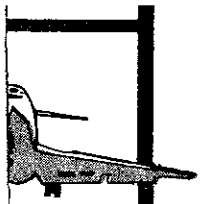

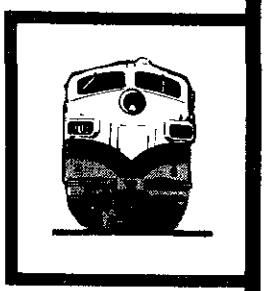

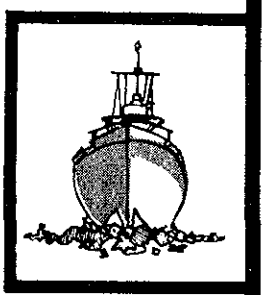

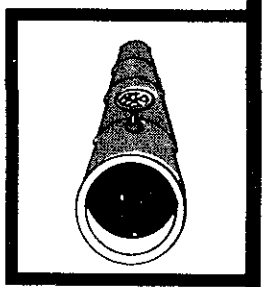

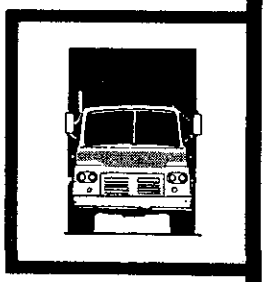

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

**HEAD-ON COLLISION BETWEEN
AMTRAK TRAIN NO. 82 AND
SEABOARD COAST LINE EXTRA 2771 SOUTH
LAKEVIEW, NORTH CAROLINA
APRIL 2, 1980**

NTSB-RAR-80-8

UNITED STATES GOVERNMENT

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16 Abstract

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The National Transportation Safety Board determines that the probable cause of this accident was the failure of the engineer of train No. 82 to perceive and comply with the "approach" aspect of a signal and his continued operation of the train at a speed too high to stop before it overran a stop signal. Contributing factors to the accident were the dense fog and the train's speed which reduced the engineer's perception time; the engineer's possible distraction by a schoolbus which crossed immediately in front of the train as it approached the signal; and the absence of means to alert the engineer that he had failed to comply with the approach signal indications.

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CONTENTS

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

Adopted: September 2, 1980

HEAD-ON COLLISION BETWEEN AMTRAK TRAIN NO. 82 AND SEABOARD COAST LINE EXTRA 2771 SOUTH LAKEVIEW, NORTH CAROLINA APRIL 2, 1980

SYNOPSIS

About 7:33 a.m., on April 2, 1980, northbound Amtrak Train No. 82 collided head-on with Seaboard Coast Line (SCL) Extra 2771 South on the single track of the SCL Railroad at Lakeview, North Carolina, after train No. 82 overran a stop signal at the north end of the double track. Twenty-nine crewmembers and ninety-four passengers were injured, and damage was estimated at $1,145,492.

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INVESTIGATION

The Accident

Amtrak train No. 82, operating on the Seaboard Coast Line Railroad (SCL) tracks, arrived at Hamlet, North Carolina, at 6:30 a.m., on April 2, 1980, with 2 locomotive units and 18 cars. At 6:40 a.m., after a crew change and a 500-mile airbrake test and inspection, which disclosed no defects, train No. 82 departed northward for Raleigh, North Carolina. The fireman checked the diesel engines, steam generators, and other equipment when the train departed, and joined the

engineer in the operating compartment of the locomotive after the train had traveled about 6 miles. The fireman proceeded to fill out the locomotive work report and noted that the previous engineer had written that the dynamic brakes were inoperative.

The engineer of train No. 82 properly complied with a train order requiring a slow speed between mileposts 232.2 and 232.8, which he had discussed with the flagman via radio. Because of an alarm received from a hot box detector, the engineer stopped the train at Addor, North Carolina, 20.5 miles north of Hamlet. The crew inspected the train and found that the alarm had been caused by a leaking steam hose between two cars, but it made no repairs. After train No. 82 departed Addor for Southern Pines, North Carolina, the train dispatcher routed it onto the west main track. (See figure 1.) None of the crewmembers took any exceptions to the manner in which the engineer operated the train.

Because train No. 82 was delayed at Addor, the train dispatcher decided to hold it at Fleet Interlocking, 13 miles north of Addor, and move a southbound freight train, Extra 2771 South, to Fleet Interlocking. This action would clear the single track for train No. 82 instead of having the two trains meet farther north. Therefore, at 7:09 a.m., the dispatcher displayed a "STOP" aspect on the northward home signal at Fleet Interlocking, aligned the switch to route Extra 2771 South from the single track onto the east main track, and cleared the signal for the southward move. The route change was completed 13 minutes before train No. 82 departed Southern Pines, North Carolina, at 7:25 a.m.

The fireman left the operating compartment while train No. 82 was stopped at the Southern Pines station and moved back to the engineroom of the second locomotive unit to service the steam generators when the train left the station. He did not use the remote control in the operating compartment for blowing down the steam generators, and he said that he did not have any confidence in the emergency alarms. None had sounded at either location. Although there was no fog between Hamlet and Southern Pines, train No. 82 encountered a dense ground fog after it left Southern Pines. Because of several rail-highway grade crossings in the area north of Southern Pines and because of the dense fog, the engineer blew the whistle frequently. Witnesses attested to the frequent sounding of the whistle through the foggy area.

As the engineer approached signal No. 222.4, he applied the air brakes to slow the train to comply with the 50-mph speed restriction through a curve just north of approach signal No. 222.4 and then released them. He said he did not see the signal aspect until he was within 100 feet of it because of the heavy fog. As he passed the signal, he said he caught a glimpse of it and called it aloud to himself as "clear."

When the lead locomotive unit of train No. 82 was approaching the crossing at State Road 2088, the engineer saw a yellow schoolbus about 5 to 6 feet to his right. He thought he saw five or six people on the bus, but he was uncertain. He said he did not see the schoolbus until he had observed the aspect of signal No. 222.4. During this time, the fireman had been moving from the rear locomotive unit toward the lead unit. He had stopped in the operating cab of the second

