

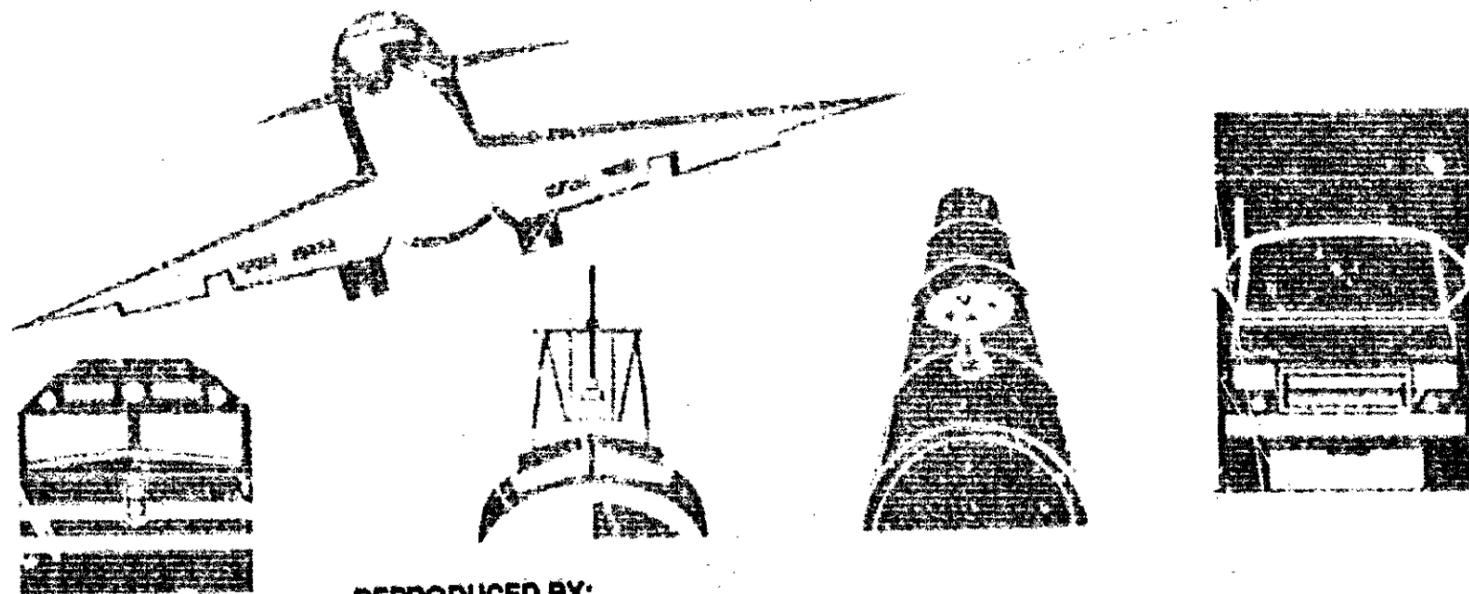
PB94-916201  
NTSB/HAR-94/01

**NATIONAL  
TRANSPORTATION  
SAFETY  
BOARD**

WASHINGTON, D.C. 20594

**HIGHWAY ACCIDENT REPORT**

**GASOLINE TANK TRUCK/AMTRAK TRAIN  
COLLISION AND FIRE IN  
FORT LAUDERDALE, FLORIDA  
MARCH 17, 1993**



REPRODUCED BY:  
DEPARTMENT OF COMMERCE  
National Technical Information Service  
Springfield, Virginia 22161

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**ADOPTED: FEBRUARY 15, 1994**

**NOTATION 6083A**

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## **EXECUTIVE SUMMARY**

About 3:13 p.m., Wednesday, March 17, 1993, an Amerada Hess (Hess) tractor-semitrailer hauling gasoline was struck by National Railroad Passenger Corporation (Amtrak) train 91. The truckdriver was attempting to cross a railroad/highway grade crossing on Cypress Creek Road in Fort Lauderdale, Florida. Traffic in the area of the crossing was congested because the left and center lanes were closed just over the crossing. Traffic was being channeled into the right lane and later shifted into a right-turn lane. The truck, which was loaded with 8,500 gallons of gasoline, was punctured when it was struck. A fire erupted, engulfing the truck and nine other vehicles. The fire killed the truckdriver and five occupants of three stopped vehicles.

The National Transportation Safety Board determines that the probable cause of the accident was the inadequacy of the precautions taken by the Broward County project manager, the design engineer, and the contractor, which resulted in traffic congestion at the railroad/highway grade crossing, and the truckdriver's decision to cross the railroad track even though the warning system had been activated.

The major safety issues discussed in this report are the performance of the truckdriver and traffic control in work zones near railroad/highway grade crossings. As a result of its investigation of this accident, the Safety Board makes recommendations to the Federal Highway Administration, the American Trucking Associations, Inc., and the Amerada Hess Corporation.

## ACCIDENT

On the day of the accident, the truckdriver followed his normal routine: he arose about 9:30 or 10:30 a.m., ate breakfast, exercised, had lunch with his wife, and drove her to work. Between 1:15 and 1:30 p.m., he called her to say he was on his way to work. He normally worked from 2 p.m. to midnight, Mondays through Thursdays. About 2 p.m., he reported to the Hess terminal in Port Everglades. The truckdriver conducted his pretrip vehicle inspection, and about 2:30 p.m., he left with a truck<sup>1</sup> that was fully loaded with gasoline en route to a Hess gas station in Margate, Florida. He had not driven the route he was planning to take for at least 9 months because he had been injured on the job 9 months before the accident and had not returned to work until a month before the accident.

