



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation *LDGH-535*

Date: September 28, 1989

In reply refer to: H-89-26 through -30

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About 6:45 a.m., central standard time, on November 19, 1988, a Greyhound bus with 45 occupants, traveling southbound through a construction zone on Interstate Highway 65 in Nashville, Tennessee, suddenly went out of control during a steering maneuver, rotated 190 degrees clockwise in the southbound lanes, overturned on its left side, and came to rest facing northbound on the southbound embankment. The unrestrained bus driver and 38 passengers were injured in the accident. Twelve passengers sustained serious injuries, and the bus driver and 26 passengers received minor injuries. Six passengers were not injured.¹

It was raining at the time of the accident, and the bus was in the right travel lane. Two cars passed the bus on the left, and one of them moved in front of the bus to let the other go by. The following distance between the bus and the next vehicle in front was therefore diminished. The bus driver indicated that he was uncomfortable with this situation and chose to steer into the left lane. The bus driver was unable to complete the lane change before the bus slid into a closed lane adjacent to the left travel lane, knocking over several channelizing barrels. The bus driver was able to introduce a rightward steering maneuver, but while the front of the bus moved rightward, its rear began to track leftward. As a result, the bus began the clockwise rotation.

The bus driver testified that he was traveling at 45 mph (which was the posted regulatory speed limit in the construction zone) at the time of the accident; however, he also indicated that he had not looked at his speedometer since entering the construction zone. Because of the rain, limited visibility, and wet road conditions, even that speed may have been too high for the prevailing conditions. However, passenger and witness statements indicated that the speed was actually significantly greater than 45 mph, with one witness placing it at 65 mph. The Safety Board therefore

¹For more detailed information, read Highway Accident Report--"Greyhound Lines, Inc., Intercity Bus Loss of Control and Overturn, Interstate Highway 65 in Nashville, Tennessee, November 19, 1988" (NTSB/HAR-89/03).

performed calculations to develop estimates of the speed of the bus prior to the accident.

Considering these calculations, which were based on tire marks and the definable conditions under which the bus tires would hydroplane,² the Safety Board concluded that the speed of the bus prior to the accident was 60 to 65 mph. It was this excessive speed that led the bus to go out of control and overturn. Furthermore, high speed exacerbated the effects of decreased coefficient of friction, which the bus encountered in the move from the right lane, which was asphalt pavement, to the left, which was concrete; and the high speed resulted in hydroplaning as the bus moved back toward the right. Thus, if the bus driver had been operating the bus at a speed appropriate for conditions, instead of nearly 20 mph over the posted speed limit, the sequence of events that comprise this accident would not have occurred.

The Safety Board also believes that the bus driver demonstrated poor judgment when he decided to change lanes instead of slowing down. If he had slowly decelerated the bus without attempting to change lanes, it is likely the accident could have been avoided. The Safety Board examined the factors that may have led to the bus driver's failure to slow his bus rather than to change lanes at such a high speed in adverse conditions.

Bus Driver Performance

The Safety Board could find no evidence that the bus driver's speeding was the result of pressure from the company to make up time or meet a schedule. In fact, driving a Greyhound bus 60-65 mph in conditions of steady rainfall and in a construction zone where the speed limit is 45 mph is not only contrary to State law and Federal regulation, it is also contrary to specific company rules. The failure to wear a lapbelt while driving a Greyhound bus is contrary to both Federal regulation and company rules. This disregard for rules is consistent with a pattern of disregard for rules and regulations the bus driver established even before he was hired by Greyhound. The bus driver reported two accidents and two speeding violations on his Greyhound employment application in 1971.

Less than 90 days after he was hired by the bus line, during his initial probationary period, he was involved in an on-duty accident. Prior to this accident in Nashville, the bus driver had been involved in 10 other accidents while operating buses for Greyhound. Although five of these accidents were classified as nonpreventable, five were classified as preventable by Greyhound officials. The bus driver's record also includes six traffic citations, five for speeding and one for failure to yield, according to Greyhound's files. In addition, he was charged on three occasions with

²Hydroplaning occurs when a vehicle traveling on wet pavement reaches a speed at which water pressure builds up under the tires. As contact diminishes between the tires and pavement, it becomes increasingly difficult for a driver to maintain directional stability. Ultimately, the ability of the tires to develop braking and turning forces can be completely eliminated.

infractions of company rules. The bus driver had been suspended four times by the company and discharged (but later reinstated) once.

