and he began the accident shift at a time when he was sleeping the previous night.

The following table outlines the driver's account of his duty/sleep hours for the 6 days before his accident. The driver's account of his duty/sleep hours varied greatly with the times listed on the company logs.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
WED	-- Off duty	-- --	Before 0000 2200	9+ 11
THU	Off duty	--	2200	10
FRI	Off duty	--	2200	10
SAT	0915 1930	2.25 9.5	1430 --	5 --
SUN	-- 0900 1830	-- 5 3	0500 1400 2130	4 4.5 5.25
MON	0245	1.75 at time of accident		

Based on the physical evidence, the irregularity of his duty/sleep hours, the change of routine from a co-driver operation to a solo operation, and the time of day (4:30 a.m.), it is reasonable to conclude that this driver was experiencing drowsiness and allowed the vehicle to drift first off the left side of the roadway and then off the right side of the roadway.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 77

Investigation No:	CRH-93-T-HF21
Type of Accident:	Overturn
Accident Location:	Fort Worth, Texas
Date and Time:	March 9, 1993, at 1:25 p.m. c.s.t.
Ambient Conditions:	Clear and dry; daylight
Vehicle(s) Involved:	1983 Peterbilt cab-over tractor in combination with a loaded van semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	9 hours
Number of hours since last slept:	6 hours
Number of hours on duty since last slept:	4.5 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination unit was northbound on State Route 360, a multilane limited access roadway. The vehicle exited the roadway onto a ramp leading to eastbound State Route 183. The combination unit passed a 40-mph advisory speed limit sign, crested a small hill, and began to descend a 3-percent grade. As the vehicle entered a moderate 625-foot-radius right hand curve, the unit overturned onto its left side. The unit slid about 210 feet before coming to rest on the left shoulder of the roadway. The left side tires of the vehicle left a pre-rollover friction mark on the roadway that was 430 feet long and had a radius of 521 feet. The driver received minor injuries.

The 47-year-old driver stated that he did not recall seeing the 40-mph advisory speed limit sign and had continued traveling about 50 to 55 mph into the right hand curve. The driver stated that wind gusts and the shifting of his vehicle's unsecured load may have contributed to the overturn. The driver's log indicated that the driver had received adequate rest during the 72 hours before the accident.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to negotiate the curve due to excessive speed.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 78

Investigation No.:	WRH-93-T-HF35
Type of Accident:	Overturn
Accident Location:	Sacramento, California
Date and Time:	March 12, 1993, at 2:15 p.m. P.s.t.
Ambient Conditions:	Clear and dry; daylight
Vehicle(s) Involved:	1993 International conventional tractor combined with a 1991 Fruehauf flatbed semitrailer (loaded)
Occupants:	2
Injuries:	2 Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	10 hours
Number of hours since last slept:	5.25 hours
Number of hours on duty since last slept:	2.25 hours
Duty/sleep pattern:	Irregular duty hours

Description of the Accident:

The combination vehicle was northbound on a two-lane roadway in a rural area of northwest Sacramento, approaching a sharp left curve. The road ran along the top of a 20-foot-high levee with steep embankments on both sides of the pavement. There were no shoulders and no superelevation on the roadway. As the vehicle entered the curve, the semitrailer tracked to the outside of the pavement and the rear wheels went onto the dirt embankment. As a result, the rear of the semitrailer began to slide down the embankment and pulled the tractor with it. The combination vehicle rolled over 1.5 times before coming to rest near the bottom of the embankment. During the rollover, the synthetic webbing binders that secured the wood molding cargo broke and, as a result, pieces of wood were scattered over the embankment and into the water at the base of the levee. The driver and the passenger in the vehicle received minor injuries.

The 61-year-old driver had been off duty for 2 days visiting his brother. During this time, it appeared that he received adequate rest. About noon on the day of the accident, the driver and his adult son picked up the combination unit at a terminal where it had been dropped off 2 days earlier to be loaded. The driver was returning to his brother's home before starting his scheduled trip when the accident occurred. The driver indicated that as he entered the curve a binder on the cargo broke, causing the load of wood molding to shift to the right. According to the driver, the shifting load caused the vehicle to slide off the pavement.

The postaccident examination of the vehicle and its cargo found evidence of a defective binder on the forward cargo load on the left side of the trailer. However, the examination determined that, based on the construction of the load of lumber and the location of the defective binder, any shifting of the load would not have been enough to cause the rear of the vehicle to slide off the roadway. The tire marks on the roadway at the point where the vehicle departed the pavement indicated that the rear wheels were side sliding as they left the roadway.

Although the driver's duty hours were irregular, it appeared that he received adequate rest each night. The irregular duty hours did not appear to contribute to this accident. The driver had been on duty 2.25 hours at the time of the accident but had been driving only 30 minutes at the time of the accident. The following table outlines his duty/sleep hours for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
TUE	0000	1.5	--	--
	0030	5.5	--	--
	1100	5	1800	8.5
WED	0330	3	--	--
THU	--	--	0000	7
	--	--	2300	10
FRI	1200	2.25 at time of accident		

Although the driver stated that he was traveling 25 mph in the curve, which had a posted advisory speed limit of 35 mph, the available evidence indicated that the driver was traveling faster than the stated speed of 25 mph and that speed was the primary factor in this accident.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway due to the incompatibility of the vehicle speed and the road curvature.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 79

Investigation No.:	WRH-93-T-HF34
Type of Accident:	Fixed Object Collision
Accident Location:	San Jose, California
Date and Time:	March 14, 1993, at 1 a.m. P.s.t.
Ambient Conditions:	Cloudy, raining, darkness with street lights
Vehicle(s) Involved:	1986 Freightliner COE tractor in combination with a 1974 Superior tank semitrailer (loaded) and a 1971 Brenner tank pull trailer (loaded)
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	12 hours
Number of hours since last slept:	15 hours
Number of hours on duty since last slept:	8 hours
Duty/sleep pattern:	Inverted duty/sleep Regular sleep hours Duty hours could not be classified

Description of the Accident:

The combination vehicle was traveling southbound on Interstate 680 exiting a broad sweeping right curve. According to the driver, who was working a regular shift and was familiar with the route, he intended to exit the freeway at an off-ramp at the foot of the curve. The driver stated that as he approached the off-ramp at a driver-estimated speed of 55 mph, the rear trailer began to "fish-tail" and he subsequently lost control of the vehicle. The combination unit jackknifed, slid across the off-ramp lane, struck a guardrail, slid into a dirt drainage ditch, and then struck a brick wall before coming to rest. The driver said the reason the rear tank semitrailer began to "fish-tail" was because of the wet, slippery conditions on the roadway. The 31-year-old driver received minor injuries.

A witness to the collision, who was traveling behind the vehicle in the #4 lane, stated that the truck did not appear to be in a position to exit the freeway. The witness stated that he saw the rear semitrailer "wiggle" a little, jackknife, then slide off the roadway and into the drainage ditch. The witness estimated that both vehicles were traveling about 55 mph at the time of the accident.

Truck tire marks were located in the #4 lane after the entrance to the off-ramp. The marks crossed over the gore point, across the single lane of the off-ramp, into the

guardrail, and then into the drainage ditch. The marks indicated that the vehicle did not jackknife until after it crossed over the gore point.

The physical evidence, the driver's stated intent to exit the off-ramp, and the witness statement regarding the position of the vehicle on the roadway suggest that the driver made a sudden turning movement to the right in an attempt to exit the off-ramp. The sloshing effect of the liquid in the tanks and the wet, slippery roadway added to the vehicle's instability during the sharp turning movement, causing the vehicle to jackknife and subsequently slide off the roadway.

The driver had inverted his duty/sleep hours on the night of the accident, following 2 days off duty; that is, he was working at a time when he had been sleeping on the previous 2 nights. At the time of the accident, the driver had been on duty 8 hours and driving for 4 hours. The following table outlines his duty/sleep hours for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
TUE	1700	11.25	--	--
WED	-- --	-- --	0415 2300	8.75 14
THU	Off duty	--	2300	10
FRI	Off duty	--	2200	12
SAT	1700	8 at time of accident		

The inverted duty/sleep hours and the number of hours on duty probably reduced the driver's level of alertness. The reduced level of alertness caused the driver to miss his exit that he routinely traveled and affected his judgment to steer abruptly to the right in an attempt to make the exit.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of control while making an unsafe steering maneuver. Contributing to this accident was the driver's reduced alertness resulting from inverted duty/sleep hours.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 80

Investigation No:	CRH-93-T-HF22
Type of Accident:	Overturn
Accident Location:	Near Evergreen, Alabama
Date and Time:	March 17, 1993, 3:00 a.m. c.s.t.
Ambient Conditions:	Cloudy and raining; darkness
Vehicle(s) Involved:	1989 Kenworth cab-over tractor in combination with a loaded van semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	1 hour
Number of hours since last slept:	3.5 hours
Number of hours on duty since last slept:	20 hours ²
Duty/sleep pattern:	Inverted duty/sleep Irregular duty hours Exceeded hours-of-service limits

Description of the Accident:

The combination unit was traveling westbound on U.S. Route 84 in a rural area on a tangent 5-percent upgrade when the right side tires departed the right lane of the roadway and entered the narrow grass shoulder at about a 2-degree angle. The truckdriver steered to the left and brought the right front tractor tire back onto the wet pavement at a point 219 feet from where it first departed the roadway. However, during the steering, the driver applied partial braking, which caused the rear of the refrigerated trailer to begin skidding down the steep grassy embankment. The trailer continued to swing to the right and rotated about 45 degrees before the right side tires dug a deep furrow. As a result, the combination unit overturned onto its right side. The vehicle slid on its right side 76 feet before coming to rest about 401 feet from where the driver applied the brakes and 457 feet from where the combination unit first left the roadway.

The 52-year-old truckdriver told the investigating police officer that he did not know how the accident had happened. The officer advised the driver that the circumstances suggested he had fallen asleep, to which the driver replied, "That's probably what happened." The driver later provided several differing accounts. He

² For the Safety Board's analysis and classification of duty status, only breaks longer than 1 hour were considered as off-duty status.

told the tractor owner that he had dropped a candy bar and was looking for it on the floor, and that the momentary inattention allowed the vehicle to wander from the roadway. During an interview with a Safety Board investigator, the driver indicated that he was looking for a candy bar in the sleeper berth of his truck when the vehicle left the pavement. The driver reportedly told the contract shipper that the accident was caused by a sudden and unexplained application of the trailer brakes.

An examination of the driver's log books revealed that the driver had made false entries; the logs indicated that he had been off duty and asleep since 8:45 p.m. the prior evening. The driver subsequently admitted that he had slept for only 1 hour and had driven for 14 hours and 600 miles during the 23 hours preceding the accident. The driver had inverted his duty/sleep hours from the previous evening and was working at the time he usually slept. His duty hours were both irregular and excessive regarding the hours-of-service 10-hour and 15-hour rules. The following table outlines his duty/sleep hours for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
FRI	-- 0815	-- 10.5	Before 0000 2200	8+ 8
SAT	0830	1	2000	9
SUN	1430	1	2000	8.5
MON	0615	6.5	2000	8.5
TUE	0545 1915	12.25 7.75	- 2300 ¹	-- 1

The driver's duty/sleep hours and the physical evidence at the scene suggest that the driver fell asleep, as he first admitted.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 81

Investigation No:	SRH-93-T-HF30
Type of Accident:	Overturn
Accident Location:	Gaylesville, Alabama
Date and Time:	March 18, 1993; at 3:30 a.m. c.s.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1979 Mack COE tractor in combination with a 1987 Theurer cargo van semitrailer
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	10 hours
Number of hours since last slept:	9 hours
Number of hours on duty since last slept:	9 hours
Duty/sleep pattern:	Irregular duty/sleep hours Inverted duty/sleep Exceeded hours-of-service limits

Description of the Accident:

The combination unit, loaded with 90 bales of cotton weighing 76,000 pounds, was eastbound on State Route 68, a two-lane highway. Just east of Gaylesville, Alabama, the unit crossed a 150-foot-long concrete bridge that had about a 1-inch drop-off where each end abuts the asphalt roadway surface. According to the driver, about 155 feet beyond the bridge, the tractor rear tires began skidding erratically without warning. As evidenced by tire marks on the highway, the unit continued along the right side of the roadway, moved leftward into the westbound lane, and then returned to the eastbound lane. The driver was not able to maintain steering control or stop the combination unit before it ran off the right side of the road into a 6-foot-deep ditch where it overturned and came to rest. The distance from the onset of erratic skidding to the final position of the combination unit was 550 feet. The tractor sustained moderate damage. The semitrailer was substantially damaged, and its cargo was spilled. The 48-year-old truckdriver was not injured.

Postaccident inspection revealed that one "U" bolt was missing on the left side of the tractor rear axle and that both "U" bolts were missing on the right side of the axle. Two broken bolts were recovered at the accident site; the third bolt was not found. The breaks on the bolts appeared bright and without rust. Also, the right rear main leaf spring was broken near its center. Failure of these components allowed the bottom of the semitrailer to move downward and contact the rear tires

of the tractor, as evidenced by the damaged tires and the tire marks on the bottom of the frame and crossmembers of the semitrailer. The insides of the recovered "U" bolts and the sides of the leaf spring showed evidence of considerable wear which is characteristic of vehicle operation with loose "U" bolts. The failure of the suspension components suggests that adequate inspection and maintenance of the tractor was not being performed.