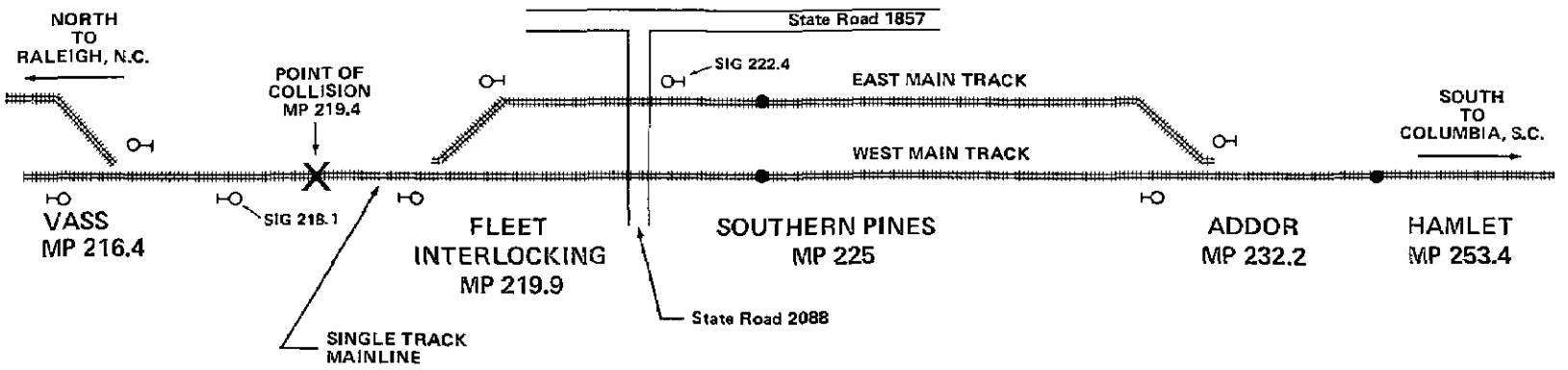


Figure 1.--Plan view of the Seaboard Coast Line Railroad between Hamlet, North Carolina, and Vass, North Carolina. (Not to scale.)

unit to check the control switch for the dynamic brakes. While he was in the operating cab of the second unit, the fireman also saw the schoolbus. Although neither the fireman nor the engineer made a report to anyone about the narrow escape of the schoolbus, the engineer noted the time and made a mental note to remember the crossing number and details surrounding the event so that he could report it later. As the train moved northward, it slowed and passed through the 50-mph restricted speed curve and then gained speed again as it moved down a 1.0 percent grade toward Fleet Interlocking, the north end of the double track.

Just before the engineer sighted the home signal at Fleet Interlocking, he made a brake application to reduce the train's speed for another 50-mph restricted speed curve just north of Fleet. When the train was about 250 feet from the interlocking home signal at Fleet, the engineer saw the "red" aspect through the fog. About the same time, the fireman returned to the operating compartment, and he also saw the "red" aspect, which he called to the engineer as "stop." The engineer repeated the aspect "stop," but he did not immediately put the train's brakes into emergency. The engineer was trying to decide whether to stop the train with a full service brake application and pass the stop signal or to put the train's brakes into emergency and attempt to stop sooner. When he recognized that the track switch was aligned for a southbound train to enter the east track, he put the train's brakes into emergency without hesitating. The train began to decelerate as it passed the "stop" signal, ran through the switch, and moved into the 3° 15' curve to the right, north of Fleet Interlocking. As the train continued northward, the engineer looked across the curve and saw the headlight of an approaching locomotive. He grabbed the radio handset and yelled, "Stop that freight train, I got past the switch at Fleet." The fireman immediately left the operating cab and stepped off the west side of the locomotive without falling, about 250 feet from the impact site. The engineer left the cab and jumped from the east side of the locomotive, about 100 feet from the impact site. The engineer testified that, when he recovered from his fall, he was adjacent to the second unit of train No. 82. (See figure 2.)

At 5:45 a.m., southbound freight train Extra 2771 South consisting of 5 locomotive units, 43 loaded cars, and 63 empty cars, left Raleigh, North Carolina. A brake test made at Raleigh disclosed no defects, and each time the brakes had been used en route to Hamlet, they operated satisfactorily. Extra 2771 South was moving about 45 to 50 mph when it approached the southward approach signal, No. 218.1, 1.8 miles north of Fleet Interlocking. The signal displayed an "approach limited" aspect, and the engineer and head brakeman called it to each other. This aspect indicated that there was a diverging route ahead which could be entered at 45 mph. The engineer reduced the locomotive throttle, but he did not apply brakes because the train had been moving on an ascending grade and had slowed to a speed that complied with the speed requirement. Before the locomotive passed the signal, the engineer and head brakeman again called it to each other, but it had not changed since it was first sighted.

Shortly after Extra 2771 South passed signal No. 218.1, the engine crew heard the engineer of train No. 82 giving the warning, "Stop that freight train," over the radio. The engineer and the head brakeman immediately put the train's brakes into emergency while the train was moving at approximately 40 mph, left the locomotive cab through a door behind the engineer's position on the west side,