On the day of the accident, the bus driver was operating a type of vehicle whose handling characteristics were very familiar to him. The route was one he had driven frequently during his career, and he had encountered the construction zone repeatedly for several weeks preceding the accident. After 17 years with Greyhound, the bus driver was not lacking in experience, but rather, a proper regard for the rules of safe driving.

Factors Affecting the Bus Driver's Alertness

The Safety Board believes that the bus driver exercised questionable judgment in his decision to switch lanes instead of slowing the bus when he was confronted with the car in front. The Safety Board sought to determine whether fatigue or insufficient nourishment could have been factors in this decision.

Fatigue.--Highway driving, particularly at night, can be a monotonous task. Also, the human circadian rhythm produces a strong tendency to sleep during the hours from 1:00 a.m. to 8:00 a.m., regardless of whether the individual is well rested. The time of this accident falls within the time of day in which statistics show human performance errors are most likely to occur. In light of these factors, the four to five hours of sleep the bus driver said he received the night before the accident may not have been enough to avoid subsequent drowsiness or degraded judgment. Furthermore, there are reasons to question whether the bus driver did in fact receive as much as four to five hours of sleep. He may have been in bed for that amount of time or longer, prior to arising at 1:45 a.m. But it is possible that he had difficulty falling asleep. The bus driver had been off duty during the two days preceding the accident. In that time he had been at home, integrating into his family's daily routine, which included sleeping during the nighttime hours. Prior to those days off, he had worked for six consecutive nights. Therefore, at the beginning of his time off he had imposed a shift in his sleep pattern, and at the end (the night prior to the accident), he reverted once again to working at night. Those transitions in rapid succession could have created disharmony in his circadian rhythm. That disharmony, in turn, could have made it difficult to fall asleep as needed the evening before the accident. This variable sleep pattern could have made the bus driver drowsy at the time of the accident. However, there are no indications that the bus driver was in fact drowsy or that he exhibited driving behavior indicative of fatigue. Further, the bus driver stated that he was alert at the time of the accident.

The Safety Board believes that in all transportation modes it is important for vehicle operators who work nights and those with fluctuating schedules to understand the impact their sleep/work patterns can have on their job performance. Companies such as Greyhound should provide education and counseling to these employees and also their families about the nature of the problem and steps that can be taken to minimize it.

Nutrition.--At the time of the accident, the bus driver had been without nourishment, other than iced tea and soft drinks, for 13-14 hours. Research suggests that an individual begins feeling the effects of hypoglycemia (low blood glucose) approximately five hours after eating a balanced meal. After 10 hours, the symptoms are likely to be very strong. Hypoglycemia can manifest itself with fatigue, dizziness, blurred vision, and diminished decision-making ability. Therefore, the bus driver could have been subject to the effects of hypoglycemia. He stated that this was his customary eating pattern.

As with the effects of night work and fluctuating sleep patterns, the effects of nutrition on job performance should be explained thoroughly to bus drivers and other vehicle operators. The Safety Board believes Greyhound should undertake an appropriate ongoing education program on this subject for its bus drivers.

As the result of any of these conditions affecting alertness, the bus driver could have slipped into a brief episode of overwhelming drowsiness or "microsleep." There is laboratory evidence that such episodes can produce inattention, forgetfulness, and performance lapses. However, there were no witness statements or other evidence indicating that the bus driver was suffering from microsleep or fatigue at the time of the accident.

Although the quantity and quality of the bus driver's sleep and his lack of nourishment for 13 to 14 hours prior to the accident are factors that could degrade driving performance, the Safety Board did not find sufficient evidence to conclude that these factors did exert such an effect. Further, the accident sequence can be fully explained by the bus driver's propensity to speed and the differential in coefficient of friction between the travel lanes.

Greyhound Management Policies

A company that employs commercial drivers has three general means of ensuring safe performance by those drivers: employment screening; training; and inservice monitoring and discipline. The fact that the bus driver in this case was able to gain employment and then continue working despite an ongoing history of speeding suggests that there have been shortcomings in the programs through which Greyhound manages its driver workforce.