Thirty days of the truckdriver's logs were examined. No evidence of excessive hours or other irregularities were found in his company logs; however, in his reconstructed account of his 96-hour history to the Safety Board investigator, he had exceeded the hours-of-service 10-hour rule 2 days before his accident. After 10 hours of sleep at home in Yazoo City, Mississippi, the truckdriver went on duty the day before the accident and headed for Trion, Georgia, a distance of 390 miles. At the time of the accident, he had traveled 365 miles and logged 8.25 hours of driving. Although the driver had inverted his duty/sleep hours and worked irregular and excessive duty hours, he apparently was sufficiently rested before going on duty the day before his accident. His duty/sleep hours does not appear to have been a factor in this accident. The following table outlines his duty/sleep hours for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	-- Off duty	-- --	Before 0000 2200	9+ 11
SUN	Off duty	--	2200	11
MON	-- 1915	-- .25	1930 2130	1.5 6.75
TUE	0415 1700	10.75 1.25 excessive	-- 1815 2100	-- 2 5.75
WED	0330 1830	5 9 at time of accident	0830	10

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's inability to maintain steering control because of the failure of the rear suspension on the tractor.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 82

Investigation No:	CRH-93-T-HF23
Type of Accident:	Overturn
Accident Location:	Amarillo, Texas
Date and Time:	March 19, 1993, 4:15 a.m. c.s.t.
Ambient Conditions:	Foggy with damp pavement
Vehicle(s) Involved:	1989 conventional Peterbilt tractor in combination with a loaded livestock semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	8 hours
Number of hours since last slept:	15.25 hours
Number of hours on duty since last slept:	6.25 hours
Duty/sleep pattern:	Irregular duty/sleep hours Exceeded hours-of-service limits

Description of the Accident:

The combination unit, loaded with 72 head of cattle, was traveling west on Interstate 40 at a driver-estimated speed of 45 to 50 mph in the right lane when it departed the left side of the roadway. Tire marks indicated that the unit departed the pavement at about a 4-degree angle, traveled 312 feet in the median, and then overturned and slid 55 feet on its left side. The combination unit sustained substantial damage. The truckdriver received minor injuries.

At the time of the accident, there was moderate to heavy fog in the area. According to the 47-year-old truckdriver, he came upon a slow moving vehicle and had to steer left abruptly and brake lightly to avoid the car. Two truckdrivers in separate vehicles, who were with the accident driver when the police arrived 30 minutes after the accident, claimed they saw the slow moving vehicle. One of the truckdrivers stated that he passed the truck and car and saw the accident in his rearview mirror. The other witness observed the accident from across the median as he was traveling eastbound. There was no evidence on the pavement to indicate that the accident driver made a steering or braking maneuver to avoid an accident.

The truckdriver had been on duty for about 40 hours in the preceding 5 work days, and had been awake for 15.25 hours at the time of the accident. The preceding day he had slept from 5 a.m. until noon. After sleeping, he remained off duty at a cattle auction until 10 p.m. when he went back on duty loading his livestock trailer.

The truckdriver worked an irregular schedule but normally tried to drive at night when the temperatures were cooler for the cattle. The driver's schedule indicated that he was approaching the hours-of-service (HOS) limitations by driving the maximum number of hours and taking off the minimum number of hours required for rest. On the day before he began driving the accident shift, he was in non-compliance with the hours of service 10-hour rule. He had 29 years of heavy truckdriving experience and had been working for his present employer for 10 months. The following table outlines his duty/sleep hours for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
MON	--	--	Before 0000	8+
	1330	1.5	--	--
	2030	10.5	--	--
TUE	--	--	0700	8
	1500	3.5	--	--
	2330	11.5 excessive	--	--
WED	--	--	1200	7
	1900	10	--	--
THU	-- 2200	-- 6.25 at time of accident	0500	8

The absence of any roadway evidence to indicate an evasive maneuver was initiated and the gradual departure of the combination unit from the roadway do not support the driver or witnesses' account of a slow moving vehicle. Further, given the moderate to heavy fog condition, it is unlikely that the eastbound truckdriver would have been able to clearly see the accident sequence. Given the driver's irregular duty/sleep hours, the excessive number of hours he had recently worked, and the time of the accident when human response is at its lowest level, the driver was probably drowsy and experienced a diminished level of alertness.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway due to a diminished level of alertness.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 84

Investigation No:	WRH-93-T-HF37
Type of Accident:	Collision—Other
Accident Location:	Jacumba, California
Date and Time:	March 20, 1993, at 12:35 p.m. P.s.t.
Ambient Conditions:	Clear, dry, sunny day
Vehicle(s) Involved:	V1: 1989 Freightliner conventional tractor combined with a 1981 Tempte refrigerated van semitrailer, empty V2: 1989 Ford Escort
Occupants:	V1: 2; V2: 0
Injuries:	V1: None; V2: Fatal (two pedestrians)
Duty/Sleep Information:	
Duration of most recent sleep period:	2 hours
Number of hours since last slept:	5.25 hours
Number of hours on duty since last slept:	4.75 hours
Duty/sleep pattern:	Irregular duty/sleep hours Exceeded hours-of-service limits

Description of the Accident:

The combination vehicle was eastbound on Interstate 8 in the outside lane descending a 5-percent grade at 55 mph. Witnesses reported that the vehicle first drifted toward the left for a short distance and then drifted back to the right. The vehicle then departed the roadway at about a 5- to 10-degree angle and drifted onto the right shoulder where it struck and overrode the back of a legally parked disabled passenger car which was well off the roadway. Two men who were standing in front of the car and working on the engine were struck by the vehicles and sustained fatal injuries. After impact, the vehicles remained connected and skidded 28 feet where they struck and damaged 48 feet of a metal guardrail. The vehicles then veered left for 269 feet, crossed both eastbound lanes, and struck and damaged 55 feet of guardrail on the left shoulder. The vehicles continued sliding along the guardrail for another 204 feet before coming to rest in the left shoulder facing east. The driver and the co-driver, who was asleep in the sleeper berth at the time of the accident, were not injured.

The driver told police that he was trying to kick a soda bottle that had fallen on the floorboard from under his foot pedals. Witness statements and the physical evidence did not support the driver's story. Illegal drugs and drug paraphernalia were found in the truckdriver's briefcase. The results of the truckdriver's blood test were "positive" for illegal drugs in the amount of 332 ng/ml of methamphetamines.

The 34-year-old truckdriver had 8.5 years of heavy truckdriving experience. He had never attended any formal truckdriving schools. A review of his driving record revealed several citations for speeding violations.

The California Highway Patrol requested an extensive audit of the truckdriver's logs. The auditor used numerous receipts found in the driver's briefcase to reconstruct the 8 days of driving before the accident day. According to the auditor, the accident driver maintained three log books and rarely did any log entries match the location and time on the receipts. The reconstructed logs showed several instances of gross non-compliance with the hours-of-service regulations. The driver voluntarily obtained inadequate amounts of rest in the days before the accident; he had only slept a total of 14.75 hours in the 4 days preceding the accident. The driver was awake and active for 27 of the 29 hours preceding the accident, visiting friends and, according to toxicological tests, using illegal drugs. He had been driving for 5 hours when the accident occurred. The following table outlines his duty/sleep hours for the 6 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
MON	--	--	0000	7
	0700	1	--	--
	1845	7.5	--	--
TUE	--	--	0215	6.75
	0900	8	1700	5
	--	--	2230	4.5
WED	0300	31 excessive	--	--
THU	--	--	1000	5.5
	1530	.75	--	--
	2245	.5	--	--
FRI	--	--	0015	7.25
	1100	3		
SAT	0300	1	0530	2
	0800	4.75 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep. Contributing to the driver's condition was his use of methamphetamines.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 85

Investigation No:	WRH-93-T-HF36
Type of Accident:	Overturn
Accident Location:	Ludlow, California
Date and Time:	March 22, 1993, at 5:00 a.m. P.s.t.
Ambient Conditions:	Clear, dry, and darkness
Vehicle(s) Involved:	1987 Peterbilt conventional tractor combined with a 1988 Utility refrigerated semitrailer, loaded
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	2.5 hours
Number of hours since last slept:	6.5 hours
Number of hours on duty since last slept:	6.5 hours
Duty/sleep pattern:	Irregular duty/sleep hours Inverted duty/sleep Exceeded hours-of-service limits

Description of the Accident:

The combination vehicle was westbound on Interstate 40 in the inside lane about 4 miles west of Ludlow, California, when the vehicle drifted off the left side of the roadway at about a 10-degree angle. The vehicle traveled 168 feet on the left paved shoulder before entering the median. It traveled another 163 feet where it overturned onto its left side when the driver tried to return to the roadway. The vehicle came to rest blocking both westbound lanes and facing in a northwesterly direction.

The 30-year-old truckdriver, who was the owner of the company, told police that he fell asleep while driving. The roadway evidence supported his statements.

The driver's logs were current and in compliance with the hours-of-service (HOS) regulations. However, his 96-hour history given to the Safety Board's investigator indicated that he was in non-compliance with the regulations before beginning the accident shift and continued to be in non-compliance at the time of the accident. The driver related that he was late for his delivery because of an engine fuel problem that developed shortly after he started the trip. He worked on the fuel problem from 4 a.m. until 1 p.m. on the day before the accident, which prevented him from obtaining adequate rest. He then drove 7 hours which caused him to be in non-compliance with the HOS 15-hour rule. He stopped and tried to sleep for 2.5 hours

in the sleeper berth. He inverted his duty/sleep hours when he awoke and drove another 6.5 hours to where the accident occurred. At the time of this accident, he was in non-compliance with the HOS 10-hour rule as well as the 15-hour rule. The driver further stated that he stopped at Ludlow, 4 miles before the accident site, for about 15 minutes because he was tired and sleepy. During the stop, he splashed water on his face, walked around, and drank a cola. After driving 4 miles, he went to sleep and ran off the side of the road. In summary, in the 24 hours before the accident, the driver had worked 20.5 hours, of which 13.5 hours were driving and the remaining were working on repairs. The following table outlines his duty/sleep hours for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
THU	0000	.75	0045	6.75
	0745	6.25	1530	6.5
	2200	.5	--	--
FRI	--	--	0000	13
	--	--	2000	1
	2100	1.25	2115	1.75
	--	--	2245	2.25
SAT	0100	1.75		
	0430	11.5	1815	9.25
SUN	0400 2230	16 excessive 6.5 excessive at time of accident	2000	2.5

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 86

Investigation No:	CRH-93-T-HF24
Type of Accident:	Fixed Object Collision
Accident Location:	Near Springtown, Texas
Date and Time:	March 23, 1993, at 2:58 p.m. c.s.t.
Ambient Condition:	Clear, sunny, and dry
Vehicle(s) Involved:	Conventional Cab 1984 International Straight Truck with a 3,500-gallon tank loaded with diesel fuel
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	2.5 hours
Number of hours since last slept:	6.5 hours
Number of hours on duty since last slept:	6.5 hours
Duty/sleep pattern:	Regular sleep hours Duty hours could not be classified

Description of the Accident:

The straight truck was traveling northbound on Texas FM 51 in a rural area on a 2-percent upgrade when the vehicle departed the right lane of the roadway, crossed the 4-foot paved shoulder, and entered the dirt shoulder at about a 4-degree angle. The vehicle continued straight ahead about 170 feet before entering a ditch and striking a culvert located beneath a farm field access road. The impact with the culvert separated the hood, grill, and front axle assembly from the straight truck. The vehicle continued to plow forward through the dirt for an additional 77 feet, coming to rest near a wire fence approximately 30 feet from the edge of the road. No evidence of braking or steering input was observed at any point along the vehicle's off-road travel path. The driver received minor injuries.

The 34-year-old driver estimated his vehicle's speed at 55 to 60 mph at the time of the accident. He stated that he was driving normally and had just finished scanning his left rearview mirror when suddenly he felt the right side tires drop off the side of the roadway. Even though he saw the culvert ahead, he did not attempt to steer back onto the roadway because of fear that the truck would rollover. He also did not apply the brake because he was "scared." The driver stated, "I was thinking, but my foot wasn't reacting."

The driver denied falling asleep and maintained that he was fully alert. He blamed his loss of control on momentary inattention and an extreme amount of slack in the steering linkage of the accident vehicle. In response to further questioning, the driver remembered that he had run off the right edge of the highway just 10 miles earlier but was able to recover without losing control of his vehicle. Despite the steering problem, he continued to operate his vehicle at 55 to 60 mph.

