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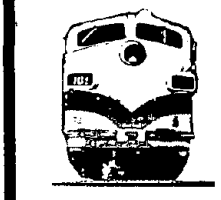

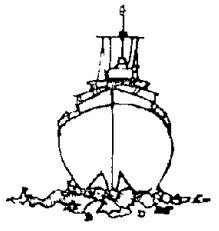

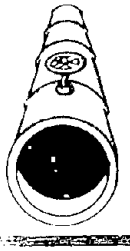



NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

RAILROAD/HIGHWAY ACCIDENT REPORT

SOUTHERN PACIFIC TRANSPORTATION COMPANY FREIGHT TRAIN/AUTOMOBILE GRADE CROSSING COLLISION

TRACY, CALIFORNIA
MARCH 9, 1975

REPORT NUMBER: NTSB-RHR-76-1

UNITED STATES GOVERNMENT

NATIONAL TECHNICAL
INFORMATION SERVICE

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. NTSB-RHR-76-1	2.Government Accession No.	3.Recipient's Catalog No.
4. Title and Subtitle Railroad/Highway Accident Report - Southern Pacific Transportation Company Freight Train/Automobile Grade Crossing Collision, Tracy, California, March 9, 1975		5.Report Date February 17, 1976 6.Performing Organization Code
7. Author(s)		8.Performing Organization Report No.
9. Performing Organization Name and Address National Transportation Safety Board Bureau of Surface Transportation Safety Washington, D. C. 20594		10.Work Unit No. 1759 11.Contract or Grant No. 13.Type of Report and Period Covered Railroad/Highway Accident Report March 9, 1975
12.Sponsoring Agency Name and Address NATIONAL TRANSPORTATION SAFETY BOARD Washington, D. C. 20594		14.Sponsoring Agency Code

15.Supplementary Notes **This report contains recommendations to the National Committee on Uniform Traffic Laws and Ordinances and to the National Highway Traffic Safety Administration to develop and implement young driver behavior monitoring and rehabilitation programs, appropriate youth-oriented alcohol safety action programs, and traffic information and control systems that recognize and attempt to deal with the impaired driver.**

16.Abstract

About 1:45 a.m. on March 9, 1975, three teenagers were killed when their auto, moving at a speed of more than 50 mph, struck the side of the leading car of a slow-moving freight train at a crossing irregularly used by trains. The presence of the crossing was indicated by warning signs 500 feet and 380 feet in advance of the crossing and by crossbucks at the crossing; a train flagman at the crossing was unsuccessful in his attempts to stop the automobile. The driver's blood alcohol level was 0.14 percent and the passengers' blood alcohol levels were 0.10 and 0.09 percent. According to California State criteria and Federal criteria, a person with a blood alcohol level of 0.10 percent is presumed to be under the influence of alcohol.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the automobile driver to make a proper approach to a known, identified crossing, and his failure to respond to the flagman's signals or to observe the train at, or on, the crossing until it was too late to avoid impact. The driver's failure to respond probably was caused by the influence of alcohol.

17.Key Words	18.Distribution Statement
Alcohol; young drivers; young driver licensing/ alcohol programs; traffic information and control devices at railroad crossings.	This document is available to the public through the National Technical Information Service, Springfield, Virginia 22151.

19.Security Classification (of this report)	20.Security Classification (of this page)	21.No. of Pages	22.Price
UNCLASSIFIED	UNCLASSIFIED	31	$4.00-2.25

NTSB Form 1765.2 (Rev. 9/74)

PRICES SUBJECT TO CHANGE

FOREWORD

This report is based upon an investigation by the National Transportation Safety Board under the authority of the Independent Safety Board Act of 1974. The California Highway Patrol, the Public Utilities Commission of California, the San Joaquin County Traffic Engineer, the Tracy Police Department, the Tracy Public Works Department, the Federal Railroad Administration, the Federal Highway Administration, the National Highway Traffic Safety Administration, and the Southern Pacific Transportation Company cooperated in this investigation.

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File No. SS-H-45

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D. C. 20594

RAILROAD/HIGHWAY ACCIDENT REPORT

Adopted: February 17, 1976

SOUTHERN PACIFIC TRANSPORTATION COMPANY
FREIGHT TRAIN/AUTOMOBILE
GRADE CROSSING COLLISION
TRACY, CALIFORNIA
MARCH 9, 1975

SYNOPSIS

About 1:45 a.m. on March 9, 1975, three teenagers were killed when their auto, moving at a speed of more than 50 mph, struck the side of the leading car of a slow-moving freight train at a crossing irregularly used by trains. The presence of the crossing was indicated by warning signs 500 feet and 380 feet in advance of the crossing and by crossbucks at the crossing; a train flagman at the crossing was unsuccessful in his attempts to stop the automobile. The driver's blood alcohol level was 0.14 percent and the passengers' blood alcohol levels were 0.10 and 0.09 percent. According to California State criteria and Federal criteria, a person with a blood alcohol level of 0.10 percent is presumed to be under the influence of alcohol.

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FACTS

The Accident

About 1:45 a.m. on March 9, 1975, a gondola car and two boxcars were being pushed northbound across the Arbor Avenue rail-highway grade crossing in Tracy, California, by a switch locomotive of the Southern Pacific Transportation Company.

The train had arrived at the crossing several minutes earlier. The locomotive had pulled the cars to within about 250 feet of the crossing. It was uncoupled from the cars and switched to a side track to run around and approach the cars from behind; it was then recoupled, and the

air brake system was connected and tested. The locomotive was in the process of pushing the cars through the crossing when the accident occurred.

A switchman, serving as a flagman at the crossing and standing at the north side of the crossing and on the east side of the tracks, had signaled the engineer to proceed over the crossing. The engineer did not sound the horn as he approached the crossing. Shortly thereafter, the flagman saw an approaching westbound automobile, which he believed must have just passed beyond the nearest intersection, located 1,750 feet east of the crossing.

The automobile approached the crossing with its headlights on high beam. The flagman began to signal the automobile by waving his trainman's electric lantern, equipped with a white light, slowly back and forth across his body at shoulder height while facing the approaching automobile. He stated that he kept waving the lantern at the automobile as the train approached the crossing, but the automobile continued to approach without slowing down.

As the gondola car was entering the crossing, the flagman began waving his lantern back and forth vigorously. The engineer apparently reacted to the signal at this point or later and applied the engine brakes to stop the train. The engineer estimated that the train's speed was 2 or 3 mph and observed that this speed was so slow that he did not need the emergency brakes to stop. The flagman stated that the train stopped, but the approaching automobile "kept on coming, kept on coming."