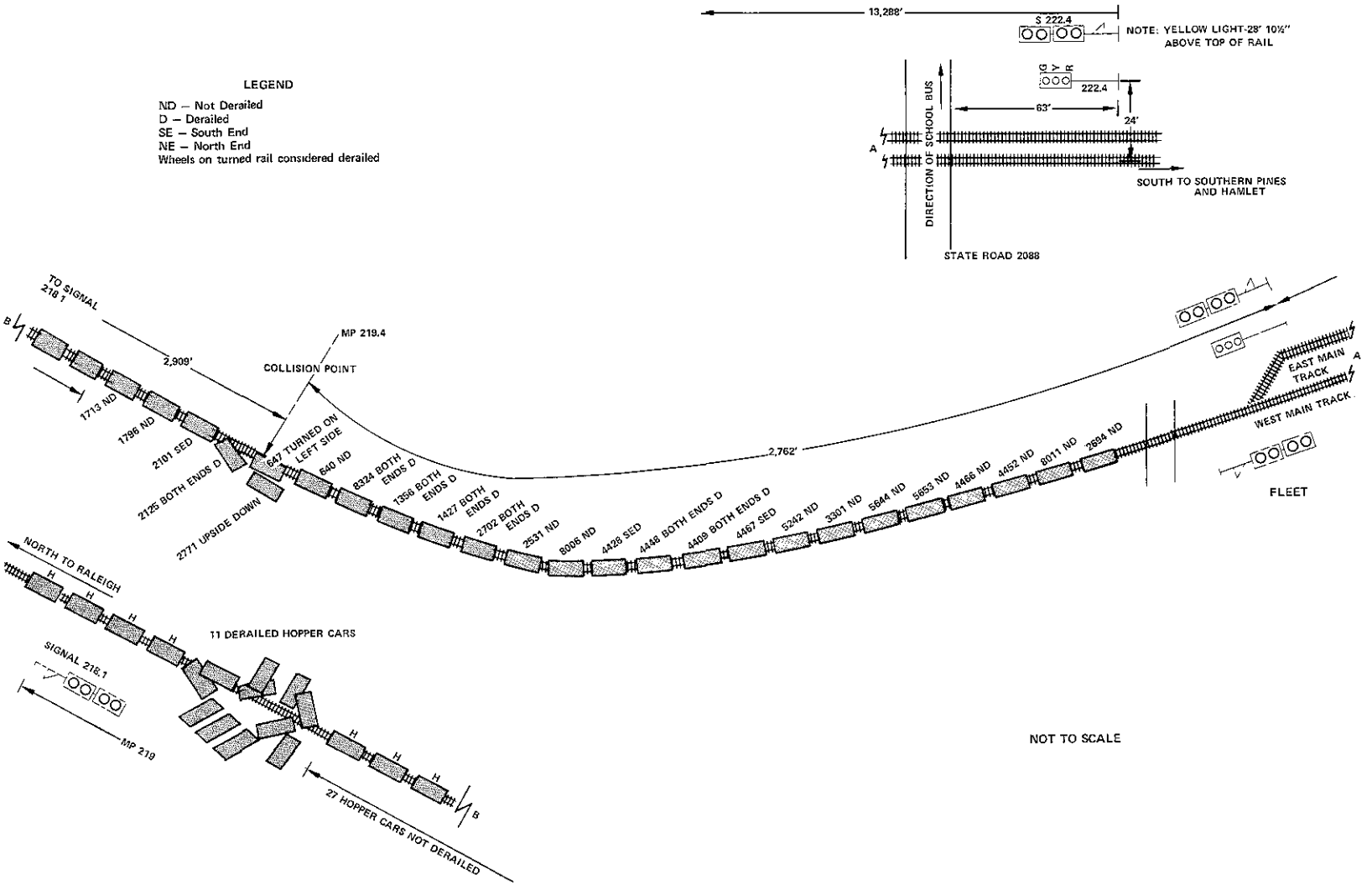


Figure 2.--Derailment site of
Train No. 82 and Extra 2771 South.

and moved back on the running board where they saw train No. 82's headlight through the fog. Both men remained on the running board momentarily until they were certain that the two trains were going to collide. The engineer jumped under the handrail straight out from about midway the lead locomotive unit, struck a piece of cut crosstie when he landed, and came to rest on a fill bank sloping up to the roadbed. He jumped about 480 feet from the impact site. The brakeman moved back to the rear locomotive steps, jumped from the lower steps, fell down an embankment, and landed on top of a culvert. He jumped about 300 feet from the impact site.

About 7:33 a.m., immediately after the crews jumped from each train, train No. 82, which was either stopped or barely moving, collided with Extra 2771 South, which was moving about 35 mph, 0.5 mile north of Fleet Interlocking. (See figure 3.)

Injuries to Persons

	Crewmembers			
Injuries	SCL	Amtrak	Passengers	Total
Fatal	0	0	0	0
Serious	1	1	5	7
Minor	3	24	89	116
Total	4	25	94	123

One hundred twenty-three persons were treated for contusions, abrasions of the lower extremities, head lacerations, bruises of the ribs and the lower abdomen, and neck and back sprains and strains caused by falls as the trains collided. One dining car crewmember of train No. 82 suffered second degree burns from spilled hot grease. The engineer of Extra 2771 South suffered a cracked vertebra in his cervical spine in his jump from the locomotive.

Damage

The operating cab of train No. 82, locomotive unit No. 647, was destroyed when the locomotive unit of Extra 2771 South overrode it. (See figure 4.) The second locomotive unit remained upright and it did not derail. The first 10 cars of train No. 82 were derailed, but did not overturn, and all stopped in line with the track structure. The eight rear cars did not derail.

Both end doors of the fourth car, a sleeping car, jammed and could not be opened; therefore, windows had to be removed so that passengers could be evacuated. Chairs, china, tableware, and cooking utensils were thrown about in one of the dining cars. Furniture was dislodged and was the source of hazard to passengers during the derailment and a hindrance to their moving about and leaving the car after the accident.

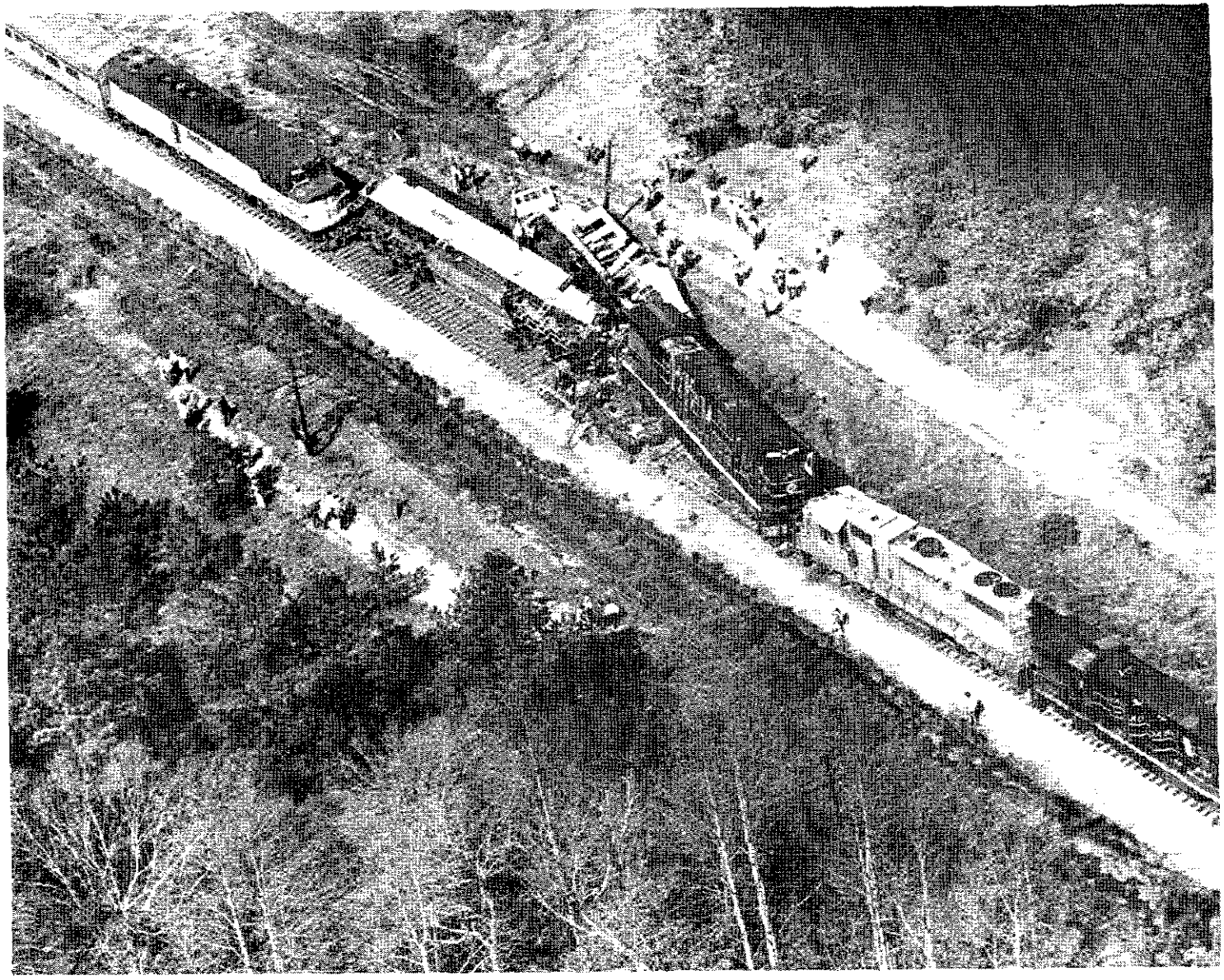


Figure 3.--Aerial view of derailment.