He was about 2 miles from the Margate gas station when the accident occurred. According to the Hess terminal manager, the driver would have reached the gas station on schedule. The round trip from the terminal to the gas station was 34 miles and took about 2 1/2 hours. The driver was, witnesses later stated, in the right lane on Cypress Creek Road, traveling west and in the process of crossing a railroad/highway grade crossing.

Cypress Creek Road is a 6-lane divided roadway that runs east and west (see figure 1), and it is crossed at the accident location by a single railroad track that runs north and south. The road was being widened, and on the day of the accident, the left and center lanes had been closed just west of the railroad track to accommodate the road work. Consequently, traffic was congested.

Five witnesses stated that the truck was stopped in traffic with its tractor underneath the crossing gate when the crossing warning system activated. These witnesses saw the crossing gate come down on the hood of the tractor near the windshield and bounce back up again. Three of these witnesses said that the truck was close to but not on the railroad track. Witnesses said that the truckdriver had the driver's side window down and that his left arm was resting on the window frame. When the gate came down on his tractor, he moved his arm inside and looked at the gate. He proceeded forward slowly as the gate was "bouncing" up and down on his tractor. The gate stuck on the tractor's exhaust stack and broke off. At that point, witnesses said, the truck stopped on the railroad track, rolled backward slightly as if the truckdriver were changing gears, and then proceeded slowly across the railroad track.

Witnesses stated that as they heard the crossing warning devices activate, two cars were stopped on the railroad track. These cars quickly moved off the track. Witnesses who were on the fifth floor of a nearby building stated that there was no traffic backup on the west side of the crossing at the time the truck was crossing the track.

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<sup>1</sup>His truck was a tractor with a cargo tank semitrailer. In this report, *tractor* refers to the power portion of the truck, *semitrailer* refers to the cargo tank portion of the truck, and *truck* refers to the entire unit.

Meanwhile, Amtrak train 91, the Silver Star, was approaching the crossing. The train consisted of a locomotive and 11 cars. It had originated in New York and was en route to Miami, Florida, but because of weather conditions and signal problems, the train was about 3 hours behind schedule. The engineer later said that when he was about 2 car lengths (a car length is about 65 feet long) north of the whistlepost, which was 1,528 feet north of the crossing, he saw a small white car on the crossing and that right behind it was a tractor that was just over the east rail.

He said that he immediately made a service brake application and started blowing the horn. He said that as the train approached the crossing, the car started to move forward. The truck, which he said was only 2 1/2 feet over the east rail, also started to move forward. When he saw that the truck would obstruct the track he immediately put the train into emergency braking.

According to the train's event recorder, the train was traveling 59 mph when a service brake application of 6 pounds per square inch was made. The speed limit was 60 miles an hour. The recorder indicates that about 5 seconds later, the train was put into emergency braking and the horn was activated. According to the event recorder, the train was traveling 35 miles an hour upon impact.

Nine witnesses stated that as the truck was proceeding slowly across the railroad track, the train struck the right rear of the semitrailer, causing the truck to rotate in a clockwise direction. The tractor and semitrailer separated and came to rest almost parallel to the track on the west side of the crossing (see figure 2). The semitrailer ruptured, spewing gasoline that immediately ignited. The fire engulfed nine vehicles on the west side of the crossing. The train remained on the track and traveled about 278 feet before it came to rest.

## **INJURIES**

The truckdriver and five occupants of other vehicles were killed during the fire. The occupants were from three eastbound vehicles that had been waiting on the west side of the crossing for the train to go by. Nineteen people on the train (11 passengers and 8 crewmembers) sustained minor injuries and were taken to area hospitals, where they were treated and released.

## **DAMAGE**

The truck was a 1991 Freightliner three-axle conventional tractor with a 34-foot-long 1977 Heil aluminum cargo tank semitrailer that had five compartments on two axles. The truck was totally destroyed. Six other vehicles were also destroyed. The estimated cost of the seven vehicles was about \$116,000. The locomotive and the first, second, and fourth cars of the train (the mail, baggage, and sleeper cars, respectively) sustained minor fire and smoke damage. The third car (the diner) came to rest on the crossing and was severely damaged by the fire. Amtrak