Physical evidence (skidmarks, final positions of the train and automobile, and pavement scars) indicated that the train was either stopped or barely moving at impact. The leading edge of the gondola car stopped about 5 feet beyond the crossing. The automobile driver applied the automobile brakes with sufficient force to lock the wheels, leaving 40 feet of skidmarks before the automobile struck the rear wheels of the front trucks of the gondola car.

The three occupants of the automobile were killed in the collision; autopsy tests indicated the driver had a blood alcohol level of 0.14 percent and his passengers had blood alcohol levels of 0.10 and 0.09 percent.

Accident Site

Arbor Avenue was a two-lane, two-way, east-west highway on the northern border of Tracy, California. (See Figure 1.) It was a lightly used roadway with an average daily traffic volume of about 500 vehicles. The 5/8-mile section of Arbor Avenue between MacArthur Drive and Holly Drive recently had been reconstructed and repaved. At the

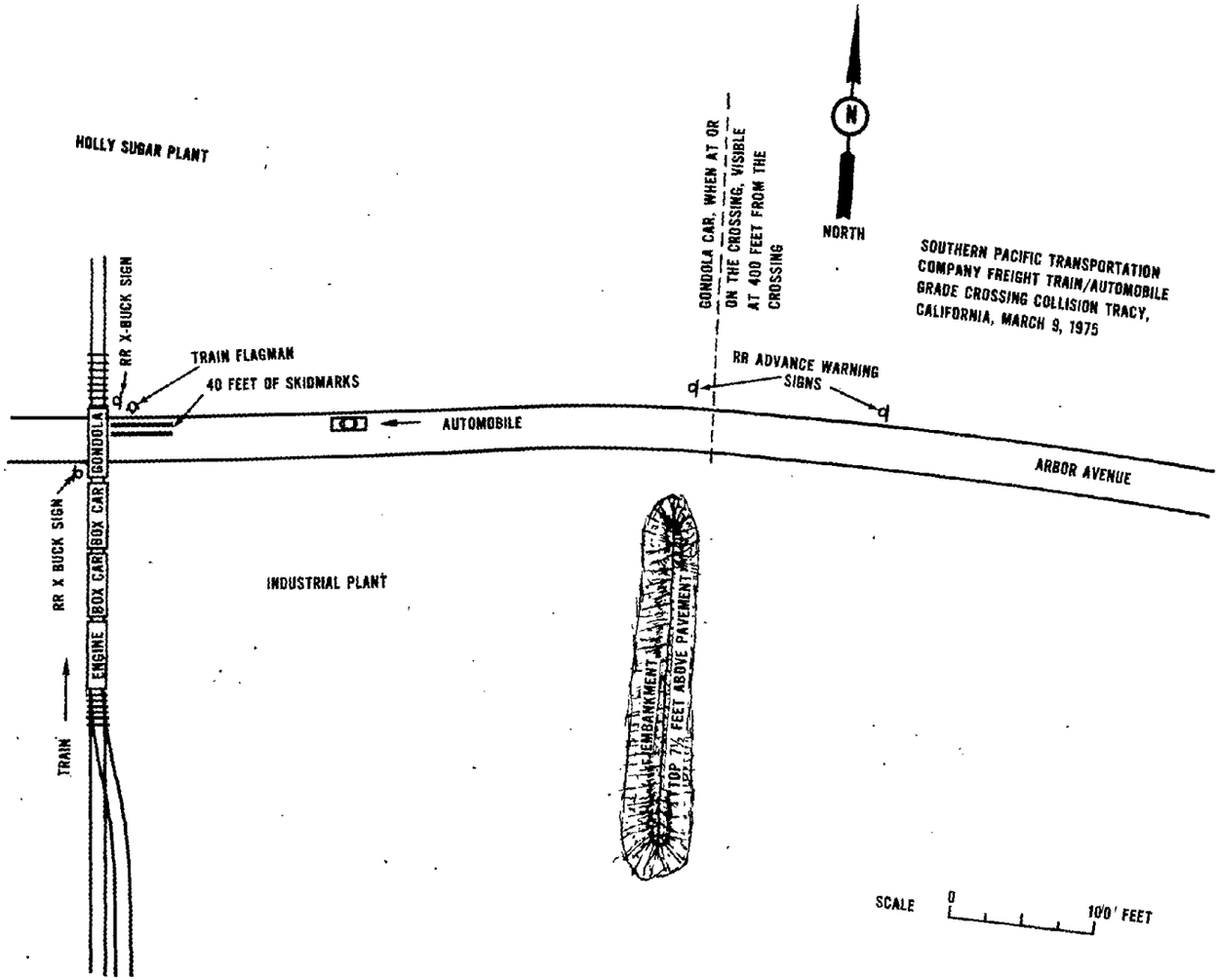

Figure 1. Accident site.

time of the Board's investigation, the pavement was being evaluated because of problems associated with its endurance under traffic use. However, the minor rough spots on the pavement surface did not affect vehicle handling or control. The coefficient of friction, as measured by a skid test, was 0.96; this indicated that the pavement was in excellent condition for stopping.

Midway between the intersections, Arbor Avenue was intersected by a north-south spur railroad line to the Holly Sugar Plant. The spur railroad line was used on an irregular basis, on the average of twice a week, except during peak harvest periods. The Southern Pacific Transportation Company serviced the plant, often between midnight and dawn.

The sugar plant and a plant on the other side of the road at the crossing were the only significant landmarks along an otherwise open, flat countryside. Off-road features associated with these plants (fences, buildings, and equipment), a dirt embankment to the south, and a cut in the slope could serve somewhat to mask the presence of a train to westbound traffic when the engine was not leading the train and the train was not at or on the crossing.

There was a 55-mph speed limit in effect along this section of Arbor Avenue although it was not posted. The California Vehicle Code 1/ requires motorists to be at a speed not exceeding 15 mph if they are within 100 feet of a crossing and cannot see the tracks for 400 feet in both directions. This limit does not apply if the crossing is controlled by gates, a warning signal, or a flagman. The California Driver's Handbook advises motorists of this law. 2/ At this crossing, the tracks were not visible for 400 feet. Safety Board investigators observed that some motorists reduced speed when they approached the crossing with no flagman present, but speeds were more in the range of 35 mph or higher rather than below 35 mph.

At the time of the accident, there were two railroad advance warning signs -- 500 feet and 380 feet east of the crossing -- and two railroad crossbuck signs at the crossing. According to the State of California's Public Utilities Commission (PUC), the crossing was inspected in mid-1974. In the opinion of its Transportation Division staff, there was no need for automatic protection at this crossing at that time. The PUC was aware that Arbor Avenue was scheduled for improvement and that the need for improvement in crossing protection would again be reviewed in such an event. 3/ After the accident, pavement markings were applied, including a "RxR" symbol and a stop line for both approaches, and one advance warning sign was removed.