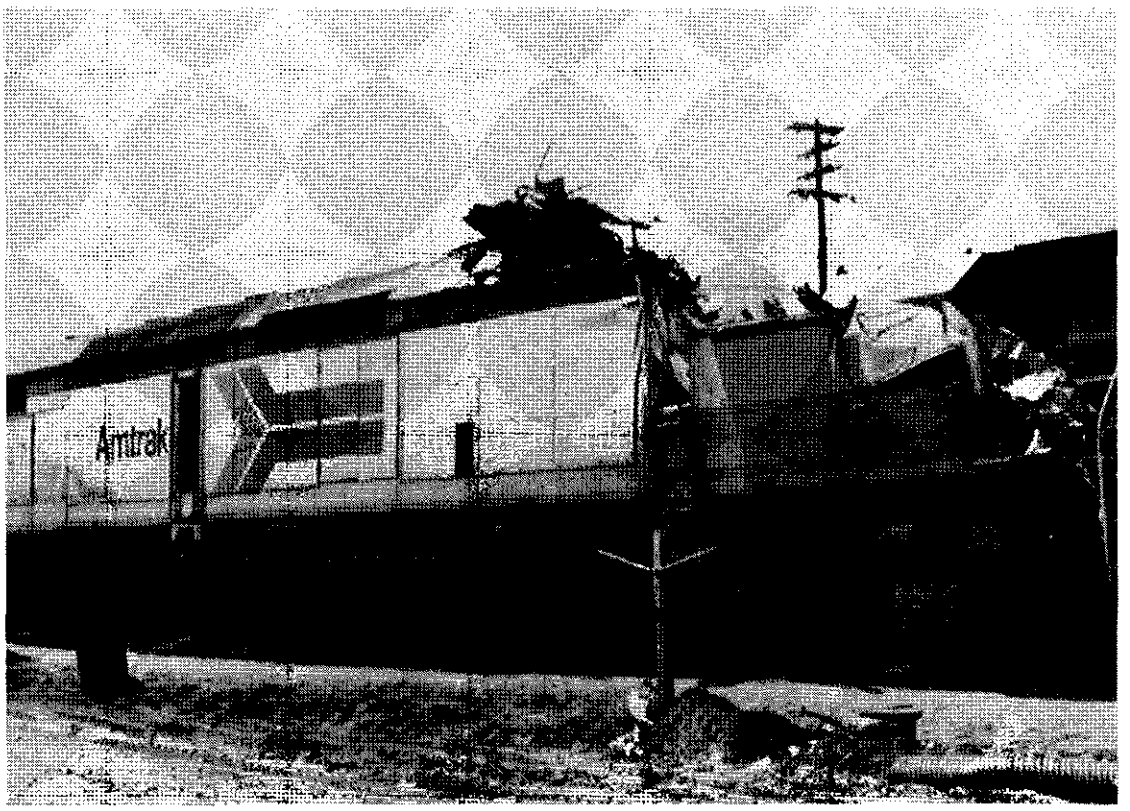


Figure 4.--Locomotive unit No. 647, train No. 82

The lead locomotive unit of the Extra 2771 South overturned on its top after overriding the Amtrak locomotive unit. The operating cab was badly crushed and the locomotive was a total loss. (See figure 5.) The second unit of Extra 2771 South derailed and the head end moved to the west. The south truck of the third unit of Extra 2771 was derailed, and one wheel of the north truck was inside the overturned east rail. The other 3 locomotive units did not derail and the cars remained on the track, except for cars 28 through 38 which derailed 0.8 mile north of Fleet Interlocking.

Crewmember Information

The traincrew and the enginecrew of train No. 82 had reported for duty on April 2, 1980, at 6:05 a.m., at the Hamlet passenger station. The crew had arrived at Hamlet on April 1, 1980, about 6:30 a.m., on train No. 82. Each crewman indicated that he had rested during the 24 hour off-duty period.

The crewmembers on Extra 2771 South reported for duty at Hamlet on April 2, 1980, at 12:15 a.m. They arrived at Raleigh on SCL train No. 276, at 5:15 a.m., and remained on continuous duty to bring Extra 2771 South to Hamlet. Extra 2771 South departed Raleigh at 5:45 a.m. The crew had been off duty before reporting at Hamlet ranging from 12 hours for the front brakeman to about 28 hours for the conductor. They all reported that they had rested well during their off-duty periods. (See appendix B.)

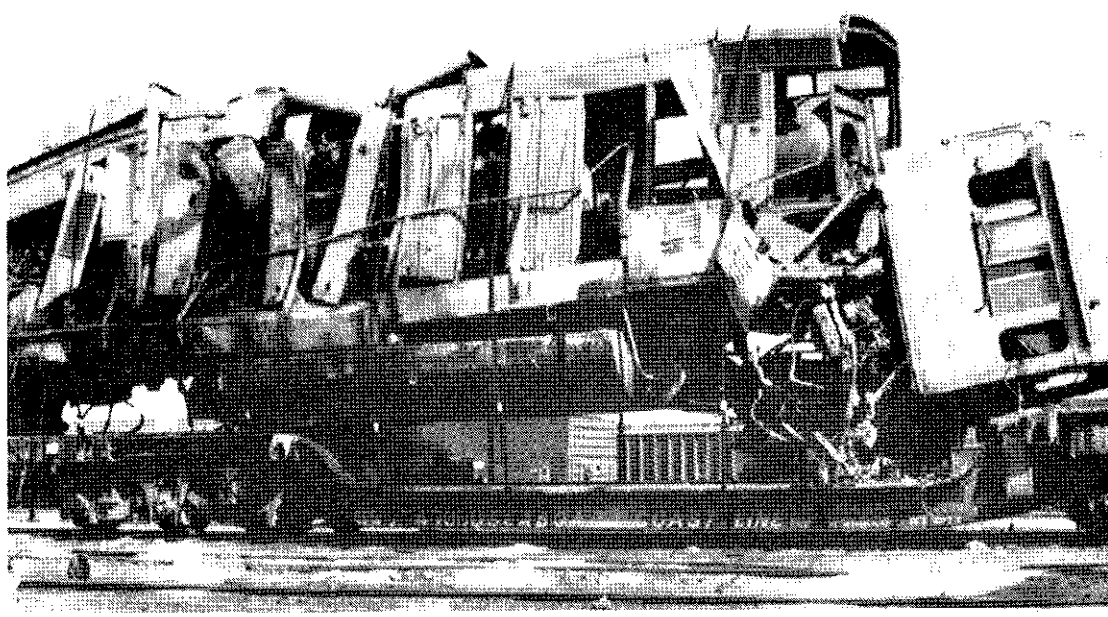


Figure 5.--Locomotive unit No. 2771,
Extra 2771 South.