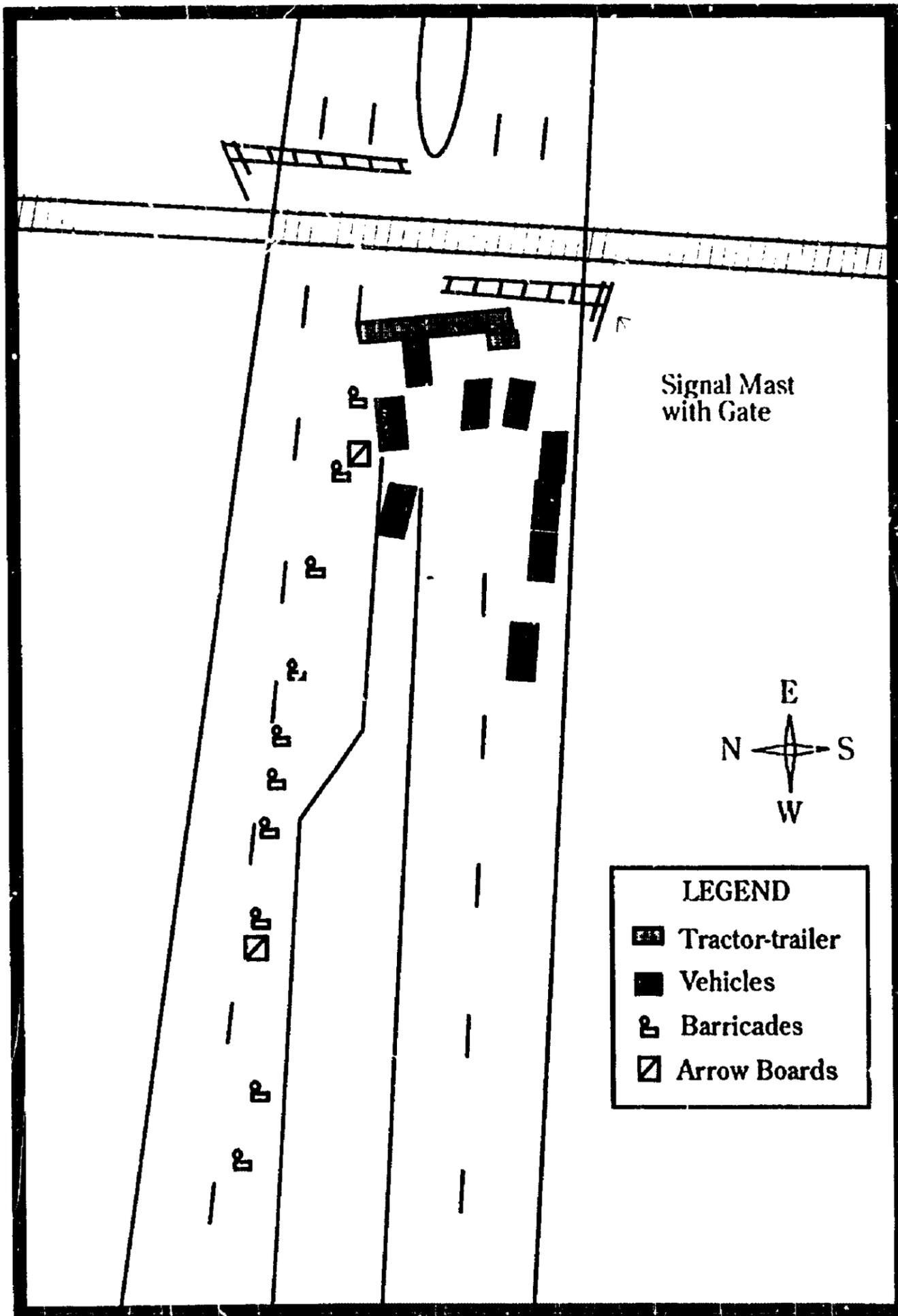


Figure 2.--Position of vehicles after collision.

estimated the equipment damage at \$900,000. In addition, the estimated cost to Hess for cleaning up the environment was about \$450,000.

## **RAILROAD**

The mile and a half of track north of the crossing is straight and level. The intersection of the railroad track and the roadway is straight and level. About 36 trains use the crossing daily.

The Safety Board measured the sight distances from an empty Hess truck and from a freight locomotive, which has about the same field of view that an Amtrak locomotive does. When the locomotive was 1,648 feet north of the crossing, the engineer was able to see the tractor on the east rail of the railroad track. He could not, however, see the semitrailer; it was obscured by the tree line. When the tractor was 8 feet east of the railroad track, the driver was able to see 3,625 feet to the north.

The crossing warning system consisted of the following items: bells, 38-foot-long gate arms, and flashing lights mounted on a mast. Also, over each lane was a set of flashing lights on a cantilever (the lights were visible to motorists going in either direction). Following the accident, the warning system was tested; no exceptions were noted, and the devices worked as designed.

No anomalies were found in the track, and according to the maintenance records, both the track and the crossing warning system had been maintained in accordance with the rules and regulations of both CSX Transportation, Inc.,<sup>2</sup> and the Federal Railroad Administration (FRA). When the air brakes on train 91 were tested, they were in working order.

An Amtrak analysis concluded that had the engineer placed the train into emergency when he first saw the tractor (when he was approximately 1,658 feet north of the crossing), the train would have come to rest at or about the point of impact. Although the engineer was able to see the tractor on the crossing before he reached the whistlepost, the tree line obscured his view of the semitrailer. Therefore, he would not have known that the truck was a gasoline tank truck until it pulled further forward onto the track. When he saw that the truck would obstruct the track, he placed the train into emergency.

The Safety Board does not believe that it is prudent for a train engineer to place a train in emergency braking every time he observes a vehicle on the track because vehicles frequently attempt to cross the railroad track after the warning system has been activated. Placing a train in emergency braking may cause adverse results. The train may derail, causing injury to its crew, its passengers, and passersby.

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<sup>2</sup>The company that governs train dispatching and operations on that track.

## **TRUCKDRIVER**

The truckdriver, who had received nine safety awards in the previous 3 years, was an experienced, qualified driver. He had a Florida Class A commercial driver's license with hazardous materials and tank-articulated vehicle endorsements, which had been issued on March 24, 1992. He had driven articulated vehicles for 18 years and had been employed by Hess for 4 years. According to the Florida Department of Highway Safety and Motor Vehicles, between 1982 and 1988, he had been cited for the following violations: speeding, three times; following too close, once; and operating a motor vehicle with improper equipment, once. The Safety Board could not determine from records whether these violations occurred while he was driving a truck. No accidents were recorded.