When the bus driver applied for employment with Greyhound in 1971, he presented a record that would have barred him from the company if he were applying today, according to a Greyhound Regional Safety Manager who testified in the investigation of this accident. That pre-employment record also may not have met the standards used in 1971, the Manager indicated as well, in which case the bus driver joined the company through an error by a hiring official.

According to Greyhound, its standards and practices for pre-employment screening have improved since the time this bus driver was hired. Certainly when a company's employment standards are upgraded, it should not be expected to dismiss those of its employees who were hired under a lower standard.

However, when public safety is involved, it is a responsibility of the company to bring the performance of such employees up to the higher standard. If such efforts, through training and other means, prove unsuccessful for some employees, those individuals should not be allowed to remain in safety-sensitive positions. In the years since he was hired, the record of the bus driver in this case suggests either that insufficient effort was given to improving his performance or that he is one of those individuals for whom routine efforts at improving performance are insufficient. In either case, his continuing pattern of disregard for speed regulations should have been identified, and steps should have been taken to prevent that behavior from putting the lives of bus passengers and others on the highway at risk.

The bus driver's job performance is generally well documented in Greyhound's records, but these records are nevertheless deficient in a number of ways. The files on the bus driver indicate not only his accidents, traffic citations,³ and company rule infractions, but also the results of on-the-job performance evaluations, annual record reviews, and other details. But Greyhound officials, including the bus driver's supervisor, could not adequately explain why the bus driver was reinstated in 1983 after being discharged from the company following his involvement in an accident, or why he was similarly reinstated in 1989 after being discharged following the accident in Nashville. Missing from the files were: documentation of the bus driver's initial training at Greyhound; results of screening by an outside firm of the bus driver's state traffic records; and detailed accounts of disciplinary action and recurrent training for the driver.

Greyhound is required under Federal regulation to review the record of each of its drivers at least once a year, to determine whether he or she continues to meet the Federal minimum standards for safe driving. In 1986 and 1987 the annual review of the accident bus driver's record was not conducted by any of the bus driver's supervisors, but instead by one supervisor's secretary. Those annual reviews may have been conducted in accordance with the letter but certainly not with the intent of 49 CFR 391.25. In part, that Federal regulation stipulates:

In reviewing a driving record, the motor carrier must consider any evidence that the driver has violated applicable provisions of the Federal Motor Carrier Safety Regulations and the Hazardous Materials Regulations. The motor carrier must also consider the driver's accident record and any evidence that the driver has violated laws governing the operation of motor vehicles, and must give great weight to violations, such as speeding, reckless driving, and operating while under the influence of alcohol or drugs, that indicate that the driver has exhibited a disregard for the safety of the public.

³Some citations are noted by the driver in the annual traffic record review all drivers are required to fill out, but missing from his central Greyhound driving record.

To be accomplished properly, such subjective assessments must be made by someone who is familiar with all aspects of the driver's record. In addition, that person should be qualified to interpret the information and have the authority to impose measures based on the findings, such as training, disciplinary action, reassignment, or discharge. A supervisor conversant with safe bus-operating practices would be more qualified to serve this function than a secretary (or any other person) who was not specifically trained for this function. Certainly, a review of the bus driver's violation record could be performed by a nonsupervisory person if provided adequate guidelines with which to base an assessment of the bus driver's record. However, the determination of whether the bus driver is fit to continue driving or is in need of additional training should be made by a supervisor knowledgeable about driving operations.

Greyhound supervisors directly observe and assess the performance of bus drivers on duty, and this practice could help maintain a high level of safety in the company's operations. But the effectiveness of this practice is undermined by giving the bus drivers notice when they are to undergo surveillance. Most drivers prone to unsafe behavior are unlikely to display that behavior when they know they are under scrutiny. That point is illustrated by the contrast between the accident bus driver's list of accrued accidents and citations and the record of his performance in supervisory bus rides and road checks. In only two of the 13 reports on those rides and checks were there notes indicating any unsatisfactory performance. The Safety Board believes that Greyhound should conduct at least a substantial portion of its supervisory bus rides and road checks without notice to the driver.