1/ State of California Vehicle Code, 1973.
2/ California Driver's Handbook, January 1974 Revision, California Department of Motor Vehicles.
3/ Letter from State of California Public Utilities Commission to law firm representing the Holly Sugar Corporation, dated October 18, 1974.

There was a slight curve to the driver's left (length 64 feet, radius 1,000 feet) which ended about 400 feet before the crossing. The roadway in the vicinity of the crossing was almost level.

There had been two other accidents at this crossing within the past 10 years. In 1967, two automobile passengers were killed when their automobile collided with the engine of a train entering the crossing. The accident occurred in daylight. No flagman was present or required, since the engine was leading the train across the crossing. In 1969, a tractor-semitrailer driver was injured seriously when his unit collided with the side of a train during daylight hours. A flagman was present and signaled the driver.

Environmental Factors

On the night of the accident, the weather was clear with no precipitation or fog; the road was dry. The ambient light did not aid significantly in the observation of items beyond the range of headlights.

Vehicles

Automobile -- The automobile was a 1969 Ford Torino GT, 2-door hardtop equipped with a 302-cubic-inch, 8-cylinder engine and an automatic transmission. It was owned by the driver's mother. Onscene photographs taken a short time after the accident indicate that the speedometer needle was stuck at the 64-mph position and that the right rear window was raised almost completely. Because the Safety Board investigated the accident about 5 weeks after it occurred, control settings, the position of windows, etc., as observed in the automobile at that time are not considered to represent their positions at the time of the accident.

There was significant damage to the front of the vehicle, notably on the right half, produced from engagement of the right front of the automobile with the rear wheels of the front trucks of the gondola car. (See Figure 2.) The roof had been peeled back to the rear roof support on the left side and to the rear of the front seat on the right side; this had occurred as the front of the automobile collapsed and the windshield and roof contacted the side edge of the gondola car.

The Freight Train -- The freight train consisted of a loaded gondola car and two empty boxcars being pushed by a General Motors Corporation (Electro-Motive Division) Model SW 1500 diesel locomotive. The cab end of the locomotive was located farthest away from the crossing.

The headlight on the end of the locomotive toward the crossing was turned off because it would have reflected against the boxcar and restricted the visibility of the engineer. Rule 17-A of the operating rules and regulations of the Southern Pacific Transportation Company

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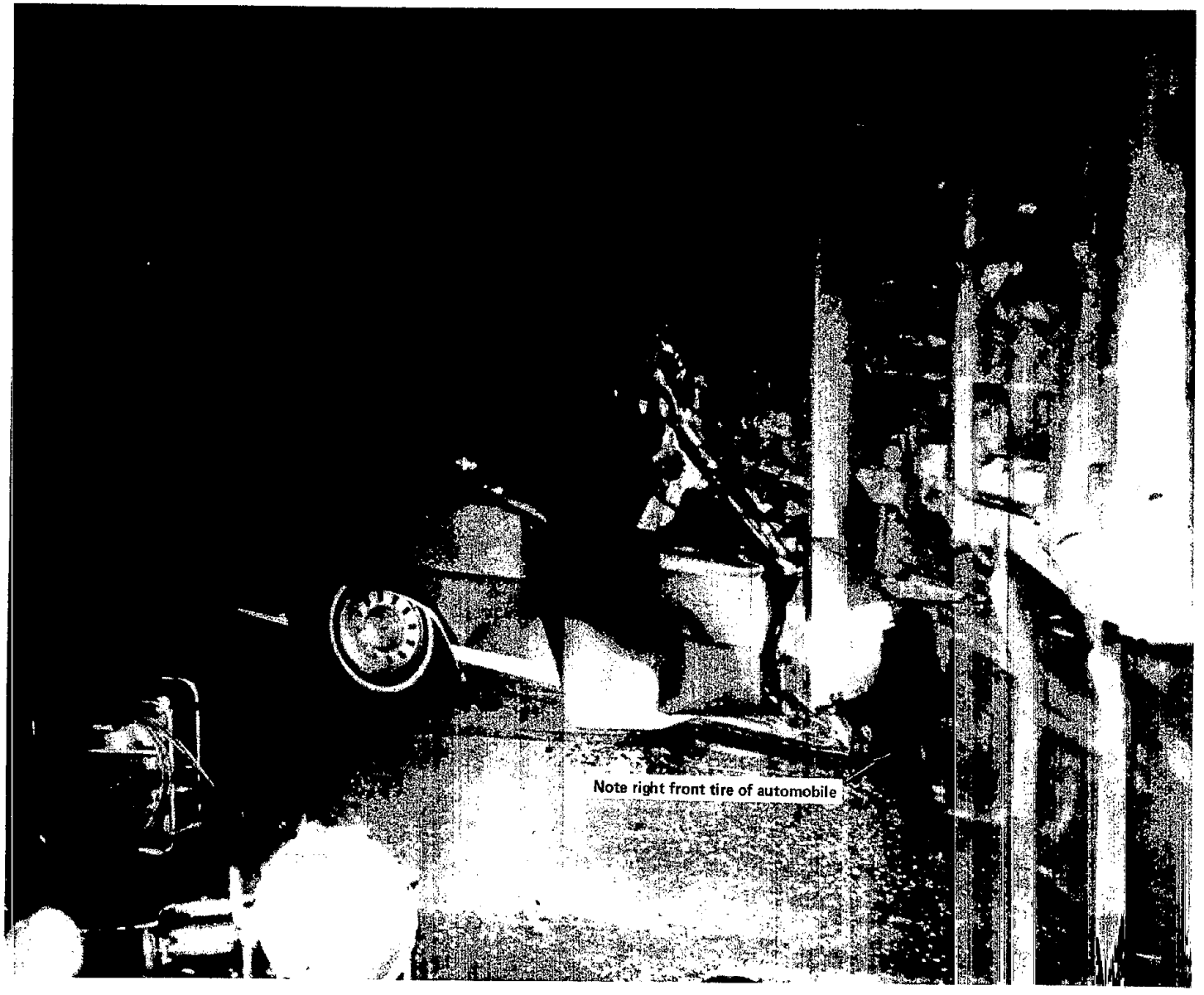

Figure 2. Final rest positions of automobile and gondola car.

states, in part: "When coupled to a car, headlight (of engine) next to car must be extinguished." 4/ The cab-end headlight of the locomotive was on, but visibility tests, conducted after the accident and using a train similar in character, indicated that the headlight would not have served to aid motorists in detecting the presence of the train.