A postaccident inspection of the accident vehicle determined that the steering linkage was worn but fully functional. The local delivery driver worked regular daytime hours and stated that he had slept well during the nights before the accident. About 15 minutes before the accident, the driver had purchased snack food and drink at a convenience store. The purchased items were found unopened in the cab of the truck. The driver's inattention may have been related to his trying to locate and open the food packages he had just purchased.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain proper control of his vehicle due to inattention.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 87

Investigation No:	WRH-93-T-HF39
Type of Accident:	Overturn
Accident Location:	Susanville, California
Date and Time:	March 24, 1993, at 4 p.m. P.s.t.
Ambient Conditions:	Daylight, clear and dry, 60 degrees Fahrenheit
Vehicle(s) Involved:	1988 Kenworth, 3-axle conventional tractor, pulling a 1988 Great Dane, 45-foot flatbed trailer loaded with lumber
Occupants:	1
Injuries:	Serious
Duty/Sleep Information:	
Duration of most recent sleep period:	11 hours
Number of hours since last slept:	9 hours
Number of hours on duty since last slept:	5 hours
Duty/sleep pattern:	Regular sleep hours Duty hours could not be classified

Description of the Accident:

The combination unit was traveling eastbound on State Route 44, rounding a series of curves and descending a moderate grade. As the combination unit was rounding an 800-foot-radius left curve, the driver looked into the left rearview mirror and noticed the trailer wheels rising off the pavement. (The driver stated that he believed he was traveling about 40 mph at the time. However, postaccident calculations based on the physical evidence at the scene indicated that he was traveling in excess of 60 mph at the time.) The driver then forcefully applied his brakes and the combination unit overturned. The lumber, fastened by nylon straps, broke away from the trailer and was scattered on the roadway and the right shoulder. The combination vehicle came to rest facing south and across both lanes of traffic. The tractor was on its right side and the trailer, slightly twisted but still attached to the tractor, was on its top with the bed in contact with the pavement. The tractor was heavily damaged and the trailer moderately damaged. The driver sustained serious injuries.

The 38-year-old driver had 13 years of experience driving heavy combination vehicles and had worked for this carrier for 5 months. He successfully completed a 9-week professional truckdriving school in 1987. This was the driver's first experience hauling lumber and his first time over this road. Most of his driving involved hauling heavy steel railroad components, which resulted in loads with a

lower center of gravity than lumber. The driver was on the return portion of a trip which began the previous week in Erie, Pennsylvania and went to Redding, California, a one-way distance of 2,600 miles. After arriving in Redding, the driver had been off duty for 33 hours prior to loading for the return trip to Pennsylvania. He stated that on the night before he departed for Pennsylvania, he slept 8 hours in the sleeper berth.

The accident occurred about 2.5 hours after he departed Redding and began his return trip east. The driver stated that he was not fatigued before the accident.

The postaccident investigation revealed that the load of lumber was improperly secured which may have contributed to the severity of the accident.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to negotiate the curve at a safe speed. Contributing to this accident was the driver's inexperience with hauling a high center of gravity load.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 88

Investigation No:	WRH-93-T-HF38
Type of Accident:	Fixed Object Collision
Accident Location:	Madera, California
Date and Time:	March 25, 1993, at 2:30 a.m. P.s.t.
Ambient Conditions:	Darkness, heavy rain, windy, 55 degrees Fahrenheit
Vehicle(s) Involved:	1981 Freightliner, 2-axle (10.3-foot wheelbase), COE tractor pulling two 1987 Fruehauf 28-foot "van" trailers, lightly loaded
Occupants:	1
Injuries:	Minor
Duty/Sleep Information	
Duration of most recent sleep period:	2.5 hours
Number of hours since last slept:	0.5 hours
Number of hours on duty since last slept:	0.5 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination unit was traveling north on State Route 99 at a driver stated speed of 55 mph. It was raining hard at the time, and the wind was blowing with maximum gusts up to 18 knots. The driver felt the drive axle wheels slipping but was able to recover without incident. Several minutes later, the combination unit had rounded a sweeping left curve and was on a straight section of roadway when the tractor drive axle wheels began to slip again. The driver said it felt like the tractor was "riding on air." He released the accelerator and the tractor began to jackknife. As he attempted to steer out of the jackknife, the entire combination unit went off the left side of the roadway and onto the earthen median. The right side of the tractor then struck the W-beam median barrier. The combination unit came to rest upright with both trailers attached and the tractor facing south in a lefthand jackknife configuration against the W-beam median barrier. Both trailers were on the earthen median facing northwest. The tractor was heavily damaged and it was considered by the carrier to be a total loss. The first trailer had moderate damage on the left side and the second trailer was lightly damaged. The driver received minor injuries.

The 44-year-old driver had 10 years of experience driving combination vehicles and about 18 months with "double trailers." He stated that he originally learned to drive large trucks from another driver when he worked in the Louisiana oil fields, but

had not attended a professional truckdriving school. The driver had been employed by this carrier for about 6 weeks before this accident.

A review of the driver's schedule revealed that he had been off duty for 4 days before beginning the accident trip. On Tuesday (March 23rd), at 10 a.m., he departed the carrier's terminal in Stockton, California. During the next 40 hours, he drove a total of 14.75 hours and covered 726 miles. He logged 22.25 hours in the sleeper berth and related that he generally slept well in the berth. Before the accident, he had pulled off the roadway and slept for 2.5 hours in the berth. The accident occurred about 30 minutes after he resumed driving. The driver related that at the time of the accident he was well rested, was feeling good, and denied the possibility that fatigue was a factor in the accident. The following table outlines his duty/sleep hours for the 4 days before the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SUN	-- Off duty	-- --	Before 0230 2200	5.5+ 8.5
MON	Off duty	--	2200	8.5
TUE	1000 1500	2 6.5	1300 2130	2 8.5
WED	0600 -- 1700	2.5 -- 6.5	0830 1200 2330	2.5 5 2.5
THU	0200	.5 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's loss of control of the vehicle due to an unsafe speed for the prevailing roadway conditions.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 89

Investigation No:	CRH-93-T-HF25
Type of Accident:	Fixed Object Collision
Accident Location:	Centerville, Texas
Date and Time:	March 27, 1993, at 5:15 a.m. c.s.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1993 Kenworth conventional tractor in combination with a loaded van semitrailer
Occupants:	2
Injuries:	2 Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	2 hours
Number of hours since last slept:	3.25 hours
Number of hours on duty since last slept:	3 hours
Duty/sleep pattern:	Irregular duty/sleep hours Exceeded hours-of-service limits

Description of the Accident:

The loaded combination unit was southbound on Interstate 45 in a rural area. Along a straightaway on a 2-percent downgrade, the truck departed the left side of the roadway, crossed the shoulder at a 4-degree angle, and entered the median. The vehicle continued ahead about 330 feet before striking a drainage berm. (The postaccident onsite investigation revealed that the first 110 feet were rolling tire marks, and the last 220 feet were skidding tire marks.) After plowing into the berm, the vehicle then vaulted about 35 feet. It then traveled an additional 140 feet in the median before coming to rest in the median and northbound left lane. The tractor's undercarriage and the cargo were destroyed. Both occupants of the vehicle received minor injuries.

The 24-year-old truckdriver had 1.5 years of experience driving heavy trucks. He had worked 3 months for his last employer before abandoning their combination on the side of the road about 1.5 days before the accident occurred. After abandoning this combination vehicle, he agreed to share the driving of the accident combination vehicle for a free ride to Conroe, Texas. Consequently, at the time of the accident, he was an unauthorized driver of the combination vehicle with only 2 hours of experience in that particular combination. Daily logs maintained by the truckdriver for the 30-day period prior to the accident showed that there was considerable variation in the time of day that he went on duty. Also, during this period he drove the maximum number of hours allowed by regulation. While he was on the road, his

on the road, his sleep periods varied and were always taken in the sleeper berth. (On several days before the accident, the driver had logged questionable and excessive numbers of hours in the sleeper berth. Because the driver abruptly abandoned his truck and never submitted his company logs, this information could not be verified.) According to the driver's account of his driving/on-duty times given to the Safety Board investigator, he had been awake a total of 19 hours before going to sleep in the sleeper berth for 2 hours while the authorized truckdriver was driving. After the 2-hour sleep, the accident involved truckdriver began driving and had driven for about 2.5 hours before the accident occurred. The driver had been on duty driving for a total of 12.5 hours within the last 24 hours with only 2.75 hours of rest during that period. The driver was in non-compliance with the hours-of-service 10-hour rule 2 days before the accident and at the time of the accident. The following table outlines his duty/sleep hours for the 5 days before the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
MON	-- 1600	-- 8	0000 --	11 --
TUE	-- 0400	-- 11 excessive	0000 2100	4 9
WED	0600	10	1600	19
THU	1100 2300	2 2	-- --	-- --
FRI	-- 0600	-- 11 excessive	0100 --	5 --
SAT	-- 0200	-- 3 at time of accident, excessive	0000	2

The truckdriver stated that he was not tired or fatigued at the time of the accident. The truckdriver told investigating police officers that he had blacked out, but that he had not fallen asleep. (The police officer's report, however, listed "fatigued or asleep" as a factor in the accident.) No medical factors were discovered in the course of the investigation that would explain why the driver blacked out. The lack of any medical reason why the driver blacked out, the driver's irregular duty/sleep hours, and the fact that he had been awake 21.5 hours with only 2 hours of sleep before the accident suggest that the driver was fatigued and probably fell asleep.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the unauthorized driver's failure to maintain his vehicle on the roadway because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 90

Investigation No:	CRH-93-T-HF26
Type of Investigation:	Overturn
Accident Location:	Near Brooksville, Alabama
Date and Time:	March 30, 1993, at 12:00 a.m. c.s.t.
Ambient Condition:	Darkness, dry
Vehicle(s) Involved:	Cab-over-engine 1979 Peterbilt in combination with a loaded van semitrailer
Occupants:	1
Injuries:	1 Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	8 hours
Number of hours since last slept:	16.5 hours
Number of hours on duty since last slept:	3.25 hours
Duty/sleep pattern:	Irregular duty hours Inverted duty/sleep

Description of the Accident:

The combination unit was traveling westbound on State Highway 67 near Brooksville, Alabama. On a 2-percent upgrade, the right side tires of the vehicle departed the paved surface at about a 4-degree angle. The right side tires of the tractor reentered the roadway about 225 feet from where they had departed the roadway. However, at a point about 84 feet after leaving the roadway, the right side trailer tires began to off-track and slide down a grassy embankment. The off-tracking trailer tires continued to travel along the shoulder for another 100 feet to the point of impact with an embankment forming an off-road access. Upon striking the off-road access area, the trailer left the ground for approximately 55 feet, landing in standing water along the roadside ditch. The trailer then traveled an additional 80 feet as both the tractor and trailer overturned. The combination unit slid on its right side for 50 feet before coming to rest blocking both lanes of the highway at a location approximately 398 feet from where it first left the roadway. The driver received minor injuries.

The 56-year-old driver stated that he was traveling about 50 mph with headlights on high beam when he approached the crest of a hill and saw the glow of approaching headlights of another vehicle. When he depressed the headlight dimmer switch, located on the floorboard near the driver's left foot, the headlights of his vehicle completely blacked out, leaving the roadway without illumination. The driver began to quickly manipulate the headlight toggle switch located on the dashboard to

his right, but the headlights did not reactivate. He then activated a separate switch operating the fog lights mounted low on the front of the truck. According to the driver, this decreased visibility and momentary inattention resulted in the vehicle's right side tires departing the paved surface and traveling along a narrow dirt and grass shoulder. The driver stated, and the physical evidence indicated, that he did not apply his brakes at any time during the accident sequence. He reported sustaining only minor bruises during the vehicle rollover. A postaccident examination of the accident vehicle's headlights and dimmer switch indicated that under normal operation the lights functioned properly.

The driver stated that he had a clear recollection of the hours and minutes prior to the accident, and that he did not feel fatigued. He received a full 8 hours of sleep the night before, rising at 7 a.m., and had returned to his sleeper berth for another 6 hours of sleep during the afternoon hours. He had driven for only about 2.25 hours during the entire day. However, the driver gave two different accounts of what he was doing during the time between 1300 and 1900 hours. He told the on-scene investigator that he was napping but marked on the log chart provided by the Safety Board that he was off duty awake drinking coffee during that time. The 14 hours of restful sleep alleged by the driver was not independently confirmed by any driver log or other source of information. The following table outlines the driver's duty/sleep hours for the 5 days before the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
WED	0530	10	2000	8
THU	0430 1000	2.5 3.5	2000	8.5
FRI	0900 1400	1 1	2000	8.5
SAT	Off duty	--	1830	9.75
SUN	1300	10.5	2330	8
MON	1000 2215	1.5 1.75 at time of accident		

The driver was an owner/operator who had some discretion in scheduling his working hours. He said he generally went to bed between 6:30 p.m. and 8 p.m., and awoke around 4 a.m. for his daily routine. This accident occurred approximately 4 hours past the driver's normal bedtime. Given this inverted duty/sleep hours and the irregular duty hours in the days before the accident, it is likely that the driver's level of alertness was substantially reduced.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 91

Investigation No:	CRH-93-T-HF27
Type of Accident:	Vehicle Collision
Accident Location:	Leona, Texas
Date and Time:	March 30, 1993, at 6:15 a.m. c.s.t.
Ambient Conditions:	Cloudy and rain; darkness
Vehicle(s) Involved:	1990 GM conventional tractor in combination with two loaded van semitrailers
Occupants:	1
Injuries:	Serious
Duty/Sleep Information:	
Duration of most recent sleep period:	4 hours
Number of hours since last slept:	11.25 hours
Number of hours on duty since last slept:	8.75 hours
Duty/sleep pattern:	Inverted duty/sleep Irregular sleep hours Duty hours could not be classified

Description of the Accident:

The combination unit was southbound on Interstate 45 in a rural area. As the driver traveled along a level straightaway, the combination departed the right side of the roadway and collided with an unoccupied passenger car parked on the shoulder. The car was knocked off the shoulder toward the right into the earthen median separating the highway and a frontage road. The combination traveled an additional 200 feet toward the right in the median before descending a bridge abutment and coming to rest in a creek bed. The tractor, first trailer, and about 5 percent of the cargo were destroyed. The driver sustained serious injuries.