Nothing indicated that he was impaired or fatigued. He had a current medical certificate. Postaccident toxicological testing revealed no evidence of alcohol or other drugs. According to his wife, he had slept well the night before. He had just started his shift about an hour before the accident occurred. The history of his previous 72 hours did not disclose any events that could have degraded his driving ability or judgement. The background investigation of the truckdriver revealed that he was a very calm, even-tempered man who led a routine life.

Witnesses stated that traffic was congested and moving slowly toward the grade crossing. The truckdriver was initially stopped behind other traffic that was stopped on the railroad track. The tractor was under the crossing gate. Because the gate was not parallel to the rail, the distance between the gate and the rail varied; at the narrowest point, the distance was 14 feet. The tractor was 22 feet long; its hood was 6 feet long. If the gate had struck the windshield area of the hood, the front of the tractor would have been about 8 feet from the east rail. The train overhung the track by 3 feet on each side of the rails, leaving about 5 feet of clearance between the front of the tractor and the train. The Safety Board concludes that had the truckdriver stayed in the position under the crossing gate, as described by the witnesses, he would have avoided the collision.

A Safety Board investigator measured the sight distance while seated in a similar tractor. With the air ride seat fully extended, the investigator was able to see the ground 16 feet in front of the tractor's bumper. Therefore, the truckdriver would not have been able to see the track directly in front of his truck. He may have believed that he had encroached on the railroad track and that it was necessary to move forward. When he moved forward, breaking through the crossing gate, and momentarily stopped on the east rail, he may have been shifting gears. Statements by the train engineer and other witnesses support this possibility.

Safety Board investigators conducted a test with an empty Hess truck to see how long it would take the truck to clear the crossing if, when it started, it was in the right lane, its front bumper was over the east rail, and it was in neutral. It cleared the crossing in 9 seconds. On June 17, 1993, the Fort Lauderdale Police Department conducted tests with a fully loaded Hess truck. One test was conducted with the truck stopped with its hood under the crossing gate. It took 11 seconds for the truck to travel 65 feet to the point of impact. Another test was

conducted with the truck's front wheels just over the east rail. It took 9 seconds for the truck to travel 55 feet to the point of impact.

The crossing warning system is designed to activate when a train is 2,875 feet north of the crossing. Tests conducted by the Safety Board of a train traveling 60 mph confirmed that 2 seconds after the train passed the sensor, the warning lights began to flash. Nine seconds later the crossing gates descended, and after another 7 seconds, the gates were fully horizontal. Fourteen seconds later or about 29 seconds after the train activated the crossing warning devices, it arrived at the crossing. If it takes about 11 seconds for a truckdriver to drive a truck across the track, that still leaves about 9 seconds before the train arrives at the crossing. The Safety Board concludes that if the accident truckdriver had not hesitated and had immediately driven across the track when the gate first came down on the tractor, he might have been able to clear the track.

Federal regulations (49 CFR 392.10) require that the driver of a hazardous material cargo tank not cross a railroad track unless he first:

Stops the vehicle within 50 feet of, and not closer than 15 feet to, the tracks; thereafter listens, and looks in each direction along the tracks for an approaching train; and ascertains that no train is approaching. When it is safe to do so, the driver may drive the vehicle across the tracks in a gear that permits the vehicle to complete the crossing without a change of gears.

According to Section 316.159 of Florida's State traffic laws:

The driver of any motor vehicle. . .carrying flammable liquids as a cargo or part of a cargo, before crossing at grade any track or tracks of a railroad, shall stop such vehicle within 50 feet but not less than 15 feet from the nearest rail of the railroad and, while so stopped, shall listen and look in both directions along the track for any approaching train, and for signals indicating the approach of a train except as hereinafter provided, and shall not proceed until he can do so safely.

In addition, Hess rules state:

Make a full stop at all railroad grade crossings whether or not they are guarded by gates and signals and do not proceed across until you have made full observations in all directions and are convinced that you can cross safely.

From interviews with family members and co-workers, the Safety Board found no evidence that indicated that the truckdriver took risks. The information gathered during the

investigation depicted the truckdriver as a dependable employee. When the crossing gate struck the hood of the tractor, the stopped truck was less than the required 15 feet from the track. However, it is likely that the congestion had compelled the driver to move ahead slowly with traffic to this position, where he was able to see further along the track to the north than he would have been able to had he been 15 feet from the track. Therefore, the Safety Board believes that when the crossing gate struck the hood of his tractor, he may have perceived that he had encroached on the railroad track.

## **ROADWAY**

**General.**--Cypress Creek Road, also known as NW 62nd Street, is a six-lane roadway with a 12-foot-wide median. It runs west, from U.S. 1 to the Florida Turnpike. A single railroad track crosses the roadway. The average daily traffic count as of February 9, 1993, is 50,500.

Cypress Creek Road and the railroad track both had a substantial volume of daily traffic. Florida's railroad/highway grade crossing safety index rating<sup>3</sup> ranges from 0 to 90; crossings that have a value of 70 or more are considered safe. Between 1979 and 1992 the Cypress Creek Road crossing has had three accidents, one involving a fatality, and has an average of 19 school bus crossings daily. Its safety index is 18.94. Based on the safety index, all crossings are then assigned a unique priority number. Florida has 4,100 public at-grade railroad/highway grade crossings with slightly over 100 accidents per year. Cypress Creek Road is ranked number 15 in the State, with the number 1 designating the worst. The recommended treatment at this crossing is an overpass; however, according to a spokesman for the Florida Department of Transportation, because the I-95 overpass is so close to the crossing, it would be extremely expensive to build either a railroad or a highway overpass at this location.