The gondola car was a drop-bottom type with fixed ends and a 70-ton capacity. The car was painted dark rust/red and had reflectorized automatic car identification markings on the side that faced the automobile. Visibility tests indicated that these markings did not appreciably aid in making the car more visible to an automobile approaching the crossing. There was no significant damage to the gondola car as a result of the impact; it was not derailed, and it remained in operation after the accident.

The Automobile Driver and Passengers

The driver was a 17-year old resident of Tracy, California, with about 1 1/2 years of driving experience. He had completed the driver education course at the local high school and held a valid California driver's license.

The three automobile occupants reportedly had been together since early that evening. They had visited friends, using a vehicle owned by one of the passengers, from about 8 to 11 p.m., during which time they and two others had reportedly shared a 6-pack of beer in 12-oz cans. Their activities between 11 p.m. and the time of the accident could not be determined.

At the time of the accident, the automobile was traveling in the direction of the driver's home, located about 1 mile to the south and west of the crossing. Since this road was the nearest westbound through route north of the driver's house, he was probably familiar with the road and knew that the crossing was there.

Toxicological tests at autopsy indicated a blood alcohol level of 0.14 percent for the driver. The two passengers had blood alcohol levels of 0.10 and 0.09 percent. The National Highway Traffic Safety Administration's Highway Safety Program Standard on Alcohol 5/ defines a driver as "intoxicated" or "under the influence" of alcohol when he exhibits blood alcohol concentrations at or higher than 0.10 percent by weight. According to the State of California's Vehicle Code, if there

4/ Rule 17A, Rules and Regulations of the Transportation Department, Effective January 1, 1969, Southern Pacific Company.

5/ Highway Safety Program Standard No. 8, Alcohol in Relation to Highway Safety, U.S. Department of Transportation, National Highway Traffic Safety Administration, October 1, 1973.

is 0.10 percent or more by weight of alcohol in a person's blood, "it shall be presumed that the person was under the influence of intoxicating liquor." 6/

The driver's traffic record, as reported by the California Department of Motor Vehicles, included:

April 9, 1974	Accident -- Hit-and-run, property damage only. Vehicle out of control on a residential street and ran across lawns, damaging fence and tree. Conviction -- Hit-and-run violation. Court restriction of 1 month and court probation (term not reported) imposed.
November 23, 1974	Accident -- Turned left from blinking red signal in front of oncoming vehicle. Adjudged free of contributing to accident by investigating officer.
December 5, 1974	Conviction -- Speeding over energy-imposed 55 mph limit.
March 9, 1975	This accident under investigation.

In addition, an examination of Tracy Police Department documents relating to police contacts with the driver revealed the following:

August 4, 1974	Citation issued/no record of conviction -- turning without due caution.

According to the State of California Vehicle Code, a driver is considered a negligent operator if he accumulates four points in 12 months, six points in 24 months, or eight points in 36 months while operating a vehicle less than 25,000 miles per year. This driver had been involved in a number of incidents, but according to the Safety Board's interpretation of the State of California's criteria for assigning points, he had accumulated only two points within a 1-year period as a result of his conviction for causing property damage by hit-and-run driving. Traffic convictions that do not indicate unsafe driving or accidents for which a driver is not judged responsible by the California Department of Transportation do not accrue points. At the time the speeding violation was issued, the safety-related benefits of a reduced speed limit had not been established. No action had been taken by the Department with respect to this driver.

6/ State of California Vehicle Code, 1973; 23126(a)(3), page 364.

All three automobile occupants apparently died instantly as a result of the impact. Each occupant incurred comminuted skull fractures and lacerations of the brain.

The Traincrew

The four-man traincrew consisted of the yard conductor, the locomotive engineer, and two switchmen. The crewmen each were performing their assigned duties at the time of the crash. The engineer had 30 years of experience in operating a locomotive; the switchman serving as a flagman at the crossing had 23 years of experience as a switchman; the switchman with the locomotive had 24 years of experience as a switchman. The yard conductor, who had 25 years of experience, was inside the plant. The switchman at the crossing had no record of violation of company rules nor was there any record of disciplinary action.

The crew had worked together extensively, had worked at this crossing on numerous occasions, and consistently had performed the same duties each time they worked at that crossing.

Rule 103 of the operating rules and regulations of the Southern Pacific Transportation Company states: "When cars are pushed by an engine, except when switching either within or outside of yard limits or when making up trains in yards, and even in above exceptions when conditions require, a member of crew must take a conspicuous position on the leading car. By night he must display a white light." Rule 103-A states in part: "Before kicking or dropping cars over a public crossing not protected by a watchman, a member of crew must take position at the crossing to afford protection to traffic." 7/ The Southern Pacific Transportation Company's interpretation of these rules is: "...if for any reason a member of crew is not in a conspicuous position on leading car displaying a white light, the crew member should take a conspicuous position in advance of the movement at the crossing displaying warning signals with white lights to any oncoming vehicular traffic." 8/

According to the PUC there was no State requirement for the railroad to use flagmen and/or flares when its trains were operating through the Arbor Avenue crossing. 9/

Rule 14 (1) of the operating rules and regulations of the Southern Pacific Transportation Company states that the whistle should be sounded: "Approaching public crossings at grade, tunnels and obscure curves; to be commenced sufficiently in advance to afford ample warning, but not less than one-forth mile before reaching a crossing, and prolonged or

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7/ Rule 103 and 103A, Rules and Regulations of the Transportation Department, effective January 1, 1969, Southern Pacific Company.

8/ Letter from Southern Pacific Transportation Company to the National Transportation Safety Board, dated July 23, 1975.

9/ Letter from State of California Public Utilities Commission to the Travelers Insurance Company, dated March 19, 1975.

repeated until engine has passed over the crossing." 10/ The Southern Pacific Transportation Company's interpretation of this rule in relation to the operation being performed is: "If initial equipment to occupy crossing is equipment rather than an engine, such as cars, no whistle signal is required. This is the reason that we require the crew member to take a conspicuous position at the crossing in advance of the movement displaying warning signals with white light to any oncoming vehicular traffic." 11/

ANALYSIS

Tests

A series of tests were conducted to reenact the sequence of events immediately before the crash in order to evaluate traincrew testimony regarding these events and to provide a framework for evaluating the contribution of potential causal and influencing factors.

Visibility tests, conducted at night and using a train similar in character to that involved in the accident, indicated that the train was not readily visible to motorists until it was at or on the crossing. The gondola car was first visible to an approaching westbound motorist from about 400 feet before the crossing when it was standing just at the edge but not on the crossing and from about 450 feet when it fully occupied the crossing. To establish these distances, the crossing was approached in an automobile traveling at 0 to 3 mph with high beams on and with the occupants looking for an object. The outline and shape of the gondola car and a slight difference in color contrast compared to its background were the main visible features of the gondola car. The visibility tests indicated that the waving lantern could be seen at least as far back as the intersection located 1,750 feet before the crossing.