The 57-year-old driver told investigators that the second trailer began weaving during the return trip from Dallas to Houston, Texas. He also stated that the second trailer began to slide off the roadway and pulled the first trailer and tractor off the roadway. He said that he struck a parked car and guardrail as the combination slid off the roadway. Damage to the combination and the passenger car indicate that the tractor collided with the car at a shallow angle and that the impact was centered. Had the second trailer pulled the combination off the roadway, the damage across the back of the car would have been distributed and less centered.

The truckdriver had 27 years of experience driving heavy trucks. According to the driver and the daily log books, the driver regularly worked nights, Monday

through Friday, with Saturday and Sunday nights off, thus voluntarily inverting his duty/sleep hours during his weekends off. The truckdriver said that this was his first day back after his regularly scheduled weekend off. The truckdriver also said that he was not tired or fatigued at the time of the accident. However, the police report listed "fatigue or asleep" as a factor in the accident. On the day before the accident, the driver had slept for only 4 hours, from 3 p.m. until 7 p.m., before he began driving at 9:30 p.m. that evening. He had driven for more than 8 hours at the time the accident occurred. The driver also had engaged in physical activity during the 2 days before the accident—cleaning his pool and yard on one day and cutting down and chopping up a tree on the other day. The following table outlines the driver's duty/sleep hours for the 6 days before the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
WED	Before 0000 2130	8.5 11	1030 --	7.5 --
THU	-- 2130	-- 11	1030 --	8.5 --
FRI	-- 2130	-- 11	1100 --	8 --
SAT	-- --	-- --	1030 2300	8 7
SUN	Off duty	--	2100	9
MON	2130	-- 8.75 at time of accident	1500	4

Given that the driver had inverted his duty/sleep hours on his days off, had slept for only 4 hours before he began driving, and had been driving for more than 8 hours when the accident occurred, it is likely that he was fatigued and his alertness significantly reduced.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 92

Investigation No:	CRH-93-T-HF28
Type of Accident:	Overturn
Accident Location:	Fort Hancock, Texas
Date and Time:	April 4, 1993, at 6:45 a.m. c.s.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1989 Freightliner COE tractor in combination with a loaded van semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	7 hours
Number of hours since last slept:	7.25 hours
Number of hours on duty since last slept:	7.25 hours
Duty/sleep pattern:	Irregular duty/sleep hours Exceeded hours-of-service limits

Description of the Accident:

The loaded combination unit was westbound on Interstate 10 in a rural area. As the driver traveled along a level straightaway, the combination departed the left side of the roadway at a 4-degree angle. The unit traveled about 220 feet with the left side wheels in the median without any observable redirection. At that point, the tire marks began to angle back toward the roadway. The unit traveled an additional 230 feet in the median before the left front wheels moved back onto the pavement. As the driver attempted to steer the combination back onto the roadway, he overcorrected. He attempted to regain control of the unit by steering first left and then right, but the trailer overturned and slid about 20 feet on the left side. At final rest, the truck was about 360 feet beyond the point where it had reentered the roadway. The tractor remained upright and coupled to the trailer as the combination came to rest facing north blocking an exit ramp and the right lane. The truck's cargo of synthetic resin alloy was dislodged and scattered over a wide area. The driver received minor injuries.

The 27-year-old driver told police that he was passing a car and was looking in his rearview mirror to determine if it was clear to move back into the right lane. He further told police that while he was looking in his rearview mirror, the combination drifted off the roadway into the median. The driver told Safety Board investigators that as he was attempting to pass a U-Haul truck for the third time,

the U-Haul truck moved left and forced him to move left to avoid a collision, at which point the combination dropped off the roadway.

Daily logs maintained by the driver for 30 days showed that there was considerable variation in the time of day that the long-haul driver went on duty. The logs indicated that the driver had inverted his duty/sleep hours on several occasions during this period. He routinely drove the maximum number of hours permitted by regulation, or more, and was on the road several days at a time. His sleep periods usually varied and ranged from as little as 5 hours to 10 hours and were always taken in the sleeper berth. The driver consistently rated the quality of sleep in the sleeper berth as "fair." The driver was in non-compliance with the hours-of-service rules at 0115, 3 days before the accident; he had driven 10 hours, slept 5 hours, and then drove another 10 1/2 hours. The driver was also in non-compliance at the time of the accident, because he began working the accident shift without taking the required 8 hour rest break before going back on duty. At the time of his accident, he had been driving for 7 hours, 5 of which he drove without a break. The truckdriver said that he was not tired or fatigued at the time of the accident. The following table outlines the driver's duty/sleep hours for the 5 days before the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
THU	-- 0930	-- 6	0000 1630	7 9.5
FRI	0200 1500	10 4	2000	5
SAT	0100	11.75 excessive	1700	8
SUN	0100	12	2200	7.5
MON	0530 2330	10.25 7.25 at time of accident, excessive	1630	7

The available evidence suggests that the driver was fatigued and inattentive. Contributing to his fatigue were his irregular duty/sleep hours and the lack of adequate rest before starting this trip.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 93

Investigation No:	CRH-93-T-HF29
Type of Accident:	Fixed Object Collision
Accident Location:	Refugio, Texas
Date and Time:	April 7, 1993, 3:30 p.m. c.s.t.
Ambient Conditions:	Cloudy with wet pavement; daylight
Vehicle(s) Involved:	V1: 1978 conventional Kenworth truck tractor in combination with an empty tanker semitrailer V2: 1975 Ford F-150 pickup
Occupants:	V1: 1; V2: 1
Injuries:	V1: Moderate; V2: Serious
Duty/Sleep Information:	
Duration of most recent sleep period:	8 hours
Number of hours since last slept:	9 hours
Number of hours on duty since last slept:	6.5 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The tractor was northbound on U.S. Highway 77 pulling an empty tanker at a driver reported speed of 50 to 55 mph. The truckdriver stated that he was crossing the Mission River bridge in the right-hand lane when he began to decelerate for a slower moving truck. The pavement was wet, and the right-hand lane in the area had polished wheelpaths with excess tar bleeding to the surface. He shifted from 10th gear to 6th gear and began a steering maneuver to the left at the same time. He reported that once he had slowed to about 40 mph, his unit went out of control with the trailer coming around to the right. He countersteered to the right but jackknifed to the left, crossed the raised median curb, and collided with a southbound pickup truck. Next, the combination unit struck and overrode the bridge rail falling 17 feet to where it came to rest below the bridge.

The tractor landed on its right side and was destroyed. The tanker remained upright, but sustained moderate damage. The truckdriver received moderate injuries. The pickup was destroyed, and the pickup driver received serious injuries.

An examination of the trailer brakes by the Texas Department of Public Safety showed that the right brake on the forward trailer axle was out of adjustment; it had a measured pushrod stroke of 2.25 inches. The tractor drive axle brakes had extensive damage and could not be examined. The tractor did not have steer axle brakes.

The 27-year-old truckdriver worked about 45 hours each week providing fuel and lubricants to fishing vessels at the port area in Brownsville, Texas. Of that time, only 12 to 15 hours a week were devoted to driving, which was done in a smaller truck. His over-the-road experience consisted of making 2 to 3 trips each month to Houston, Texas, for fuels and lubricants. He had been a truckdriver for 3.5 years. Although the driver had a commercial drivers license, the motor carrier had never given him any training on driving in inclement weather conditions.

The truckdriver had been off duty for 12 hours before beginning the duty shift on which the accident occurred. He had driven 200 miles on the day of the accident and had taken a rest break approximately 1 to 1.5 hours before the accident.

When questioned, the truckdriver stated that he did not use his brakes to slow down until he had already lost control. However, evaluation of the wet pavement friction, axle loading, and braking forces showed that with a light brake application the trailer brakes would have locked before the tractor and begin to swing out. Moreover, the steer axle had no brakes; tests have shown that tractors without steer axle brakes are much more susceptible to jackknifing. Finally, the simultaneous steering maneuver to the left created a lateral force demand that, combined with the downshifting and probable braking, resulted in a loss of traction.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was a loss of control that developed when the driver made simultaneous braking and steering maneuvers on the slippery surface. Contributing to the accident was the driver's inexperience, the absence of front axle brakes on the tractor, and the failure of the carrier to provide inclement weather driver training to its drivers.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 94

Investigation No:	CRH-93-T-HF30
Type of Accident:	Overturn
Accident Location:	Sierra Blanca, Texas
Date and Time:	April 8, 1993, at 5:35 a.m. c.s.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1993 White/GMC conventional tractor in combination with a loaded van semitrailer
Occupants:	2
Injuries:	Serious, minor
Duty/Sleep Information:	
Duration of most recent sleep period:	4.5 hours
Number of hours since last slept:	3.25 hours
Number of hours on duty since last slept:	3.25 hours
Duty/sleep pattern:	Irregular duty/sleep hours Exceeded hours-of-service limits

Description of the Accident:

The loaded combination unit was westbound on Interstate 10 in a rural area. As the driver traveled along a level straightaway, the combination departed the right side of the roadway and struck a guardrail. The combination traveled about 430 feet on the gravel roadside before reentering the roadway. The unit traveled an additional 210 feet on the concrete shoulder, colliding with 115 feet of guard rail before departing the right side of the roadway a second time. The unit then traveled 130 feet on the gravel roadside, overturned onto the driver side, and slid 175 feet before coming to a stop. The tractor was extensively damaged on the driver side; the trailer was moderately damaged on that side. The driver sustained serious injuries; the co-driver, who was asleep in the sleeper berth at the time of the accident, received minor injuries.

The 26-year-old driver told investigators that he thought he hit something in the roadway with the right steer axle wheel. According to the driver, the tractor pulled toward the passenger side and as he tried to regain control of the truck it overturned onto the driver side. There was no physical evidence at the scene to support this contention. The police officer's report cited "fatigue or asleep" as a factor in the accident.

Daily logs maintained by the driver for 30 days showed that there was considerable variation in the time of day that the long-haul driver went on duty. He

routinely drove the maximum number of hours allowed by regulation and was on the road 3 days at a time. While on the road, his sleep periods usually varied and ranged from 4 hours to 6 hours. These sleep periods were always taken in the sleeper berth while the co-driver operated the vehicle. A review of the driver's trip times and off-duty times at home revealed that the driver had only 13 hours or less of off-duty time at home after three of the four most recent trips. Normally, he was off duty for 32 to 36 hours between trips. Also, during the week before the accident, the driver was twice in violation of the hours-of-service regulations. The truckdriver said that he was not tired or fatigued at the time of the accident. The following table outlines the driver's duty/sleep hours for the 6 days before the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
FRI	--	--	2200	6
SAT	0400 1600	8 5 excessive	1200 2100	4 4
SUN	0100 --	7 --	0800 2200	9 11
MON	1800 2230	.5 6	1830 --	4 --
TUE	-- 0800 1900	-- 6.5 7.5 excessive	0430 1430 --	3.5 4.5 --
WED	-- 0430 1700	-- .5 5	0230 0800 2200	2 8 4.5
THU	0230	3.25 at time of accident		

Although the driver stated that he was not tired or fatigued at the time of the accident, the available evidence, including the irregular duty/sleep hours and the lack of adequate time to rest properly before and during this trip, suggests that the driver was fatigued and his alertness significantly reduced.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 95

Investigation No:	SRH-93-T-HF31
Type of Accident:	Rollover
Accident Location:	Browns, Alabama
Date and Time:	April 8, 1993, at 6:30 a.m. c.s.t.
Ambient Conditions:	Cloudy and dry, dawn
Vehicle(s) Involved:	1990 Mach tractor with a loaded 1982 Pinson dry bulk semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	5.25 hours
Number of hours since last slept:	3.5 hours
Number of hours on duty since last slept:	2.75 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination unit was traveling westbound on a straight and level section of U.S. 80 en route to a farm. As the driver approached the exit ramp at State Route 5, he moved into the deceleration lane and attempted to exit onto the ramp. Tire marks at the scene indicate that the right side tires dropped off the right edge of the pavement into a chuck hole, then came back onto the pavement. The marks continued for 200 feet, where the left side tires departed the edge of the asphalt. Marks in the earthen area to the left of the ramp indicated that the combination unit was redirected back toward the ramp. The unit traveled forward another 100 feet and came to rest on its left side. The cab of the tractor was extensively damaged. The truckdriver received minor injuries.

The 38-year-old driver of the combination unit was an experienced driver, having driven large commercial vehicles for more than 17 years. Before driving for this carrier, the driver was employed as an instructor at a commercial vehicle driving school.