In 1990, Broward County hired the engineering firm of Kunde, Sprecher, Yaskin, & Associates, Inc., (referred to in this report as the design engineer) to design plans and to provide construction inspection services for widening Cypress Creek Road. In 1992, the County contracted with W. Jackson & Sons Construction Company (referred to in this report as the contractor) to construct the project. The project was expected to take 540 days and involved widening the roadway from six to eight lanes, resurfacing the highway, constructing storm drainage, and installing signalization, signing, pavement markings, landscaping, irrigation, and street lights. The completion date was January 1994.

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<sup>3</sup>A safety index is calculated each year to identify the accident potential of every public grade crossing. It is an algorithm derived from: 1) Florida's train accident experience (a 6-year accident history is used), 2) the traffic volumes (both highway and railroad), and 3) the speeds of the trains and the highway traffic. After a certain value is obtained, adjustments are made based on specific accident history and the number of daily school bus crossings.

**Work Zone.**--The accident happened on the 241st day of the project, when the contractor was installing drainage and laying pipe about 236 feet west of the crossing. (See figures 3 and 4.) On the east side of the crossing, all three westbound lanes were open. The contractor had posted warning signs 1,500, 1,000, and 500 feet east of the crossing that said, "Road Construction Ahead," and gave distance information.

On the west side of the crossing, the left and center lanes were closed, and traffic was channeled into the right lane and later shifted<sup>4</sup> into a right-turn lane. The left lane was blocked by barricades and a right-arrow board located about 60 feet west of the crossing. Barricades between the left and center lanes led up to a second right-arrow board, which was in the center lane about 200 feet west of the crossing. Traffic was being moved into the right lane and into a right-turn lane, which was being used as a through lane.

Six witnesses stated that the lane constriction had caused traffic to back up onto the track. The Safety Board concludes that the taper and shift design of the work zone caused congestion at the railroad/highway grade crossing.

One witness, who had driven over the track just before the truck did, said there was a piece of construction equipment in the center lane. The witness said a man was sitting on the equipment and a flagman was standing in front of it, apparently motioning traffic into the right lane. Two other witnesses said that they had seen a flagman; however, officials from the construction company said that they were not using a flagman at the site. Another witness stated that immediately after the accident, the construction workers were moving pieces of heavy equipment away from the fire, and it is not known exactly where this equipment was located.

The traffic control plan called for the work zone to be configured the way it was only from 9:30 a.m. to 3:30 p.m. on one day, the day of the accident. One of the provisions of the construction contract stated:

The contractor shall provide the services of uniformed off-duty police officers to supervise traffic control and maintain safety along the routes of the work, particularly when working near intersections or where his operations causes traffic congestion.

When the County project manager was asked about this provision, he replied that it meant that when a police officer was necessary, the contractor had to pay his salary. The contract did not specify where the police officer would be stationed, and the county project manager stated that police officers are normally used to direct traffic in highway intersections. The contractor had not hired a police officer to direct traffic at the time of the accident.

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<sup>4</sup>A shift is the temporary lateral movement of the thru-traffic lanes.

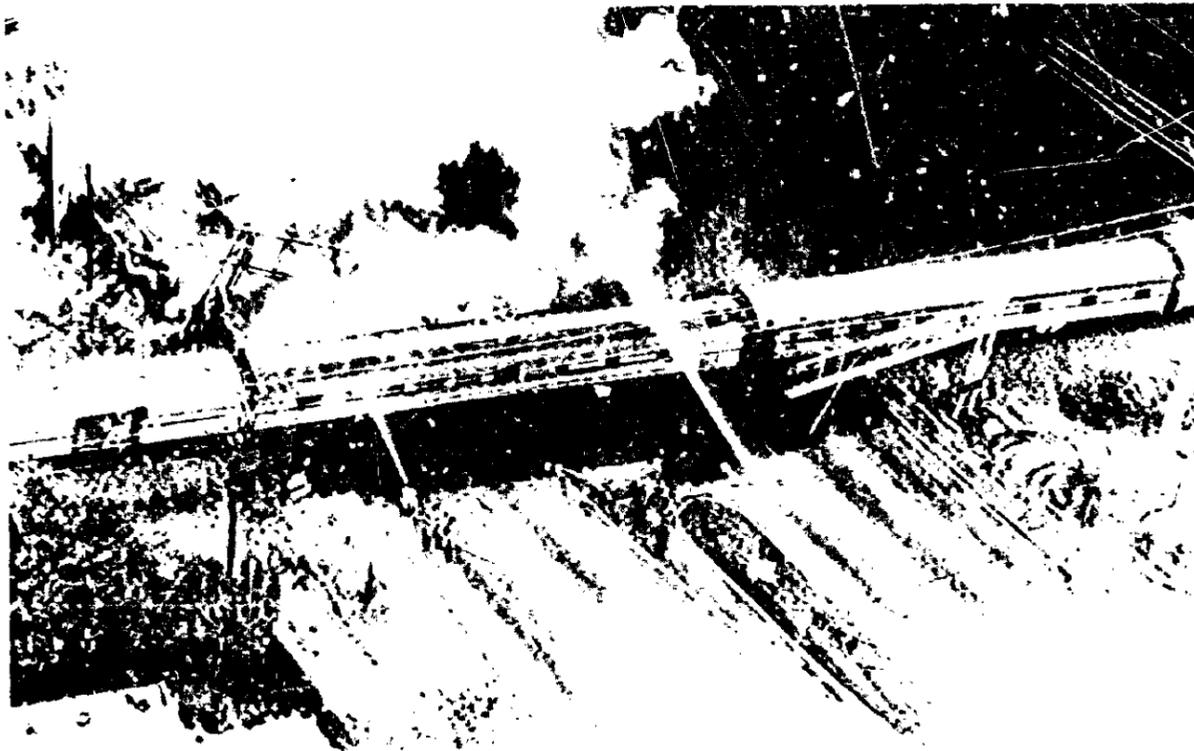


Figure 3.--Aerial view of accident.