Track Information

The single main track in the area of the accident consisted of 132-pound RE continuous welded rail (CWR) laid on hard wood crossties with 7 3/4- x 14-inch double shoulder tieplates. The crossties were spaced 18 to 22 inches apart. One rail-holding spike was used on each side of the rail on tangent track and an additional rail-holding spike and two plate-holding spikes were used on the curved track. Every other tie was box anchored. The track was laid on granite stone ballast. It was maintained in accordance with the Federal Railroad Administration's (FRA) specifications for Class 4 track. The overall condition of the track, including elevation, curvature, crosslevel and gage, was good.

State Road 2088 is a 23-foot wide highway crossing. It crosses the two main tracks of the SCL from west to east about 63 feet north of signal No. 222.4 and deadends at State Road 1857, about 35 feet east of the east main track.

Train Information

Train No. 82 was powered by Amtrak locomotive units No. 647 and No. 640. The train consisted of three baggage cars, three sleeping cars, two dining cars, nine coaches, and one tavern car. The two locomotive units were SDP-40F models and were manufactured by the Electro-Motive Division (EMD) of General Motors. Each unit was equipped with two 6-wheel trucks, and each was powered by a 3,000-hp turbo-charged diesel engine. Each locomotive unit weighed about 400,000 pounds, was 72 feet 4 inches long, and was equipped with 26L airbrake equipment, an alertor safety device, radios, cab signals, and train control equipment. However, the cab signals and train control equipment could not be used on the SCL track because the wayside system was not compatible. The units also were equipped with Barco speed recorders, but the speed recorder on locomotive unit No. 647 was not operating.

The SDP-40F locomotive units were equipped with alarms to alert an engine crewman to various failures which include low-steam pressure indications on the steam generators. A button located in the operating cab enabled a crewman to blow down the steam generators without going to the engineroom.

The passenger equipment of train No. 82 was built over a period of years between 1947 and 1960 by various equipment manufacturers. The train contained stainless steel and nonstainless steel cars. Most of the passenger-carrying cars were equipped with emergency tools and fire extinguishers.

Extra 2771 South's locomotive consisted of one General Electric (GE) model U23B (unit No. 2771); one GE model U36C (unit No. 2125); one GE model U18B (unit No. 1796); one GE model U30B (unit No. 1713); and one EMD model GP-38-2 (unit No. 4401). The locomotive weighed 1,442,800 pounds, and it was 302 feet long. Each locomotive unit had two 4-wheel trucks and was equipped with type 26L airbrake equipment. However, unit No. 1713 was not being used as a power unit, but the brake system was operable. Extra 2771 had a trailing tonnage of 5,258 tons.

Method of Operation

Trains are operated through the area of the accident by a traffic control (TC) system controlled by a train dispatcher at Raleigh who remotely controls the switches and interlocking home signals. There are no track/wayside facilities to operate cab signals or train control. Fleet Interlocking is located at the north end of a double track, which extends 13 miles southward to Addor. It consists of one switch with signals by which trains can be routed to the single or double track.

The northward approach signal to Fleet Interlocking, signal No. 222.4, which governs northward movements on the west main track, is located 2.52 miles south of the home signal at Fleet. It is positioned 24 feet east of the center line of the west main track, and the yellow light unit of the signal is mounted 28 feet 10 inches above the top of the rail. The signals on the SCL's Raleigh Division are color-light type. Signal No. 222.4 can display a green, "clear" aspect; a yellow, "approach" aspect, and a red aspect over a number plate, "restricted proceed" aspect. Normally, the signal can be seen about 1 1/2 miles in approach to it. However, since the signal light is difficult to perceive at a close range, a prism installed in the lens enables an engine crew to observe the aspect closeup. SCL operating rule 27 reads, in part, "a signal imperfectly displayed, or the absence of a signal at a place where a signal is usually shown, must be regarded as the most restricted indication that can be given by that signal; . . . ."

Locomotives are equipped with radios which can be used to contact the dispatcher, other locomotives, or mobile units. The cabooses are equipped with a fixed radio and a portable set. The conductor and flagman of train No. 82 had walkie-talkies by which they could talk to the engineer or other units if they were within range.

Model SDP-40F locomotive units have been involved in several accidents which occurred in curves, generally 3° or greater at speeds over 40 mph. As a precaution, the SCL had restricted the speed of these locomotives to speed limits specified through curves identified in SCL Time Table No. 1, effective October 28, 1979. The speed restriction through some curves applied only to the locomotive, while others applied to the entire train. The two curves for which the engineer of train No. 82 had slowed required that the train's speed be reduced to 50 mph only for the locomotive. Unless otherwise restricted, the maximum authorized speed for passenger trains between Hamlet and Raleigh is 79 mph.

Meteorological Information

At 6:00 a.m., on April 2, 1980, the weather was reported as 42° F and clear at Hamlet Yard. Ground fog was reported as heavy in the area north of Southern Pines and extending to the area north of Vass, North Carolina. State Road 2088 was covered by heavy fog and visibility was limited to about 250 feet.

Survival Aspects

The injured persons were treated and seven persons were admitted to the Moore Memorial Hospital at Pinehurst, North Carolina. The quick reporting of the accident by the traincrews to the SCL's Chief Dispatcher's office in Raleigh enabled the railroad to inform the hospital of the accident promptly. The hospital

implemented its Plan for the Care of Mass Casualties within 15 minutes. The Plan was activated by the Moore County Emergency Communications System which received notification of the accident only 4 minutes after it occurred. Emergency units throughout Moore County and surrounding Lee and Hoke Counties responded to the call. Two army Medivac helicopters were flown to the scene from nearby Fort Bragg to lend assistance in evacuating the injured. The first ambulance arrived at the accident scene at approximately 8:20 a.m. By 10:30 a.m., all injured persons were either being treated, or had been treated, admitted, or released.

Tests and Research

The inspection and testing of the signal system between the opposing approach signals to Fleet Interlocking disclosed no defects and the system functioned as intended. The signal aspect at signal No. 222.4 is selected over the contact of a polar/neutral relay 1/ identified as MNHDR. A two-position polar contact selects a circuit that either causes a green or yellow light to be displayed. It will remain in the last position used until it is changed by the train dispatcher through the operation of his control machine. A polar contact in a reverse position selects a yellow light. Once the dispatcher initiates action that will cause the polar section of the MNHDR relay at signal No. 222.4 to pole reverse, 2/ the yellow light will be selected automatically when the home signal at Fleet Interlocking is at stop. Then, when the neutral portion of the relay is energized, a.c. power is applied to the yellow signal lamp and the approach aspect is displayed. When a train passes signal No. 222.4, the neutral portion of the relay is deenergized and the a.c. power is removed from the yellow lamp and switched to the red lamp, which causes the signal to display a restricting aspect. However, the polar contact, which selects the yellow lamp, is not affected by the passage of a train, and it remains in the position in which it was used last. The polar contact of relay MNHDR was still in the position which selected the yellow lamp after the accident. (See appendix C.)