A test was made with an automobile traveling at 70 mph and with the gondola car standing at the edge but not on the crossing. With the driver looking for an object, he was able to sight the gondola car and skid the automobile to a stop 200 feet before the crossing.

A second series of tests were staged to document the acceleration and braking capability of the train. The train was started at a point where the leading edge of the gondola car was located 245 feet before the crossing, and the train was accelerated toward the crossing under constant throttle settings. A signal to stop was given when the gondola car was at the edge but not on the crossing. The train was stopped using

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10/ Rule 14(1), Rules and Regulations of the Transportation Department. effective January 1, 1969, Southern Pacific Company.

11/ Letter from Southern Pacific Transportation Company to the National Transportation Safety Board, dated January 15, 1976.

the engine brake only. With the exception of the constant throttle settings, these precrash conditions had been based on traincrew testimony.

During three tests conducted at a "one-notch" throttle setting, the train entered the crossing at a speed of 5 to 6 mph and upon braking, the leading edge of the gondola car came to rest in the range of 10 to 20 feet farther than its final position on the night of the accident. For this test to be representative of the actions on the night of the accident, it would have been necessary for the engineer to have been alerted by the flagman's vigorous signals and to have applied the brakes when the leading edge of the gondola car was 10 to 20 feet before the crossing. For the "two notch" tests to be representative, it would have been necessary for the engineer to have reacted when the leading edge of the gondola car was 70 feet before the crossing.

If the engineer's 2- to 3-mph speed estimate is accurate, it would have been necessary for him to have responded to the flagman's vigorous signals when the leading edge of the gondola car was 15 to 25 feet onto the crossing. This later response is conceivable since the flagman's signals were being directed at the automobile, not the engineer.

Tests, the physical evidence, and the traincrew testimony indicate that the train probably entered the crossing at a speed of about 4 mph or less and that the vigorous phase of the flagman's signals were being given for a time period of at least 7 to 8 1/2 12/ seconds before impact. This range in time accounts for the possibility that the train moved forward for a few feet after the collision while completing its stop.

The severity of damage to the automobile and the 55-mph speed limit suggest a speed of 50 mph or more for the automobile before its wheels were locked.

A test car was driven toward the flagman involved in the accident in an attempt to permit a judgment of the speed of the automobile as it approached the collision. The flagman, standing in a position similar to that taken on the night of the accident, could not relate a known speed of the test car with that of the automobile involved in the accident but did note that approach speeds of 45 mph seemed too slow. During these test runs, the flagman was instructed to begin the more vigorous signals to the test car when it reached a position where, in his words, "it should have been stopping but was not." At approach speeds in the range of 55 to 65 mph, it was repeatedly established that this position was about 625 feet before the crossing.

12/ 8 1/2 seconds is the time required to stop the train from an initial velocity of 4 mph, assuming a 2-second delay from perception to onset of braking.

A vehicle at a speed of 60 mph (88 feet per second) travels a distance of 625 feet in about 7 seconds; a vehicle at a speed of 50 mph (73.4 feet per second) travels a distance of 625 feet in about 8 1/2 seconds. Upon locking its wheels at speeds above 50 mph, an automobile slides 40 feet in about 1/2 second or less.

Factors of Potential Influence to the Accident

Toxicological tests at autopsy indicted that the driver was above the legally defined level of intoxication and his passengers were at or near that level. Calculations indicate that the driver would have had to drink the equivalent of five to six 12-oz cans of beer to achieve a 0.14 percent level of blood alcohol and drink the equivalent of an additional can of beer every 2 hours to maintain that level. Additionally, the other occupants would have had to drink the equivalent of three to four 12-oz cans of beer each to achieve their levels of blood alcohol.

The influence of alcohol on driver performance is well-documented and its unique influence upon young drivers has been pointed out by the Safety Board 13/ and other agencies. In a special study of young drivers, it was noted that "...Even low levels of alcohol between 0.01 and 0.04 percent significantly increase the accident vulnerability of the 18 and 19 year olds and those over 70....Alcohol has a major impact on accident vulnerability at BAC (Blood Alcohol Content) levels above 0.10 percent, but once again these levels appear to be related to age, with the greatest effect occurring for younger and older drivers." 14/ The intoxicated driver is cited as a common cause of crossing accidents. 15/

The accident crossing was irregularly used by trains, road traffic was light, and it probably was not readily apparent to the driver that the view of approaching trains might be restricted during certain train operations. This could have led the driver to develop a pattern of high-speed approaches at this crossing. Also, research on the effects of alcohol indicates that the effects of alcohol cause excessive risk-taking or disorganization, and that drivers may speed or make risky maneuvers during driving as a result of alcohol use. 16/

13/ National Transportation Safety Board Special Study, "Youth and Traffic Safety Education," July 1, 1971, NTSB-STS-71-3.

14/ "Alcohol, Drugs and Young Drivers" by Robert B. Voas, published by the National Highway Traffic Safety Administration; May 1974.

15 Safety at the Crossing, State of California, Driver Education.

16 "Motivational and Cognitive Effects of Alcohol" by Herbert Barry III, Alcohol, Drugs, and Driving; prepared for the National Highway Traffic Safety Administration, March 1974. DOT-HS-801 096.

Although the slow, lateral waving signals followed by more vigorous signals are often used to alert, slow, and stop traffic, they are not the only signals used. There was no explanation of these and other hand signals in the State of California Driver's Handbook or in training manuals used in the driver training course taken by the driver. 17/ Further, there is no National system of hand traffic control signals, especially for use at night, which persons authorized to direct traffic are required to apply or drivers are required to know. A new driver probably would have to experience the use of these signals to learn their meaning. It is not known whether this driver, who had 18 months of driving experience, would have understood these signals. However, even if the driver had been exposed to training regarding their meaning, it is not known whether he would have retained this information and applied it while intoxicated. He did not apply the other training information which had been made available to him during driver training concerning how to approach a crossing properly.

Along with information warning him to be especially cautious at crossings he was familiar with, the driver was advised to: "Approach a grade crossing with great caution; treat a railroad crossing just as you would a dangerous street or road intersection; most important of all, you can easily see, hear and avoid that train if you will take some simple precautions: when you approach the crossing, slow down to give yourself a chance to find out if a train is coming, look carefully in each direction, lower your car window before you reach the crossing so that you can hear. Silence your radio." 18/ If the driver was not aware that the crossing was protected by a flagman, it was his responsibility to adhere to the 15-mph speed law.