The exit ramp consisted of a 375-foot deceleration ramp that enters into a right curve with a radius of 249 feet. The driver indicated that he was traveling about 35 mph when he attempted to exit U.S. 80. The critical speed of the 249-foot-radius curve was in the range of 45 to 50 mph. Therefore, it is reasonable to conclude that the truck had to be traveling at a minimum of between 45 and 50 mph to create a rollover condition.

When interviewed, the driver said that he normally went to bed between 9 p.m. and 10 p.m., woke up around 3:30 a.m., and was at work between 4 and 4:30 a. m. each day. According to the driver's statement, he averaged 5.8 hours of sleep daily during the 4 days immediately preceding the accident. During the 82 hours immediately preceding the accident, the truckdriver received a total of 23 hours of sleep.

The available evidence suggests that the driver entered the 249-foot-radius exit ramp curve at an excessively high speed and was unable to maintain his vehicle in the single lane of the off ramp. The driver's judgment may have been impaired because of a lack of adequate sleep.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to negotiate the exit ramp curve at a safe speed because his judgment was impaired due to reduced alertness.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 96

Investigation No:	WRH-93-T-HF41
Type of Accident:	Overturn
Accident Location:	Oceanside, California
Date and Time:	April 14, 1993, at 4:45 p.m. P.s.t.
Ambient Conditions:	Clear, dry, sunny day
Vehicle(s) Involved:	1981 Freightliner COE tractor in combination with a 1981 Hobbs flatbed semitrailer, loaded
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	3.5 hours
Number of hours since last slept:	14.75 hours
Number of hours on duty since last slept:	12 hours
Duty/sleep pattern:	Irregular duty hours Exceeded hours-of-service limits

Description of the Accident:

The combination vehicle was departing a rest area to enter the northbound traffic lanes of Interstate 5. The flatbed was loaded with a large metal box container full of flat can lids. While negotiating the 485-foot-long entrance ramp on an 8-percent downgrade, the truck failed to complete the sharp right turning curve at the foot of the ramp safely. At the beginning of the curve, the tractor's left side tires struck and overrode the left curb of the ramp, and entered the raised dirt area between the ramp and the right shoulder of the Interstate. The combination moved into the outside lane of the highway in a sharp right turning configuration, causing the vehicle to lean to the left. The semitrailer overturned onto its left side when the fifth wheel failed causing the semitrailer and tractor to separate. The tractor did not overturn. The cargo remained secured to the trailer. The driver was not injured.

The 38-year-old driver stated that after he overrode the curb, he was going straight ahead to enter the outside northbound lane of the highway. However, there was a northbound truck combination approaching so he had to turn back sharply to the right. This caused the vehicle's weight to shift and to lean to the left. He stated that he heard a loud snapping noise just before the trailer overturned. He could not give a reason why he initially struck and overrode the curb. The postcrash inspection found preaccident cracks in the broken fifth wheel bracket caps. Physical evidence indicated that had these caps not broken off, the tractor would have overturned with the semitrailer.

A review of the driver's daily logs showed that he returned home at the end of each work day. The review indicated, however, that in the past 38 hours, the driver had received only 3.5 hours of sleep. The review also indicated that the driver was in non-compliance with the hours-of-service rules beginning the day before the accident and continuing through the accident day. He had driven a 14.25-hour shift and a 9.25-hour shift with only 5.5 hours off between shifts. The following table outlines the driver's duty/sleep hours for the 5 days before the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	--	--	2000	10.5
SUN	Off duty	--	1900	6.5
MON	0300	12.75	1900	7
TUE	0315 1300	8.25 8.5 excessive	-- 2230	-- 3.5
WED	0315 1430	9.75 2.25 at time of accident		

The driver's reduced alertness due to a lack of adequate sleep and duty hours that exceeded hours-of-service limits probably impaired his judgment when he entered the highway on a sharply curved entrance ramp at too high of a speed.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to negotiate the entrance curve at a safe speed because his judgment was impaired due to lack of sleep and duty hours that exceeded the hours-of-service limits. Contributing to the overturn were pre-existing cracks in the fifth wheel.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 97

Investigation No:	SRH-93-T-HF32
Type of Accident:	Overturn
Accident Location:	Eutaw, Alabama
Date and Time:	April 24, 1993; at 6:30 a.m. c.s.t.
Ambient Conditions:	Clear and dry; dawn
Vehicle(s) Involved:	1990 Volvo conventional tractor in combination with two semitrailers: a 1985 Fruehauf and a 1985 Pines
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	7 hours
Number of hours since last slept:	9.5 hours
Number of hours on duty since last slept:	8.5 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination unit was en route to Meridian, Mississippi, on Interstate 59 when it ran off the left side of a straight and level section of the two-lane southbound roadway. The unit moved across and departed the shoulder, equipped with rumble strips, at a 4-degree angle. It continued along the sloped grassy embankment until the truckdriver steered to the right and returned to the left edge of the road, a distance of about 445 feet. The combination unit became disoriented and the rear trailer overturned onto its left side. After it moved across the roadway for another 195 feet, it came to rest in the right section of the highway. The tractor and lead trailer remained upright with only the rear pintle coupling damaged. The rear trailer sustained minor damage. The truckdriver was not injured.

The 47-year-old truckdriver said that because a deer moved slowly from the right roadside into his path in the right travel lane, he steered to the left lane. He said the deer ran in that direction (leftward), and he therefore steered farther to his left and ran off the asphalt road to avoid hitting the deer. The truckdriver said that had he remained in the roadway, he would not have had adequate distance to reduce speed sufficiently to avoid the deer. Nevertheless, the 68-foot-long tractor/twin trailer unit avoided collision with the deer that reportedly was on a course that put it in line to strike the right side of the vehicle. The police report listed the cause of the accident as "the driver apparently fell asleep." The 4-degree departure angle from the roadway is characteristic of driver inattention rather than evasive steering.

Examination of the truckdriver's daily logs for 30 days revealed no evidence of duty hours that exceeded the hours-of-service limits. The truckdriver departed Greenville, South Carolina and at the time of the accident had traveled 390 miles in 8.5 hours, which he logged as 7.5 hours driving with 1 hour (3 to 4 a.m.) off duty. The following table outlines the driver's duty/sleep hours for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
TUE	-- 1600	-- 12	Before 0000 --	7+ --
WED	-- 1800	-- 5.5	0500 --	8 --
THU	0100 1930	4.5 4	0700 --	8 --
FRI	0100 2200	5.5 8.5 at time of accident	1400	7

Although no evidence of excessive duty hours was found, the driver was driving the maximum allowed number of hours each shift and the accident occurred after 7.5 hours driving during early morning hours when the truckdriver was more likely to be less attentive to the driving task. The facts and circumstances of the accident indicate that the truckdriver's alertness was reduced and he was probably asleep when the truck left the roadway.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of the accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 98

Investigation No:	WRH-93-T-HF42
Type of Accident:	Non-Collision
Accident Location:	San Bernardino, California
Date and Time:	April 26, 1993, at 3:00 a.m. P.s.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1984 Freightliner COE tractor in combination with a 1989 Transcraft flatbed semitrailer, loaded
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	0.25 hours
Number of hours since last slept:	14.75 hours
Number of hours on duty since last slept:	8.5 hours
Duty/sleep pattern:	Irregular sleep hours Duty hours could not be classified

Description of the Accident:

The combination vehicle was eastbound on State Route 138, negotiating a sharp right "horse shoe" turn on the narrow highway. The curve's center radius was 40 feet, and the inside radius was 28 feet. This roadway design forces large vehicles (i.e., tractor-semitrailer combinations) to travel on the left side of the roadway (across the double yellow lines) so that the right side wheels remain on the pavement. The driver did not keep his vehicle far enough to the left, due to an oncoming vehicle. During his turn, the right wheels of the trailer went off the pavement which allowed the rear portion of the trailer to slip down a steep dirt embankment. The tractor, however, remained on the roadway. The driver was not injured and the cargo of wood railroad ties did not spill.

The 32-year-old truckdriver stated that while in the turn, an on-coming westbound car made him cut his wide turn short, which caused the rear tire to slide off the pavement. The roadway evidence tended to support the driver's statement.

Daily logs maintained by the truckdriver showed that this was the first day of his work week after being off duty for 2 days. On the accident trip, the driver drove for 7.5 hours, stopping twice for less than 15 minutes each, to perform safety checks on the vehicle and load. Although the driver's sleep start times were irregular, he had adequate rest before beginning his shift and he indicated that he did not feel

tired or fatigued at the time of the accident. The following table outlines the driver's duty/sleep hours for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
WED	-- 0030 1830	-- 7 9	Before 0000	.5+
THU	--- 1030	-- 10.5	0330 --	7 --
FRI	0100 0930	.75 5.75	0145 --	7.75 --
SAT	Off duty	--	0500	4.5
SUN	-- 1830	-- 8.5 at time of accident	0200	10.25

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's inability to maintain his vehicle in the designated travel lane due to vehicle incompatibility with the roadway design.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 99

Investigation No:	WRH-93-T-HF43
Type of Accident:	Overturn
Accident Location:	Viola, California
Date and Time:	May 3, 1993, at 12:15 p.m. P.s.t.
Ambient Conditions:	Cloudy, raining with an isolated hail storm
Vehicle(s) Involved:	1978 Peterbilt conventional dump truck in combination with a 1978 Reliance dump trailer (both loaded)
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	7.5 hours
Number of hours since last slept:	8.25 hours
Number of hours on duty since last slept:	5 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination vehicle was westbound on State Route 44, negotiating a series of "S" curves with 5- to 7-percent downgrades. The posted advisory speed limit was 40 mph. While negotiating a left hand curve, the vehicle departed the right side of the roadway. The unit traveled ahead about 90 feet at which point the left side tires returned to the roadway. The vehicle traveled about 780 feet with the right side tires in the dirt shoulder. As the driver attempted to bring the vehicle back onto the roadway, the vehicle overturned onto its left side. The trailer broke free of the dump truck, and the cargo (gypsum gravel) scattered over a wide area. The dump truck came to rest on its left side facing southeast in the middle of the roadway. The trailer came to rest facing northwest partially in the eastbound lane and partially in the right shoulder. The truckdriver received minor injuries.

The 51-year-old truckdriver blamed the accident on an isolated hail storm that left an inch of pea-size hail on the roadway and surrounding area. He claimed that a passenger car in front of him slid out of control on the hail and that he lost control while trying to avoid hitting that vehicle.

The statements of the driver of the passenger car contained in the police report contradicted the truckdriver's statements. The driver of the passenger car said that he encountered the isolated hail storm about 1/4 mile before the accident site. He had not seen any tire tracks in the hail on the roadway that indicated another vehicle

had preceded him. Rounding the curve in the roadway, he encountered the overturned truck. He attempted to avoid the truck and spun-out on the roadway. The physical evidence on the roadway (truck tire marks before the accident site) also contradicted the truckdriver's statement.

A review of the driver's logs did not show any evidence of non-compliance with the hours-of-service regulations. The review indicated that the driver's duty/sleep hours were irregular. He had spent the night before the accident at home, slept for 7.5 hours, and had been on duty for about 5 hours before the accident. Four of the 5 hours had been spent driving. He had taken three breaks in the 4 hours driving time; the last one being about 5 minutes before the accident. The following table outlines the driver's duty/sleep hour for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
THU	-- 0230	-- 9.5	Before 0000 2300	2.5+ 7
FRI	Off duty	--	2230	7.5
SAT	-- 1900	-- 12.5	1100 --	6 --
SUN	-- --	-- --	1700 2030	2 7.5
MON	0500 0730	.25 4.75 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to negotiate the curve at a safe speed for the prevailing conditions.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 100

Investigation No: WRH-93-T-HF44
Type of Accident: Overturn
Accident Location: Ocotillo, California
Date and Time: May 5, 1993, at 12:30 a.m. P.s.t.
Ambient Conditions: Darkness, clear and dry, 65 mph limit (35 mph for trucks)
Vehicle(s) Involved: 1992 Peterbilt, 3-axle conventional tractor, pulling 1987 Monon, 48-foot "van" trailer loaded with paint
Occupants: 2
Injuries: Minor
Duty/Sleep Information:
 Duration of most recent sleep period: 4.5 hours
 Number of hours since last slept: 2 hours
 Number of hours on duty since last slept: 2 hours
 Duty/sleep pattern: Irregular duty/sleep hours

Description of the Accident:

The combination unit was descending a 9-mile grade on Interstate 8 at a driver stated speed of 40 mph. Shortly after the vehicle rounded a left curve with a 2,000-foot radius, a 3-percent superelevation, and a 4.8-percent downgrade, the unit gradually drifted onto the left shoulder and brushed against a 6-inch asphalt curb, depositing about 90 feet of tiremarks along the inside of the curb. The marks began very light, and then graduated to a heavy tiremark where the tires went over the curb at about a 5-degree angle. Braking did not occur until after the truck went over the curb. The truck then went onto a soft downward sloping embankment. The truck then traveled forward an additional 100 feet before gently rolling onto its left side. The combination unit came to rest facing east parallel to the roadway and about 10 feet north of the pavement. The left sides of both the tractor and trailer received moderate damage. The driver and the co-driver, who was asleep in the sleeper berth at the time of the accident, both sustained minor injuries.