Training.--Greyhound's eight-week initial training program for bus drivers, as described by company officials in testimony, appears to provide adequate preparation for new hires. Although Greyhound could not provide records of the accident bus driver's participation in this program, he did testify that he received the training, and there is documentation that he successfully passed the written examination and road test given at the conclusion of the course.

According to the Regional Safety Manager, the recurrent training provided by Greyhound is directed primarily toward the recently hired bus drivers. Beyond that, the purpose of the company's recurrent training appears to be one of correcting demonstrated shortcomings rather than preventing them. Involvement in an accident can be grounds for attending a remedial training session, as the bus driver in this case did on four occasions. Under current Greyhound procedures, a pattern of citations or rule infractions can also prompt the requirement that a bus driver receive recurrent training. The Regional Safety Manager did indicate in testimony that recurrent training is "pretty much mandatory." However, the accident bus driver registered his impression that participation is left to the discretion of the individual employee.

Company records document the bus driver's attendance in 10 training sessions during 17 years of employment. The only recorded instance in which hazardous weather operations were addressed in this training was in November

1981, when the bus driver viewed the film titled "Adverse Weather." He indicated that he received no behind-the-wheel recurrent training on safe practice in bad weather.

The Safety Board believes that recurrent training such as films, seminars, or behind-the-wheel sessions should be used to keep bus drivers generally well educated about the standards of safe practice, in addition to specific remediation of demonstrated unsatisfactory performance. In order for that approach to be successful, participation in recurrent training should be regularly scheduled and mandatory for all bus drivers.

The bus driver's performance and attendance in this mandatory training should be well documented in the bus driver's record. Furthermore, recurrent training should prepare a bus driver for the physical and mental demands placed on him or her when driving in hazardous weather or road conditions. Emphasis should be placed on, but not limited to, issues such as speeding, driving during periods of reduced visibility, hydroplaning, road construction hazards, highway surface frictional properties, and proper rest and nutrition.

The Safety Board believes that the limited recurrent training that this bus driver received did not prepare him for the conditions he encountered the morning of the accident. If the experience of the bus driver in this case is at all representative, it is possible that many Greyhound bus drivers are in need of an enhanced recurrent training program, one that specifically addresses bus operations during periods of adverse weather.

Company Evaluation of Driver's Medical Condition and Vision.--As required by Federal regulation, the bus driver was periodically examined by physicians, and Greyhound used the results of these examinations to determine his continuing fitness for service. He has also been under the care of personal physicians and optometrists. Concerning both general health and vision, there have been significant discrepancies between the findings of the company-designated physicians and those of the personal practitioners.

In the two examinations for which Greyhound was able to provide records, the bus driver's blood pressure was measured and reported to have been at levels that are within the standards established by the Federal Highway Administration (FHWA). The bus driver, though, had a clinical history of hypertension. Similarly, following the bus driver's 1986 company physical examination, he was certified to drive without corrective lenses; but examinations by personal optometrists in 1986 and 1989 indicated not only visual acuity that would require the use of corrective lenses under FHWA standards, but also other vision problems such as blurred vision and problems with bright lights and night vision. The Safety Board could not determine the reasons for these sharply differing results in objective medical and vision tests.

The bus driver knew that he had vision problems and that he was being treated for high blood pressure (though he may not have recognized the term hypertension). In addition, even though he may not have known the clinical terms for his other conditions, such as hypothyroidism and depressive

neurosis with anxiety reaction, he probably did recognize that there were additional conditions in his medical history that might adversely affect his driving ability. Yet the bus driver did not notify the company physician about the diagnosis and treatment of these conditions. And the bus driver also did not disclose them when he filled out the written medical history forms as part of his biennial physical examinations.

The purpose of the federally required biennial examination is explained in the instructions given to examining physicians:

In the interest of public safety, the examining physician is required to certify that the driver does not have any physical, mental, or organic defect of such a nature as to affect the driver's ability to operate safely a commercial motor vehicle.⁴

Such an authoritative finding was not made for this bus driver, and one reason may have been his failure to disclose his full medical history, or to direct the examining physician to the personal physicians who could do so. There was nothing compelling the bus driver to make such a full disclosure. Greyhound does require that medical history forms be completed at each physical examination, but there is no explicit requirement, in either Greyhound policy or Federal regulation, that the forms be filled out in a manner that is not only accurate but also complete.