An inspection and airbrake test on the equipment of train No. 82 and Extra 2771 South at the site did not reveal any defects that would have reduced either trains' braking capability.

The Barco speed tape recorder on locomotive unit 640 in train No. 82 was removed and bench tested with the following results:

Correct Speed (mph)	Recorder Speed (mph)
10	11
20	22
30	33
40	44
50	55
60	66
70	77
80	88

1/ A relay which operates in response to a change in the direction of current in its controlling circuit and the armature of which may or may not remain at full stroke when its control circuit is interrupted. (AAR Signal Section, Part 55)
2/ A reversal of current through the controlling circuit causes a polar contact to change to the opposite mating contact, i.e., from a normal contact to a reverse contact.

The engineer, who had operated train No. 82 between Columbia, South Carolina, and Hamlet, checked the speedometer on locomotive unit No. 647 by timing his speed over a measured mile and found that the speedometer was correct at 50 mph. Between these points, the speed tape recorder on unit No. 640 indicated 50 to 60 mph.

ANALYSIS

Operations

The plan of the train dispatcher to hold train No. 82 at the north end of the double track and move the southbound freight train onto the east main track was an acceptable action and had been done many times before the accident. The dispatcher normally does not advise crewmembers of trains that are affected by such a movement. Under the operational procedures of a traffic control system, trains are operated on signal indications, and it is the responsibility of each engineer to obey the signal indications. The expectation that they will obey the indications carries with it the responsibility of properly interpreting and understanding signal aspects. If inclement weather obscures a signal so that an aspect cannot be seen clearly or if it is questionable, by rule, the engineer is required to consider that the signal is displaying its most restrictive aspect. Therefore, if the engineer of train No. 82 had not clearly seen the aspect of signal No. 222.4, he would have been required to operate the train as though it displayed a restricting aspect and should have been prepared to stop within one-half the range of vision, short of an obstruction or another train, but not exceeding 20 mph until the next signal was reached.

The engineer first observed ground fog just north of Southern Pines. He did not reduce his train's speed because of the fog, but rather he began to blow the whistle repeatedly as a precaution as he approached and crossed several rail-highway grade crossings in the area. Even though the fog was too dense for him to see in advance the aspect displayed by signal 222.4, he blew the whistle for State Road 2088 crossing, according to witnesses, and he made a brake pipe reduction to slow for the 50-mph speed restriction through the curve between mileposts 221.2 and 222.0, which was indicative that he knew his location.

Under ideal light and visibility conditions, if an engineer did not look at signal No. 222.4 until he was within 100 feet of it, it would be difficult for him to perceive the aspect. Signal No. 222.4 was focused to a point a little more than 1 mile from it. As the focal point is passed, the intensity of the signal light will diminish slightly. Within the 100-foot range, even though the signal lenses have optical prisms ground into them to deflect the signal light to a point where it can be viewed from close range, it is difficult to perceive the aspect. The width of the light beam deflected by the prism for a close view might be as little as $\pm$10 feet from the beam's center. When close viewing is undertaken, obstructions, such as those presented by the locomotive cab, result in the viewing time being extremely short.

The inspection and tests of the signals indicated that signal No. 222.4 was displaying a yellow indication as train No. 82 approached and passed it. Possibly, distraction by the schoolbus incident, restricted visibility because of the fog, reduced perception time caused by the speed of the train and the fog, and the focus

characteristics of the signal light beam all could have contributed to the engineer's failure to perceive the yellow aspect of signal 222.4. The engineer did not testify to the actual aspect he saw on signal No. 222.4, but merely said, "I called it clear." Therefore, the Safety Board must conclude that the engineer did not see the actual signal aspect but instead was preconditioned somewhat by a clear signal at Southern Pines and past operating routines. The engineer did not normally meet a train at Fleet, and he was running on the west main track, which would not have required his train to take a diverging route.

The absence of the fireman from the cab and the lack of operative train control and cab signals did not provide the backup which could have alerted the engineer that he was passing a yellow signal at an excessive speed. Once the engineer failed to perceive the yellow aspect of signal No. 222.4 and approached the next signal expecting it to display an indication of approach or clear, with the sight distance restricted because of the fog, it was inevitable that the train would overrun the stop signal.

The Safety Board cannot determine what effect the absence of the fireman from the operating cab had on the cause of the accident. With multiple unit locomotives, it is not unusual for a fireman to leave the operating compartment to check or service equipment of the trailing units. However, the fireman of train No. 82 should have used the remote control to service the steam generators since no trouble had been reported with the remote controls or the alarms and he had no reason to suspect that everything was not operating properly. It is reasonable to assume that if the fireman had been in the operating compartment, he may have perceived the yellow aspect of signal No. 222.4. If the locomotive had been equipped with operable cab signals or automatic speed control, the engineer would have received an audible indication when the locomotive passed signal No. 222.4.

Since February 1972, the Safety Board has recommended that FRA require as a minimum that all passenger trains be equipped with continuous automatic speed control (train control). Since that time, the Safety Board has indicated to the Federal Railroad Administration (FRA) in two accident reports 3/ the need for train control. The FRA's response indicates that the requirement cannot be justified because of the cost and that training and testing of employees is a better way to accomplish the goal. The continuing occurrence of collisions between trains operating by signal indications suggests that electronic or mechanical backup is needed.

3/ Railroad Accident Report--"Rear-End Collision of Two Texas and Pacific Railroad Company Freight Trains, Meeker, Louisiana, May 30, 1975" (NTSB-RAR-75-9), and Railroad Accident Report--"Rear-End Collision of Conrail Commuter Trains, Philadelphia, Pennsylvania, October 16, 1979" (NTSB-RAR-80-5).

Furthermore, the Safety Board has indicated in a number of train accident reports 4/ that the presence of operating radios could have prevented or ameliorated the effects of the accidents. The radio warning by the engineer of train No. 82 to oncoming Extra 2771 South allowed the crew sufficient time to apply the brakes and detrain before the trains collided. This action probably saved the lives of the crewmembers and reduced the severity of injuries to the passengers. The use of the radio in this accident indicates again that a dependable, operating radio can be an effective safety tool in train operation.

Performance of Trains

The manner in which the engineer and crew operated Extra 2771 South between Raleigh and Lakeview appears consistent with the SCL's operating rules and procedures. The operation and movement of train No. 82 also was consistent with applicable operating procedures until it passed approach signal No. 222.4 at an excessive speed.