The 36-year-old driver had 12 years of experience driving combination vehicles. Although experienced, in 1991 he attended a professional truckdriving school and graduated first in his class. The driver was employed by this carrier for 2 weeks and had driven only the accident tractor. He was working in a team operation with his wife, who was the co-driver on the accident trip.

About 9 hours after the accident, the driver gave a urine sample at a local hospital for drug testing. The results of the screening were negative for all drugs tested, which included cocaine. Shortly after requesting that the driver give this specimen, the carrier realized that the testing was not being performed by a laboratory approved by the National Institute on Drug Abuse (NIDA). The carrier requested that he submit a second specimen later that evening when the driver returned to Phoenix where the carrier was based. This specimen, taken about 20 hours after the accident, revealed a positive reading of cocaine.

According to the Federal Motor Carrier Safety Regulations, Part 391.115 (b), a NIDA approved laboratory must be used for "postaccident" drug testing. Furthermore, according to Part 391.87 (a), the medical review officer is only required to release whether the test results are positive or negative, and if it is positive, the name of the drug found. They are not required to release the quantification of the substance found. In the case of cocaine, it is considered positive when the quantity is above the level of 300 NG/ML. For official reporting purposes, any reading below 300 NG/ML would be considered negative. Therefore, it was not learned if there was the presence of cocaine in the initial urine specimen submitted 9 hours after the accident, nor can it be stated with certainty why the first specimen was negative and the second specimen positive. It was learned that both laboratories employed a two tier testing method and both of them used 300 NG/ML as a cutoff point for a positive cocaine reading.

Both the driver and his wife (the co-driver) related that they were at a party the previous Saturday evening, about 72-76 hours before the accident. The driver related that there were persons at the party smoking cocaine in a pipe. He denied using cocaine at this party, but his wife speculated that someone might have put "something" in her husband's drink.

The driver went off duty on Saturday from 6 p.m. until the following day, Sunday, at 9:30 p.m. when the driving team departed for the Los Angeles area. They returned to Phoenix the next day (Monday) and arrived there about 10:15 p.m. About 12:30 a.m., 2.5 hours later, the driving team again departed for Los Angeles. According to the logs, the co-driver began driving this trip and the accident driver was in the sleeper berth from 12:00 a.m. until 5:30 a.m. They changed drivers at Indio, California. The accident driver drove the next 130 miles and arrived in the Los Angeles area to make a delivery about 8 a.m. (Tuesday). They departed Los Angeles at 10:15 a.m. with the accident driver driving. After making several intermediate stops, they arrived in San Diego at 4:45 p.m. This was the last driver log entry before the accident. The driving team then unhooked the trailer and drove in the tractor to get something to eat. They returned to the loading site and went to sleep in the berth around 6 p.m., waiting for the trailer to be loaded. The driver related that he slept until 10:30 p.m., at which time the trailer loading was completed. They departed San Diego about 10:45 p.m. and had driven approximately 95 miles in 1.75

hours when the accident occurred. The following table outlines the driver's duty/sleep hours for 4 days before the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	-- 0745	-- 10.25	Before 0000 2300	3.75+ 11.5
SUN	2030	6.5	--	--
MON	-- 1400	-- 5.25	0300 1915	7.25 3
TUE	-- 0530 1015 1545 2230	-- 2.25 3.5 1.25 2 at time of accident	0000 -- -- 1800	5.5 -- -- 4.5

The driver vehemently denied the possibility of having fallen asleep while driving and related that a "vacuum-like force with tremendous power" forced his vehicle off the roadway. Weather reports for this area did not reveal any high winds or other air current phenomena on the evening of the accident. The physical evidence at the scene also does not support the driver's explanation that he was forced off the road. Braking was not initiated until after the truck ran over the raised asphalt curb. The noise and jarring of the vehicle upon traveling over the curb probably startled the dozing driver. Although the driver related that he had been getting good sleep in the sleeper berth, given that his duty/sleep hours were very irregular and that his recent sleep periods averaged only about 4 hours, it is possible that his level of alertness was substantially reduced and that he fell asleep.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 101

Investigation No:	WRH-93-T-HF45
Type of Accident:	Overturn
Accident Location:	Barstow, California
Date and Time:	May 5, 1993, at 5:00 a.m. P.s.t.
Ambient Conditions:	Clear, dry, and darkness
Vehicle(s) Involved:	1993 Freightliner COE tractor in combination with a 1981 Fruehauf van semitrailer and a 1988 Strick van semitrailer (both loaded)
Occupants:	1
Injuries:	Minor
Duty/Sleep Information	
Duration of most recent sleep period:	5 hours
Number of hours since last slept:	15.5 hours
Number of hours on duty since last slept:	5.5 hours
Duty/sleep pattern:	Inverted duty/sleep Irregular sleep hours Exceeded hours-of-service limits Duty hours could not be classified

Description of the Accident:

The combination vehicle was southbound on Interstate 15 in the outside lane when it drifted onto the right shoulder and traveled against a 6-inch-high asphalt curb for 234 feet. In the next 200 feet, it overrode the curb several times before it went down a dirt embankment off the right side of the roadway at a 10-degree angle. The embankment had a downward slope of about 35 degrees. No braking occurred until after the vehicle overrode the curb. The vehicle continued for another 100 feet crossing over a drainage ditch. Fifty-five feet beyond the drainage ditch, the rear trailer separated from the other vehicles and overturned onto its right side. The tractor and front trailer continued forward an additional 75 feet and came to rest upright, 75 feet west of the roadway, facing in a northwest direction. The tractor was at a 90-degree angle to the trailer's right side at point of rest. The cargo remained in the trailers and a hazardous materials cylinder (hydrogen fluoride, classified as corrosive and poison gas), located in the rear trailer, maintained its integrity. The driver had 9 months of heavy truckdriving experience and had completed a formal truckdriving school before being laid off from his previous employer. His actual driving time in the accident vehicle was 10 hours.

The 50-year-old truckdriver said the accident occurred when he took his eyes off the roadway for 3 to 5 seconds as he reached into an ice chest that was on the console to his right. He felt a jolt when the truck hit the curb and was unable to steer the truck back into the traffic lane. He said that he unfastened his seatbelt while the vehicle was in motion so he could jump if necessary.

A review of the driver's daily logs and an interview with the driver revealed his 48 hours of activities before the accident. During the first 12 hours, he was off duty from the job, and he completed general repairs and duties around his home. He then slept for 3.5 hours (napping) before reporting to work. He was on duty (not driving) for 3 hours and then drove for 6 hours from Los Angeles to Las Vegas. In Las Vegas, he tried to sleep in a motel/casino for 5 hours, but he was unable to sleep so he spent the next 10 hours walking around and sightseeing. He reported back to work at 11:30 p.m. for the return trip to Los Angeles and had been driving 3 hours when the accident occurred. The driver's rest hours were irregular and he had inverted his duty/sleep hours at the time of the accident. The following table outlines his duty/sleep hours for the 6 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
THU	0430	3.75	0845	5.5
	1430	4.25	1845	7
FRI	0145	6.25	--	--
SAT	--	--	0000	5
	0500	5	1000	6
	1600	6 excessive	--	--
SUN	Off duty	--	2200	10
MON	2330	9	2000	3.5
TUE	-- 2330	-- 5.5 at time of accident	0830	5

The driver further stated that the reason he was having trouble sleeping was that his body was still adjusting to working at night, after being accustomed to working 8 a.m. to 5 p.m. over the last 20 years. A review of the driver's log indicated that he had been in violation of the hours-of-service rule 4 days before the accident.

Considering the physical evidence and his duty/sleep history as outlined above, particularly the fact that at the time of the accident he had been awake more than 15 hours, it is reasonable to assume that the driver was fatigued and momentarily fell asleep.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 102

Investigation No:	SRH-93-T-HF33
Type of Accident:	Overturn
Accident Location:	Trenton, Georgia
Date and Time:	May 6, 1993, 2:00 a.m. e.s.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1987 International cab-over-engine tractor in combination with a loaded 1986 Strick van semitrailer
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	8 hours
Number of hours since last slept:	18 hours
Number of hours on duty since last slept:	18 hours
Duty/sleep pattern:	Irregular duty/sleep hours Exceeded hours-of-service limits

Description of the Accident:

The combination unit was traveling westbound on Interstate 24 in Dade County about 7 miles north of Trenton, Georgia en route to Mt. Vernon, Illinois. The trailer was loaded with 44,000 pounds of nylon fiber rolls in Barnesville, Georgia and departed around 10 p.m. The combination unit was in a 1,900-foot radius right curve on a 1-percent downgrade when it left the roadway at a 5-degree angle and entered the median. It continued forward 450 feet before the combination unit rolled onto its left side and came to stop in the median. The truckdriver was not injured.

Although the 53-year-old truckdriver told the investigating police that he was unable to remember the accident, he was certain about his hours on and off duty. He stated that after 8 hours off duty before the accident trip, he drove for 16 hours up to the time of the accident. The driver had received only 8 hours of sleep in the 48 hours before the accident. The driver was in non-compliance with the hours-of-service 10-hour and 15-hour rules at the time of the accident. The accident occurred at 2 a.m., a time when the driver was usually sleeping on previous nights. Log sheets for the 96 hours preceding the accident were not located. He reconstructed his schedule for that time period and the information is listed in the following table.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SUN	--	--	Before 0000	11+
	1100	4	1500	2
	1700	3	2100	12
MON	0930	.5	2230	9.5
	1630	6		
TUE	1630	7.5	--	--
WED	--	--	0000	8
	0800	18 at time of accident, excessive		

The police report listed the accident as "driver fell asleep." Given the driver's lengthy on-duty time and his irregular duty/sleep hours, it is likely that the truckdriver was fatigued and momentarily fell asleep, allowing his combination unit to drift off the roadway.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 103

Investigation No:	CRH-93-T-HF32
Type of Accident:	Overturn
Accident Location:	Arlington, Texas
Date and Time:	May 6, 1993, at 7:25 a.m. c.s.t.
Ambient Conditions:	Clear and dry; daylight
Vehicle(s) Involved:	1989 Peterbilt conventional tractor in combination with a tanker semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	6.5 hours
Number of hours since last slept:	4.5 hours
Number of hours on duty since last slept:	3.5 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The loaded combination was southbound on State Highway 157 and entered an entrance ramp leading to eastbound Interstate 30. As the combination attempted to traverse the 20-degree left-hand curve with a 7-percent superelevation, it overturned onto the passenger side, rolled, and slid to a stop on the outside median. The combination was destroyed and about 10 percent of its cargo of diesel fuel was spilled.

The 31-year-old driver told investigators that he had reduced his speed to about 25 mph on the entrance ramp. He also said that by the time he realized that the trailer was overturning it was too late to do anything. Contrary to the driver's claim, the physical evidence indicated that the combination was traveling well in excess of the posted advisory speed by 15 to 19 mph when it began to overturn.

The truckdriver had 9 years of experience driving heavy trucks. According to company records, the driver had regular routes and worked scheduled hours regularly. The driver had stated that he had been on duty about 3 hours before the accident occurred and that he did not feel tired or fatigued. He said that he had loaded at the company terminal, made one delivery, loaded again, and was on his way to the next delivery when the accident occurred. The available evidence suggests that the driver was traveling at an unsafe speed as he attempted to negotiate the curved entrance ramp.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to negotiate the exit ramp curve at a safe speed.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 105

Investigation No:	WRH-93-T-HF47
Type of Accident:	Overturn
Accident Location:	Lompoc, California
Date and Time:	May 18, 1993, at 1:15 p.m. P.s.t.
Ambient Conditions:	Clear, dry, sunny day
Vehicle(s) Involved:	1988 Freightliner COE tank truck (loaded) combined with a 1988 Westmark tank trailer (loaded)
Occupants:	2
Injuries:	Minor (driver and co-driver)
Duty/Sleep Information:	
Duration of most recent sleep period:	8.25 hours
Number of hours since last slept:	8.25 hours
Number of hours on duty since last slept:	7.25 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination vehicle was making a left turn into the main gate at Vandenberg Air Force Base (AFB) from the outside left turn lane of the westbound lanes of Casmalia Road, at the intersection of California Boulevard. The combination made the turn too wide and was headed toward the curb. The driver jerked the steering wheel left causing the tanker truck to jackknife to the left and overturn to the right. It rolled 270 degrees and came to rest on its left side on the southwest corner facing in a northeasterly direction. The tank trailer broke away from the tank truck and came to rest upright facing south next to and on the right side of the tanker truck. The cargo of gasoline spilled and caught fire. The fire destroyed both vehicles and damaged the AFB entrance gate stone wall. Both the driver and the instructor co-driver escaped with only minor burns.

The vehicle was driven by a 42-year-old male student driver with only 7 days of actual driving time in heavy trucks. The driver was under the tutelage of an experienced driver/instructor who was sitting in the passenger seat. The student driver completed a formal truckdriving school in July 1992. He was hired by this carrier on May 3, 1993.

The student driver stated that during the left turn he missed a down-shift from 4th to 3rd gear and looked down at the shifter to find 3rd gear. When he looked up, he was too far into the intersection to make the turn without hitting the curb. He

immediately jerked the wheel to the left which caused the truck to jackknife and overturn. The instructor confirmed that the student driver had been having problems shifting all week long. The physical evidence on the roadway supported the statements of the driver and instructor.