One means of encouraging bus drivers to give a full accounting is to require them to vouch for the information they are providing. At present there is a place on the physical examination form for the bus driver to sign, permitting the report on the examination to be sent to Greyhound. If a bus driver were also required to certify by that signature that he or she has made a full and truthful disclosure, this might ensure greater vigilance in filling out the form.

Such certification already exists in the aviation industry. The following statement is from the Federal Aviation Administration's Form 8500-9 for medical certification of pilots:

I hereby certify that all statements and answers provided by me in this examination form are complete and true to the best of my knowledge, and I agree that they are to be considered part of the basis for issuance of any FAA certificate to me. I have also read and understand the Privacy Act statement that accompanies this form.

NOTICE: Whoever in any matter within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals or covers up by any trick, scheme, or device a material fact, or who makes any false, fictitious or fraudulent statements or

⁴49 CFR 391.43(c).

representations, or makes or uses any false writing or document knowing the same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than \$10,000 or imprisoned not more than 5 years, or both. (U.S. Code, Title 18, Sec. 1001.)

In addition to the foregoing, the Safety Board believes the signed statement should also give the examining physician the authority to obtain additional information on the bus driver if such information is necessary. Further, the statement should prohibit significant omissions and require the bus driver to notify the certifying physician if his medical condition changes following the examination. The Safety Board believes that Greyhound should incorporate such a statement into the medical history form its bus drivers fill out when they receive the federally required biennial physical examination. Additionally, Greyhound medical examination forms require the bus driver to provide information on any illness or injury in the preceding year, although the medical examinations are performed on a biennial basis. The Safety Board believes that to compile a complete medical history for the bus driver, this section should be modified to cover the full two-year period between examinations.

Therefore, the National Transportation Safety Board recommends that Greyhound Lines, Inc.:

Review and modify, as needed, company policies and procedures to identify bus drivers with unsafe performance records and then prevent them from continuing to operate buses in a manner hazardous to public safety. (Class II, Priority Action) (H-89-26)

Develop a structured recurrent training program, encompassing classroom instruction as well as simulator and/or behind-the-wheel instruction, designed to help maintain the performance of company bus drivers at high standards, and require all bus drivers to participate on a regular basis; include in this program instruction on safe bus operations in adverse weather conditions. (Class II, Priority Action) (H-89-27)

Revise the form bus drivers are required to complete as part of their biennial physical examinations so that by signing the document they certify that the medical history they have provided is both complete and accurate and that Greyhound has the authority to obtain information on the bus drivers' medical history from their personal health care providers; and revise the form to require bus drivers to provide information on any illness or injury incurred during the previous two years or since the last certification examination. (Class II, Priority Action) (H-89-28)

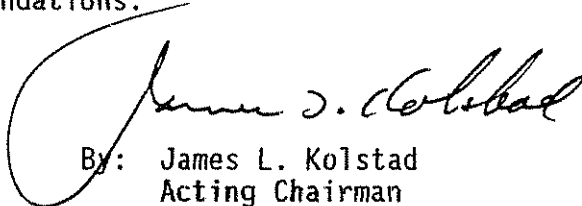
Establish and enforce a policy that each individual conducting the federally required annual review of a bus driver's traffic record be a supervisor who is familiar with that record, qualified to interpret it, and authorized to impose appropriate measures in response to findings from the review. (Class II, Priority Action) (H-89-29)

Institute a program to educate company bus drivers about the need for proper nourishment while on duty and also to educate both bus drivers and their families about the stresses imposed by night work and shift work, as well as the adverse effect these stresses can have on safe job performance. (Class II, Priority Action) (H-89-30)

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "... to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations H-89-26 through -30 in your reply.

Also, as a result of its investigation, the Safety Board issued Safety Recommendations H-89-31 and -32 to the Federal Highway Administration and H-89-33 to the Tennessee Department of Transportation.

KOLSTAD, Acting Chairman, and BURNETT, LAUBER, NALL, and DICKINSON, Members, concurred in these recommendations.



By: James L. Kolstad
Acting Chairman