The actual speed tests made by the engineer of train No. 82 between Columbia and Hamlet indicated that the speed recorder on locomotive unit 640 was fast. Although his tests correlate with and substantiate the postaccident test results, the exact points on the tape correlated to wayside mileposts cannot be positively identified. According to the speed tape, with the correction factor applied as determined by the bench tests, the engineer of train No. 82 was operating in excess of the authorized speed at several points. However, there is no evidence that overspeed per se was a factor in the accident. Since the engineer had understood that signal No. 222.4 displayed a clear aspect, when, in fact, it was in an approach aspect, he was exceeding the authorized speed for that signal block. This in turn caused him to overrun the stop signal at Fleet Interlocking; however, the overspeed, under the circumstances, was not a relevant factor. It undoubtedly prolonged the train's stopping distance, but the difference the overspeed made compared to the authorized speed for a clear block condition would not have given Extra 2771 South the additional distance it would have required to stop. It may have reduced the severity of the accident slightly since train No. 82 would have stopped farther south and Extra 2771 South would have had more braking distance. However, overspeed operations should not be condoned.

Impact and Damage

Since the fireman of train No. 82 was able to remain on his feet when he detrained about 250 feet from the impact site, it is probable that the train had stopped by the time it collided with Extra 2771 South, which was probably moving

4/ Railroad Accident Report--"Head-On Collision of Two Penn Central Freight Trains at Herndon, Pennsylvania, March 12, 1972" (NTSB-RAR-73-3); Railroad Accident Report--"Head-On Collision of Two Burlington Northern Freight Trains near Maquon, Illinois, May 24, 1972" (NTSB-RAR-73-4); Railroad Accident Report--"Collision of St. Louis-San Francisco Railway Trains 3210 and 3211, Mustang, Oklahoma, September 1, 1974" (NTSB-RAR-75-6); Railroad Accident Report--"Penn Central Transportation Company, Train Collision, Leetonia, Ohio, June 6, 1975" (NTSB-RAR-76-2); and Railroad Accident Report--"National Railroad Passenger Corporation (AMTRAK) Head-End Collision of Train No. 111 and Plasser Track Machine Equipment, Edison, New Jersey, April 20, 1979" (NTSB-RAR-79-10).

about 35 mph. Train No. 82's engineer testified that the passenger train was moved back about one locomotive unit length. The sudden impact by the moving freight train and either the reversed direction of movement of the passenger train or its sudden start backward with the brakes set accounts for the falls described by passengers and crewmembers.

The destruction of both locomotive operating compartments in this collision is not unexpected because of the speed and mass involved. Locomotive crashworthiness has been a subject studied for some time by the FRA and private industry. While it is difficult to define how the cabs of these two locomotive should have been designed to have withstood the crash forces, it is still an area where continued work needs to be done. If the high compressive forces had not caused the empty hopper cars in the freight train to derail, the damage to the passenger train and injuries to the passengers and crew probably would have been much greater.

The distorted end doors in the one sleeping car presented a problem, but since the car was upright, broken or removed windows provided ready evacuation routes. The loose furniture and table settings in the dining cars continue to be hazardous and detrimental to the occupants' postaccident activities. Fortunately, the tables remained fastened to the floor and wall, but the unsecured chairs and table settings were a problem because of clutter and missile action, as they were in the accidents at Pulaski, Tennessee, 5/ and Elma, Virginia 6/. The passengers and crewmembers in cars other than the diner seem to have been affected primarily by the sudden or rough stop and the reversal of the train's direction.

Rescue Procedures

Prompt action by the engineer of train No. 82 in reporting the accident and the correspondingly prompt action of the rear crewmembers of Extra 2771 South in summoning emergency assistance was a determining factor in having the injured cared for in a short time. The value of local hospitals having an Emergency Preparedness Plan was demonstrated very effectively. The emergency units that responded were capable and prompt in their services. Response by the Medivac Units from Fort Bragg shows an emphasis on emergency preparedness. All units are to be commended for their performance. In addition to the excellent work of emergency personnel, the uninjured members of both trains did a commendable job in aiding the injured and responding to the emergency.

One other important aspect that was brought out in the emergency response to this accident merits comment. The rear brakeman of Extra 2771 and the fireman of train No. 82 were familiar with the geography of the area and were able to direct first aid units into the scene of the accident quickly. Their effective actions were the results of knowledge of the local area which demonstrates the value of having emergency units along the routes familiar with railroad properties and qualified to work with such emergencies.

5/ Railroad Accident Report--"Derailment of Amtrak Train on Louisville and Nashville Railroad, Pulaski, Tennessee, October 1, 1975" (NTSB-RAR-76-6).
6/ Railroad Accident Report--"Derailment of Southern Railroad Company Train No. 2, The Crescent, at Elma, Virginia, December 3, 1978" (NTSB-RAR-79-4).

CONCLUSIONS

Findings

1. The brakes of train No. 82 and Extra 2771 had no significant defects.

2. The track met FRA requirements and was not a causal factor in the accident.

3. The signal system had no defects that would have contributed to the cause of the accident.

4. Ground fog prevented the engineer from clearly seeing and distinguishing the aspect displayed by signal No. 222.4, and he did not see it.

5. Signal No. 222.4 displayed an approach aspect as train No. 82 approached and passed it.

6. The engineer of train No. 82 may have been distracted by the schoolbus near collision incident at State Road 2088 crossing near signal No. 222.4.

7. Operable cab signals and/or an automatic train control system could have prevented this accident.

8. Train No. 82 was stopped or almost stopped at the time of the impact.

9. The radio warning by the engineer of train No. 82 allowed the head-end crew of Extra 2771 South time enough to activate the brakes and to detrain before the collision, which reduced the severity of the collision.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the engineer of train No. 82 to perceive and comply with the "approach" aspect of a signal and his continued operation of the train at a speed too high to stop before it overran a stop signal. Contributing factors to the accident were the dense fog and the train's speed which reduced the engineer's perception time; the engineer's possible distraction by a schoolbus which crossed immediately in front of the train as it approached the signal; and the absence of means to alert the engineer that he had failed to comply with the approach signal indications.

RECOMMENDATIONS

As a result of its investigation of this accident and because accident investigations conducted in the past that involved similar circumstances have continually indicated the need for such action, the Safety Board reiterates the following recommendation, issued on February 7, 1972, 7/ to the Federal Railroad Administration:

> "Develop a comprehensive program for future requirements in signal systems...that will require as a minimum:
>
> a. that all mainline trains be equipped with continuous cab signals in conjunction with automatic-block signals;
>
> b. that all passenger trains be equipped with continuous automatic speed control (train control)."

* * * *

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PATRICIA A. GOLDMAN
Member

/s/ G. H. PATRICK BURSLEY
Member

ELWOOD T. DRIVER, Vice Chairman, did not participate.