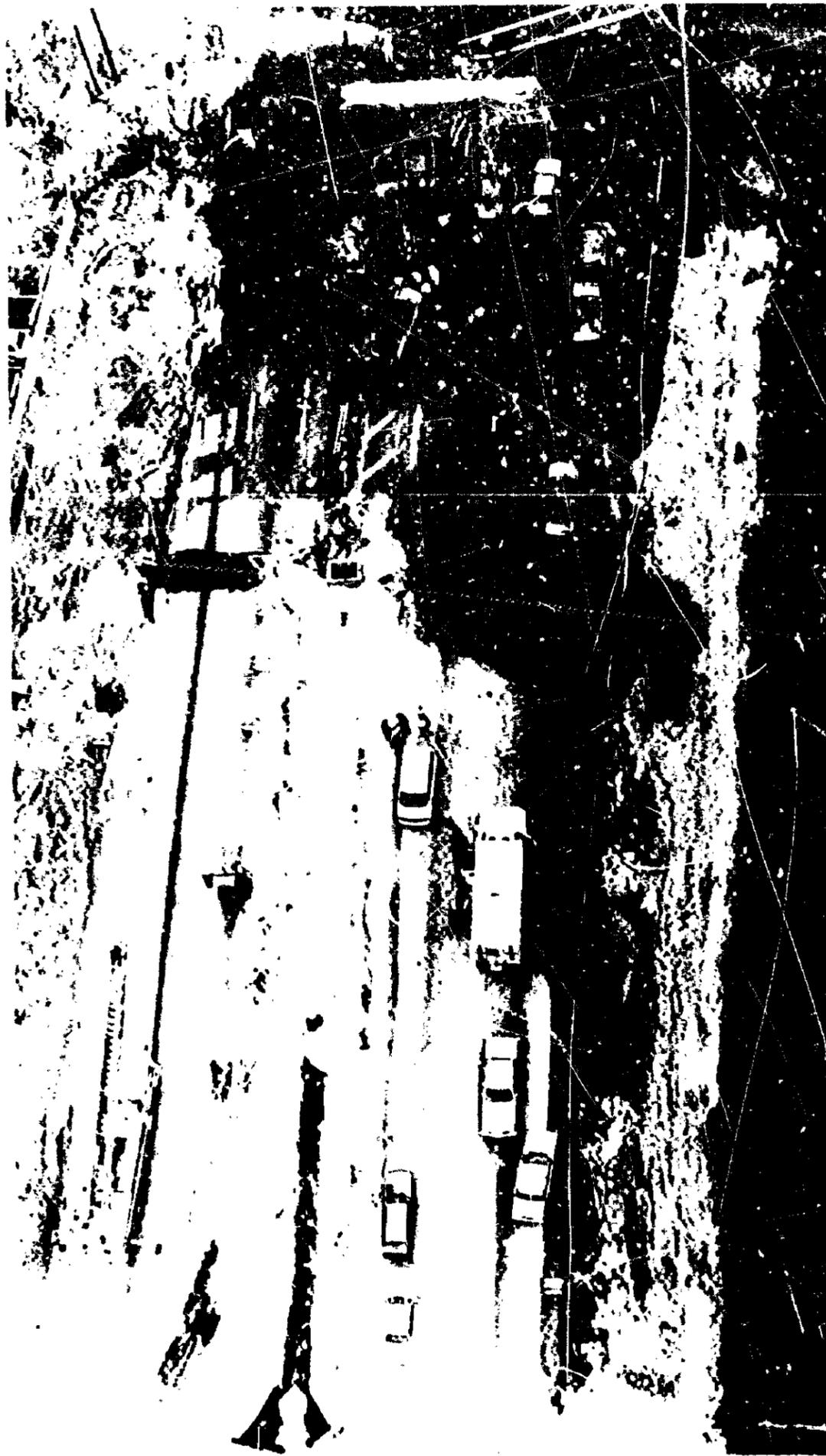


Figure 4.--Postaccident damage.

During previous phases of the project, the lanes had been closed by tapering the traffic on the east side of the crossing. This had resulted in congestion at a highway intersection just east of the tapering, and the intersection's two left-turn lanes had backed up. Consequently, the contractor with the design engineer's approval had moved the tapering to the west side of the crossing.

There are no indications that the County project manager, the design engineer, or the contractor consulted with the railroad about how the crossing might be affected by changing the location of the tapering. The Safety Board concludes that neither the County project manager, the design engineer, nor the contractor adequately considered either the traffic congestion or the resulting obstruction of the railroad/highway grade crossing. The Safety Board also concludes that once congestion developed, neither the County project manager, the design engineer, nor the contractor took adequate precautions to ensure safe traffic control in the work zone near the railroad/highway grade crossing.

That the County relied heavily on the design engineer was evident from the design engineer's "umbrella" contract. It specified that the design engineer was responsible for reviewing and approving the contractor's shop drawings, including all drawings, diagrams, illustrations, brochures, schedules, and other data prepared by the contractor, to be used during construction. Under the contract, the design engineer was also responsible for giving written monthly progress reports to the County project manager, for relaying the County project manager's instructions to the contractor, for recommending whether the County project manager should approve change orders, and for inspecting the site each day.