The approach to the crossing was easily negotiable and did not require unusual driver attention even at high speed. If the driver elected to approach the crossing at high speed, he at least should have been looking ahead to see if the crossing were occupied. Even if it were assumed that no signal was given to the driver, he should have been able to detect the gondola car through the high-beam illumination provided by his headlights and to stop before striking the train.

The tests indicated that vigorous warning signals were given. Even if they were the only signals given, they were unusual in character and were begun early enough to have allowed the driver to realize that something was ahead so he would be ready to stop before reaching the signal. If nothing else, these signals should have attracted his attention toward the crossing, where he could have detected the gondola

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17/ California Driver's Handbook, January 1974 revision, California Department of Motor Vehicles. Sportsmanlike Driving - 6th Edition, American Automobile Association. Safety at the Crossing, State of California, Driver Education.

18/ Sportsmanlike Driving, 6th Edition, American Automobile Association.

car at or on the crossing. If both the slower and the more vigorous signals were given, as stated by the traincrew, he would have had even more time to react.

Accident Countermeasures

The Safety Board examined possible actions which might have prevented the accident. The countermeasures discussed here, for the most part, go beyond current safety efforts employed nationally.

Methods that would ordinarily be expected to increase the margin of safety at this crossing -- improving the detectability of trains through the use of running lights, reflectorized or distinctly colored railroad cars, or overhead illumination of the crossing; improved hand or portable signaling devices; automatic gates and signals -- were examined to determine their potential for preventing an accident involving a driver impaired by alcohol. However, whereas considerable research has been performed with respect to an impaired driver's ability to respond to traffic situations in general and to simple signal monitoring, only limited research has been performed specifically to develop signals or systems which seek to control impaired drivers. That research is not applicable to this accident. Further, no research has been performed that indicates the effectiveness of those systems in use at railroad crossings with respect to controlling the impaired driver. For example, the PUC had established that in those locations where crossbucks were replaced with automatic gates, vehicle-train accidents in general were reduced by 90 percent. 19/ However, it is not known whether accidents involving impaired drivers, especially at high levels of impairment, also were effectively reduced. As a result, it is not now possible to predict, with any degree of certainty, which, if any, methods would have been successful in achieving an appropriate reaction from this driver at his level of impairment.

The ability of the train horn, if sounded, to alert the driver also was examined. Research performed for the Federal Railroad Administration indicates that horns are marginally effective as warning devices in high speed encounters, for example, with a train moving at 50 mph and a motor vehicle moving at 50 mph. 20/ There is no research to indicate whether an impaired driver is likely to be alerted more effectively by an audible signal. A review of the influences of alcohol upon vision, tracking, and attention indicates that "alcohol affects the ability to process appreciable quantities of information when these arrive from more than one source

19/ Letter from State of California Public Utilities Commission to the National Transportation Safety Board, dated August 28, 1975.

20/ Report to Congress; Railroad - Highway Safety, Part 1: A Comprehensive Statement of the Problem; prepared by the Federal Railroad Administration.

simultaneously, as is typical of the requirements for driving." 21/ It was not possible to establish the position of the car windows, the settings for the radio, or other factors that would serve to influence the background noise through which the train horn would have to be heard. Therefore, no conclusion could be made regarding the ability of the train horn, if sounded, to alert the driver.

There was no indication that rescheduling of trains to operate during daylight only would improve safety at the crossing, since previous accidents at this crossing occurred during daylight. Requiring trains to stop just before the crossing before proceeding over the crossing would increase rather than decrease exposure time.

The driver had been involved in four previous traffic-related incidents in the year preceding the accident. According to the State of California criteria for suspension and revocation of licenses, the circumstances of each incident were not individually or collectively sufficient to warrant significant corrective action. In its special study, "Youth and Traffic Safety Education," published on July 1, 1971, the Safety Board recommended that:

> The National Highway Traffic Safety Administration (NHTSA) consider expanding the National Highway Traffic Safety Program Standard on Driver Licensing to provide for a 2-year period of probationary licensing for drivers under 21, during which time they would be expected to demonstrate the achievement of competence and maturity in driving. Such provisional licensing would facilitate suspension or revocation for cause and placement of mildly errant drivers into improvement programs before poor behavior and attitudes become habitual. 22/

NHTSA reported in August 1975 that the Highway Safety Program Standard on Driver Licensing is being revised, along with all 17 other Highway Safety Program Standards. A draft of the proposed standard on licensing is expected to be completed by the spring of 1976. All new or revised Highway Safety Program Standards must be reviewed and approved by the Congress before they may be adopted. According to NHTSA, the revised Standard on Driver Licensing will not be so specific as to characterize particular programs of the type suggested by the Board. The current standard recommends rather than requires the adoption of specific programs by the States and this same approach is expected to be continued in the revised standard. The current standard refers the

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21/ "Alcohol Influences Upon Sensory Motor Function, Visual Perception, and Attention" by H. Moskowitz; Alcohol, Drugs and Driving; prepared for the National Highway Traffic Safety Administration; March 1974; DOT-HS-801 096.

22/ National Transportation Safety Board Special Study, "Youth and Traffic Safety Education," July 1, 1971, NTSB-STS-71-3.

States to Chapter 6 of the Uniform Vehicle Code, 23/ as established by the National Committee on Uniform Traffic Laws and Ordinances, for additional guidance regarding driver licensing.

According to the National Committee, the laws of 18 States and Chapter 6 of its Uniform Vehicle Code contain provisions for special licensing of young drivers under a specified age. 24/ Fourteen of these 18 States and Section 6-111(b) of the Uniform Vehicle Code provide that licenses for these young drivers be of a different color, be marked "provisional," or use some similar method for indicating that a driver is less than a certain age. The laws of 6 of these 18 States also have provisions to detect mildly errant drivers, to establish special criteria for suspension or revocation of a license, and to require entry into a driver improvement or training course before a driver may reapply for another license.

The most strict of these laws require that licenses be revoked if the driver is convicted of one moving traffic violation. Section 6-111(b) of the Uniform Vehicle Code does not contain these additional provisions. According to the National Committee, this section was considered for elimination from the code but was retained for its "possible psychological impact on young drivers."

Since 1965, the State of New York has had a probationary license system for all new drivers licensed except for those held by drivers from States with road test reciprocity with the State of New York. Under this system, the license of a probationer is revoked if he is convicted of one serious moving violation (including hit-and-run driving) or two less serious moving violations. The probationer is required to attend a driver improvement clinic before approval of his application for another license. In the first 2 years of the program, there was a significant reduction in the number of male drivers under 20 years old whose licenses were revoked once (4.2 percent) as compared to a control group of similar drivers who would have lost their license had the probationary license law been in effect (6.0 percent). Also, there was a significant reduction in the number of probationary drivers who had their licenses revoked a second time. Rather than a predictable 3.23 percent if the program had no appreciable influence, only 2.4 percent had their licenses revoked again. 25/

According to the criteria of the State of New York, the driver involved in this accident would have been detected as a mildly errant

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23 Uniform Vehicle Code and Model Traffic Ordinance, 1968 revision; National Committee on Uniform Traffic Laws and Ordinances.