A review of the driver's daily logs showed that he returned home every night and was off duty on the weekends.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain proper control of his vehicle while making a left hand turn because of the driver's inexperience.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 106

Investigation No.:	WRH-93-T-HF48
Type of Accident:	Fixed Object Collision
Accident Location:	Beaumont, California
Date and Time:	May 24, 1993, at 4:45 a.m. P.s.t.
Ambient Conditions:	Clear and dry, with street lights
Vehicle(s) Involved:	1988 Freightliner COE tractor in combination with a 1984 Midway bin-type semitrailer (empty) and a 1984 Midway bin-type trailer (empty)
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	4 hours
Number of hours since last slept:	4.75 hours
Number of hours on duty since last slept:	4.75 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination vehicle was eastbound on Interstate 10 in the City of Beaumont. The driver was en route from Shafter, California, to Westmoreland, California, to pick up a load of freshly picked agricultural produce. The 300-mile one-way trip began about 12:30 a.m. About 4 hours into the trip, the vehicle drifted onto the right shoulder at a 4.5-degree angle and sideswiped the right guardrail. It bounced off the guardrail and came to rest in the No. 4 lane of eastbound traffic. The driver was not hurt.

The 38-year-old driver indicated that he fell asleep while driving. The driver also stated that he had been feeling drowsy and started to inadvertently go onto an off ramp 1 hour before the accident.

A review of the driver's log for the 30 days before the accident indicated that this was the second day of his work week. His duties included driving from central California to the Imperial Valley area in the southern part of the State. He would pick up up fresh agricultural produce in the Imperial Valley and return to central California. A round trip took about 14 to 18 hours, including a 4- to 6-hour layover while waiting for the cargo to be loaded. The driver went off duty during the waiting period and was supposed to rest for the return trip. According to the driver, he rarely slept during his sleeper berth time. Due to the seasonal nature of the cargo and the necessity to return the fresh produce quickly to the processors, the driver

worked the maximum hours allowable (which is 12 hours of driving with 8 hours off duty in between, because he is an intrastate driver) each week for several weeks. This schedule did not allow the driver sufficient quality rest times. The driver said he had narrowly avoided another accident the week before this accident due to his fatigued condition. The following table outlines his duty/sleep hours for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
THU	-- 0530 1630	-- 6.5 6	Before 0000 1200 (berth)	5.5+ 4.5
FRI	-- Off duty	-- --	0000 1900	12 13
SAT	-- 2230	-- 6.25	1800 --	4.5 --
SUN	-- 1130	-- 6.25	0445 (berth) 2000	6.75 4
MON	0000	4.75 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 107

Investigation No:	WRH-93-T-HF49
Type of Investigation:	Overturn
Accident Location:	Arcata, California
Date and Time:	May 26, 1993, at 6:15 a.m. P.s.t.
Ambient Conditions:	Daylight, cloudy and light drizzle, 55 degrees Fahrenheit
Vehicle(s) Involved:	1986 Peterbilt, 3-axle conventional tractor, pulling a 1987 Western, 48-foot "curtain van" trailer loaded with wood chips
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	4.5 hours
Number of hours since last slept:	4.75 hours
Number of hours on duty since last slept:	3.75 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination unit was traveling westbound on State Route 299 at a driver stated speed of 55 to 60 mph during light drizzle. As the driver was exiting a right curve with a 1,000-foot radius, the combination unit crossed over the narrow paved shoulder, dropped several inches onto a soft earthen shoulder, continued forward for about 100 feet and struck a dirt embankment. The ground was soft due to recent extended periods of rainfall. After leaving the roadway, the driver related that he attempted to steer back onto the road but was thrown into the right passenger seat as he did not have his seatbelt on. As the combination unit continued forward, out of control, the trailer rolled onto its right side. The combination unit came to rest facing northwest, diagonally across the roadway, with the "curtain van" semitrailer on its right side and the tractor leaning to the right. The front wheels of the tractor were on the right earthen shoulder, and the left drive axle wheels were about 6 feet off the pavement. During the accident sequence, the load of wood chips was scattered on the roadway, shoulder, and embankment. The final resting position of the combination unit was about 300 feet west of where it initially departed the roadway. The tractor and semitrailer were heavily damaged. The driver sustained minor injuries.

The 29-year-old driver, who had 11 years of experience in heavy combination vehicles, had worked for this carrier for about 2 years.

On the day before the accident, the driver departed Redding at 8 a.m. and made a roundtrip to Oakland, California. On this day, he drove 450 miles and recorded 9 hours driving time. He related that he went to sleep that night about 9 p.m. and got up at 1:30 a.m. He described the quality of his sleep as "excellent," although the 4.5 hours of sleep was substantially less than what he normally received (average of 8 hours) before going on duty. After departing his residence, he drove to the carrier's nearby terminal and departed there at 2:30 a.m. During the first hour of driving, he drove 48 miles over mountainous terrain and drank several cups of coffee en route. He stopped in Weaverville, California, at 3:30 a.m. where he loaded his trailer with wood chips. He departed at 4 a.m. and continued west on the two-lane mountainous roadway. The accident occurred about 2.25 hours after departing Weaverville. He had driven this additional 85 miles without stopping or drinking more coffee.

During the 7 days before the accident, the driver recorded 33.25 hours of driving and 45.75 hours of on-duty time, both well below the maximum hours allowed during this period. The driver related that he works very irregular hours. However, an examination of his driving logs for the previous 25 days revealed that he never had a starting time as early as 2:30 a.m. Furthermore, the earliest other starting time during this 25-day period was 6 a.m. On one occasion 10 days before the accident, the driver drove between 1 and 4 a.m. while on a multiple-day trip.

The driver related that he was extremely familiar with this roadway. During an interview with a Safety Board investigator, the driver related that he did not know what caused the accident but denied falling asleep.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 108

Investigation No:	CRH-93-T-HF35
Type of Accident:	Overturn
Accident Location:	Near Three Rivers, Texas
Date and Time:	May 26, 1993, at 11:45 p.m. c.s.t.
Ambient Conditions:	Clouds and rain; darkness
Vehicle(s) Involved:	Cab-over-engine 1981 Freightliner in combination with a loaded flatbed trailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	9 hours
Number of hours since last slept:	15.75 hours
Number of hours on duty since last slept:	12.25 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The combination unit was traveling southbound on Interstate 37 north of Three Rivers, Texas, when the vehicle departed the roadway to the left and entered the grassy median at a 4-degree angle. The vehicle traveled about 550 feet across the median and entered the northbound lanes of travel, still headed southbound, nearly striking an unprotected concrete bridge wall spanning a small stream. The driver steered right in order to avoid the concrete bridge wall on the opposite side of the roadway. In so doing, his vehicle rolled onto its left side at a point about 225 feet from where he had entered the northbound lanes of travel. The vehicle then slid to a stop at a point about 190 feet from the point of rollover and about 965 feet from where it left the pavement. The tractor and trailer came to rest with the tractor on its left side, and the flatbed trailer twisted nearly another 90 degrees counterclockwise, resting on the truck bed with the rear tandems pointing upward. The cargo of wood building materials had broken free of the nylon straps at the point of rollover and was scattered about the accident scene. The driver sustained minor injuries.

The 45-year-old driver indicated that he had fallen asleep and recalled awakening as the vehicle entered the median. He chose not to apply his brakes but simply "to ride out" the accident sequence in an attempt to avoid jackknifing. He stated that he purposely drove up onto the northbound lanes, steering between the bridge rails and turning right in an attempt to avoid hitting the far side of the bridge.

The driver, who had been awake for about 16 hours and on duty for more than 12 hours when the accident occurred, admitted having felt fatigued for some time. He stated that the vehicle's air conditioner had broken the day before the accident, and he became sleepy in part due to the warm night air and the noise and turbulence created by his open window. A following trucker had advised via CB radio that the accident involved driver was weaving all over the roadway. The driver had intended to pull over and rest at the next available rest stop but fell asleep before he could do so. The driver's duty/sleep hours were irregular and he continued to drive at a time when he was usually going to sleep. The following table outlines his duty/sleep hours for the 5 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	-- 0800	-- 3	Before 0000 2230	7+ 10.5
SUN	Off duty	--	--	--
MON	-- Off duty	-- --	0000 2030	8 6.5
TUE	0400 1530 1800	3 .5 5	-- 2300	-- 9
WED	0800 1100 2200	1.5 9 1.75 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain his vehicle on the roadway because he fell asleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 109

Investigation No:	SRH-93-T-HF34
Type of Accident:	Overturned
Accident Location:	Cumming, Georgia
Date and Time:	May 5, 1993; at 6:00 a.m. e.s.t.
Ambient Conditions:	Cloudy and dry; dawn
Vehicle(s) Involved:	1973 Freightliner tractor in combination with a 1962 Fruehauf partially filled tanker semitrailer
Occupants:	1
Injuries:	Serious
Duty/Sleep Information:	
Duration of most recent sleep period:	5 hours
Number of hours since last slept:	5 hours
Number of hours on duty since last slept:	3.25 hours
Duty/sleep pattern:	Regular sleep hours Duty hours could not be classified

Description of Accident:

The combination unit was eastbound on State Route 365 in a rural area of Forsyth County, Georgia, en route to a rendering plant some 12 miles away. The 8,700-gallon cargo tank was filled to an estimated 65-percent capacity with chicken fat. In a 700-foot-long, 740-foot-radius right curve, the combination overturned onto its left side in the roadway. Spiral-shaped scrapes in the westbound lane and scratches on the bevel-shaped outer edge of the left rear wheel of the semitrailer indicated that the vehicle overturned within the roadway and that the rear portion of the semitrailer was first to overturn. Some 195 feet after it overturned, the combination unit moved off the left side of the roadway. It continued another 110 feet in a northeasterly direction, struck some brush and small trees, and came to rest 32 feet off the edge of the roadway. The combination unit was substantially damaged, and most of its cargo spilled from damaged outlets and ruptures. The truckdriver was trapped in the demolished cab for over 2 hours; he was critically injured.

The 24-year-old truckdriver said that he was very familiar with the highway, was traveling 54 to 55 mph and did not brake for the curve. He said that he had no memory of a few seconds immediately before or after the accident and that he did not know what caused the accident.

The volume and lateral surging of the liquid cargo affected the center of gravity of the semitrailer. (The 65 percent of capacity was an estimate as no scales were available.) Manufactured with four compartments, the cargo tank had since been converted to a single compartment unit which allowed a greater surge longitudinally when the vehicle decelerated, particularly if it were braked hard in a curve. The police report indicated that the load shifted.

Nine months' experience in combination units with less than 1 month of that in transporting liquid cargos likely contributed to the truckdriver's failure to maintain control and keep his vehicle upright in the roadway.

The truckdriver routinely drove weekday scheduled runs and spent each night at home. After being off duty Saturday and Sunday, he departed the Cumming area about 2 a.m. on a roundtrip to Rome, a distance of about 136 miles. He made a stop at a chicken processing plant in Rome and began his return trip. At the time of the accident, the truckdriver had driven 124 miles and was within 12 miles of his destination. Also, a few minutes before the accident he had refreshments at a truck stop.

During the previous week, the truckdriver had been on runs scheduled mostly during daytime hours. On the morning of the accident, the driver began driving 5 to 6 hours earlier than his normal start time, a time when he was normally sleeping. The driver had received only 5 hours of sleep the night before the accident, significantly less than his usual amount of 10 to 12 hours. The lack of adequate sleep may have diminished the driver's level of alertness.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to maintain control of his vehicle due to a combination of its speed, center of gravity, and the turning radius. Contributing to this accident was the driver's minimal experience with transporting liquid cargo and his reduced alertness due to the lack of adequate sleep.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 110

Investigation No:	CRH-93-T-HF36
Type of Accident:	Overturn
Accident Location:	Agua Dulce, Texas
Date and Time:	June 2, 1993, 9:30 a.m. c.s.t
Ambient Conditions:	Cloudy and dry
Vehicle(s) Involved:	1987 White/Volvo truck tractor in combination with a loaded tanker semitrailer
Occupants:	1
Injuries:	None
Duty/Sleep Information:	
Duration of most recent sleep period:	10 hours
Number of hours since last slept:	3.5 hours
Number of hours on duty since last slept:	3 hours
Duty/sleep pattern:	Irregular duty hours

Description of the Accident:

The combination unit was traveling east on Farm-to-Market (FM) 665, about 1.3 miles east of FM 70. The tanker was loaded with 9,000 gallons of propane, and the combination unit weighed about 76,900 pounds. The truckdriver reported that he heard a loud popping noise and thought that he had a flat trailer tire. He stated that he slowed to about 5 mph and began steering to the right to pull onto the south roadside. When the right side tires of the combination unit traveled onto the soft roadside, they sank 2 feet causing the combination unit to overturn onto its right side. The short distance the combination unit traveled after it overturned was consistent with the driver's estimate that he was traveling about 5 mph when he pulled onto the roadside. The tractor received moderate damage; the tanker was undamaged and none of the propane leaked from the tanker. The truckdriver was not injured.