The County project manager said that although the project was a County one, the County's primary function was to administer funds when each phase of the project was completed.

#### ***MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES***

**Government Standards.**—Although the design engineer and the contractor were required to comply with the *Manual on Uniform Traffic Control Devices (MUTCD)*,<sup>5</sup> the manual does not specifically address work zones near grade crossings. Under 6A-3, "Construction and Maintenance," the manual states:

Since it is not practical to prescribe detailed standards of application for all the situations that may conceivably arise, minimum standards are presented here for the most common situations. It is emphasized that these are minimum desirable standards for normal situations and that additional protection must

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<sup>5</sup>The Florida Department of Transportation has adopted the MUTCD published by the U.S. Department of Transportation, Federal Highway Administration, for mandatory use on State maintained highway system.

be provided when special complexities and hazards prevail. The protection prescribed for each situation shall be based on the speed and volume of traffic, duration of operation and exposure to hazards.

Under 6C-2a, "Taper Lengths," it states:

The single most important element, within the system of traffic control devices commonly used in construction and maintenance areas (where a reduction in pavement width is involved), is the taper that is provided for channelization. An inadequate taper will almost always produce undesirable traffic operations with resulting congestion and possible accidents through the area.

For construction and maintenance purposes, the merging tapers have the longest required length. A merging taper is used to close a lane on a multilane roadway and to direct traffic in the closed lane to merge into a gap in the adjacent traffic stream and to move into it. The taper should be long enough so that drivers of vehicles approaching side by side have sufficient length in which to adjust their respective speeds and merge into a single lane before the end of the transition.

Although the MUTCD does not explain how to taper near a crossing, the traffic congestion on the railroad track indicates that the tapering probably should have been completed on the east side of the railroad track. According to the MUTCD, combining two traffic control techniques, tapering and shifting, is contrary to the basic safety principles and goals governing the design of construction sites. Part 6A-5 states that "the goal is to route traffic through such areas with geometric and traffic control devices as nearly as possible comparable to those for normal highway situations."

When the tapering had been east of the crossing, traffic had become congested, which probably should have warned the contractor that when the tapering was shifted to the west of the crossing, it was likely that traffic congestion would continue. Moreover the congestion would be on a railroad track. Had the design engineer and the contractor recognized the potential for traffic congestion, they might have realized that such special precautions were required as hiring an off-duty police officer or a flagman to "supervise the traffic and maintain safety."

The MUTCD does not provide guidance for setting up work zones near railroad/highway grade crossings. Because the MUTCD sets forth minimum standards widely used by Federal, State, and local governments, as well as by private industry, the Safety Board believes that the Federal Highway Administration (FHWA) should include in the MUTCD minimum standards on channelization of traffic at work zones to minimize traffic congestion over railroad/highway

grade crossings. The MUTCD will not be revised until 1995. The Safety Board understands, however, that several training courses will be given and believes that the FHWA should incorporate guidance in its construction and maintenance training courses that addresses work zones near railroad/highway grade crossings.

**The MUTCD addresses responsibility in Part 6A-4:**

The responsibility for the design, placement, operation, and maintenance of traffic control devices rests with the governmental body or official having jurisdiction.

Although the contractor and the design engineer were jointly responsible for the insufficiency of the traffic control plan used on the day of the accident, they were acting as agents for the County; and according to the MUTCD, the County was ultimately responsible for the safety of the work zone design.

**Operation Lifesaver.**--In January 1987, the Safety Board issued Safety Recommendation R-86-60 to Operation Lifesaver, Inc.<sup>6</sup> (OLI), asking it to expand its program to deal specifically with the problems of trucks carrying bulk hazardous materials, especially petroleum products, over grade crossings. In response, the OLI has accomplished the following:

- Developed a new section in its trainer textbook that deals specifically with training professional drivers.
- Distributed to the States 200,000 copies of its professional-driver brochure, "Working Together for Safety."
- Given speeches to numerous trucking companies and provided written educational material for many other companies.
- Developed a video, "Physics 101," to distribute to companies for group presentations.

The OLI also responded that it is "aware of the seriousness of the problem and will continue to pursue avenues with which [it] can deliver the OLI message to commercial drivers." The OLI anticipates a significant outreach to the trucking population in 1994. The Safety Board has classified this recommendation as "Closed--Acceptable Action," based on the response provided by the OLI.

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<sup>6</sup>An active, continuous public information and education program to help prevent and reduce the number of crashes, injuries and fatalities and improve driver performance at the nation's 300,000 public and private railroad/highway grade crossings. Each State has an Operation Lifesaver program coordinator.

Following the accident, the FHWA sent a memorandum on June 28, 1993, to its regional administrators advising them of the accident. The memorandum stated that:

Designers or traffic engineers involved with the planning or designing of work zone traffic control layouts must take extra care to avoid creating conditions, either by lane reductions or flagging operations, where vehicles can unexpectedly be stopped on the railroad tracks. If the work phasing or physical layout cannot avoid the queuing of vehicles across the tracks, it may be necessary to provide a police or flag persons at the crossing to control the traffic at this point, even if it has automatic warning devices. Also, every effort should be made to have space available adjacent to the traveled surface for an escape route on the downstream side of the crossing in case of emergency.