24 Driver Licensing Laws Annotated, 1973 revision; National Committee on Uniform Traffic Laws and Ordinances.

25/ State of New York Department of Motor Vehicles, "The Probationary License Program"; A Program Proposal; December 1968.

driver, his license would have been revoked, and he would have been required to attend a driver improvement clinic before approval of his application for another license.

In its special study, "Youth and Traffic Safety Education," the Board also recommended that NHTSA "Develop new and/or supplemental efforts in their alcohol safety action programs specifically designed for the young drinking driver, beyond those now contemplated or in use." On January 17, 1975, NHTSA reported in response to this recommendation that several Alcohol Safety Action Program (ASAP) projects already had emphasized youth-oriented, alcohol safety-driver improvement programs. According to NHTSA, the effectiveness of these programs has not been established adequately. NHTSA also reported that its interest in new alcohol safety programs specifically designed for the young drinking driver were reflected in the initiation of the young problem drinker/driver demonstration projects to be implemented during Fiscal Year (FY) 1975. The program would be designed to determine the relative effectiveness of several treatment approaches (e.g. education, group therapy, incar training, etc.) and combinations of such programs in reducing drinking/driving problems of young drivers. These programs were not initiated during FY 1975, and are now scheduled for implementation in FY 1976.

It is believed that the driver involved in this accident was experimenting with the use of alcohol and was not a problem drinker. Screening methods have not been devised that would have identified whether or not this driver had a reasonable probability for combining drinking and driving even if he had been detected as a mildly errant driver.

One method to control driver behavior would be to proscribe his driving during time periods with a high potential for combined drinking and driving. According to the National Committee on Uniform Traffic Laws and Ordinances, five States (Illinois, Louisiana, Massachusetts, Pennsylvania, and New York) have laws which provide that licenses issued to all persons within specified age groups (usually 16 to 18 years old) are valid only during certain hours of the day. These hours vary, but usually driving is not permitted during the period between 1 a.m. and 5 a.m. The Uniform Vehicle Code does not contain similar provisions. This type of restriction, especially if enforced for a longer period of the day, might serve to prevent accidents of the type found in this case. Likewise, such a restriction might deter owners (the mother in this case) from permitting use of their cars by a restricted driver.

CONCLUSIONS

1. The blood alcohol level of the driver was above the California legal limit and the nationally recommended limit of 0.10 percent, at which a person is considered to be under the influence of alcohol.

2 The train probably was moving at 4 mph or less as it entered the crossing, the vigorous phase of the flagman's signals were being given for a time period of about 7 to 8 1/2 seconds before impact, while the automobile continued to approach the crossing at 50 mph or more without apparent reaction by the driver until about 1/2 second before impact.

3. It is unknown whether the driver saw or knew the meaning of the flagman's lantern signals because his driving experience was limited and such signals had not been addressed during his driver training. It is also unknown whether he would have retained and applied such information because he did not apply other information which had been made available to him concerning the proper approach to a railroad crossing.

4. There is no National system of hand traffic control signals which all persons authorized to direct traffic are required to apply or drivers are required to know.

5. Even if no signal had been given to the driver, the approach to the crossing was not complex and he should have at least been looking ahead to see if the crossing were occupied; if he had looked, he should have seen the gondola car soon enough to make a safe stop, even when operating at a speed of 50 mph or more.

6. Even if only the more vigorous flagman's signals were given, they were unusual in character and were begun early enough to have allowed the driver to realize that something was ahead so that he could be ready to stop before reaching the signals. If nothing else, these signals should have attracted his attention toward the crossing where he could have detected the gondola car at or on the crossing.

7. If both the slower and the more vigorous warning signals were given, as stated by the traincrew, the driver should have had even more time to react.

8. The traffic information and control systems in use probably would have been adequate for an alert, unimpaired driver.

9. Due to a lack of research to determine how effectively current signals and systems control the impaired driver and the unavailability of specifically developed systems which seek to control the impaired driver, it is not possible to determine what improvements in traffic information and control at this crossing would have prevented this accident.

10. Altering procedures to allow trains to operate only during daylight or to require the train to stop just before the crossing would not improve safety at this crossing.

11. Although the driver had been involved in four previous traffic-related incidents in the year preceding the accident, the character or circumstances of each incident were not individually or collectively sufficient to initiate corrective action pursuant to the vehicle code of the State of California.

12. Although some States have programs for young driver behavior monitoring and rehabilitation that may have prevented this accident, there are no such programs in California or on a National basis.

PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the automobile driver to make a proper approach to a known, identified crossing, and his failure to respond to the flagman's signals or to observe the train at, or on, the crossing until it was too late to avoid impact. The driver's failure to respond probably was caused by the influence of alcohol.

RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board submitted four recommendations to the National Highway Traffic Safety Administration and one recommendation to the National Committee on Uniform Traffic Laws and Ordinances. (See Appendixes A and B.)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ WEBSTER B. TODD, JR.
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ LOUIS M. THAYER
Member

/s/ ISABEL A. BURGESS
Member

/s/ WILLIAM R. HALEY
Member

February 17, 1976

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

APPENDIX A

ISSUED:

Forwarded to:

Honorable James B. Gregory
Administrator
National Highway Traffic Safety
Administration
400 Seventh Street, S. W.
Washington, D. C. 20590

SAFETY RECOMMENDATION(S)

H-76-2 through H-76-5

About 1:45 a.m. on March 9, 1975, near Tracy, California, three teenagers were killed when their auto struck the side of the leading car of a slow-moving freight train at a crossing used irregularly by trains. The presence of the crossing was indicated by warning signs 500 feet and 380 feet in advance of the crossing and by crossbucks at the crossing; a train flagman present at the crossing was unsuccessful in his attempts to stop the automobile. The driver's blood alcohol level was 0.14 percent and the passengers' blood alcohol levels were 0.10 and 0.09 percent. According to California State and to Federal criteria, a person with a blood alcohol level of 0.10 percent is presumed to be under the influence of alcohol.

Three elements related to this accident are of concern to the National Highway Traffic Safety Administration. These elements are the need to develop and implement (1) railroad traffic information and control systems that recognize and attempt to deal with the impaired driver, (2) young driver behavior monitoring and rehabilitation programs, and (3) appropriate youth-oriented alcohol safety action programs.