On the day of the accident, there were visual cues to indicate that the roadside was soft. It had rained for several days before the day of the accident, and there was water standing in the fields and ditches on both sides of the road.

The 44-year-old truckdriver stated that he had slept for 10 hours on the night before the accident and that he felt refreshed on the morning of the accident. He took sinus medication on the night before the accident but stated that it did not adversely affect his sleep period. He had been on duty for 3 hours at the time of the accident. On Tuesday, the day before the accident, the driver worked 12.5 hours. He

only worked 2.5 hours on the preceding Monday, and he was off duty on the preceding Sunday. His logbooks for the period May 1 through May 27 indicated that he was off duty on 8 days and worked 19 days. During those 19 days, he worked 167.5 hours or an average of 8.8 hours a day. Although his duty hours were irregular, they do not appear to be a factor in the accident. The following table outlines his duty/sleep hours for the 4 days before his accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	-- 0530	-- 6.5	Before 0000 2230	5.25+ 10
SUN	Off duty	--	2100	9
MON	0645	2.75	2030	7.5
TUE	0415	12.75	2000	10
WED	0630	3 at time of accident		

There was no evidence to indicate that there were any mechanical problems with the combination unit nor any physical problems with the truckdriver. The truckdriver apparently became preoccupied with a suspected mechanical problem and failed to recognize the hazard of the soft roadside.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's maneuvering onto the roadside, which was soft, and resulted in the unit overturning.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 111

Investigation No:	CRH-93-T-HF37
Type of Accident:	Overturn
Accident Location:	Dallas, Texas
Date and Time:	June 2, 1993, at 1:22 a.m. c.s.t.
Ambient Conditions:	Clear and dry; darkness
Vehicle(s) Involved:	1993 White/GMC conventional tractor in combination with a flatbed semitrailer
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	7.5 hours
Number of hours since last slept:	7 hours
Number of hours on duty since last slept:	3 hours
Duty/sleep pattern:	Irregular duty/sleep hours

Description of the Accident:

The loaded combination was eastbound on Interstate 30 in an urban area. The combination traveled about 830 feet into a 14-degree left-hand curve with a 9-percent superelevation and a 1-percent downhill slope when it overturned onto the passenger side. The vehicle slid about 170 feet to a stop blocking the eastbound lanes. The cargo of plastic PVC pipe dislodged and scattered over a wide area. The truckdriver received minor injuries.

The 24-year-old driver told investigators that a passenger car had cut him off and that as a result he began braking. While he was braking, the semitrailer swung out and flipped over, causing the tractor to flip over onto the passenger side. There was no evidence to support this scenario. The physical evidence at the scene indicated that the vehicle was traveling at an excessive speed to negotiate the curve safely for the existing loaded configuration of the semitrailer.

Daily logs maintained by the driver for 30 days showed that there was considerable variation in the time of day that the long-haul driver went on duty. In addition, the driver had falsified his logs for the 2 days he reported being off duty before the accident. His sleep periods were always taken in the sleeper berth and also varied in duration. The following table outlines the driver's duty/sleep hours for the 5 days before his accident. The driver stated that he did not feel tired or fatigued at the time of the accident.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	-- 0800	-- 8	Before 0000 2200	8+ 12
SUN	1200	6	2300	11
MON	1300	7	2300	1.5
TUE	0030 0700 0900 1500	2 .5 3.5 1.5	0230 2300	4.5 7.5
WED	0630 1100	.5 2.5 at time of accident		

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the driver's failure to negotiate the curve at a safe speed.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 112

Investigation No:	DCA-93-MH-002
Type of Accident:	Collision with overpass
Accident Location:	Evergreen, Alabama
Date and Time:	May 19, 1993, at 1:35 a.m. c.s.t.
Ambient Conditions:	Darkness, clear and dry
Vehicle(s) Involved:	V1: 1989 Navistar International tractor with a loaded bulk-cement-tank trailer V2: 1979 Chevrolet Impala V3: 1993 Navistar International tractor- semitrailer
Occupants:	V1: 1; V2: 1; V3: 1
Injuries:	V1: Serious; V2: Fatal; V3: Fatal
Duty/Sleep Information:	
Duration of most recent sleep period:	9.5 hours
Number of hours since last slept:	18 hours
Number of hours on duty since last slept:	8.75 hours
Duty/sleep pattern:	Inverted duty/sleep Irregular sleep hours Duty hours could not be classified

Description of the Accident:

Vehicle 1, a 1989 Navistar International tractor with bulk cement tank trailer, was traveling south on Interstate 65 near Evergreen, Alabama. About 300 feet north of the County Road 22 overpass crossing I-65, the cement truck left the right pavement edge. The semitrailer tracked to the right of the tractor as it continued at a 5-degree angle along the embankment. The tractor overran a W-beam guardrail in front of the overpass two-column bent. The semitrailer collided with and demolished the north column; the south column remained upright but tilted toward the south. Two spans of the overpass that were supported by the bent collapsed onto the semitrailer and the southbound lanes of I-65, sending a cloud of cement dust into the air. The tractor had traveled under and cleared the overpass before it came to rest on I-65. The 47-year-old truckdriver sustained fractured ribs and lacerations and was hospitalized. He probably survived this accident because he was wearing his lap/shoulder belt, which prevented him from being ejected and incurring more severe injuries.

Two other southbound vehicles subsequently collided with the fallen bridge spans: a 1979 Chevrolet Impala traveling about 60 mph and a 1993 Navistar

International tractor-semitrailer traveling about 65 mph and hauling steel reinforcing bars. The Impala driver applied her brakes and slowed her speed to about 23 mph before impact, according to the Alabama Department of Public Safety. Neither driver wore a seatbelt, although seatbelts are required by Alabama State law. Both drivers sustained nonsurvivable injuries. None of the motor vehicles carried any passengers.

At the accident site, I-65 is a four-lane divided highway with a depressed grass median. The southbound road consists of two 12-foot-wide lanes, a 4.5-foot-wide scored left shoulder, and a 10-foot-wide scored right shoulder. The rumble strips are 1-inch-wide, 1/2-inch-deep, staggered 3-foot-long grooves spaced 8 inches apart and perpendicular to traffic. The approach alignment is a large radius curve to the left.

The bridge overpass was constructed in 1961 and conformed to design guidelines at the time. The spans, noncontinuous concrete decks supported by steel girders, were supported by three two-column bents and two abutments. Each column measured 2.5 feet by 3 feet, and the 3-foot face was parallel to the road. The columns in the collision were 8 feet from the edge of the shoulder. The W-beam guardrail, which flared away from the traveled way, was installed in front of the columns in 1989.

In his statement to the Safety Board investigator, the truckdriver stated that just before the accident, the truck was traveling between 65 and 68 mph in ninth gear. The truck was in the right-hand lane, and he first realized "something was wrong" when he heard noise and felt the truck being pulled to the right; he "heard metal or some kind of racket underneath the trailer or back part of the unit." The truckdriver remembered steering, trying to get off the guardrail, and then being removed from the truck by rescue workers. The truckdriver said that he did not apply the brakes and did not remember hitting the bridge. A witness who tried to help the truckdriver get out of the cab of his truck stated that the first thing the truckdriver said was, "What the [expletive] happened?"

In the interview with the driver, he reported that he customarily drove at night and had followed the same schedule since late 1991: he began his shift between 4:30 and 6 p.m. and went off duty between 3 and 4 a.m. He reported that he usually slept 8 to 10 hours after going off duty on the nights that he worked.

Recapping the days before his accident, the truckdriver stated that he worked from 4 a.m. until 10:30 a.m. (6 hours of driving) on Saturday, May 15, went off duty at noon, and retired about 10 p.m. He woke at 7:30 a.m. on Sunday, May 16, worked on his car for several hours, and went on duty at 5 p.m. and began driving at 6 p.m. He went off duty on Monday, May 17 between 3 and 3:30 a.m., went to bed and slept until 2 or 3 p.m.; he did not work that night and retired around 10 p.m. He rose between 7 and 8 a.m. on Tuesday, May 18, spent part of the day relaxing around his house, and spent about 2 hours helping his father hang a sheet of new dry wall. He began driving at 5 p.m.

The driver's reported duty/sleep hours, outlined in the following table, indicated that during this 4-day period, he reversed his sleep and wake schedule on a nightly basis. This disruption in his duty/sleep hours, combined with being on duty 8.5 of the 18 hours he had been awake at the time of the accident, is consistent with a compromised state of alertness. Moreover, the accident occurred at 1:35 a.m., a point in the truckdriver's circadian cycle at which his alertness and ability to perform would be reduced, particularly after two disruptions in the duty/sleep hours of his schedule.

Day	Began Duty	Hours On Duty	Began Sleep	Hours Slept
SAT	-- 0345	-- 6.75	Before 0000 2200	3.75+ 9.5
SUN	1700	10.5	--	--
MON	-- Off duty	-- --	0400 2200	10 9.5
TUE	1700	8.75 at time of accident		

Over the 6.5-hour period following the accident, many blood and urine samples were collected from the truckdriver for the specific purpose of treating the truckdriver's postaccident medical condition and not in response to Federal or State postaccident toxicological testing requirements or law enforcement purposes. The Safety Board arranged to have all specimens sent to the Center for Human Toxicology (CHT) for drug testing. Because all specimens tested were positive for marijuana, the Safety Board concludes that the truckdriver had used marijuana some time before the accident. However, inconsistencies among the tests performed on the various samples make it impossible to establish with certainty the time of ingestion, amount ingested, or the specific effect that the drug may have had on the truckdriver's performance in this accident. Thus, the Safety Board cannot conclusively establish that the use of marijuana contributed to the accident.

In a review of the current design guidelines for highway bridges, investigators found that the guidelines recommend the placement of bridge columns, where feasible, 30 feet or more from the edge of the traveled way. This area is referred to as the clear zone. Bridge columns within the 30-foot clear zone can either be protected from collision or have damage from a collision minimized by the placement of appropriate protective devices. Most traffic barriers, such as the W-beam guardrail in this accident, are designed primarily to protect passenger cars from roadside obstacles. However, some high performance barriers can provide improved bridge column protection, as well as protect heavy vehicles from roadside obstacles. The Safety Board concludes that the location of the columns in this accident, within the

30-foot clear zone and with only W-beam guardrail protection, made the columns vulnerable to a high-speed heavy-vehicle collision.

Redundancy can be designed into a bridge so the loss of a substructure element, such as the north column in this accident, will not necessarily result in the collapse of the bridge. During a bridge failure, loads previously carried by the failed substructure member can be redistributed throughout a redundant substructure to other support members. The Safety Board concludes that the simply supported spans and the nonredundant design of the substructure in the County Road 22 overpass made the bridge vulnerable to collapse.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of the accident was the truckdriver's failure to maintain his vehicle in the driving lane because of reduced alertness consistent with falling asleep. Contributing to the accident may have been the truckdriver's use of marijuana. Contributing to the severity of the accident was the collapse of the bridge, after the semitrailer collided with and demolished the north column, that was a combined result of the nonredundant bridge design, the close proximity of the column bent to the road, and the lack of protection for the column bent from high-speed heavy-vehicle collision.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

CASE NO. 113

Investigation No.:	WRH-93-T-HF46
Type of Accident:	Fixed object collision
Accident Location:	Redding, California
Date and Time:	May 12, 1993, at 11:27 a.m. P.s.t.
Ambient Conditions:	Clear and dry, daylight
Vehicle(s) Involved:	1974 Peterbilt conventional tractor in combination with a 1974 Peerless pole trailer (loaded)
Occupants:	1
Injuries:	Minor
Duty/Sleep Information:	
Duration of most recent sleep period:	8.5 hours
Number of hours since last slept:	6.5 hours
Number of hours on duty since last slept:	5.25 hours
Duty/sleep pattern:	Regular duty/sleep hours

Description of the Accident:

The combination vehicle was traveling southbound on a rural two-lane, winding road in mountainous terrain. The truck entered a 684-foot-radius left hand curve at a speed which caused the vehicle to drift to the right side of the pavement. The driver applied the brakes, but the momentum of the vehicle took it off the right side of the roadway, across a 1-foot asphalt shoulder, and into a 6-foot-wide, 18-inch-deep drainage ditch. It struck a cement drainage pipe, which ran perpendicular to and under the roadway, and started to roll over onto its right side. The right side of the truck struck the side of the hill that rose sharply from the drainage ditch and slid along the hillside without fully overturning. The driver received minor injuries.

The 38-year-old driver had 7 years of truckdriving experience hauling freshly cut logs. He indicated he was traveling only 25 to 30 mph when he entered the curve. He stated that he was well rested, having had 8.5 hours of sleep the night before.

Physical evidence at the accident site included 29 feet of locked wheel skid marks on the pavement before the vehicle departed the roadway. The vehicle traveled an additional 158 feet in the drainage ditch with the brakes applied. Based on these distances, it appears the vehicle was traveling at a speed much greater than the stated speed of 25 to 30 mph by the driver. The speed limit was posted at 55 mph. There was no advisory speed limit sign posted on the curve.

Probable Cause:

The National Transportation Safety Board determines the probable cause of this accident was the driver's failure to maintain his vehicle on the narrow curved roadway due to a combination of its speed, center of gravity, and the turning radius.