On July 2, 1993, the Chief of the Highway Rail Crossing and Trespasser Division of the FRA sent a memorandum to the regional directors advising them of the accident and recommending that they pass the word along to their State highway contacts. The memorandum listed several recommendations that he intended to pursue. One of the recommendations was that the FHWA amend the MUTCD to address controlling highway traffic over railroad crossings in or near work zones. He also recommended that the OLI make a concerted effort to reach fleet owner/operators and drivers of hazardous materials with messages and training in safely traversing railroad/highway grade crossings.

In December 1993, a final rule amending Part VI of the MUTCD was written, and as a result of the Safety Board's investigation of this accident, a paragraph was added that advises the users of the MUTCD to coordinate and communicate with other modes of transportation and entities, such as the railroads, the fire departments, the police, and utilities, affected by construction zones.

The Safety Board is pleased that these government agencies and the OLI have taken the initiative to inform others of the circumstances of this accident and to emphasize that measures should be taken to prevent similar accidents from occurring.

#### **MOTOR CARRIER OPERATIONS**

Amerada Hess Corporation (Hess), headquartered in Woodbridge, New Jersey, is a private interstate carrier that has been operating since 1951 on the east coast of the United States. Hess employs 350 drivers and owns 165 combination units. The Fort Lauderdale terminal employs 24 drivers. The terminal has two shifts and serves 55 gas stations in the south Florida area, of which 25 are in Fort Lauderdale. The FHWA's Office of Motor Carriers last conducted a safety audit of Hess in April 1990, and the carrier received a "satisfactory" rating. The investigation revealed that the carrier complied with the required Federal Motor Carrier Safety Regulations.

The selected route from Port Everglades to Margate was I-595 west, I-95 north, Cypress Creek Road west, and Route 441 north to the gas station. This route entailed traveling on interstate highways as far as possible and exiting onto a secondary road as close to the gas station as possible. Although there were several other possible routes that did not involve railroad/highway grade crossings, the routes did involve traveling long distances in heavy traffic on secondary roads with numerous traffic lights. The Safety Board believes that the route taken by the truckdriver was an appropriate route when considering safety.

The carrier conducts monthly 2-hour-long in-service training sessions for its drivers. However, Hess does not have a grade crossing safety program, and carrier representatives are not familiar with the OLI program. Since the accident, Hess truckdrivers have been shown a videotape dealing with safety regulations, statutes, and procedures governing railroad/highway grade crossings.

Hess is a member of the American Trucking Associations (ATA), and although the ATA acknowledged that its members receive literature periodically about railroad/highway grade crossing safety, a Hess representative indicated that the railroad/grade crossing safety information available to its drivers was from the commercial driver license manual. The OLI has provided a copy of its video to the ATA so that the ATA can include it among the video selections it makes available to its members. The OLI indicated to the Safety Board that the ATA has asked it to provide programs that may improve the performance of professional drivers at grade crossings. The Safety Board believes that the ATA should alert its members specifically to the potential dangers involved in approaching work zone areas that are adjacent to railroad/highway grade crossings. Further, the Safety Board believes that Hess should develop and implement a grade crossing awareness training program, including participation in the OLI program, to instruct truckdrivers in the potential dangers at railroad/highway grade crossings.

#### **EMERGENCY RESPONSE**

The Broward County fire department was notified of the accident at 3:14 p.m. and arrived on scene at 3:25 p.m. A command post was established within 100 yards of the collision site, and the Fort Lauderdale Fire Department Battalion Chief served as incident commander. A hotel adjacent to the accident scene was evacuated immediately after the accident occurred. The fire was under control at 4:07 p.m. Emergency rescue personnel responded quickly from four different jurisdictions, and the Safety Board concludes that the emergency response was timely and effective.

## CONCLUSIONS

### Findings

1. The emergency response was timely and effective.
2. Had the truckdriver stayed in the position under the crossing gate, as described by the witnesses, he would have avoided the collision.
3. If the truckdriver had not hesitated and had immediately driven across the track when the gate first came down on the tractor, he might have been able to clear the track.
4. The taper and shift design of the work zone caused congestion at the railroad/highway grade crossing.
5. Neither the County project manager, the design engineer, nor the contractor adequately considered either the traffic congestion or the resulting obstruction of the railroad/highway grade crossing.
6. Once congestion developed, neither the County project manager, the design engineer, nor the contractor took adequate precautions to ensure safe traffic control in the work zone near the railroad/highway grade crossing.

### Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the inadequacy of the precautions taken by the Broward County project manager, the design engineer, and the contractor, which resulted in traffic congestion at the railroad/highway grade crossing, and the truckdriver's decision to cross the railroad track even though the warning system had been activated.

## RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board makes the following recommendations:

--to the Federal Highway Administration:

Include in Part VI of the *Manual on Uniform Traffic Control Devices* minimum standards on channelization of traffic at work

zones to minimize traffic congestion over railroad/highway grade crossings. (Class II, Priority Action) (H-94-1)

Incorporate guidance in your construction and maintenance training courses that addresses work zones near railroad/highway grade crossings. (Class II, Priority Action) (H-94-2 )

--to the American Trucking Associations, Inc.:

As part of your safety program, notify your members of the circumstances of this accident and alert them to the potential dangers when approaching work zone areas adjacent to railroad/highway grade crossings. (Class II, Priority Action) (H-94-3)

--to Ameraaga Hess Corporation:

Develop and implement a grade crossing awareness training program, including participation in the Operation Lifesaver Program, to instruct your truckdrivers in the potential dangers at railroad/highway grade crossings. (Class II, Priority Action) (H-94-4 )

**BY THE NATIONAL TRANSPORTATION SAFETY BOARD**

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February 15, 1994