In an effort to find ways to prevent or to reduce the severity of this type accident, the National Transportation Safety Board considered existing traffic information and control measures. However, due to a lack of research regarding the effectiveness of signals and systems in use and a lack of research to develop such systems with respect to controlling the impaired driver, it was not possible to predict which if any improvements in traffic information and control systems might serve to achieve appropriate reactions from impaired drivers.

APPENDIX A

Specific focus on the development of hand or portable signaling standards that recognize the need to deal with the impaired driver could benefit a number of segments of the transportation industry. Increased protection and control would result not only at railroad crossings but also at highway construction areas, accident scenes, or any site involving the temporary direction of traffic. While it is recognized that it is difficult to design for the impaired driver, it is especially necessary in situations where persons are directly exposed to this type of driver as a result of being required to provide temporary protection and control at some location.

The NHTSA has and continues to focus considerable attention on detecting, retarding, and correcting aberrant driver behavior, especially with respect to alcohol abuse. Also, the NHTSA continues to focus attention on examining alternative approaches in these areas, rather than reaching a firm decision as to what current model programs, legislative and administrative authorities might represent effective programs to pursue nationally.

In 1971, the Safety Board recommended that NHTSA consider expanding its Highway Safety Program on Driver Licensing "to provide for a 2-year period of probationary licensing for drivers under 21, during which time they would be expected to demonstrate the achievement of competence and maturity in driving. Such provisional licensing would facilitate suspension for cause and placement of mildly errant drivers into improvement programs before poor behavior and attitudes become habitual."1/ A program of this type has been employed by the State of New York since 1965 with demonstrated effectiveness. In this regard, it has also been noted that NHTSA recently has awarded a contract which in part would reexamine the feasibility of placing mildly errant drivers with a reasonable probability for combining drinking and driving into improvement programs. The Safety Board also understands that (1) NHTSA currently refers the States to the Uniform Vehicle Code as established by the National Committee on Uniform Traffic Laws and Ordinances for more specific guidance regarding driver licensing, (2) revision of the current NHTSA standard could be delayed for several years, and (3) the present NHTSA philosophy is that the next revision of the standard will not refer the States to

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1/ National Transportation Safety Board Special Study, "Youth and Traffic Safety Education," July 1, 1971, NTSB-STS-71-3.

the Uniform Vehicle Code and will not include specific programs of the type suggested by the Board. The scope and magnitude of the young driver safety problem are such that specific guidance should be provided at an early date.

In 1971, the Safety Board also recommended that NHTSA "develop new and/or supplemental efforts in their alcohol safety action programs specifically designed for the young drinking driver, beyond those now contemplated or in use." The effectiveness of early efforts in this regard could not be established by NHTSA. Now it appears that NHTSA is initiating a second series of programs which will focus primarily on the young problem drinker and that the initiation of these programs is being delayed even though this is a recognized priority area. The Safety Board is concerned that these programs will follow a pattern similar to the Alcohol Safety Action Programs that focus on the apprehended offender, whereas an effort should be pursued that would encompass all aspects of young driver improvement in relation to combined drinking and driving.

Therefore, the National Transportation Safety Board recommends that the National Highway Traffic Safety Administration:

1. Determine and report the effectiveness of traffic information and control systems currently in use at railroad crossings, considering in particular their ability to warn and achieve an appropriate reaction from impaired drivers. (H-76-2) (Class II, Priority Followup)

2. Develop and report more effective systems and standards for conveying traffic information to impaired drivers at temporary traffic control sites (e.g., railroad crossings, construction sites, etc.) and protecting those persons controlling traffic. (H-76-3) (Class II, Priority Followup)

3. Study the effectiveness of the several forms of probationary licenses already in effect for young drivers, devise and incorporate model guidelines, and insure their rapid implementation into its Highway Safety Program Standard on Driver Licensing. (H-76-4) (Class II, Priority Followup)

4. Initiate promptly programs which emphasize youth-oriented Alcohol Safety - Driver Improvement programs. These programs should be directed not only toward the apprehended offender,

APPENDIX A

but also toward the driver with a history of mildly errant behavior and a reasonable probability for combining drinking and driving. (H-76-5) (Class II, Priority Followup)

TODD, Chairman, McADAMS, THAYER, BURGESS, and HALEY, Members, concurred in these recommendations.

By: Webster B. Todd, Jr.
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

APPENDIX B

ISSUED:

Forwarded to:

The National Committee on Uniform
Traffic Laws and Ordinances
Suite 430
1776 Massachusetts Avenue, N. W.
Washington, D. C. 20036

SAFETY RECOMMENDATION(S)

H-76-6

About 1:45 a.m. on March 9, 1975, near Tracy, California, three teenagers were killed when their auto struck the side of the leading car of a slow-moving freight train at a crossing used irregularly by trains. The presence of the crossing was indicated by warning signs 500 feet and 380 feet in advance of the crossing and by crossbucks at the crossing; a train flagman present at the crossing was unsuccessful in his attempts to stop the automobile. The driver's blood alcohol level was 0.14 percent and the passengers' blood alcohol levels were 0.10 and 0.09 percent. According to California State and to Federal criteria, a person with a blood alcohol level of 0.10 percent is presumed to be under the influence of alcohol.

In an effort to find ways to prevent or to reduce the severity of this type accident, existing legislative and administrative authorities were examined to determine their potential for detecting, retarding, and controlling aberrant driver behavior, especially with respect to alcohol. It was determined that the Uniform Vehicle Code of the National Committee is the current source of information for specific guidance regarding driver licensing. However, whereas several States have provisions in their codes that would have permitted detection and improvement of this driver's behavior through provisional licensing, the National Committee's Uniform Vehicle Code does not contain these additional provisions.

The Safety Board in 1971 pointed out the need for these provisions to the National Highway Traffic Safety Administration (NHTSA) as part of an overall effort to improve young driver performance. It is our understanding that NHTSA, in its Highway Safety Program Standard on Driver Licensing, currently refers the States to the Uniform Vehicle Code for more specific guidance regarding driver

APPENDIX B

licensing, and that revision of the current NHTSA standard could be delayed for several years. In view of the scope and magnitude of the young driver safety problem, there is a need now for improved legislative and administrative authorities. One of the best methods to gain awareness and consideration of these authorities by the States would be through the inclusion of these authorities in the Uniform Vehicle Code of the National Committee. Therefore, the National Transportation Safety Board recommends that the National Committee on Uniform Traffic Laws and Ordinances:

> Study the effectiveness of various probationary licenses already in effect for young drivers, devise model guidelines, and insure their early availability in its Uniform Vehicle Code. (Recommendation H-76-6) (Class II, Priority Followup)

TODD, Chairman, McADAMS, THAYER, BURGESS, and HALEY, Members, concurred in this recommendation.

By: Webster B. Todd, Jr.
Chairman