September 2, 1980

7/ Special Study--"Signals and Operating Rules as Causal Factors in Train Accidents, February 7, 1972" (NTSB-RSS-71-3).

APPENDIX A

OPERATING RULES

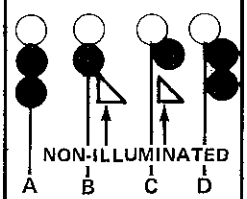
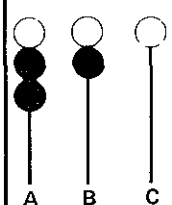
34 All members of the crew located in the operating cab of an engine must, and other members of crew will when practical, communicate to each other in an audible and clear manner the name of each block and interlocking signal affecting movement of their train or engine as soon as the signal is clearly visible and again just before passing that signal It is the responsibility of the engineman to have each crew member in the cab of the engine comply with these requirements including himself

101 When scheduled time of trains between stations indicates a speed in excess of the designated maximum, it conveys no authority to exceed the authorized maximum speed

Trains and engines must be fully protected against any known condition which interferes with their safe passage When conditions are found which may interfere with the safe passage of trains at normal speed and no protection has been provided, such action must be taken as will insure safety

102-F. When school buses or motor vehicles carrying dangerous commodities fail to stop at crossings, or driver of any vehicle fails to observe reasonable precautions at crossings when trains are approaching, such instances, with all available pertinent facts, should be reported to the superintendent

105-A Unless otherwise provided, speed restrictions apply for the entire length of the train A member of the crew on rear of train must notify engine crew by radio or give proceed signal, if practicable, after rear of train has passed through speed restricted territory

RULE	ASPECT HIGH SIGNAL	RULE	NAME	INDICATIONS
505		505	APPROACH LIMITED	Proceed, approaching next signal not exceeding 45 miles per hour; not exceeding 45 miles per hour through turnouts
512		512	APPROACH	Proceed preparing to stop at next signal Train exceeding 40 miles per hour must at once reduce to that speed, until it can be plainly seen that indication of next signal allows train to proceed

952 Enginemen have charge of the engine and jurisdiction over the fireman in all his duties and, in the absence of the conductor, over the trainmen

APPENDIX B

PERSONNEL INFORMATION

Train No. 82

James Edwin Butt, Jr., Engineer

James Edwin Butt, Jr., 64, was employed on March 18, 1937, by the predecessor of the SCL as a fireman. He was promoted to engineer on July 1, 1942. He passed a medical examination on October 30, 1979. He was required to wear eye glasses and he had them on at the time of the accident.

Garmon Wayne Edens, Fireman

Garman Wayne Edens, 37, was employed by the SCL as a switchman on April 9, 1969. He was promoted to yard foreman on May 21, 1970, entered the SCL engineman trainee program as a fireman on January 9, 1977, and was approved as a fireman on May 18, 1977. He was promoted to engineman on April 19, 1979. He passed his last medical examination on April 18, 1967.

Joseph Grey Singletary, Conductor

Joseph Grey Singletary, 45, was employed on June 30, 1953, by the predecessor of the SCL as a trainman. He was promoted to conductor on May 10, 1963. He passed his last medical examination on May 16, 1978.

Ernest Ronald Bryant, Flagman

Ernest Ronald Bryant, 39, was employed on April 23, 1967, by the predecessor of the SCL as a trainman. He was promoted to conductor on March 19, 1970. He passed his last medical examination on April 23, 1967.

Edward Hampton Ramsey, Jr., Baggagemaster

Edward Hampton Ramsey, Jr., 51, was employed on February 29, 1952, by the predecessor of the SCL as a switchman. He transferred from switchman to trainman on May 13, 1954, and he was promoted to conductor on May 10, 1963. He passed his last medical examination on June 30, 1968.

Extra 2771 South

Clifton Wayne McGee, Engineman

Clifton Wayne McGee, 40, was employed on June 21, 1961, by the predecessor of the SCL as a yard fireman, and he was promoted to yard engineer on May 20, 1964. He transferred in service as a trainman on June 13, 1964, and then back into engine service as a road fireman on May 7, 1966. He was promoted to engineman on June 20, 1969. He passed his last medical examination on June 9, 1979.

Jimmie Ronald McLaurin, Brakeman

Jimmie Ronald McLaurin, 43, was employed on March 3, 1956, by the predecessor of the SCL as a trainman. He transferred in service as a switchman on February 1, 1959, and was promoted to yard conductor on April 1, 1961. He transferred back into road service as a trainman on June 15, 1966, and he was promoted to conductor on March 12, 1970. He passed his last medical examination about April 26, 1980.

Lee Monroe Suggs, Conductor

Lee Monroe Suggs, 37, was employed on June 30, 1960, by the predecessor of the SCL as a trainman. He was promoted to conductor on February 16, 1964, and he passed his last medical examination on June 30, 1960.

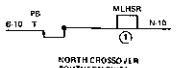
James Richard Loving, Flagman

James Richard Loving, 41, was employed on September 21, 1962, by the predecessor of the SCL on September 21, 1962, as a trainman. He was promoted to conductor on August 1, 1966, and he passed his last medical examination on September 21, 1962.

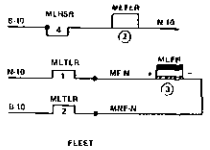
Each crewmember of each train was current on the operating rules examination. The SCL only requires medical examinations at the time an employee is hired, and no further medical examinations are required until the age of 40. After the age of 40, medical examinations are required every 2 years, and after age 50, each year until retirement.

APPENDIX C

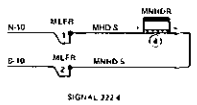
CIRCUIT FOR SIGNAL 222.4



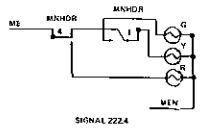
Dispatcher initiates code to energize relay No 1, MLHSR at North Crossover, Southern Pines which causes relay No 2, MLTLR to be energized



Relay MLTLR causes negative battery to be applied to the positive control of relay No 3, MLFR which becomes energized and poles the polar contacts reverse

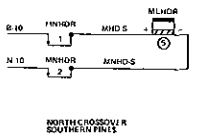


The reversed polar contacts of relay MLFR causes negative battery to be applied to the positive control of relay No 4, MNHDR which becomes energized and poles the polar contacts reverse

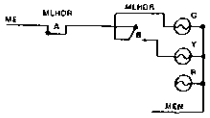


When relay No 4 MNHDR is energized and poled reverse, a combination of the neutral and polar contacts lights the yellow lamp in signal 222 4

After a northbound train passes signal 222 4, the neutral contact (4) of relay MNHDR is opened and the red lamp is lighted The polar contact (1) remains in the reverse position until the dispatcher initiates a code to clear the signal to proceed at north crossover, Southern Pines, and also to clear the signal to proceed at Fleet

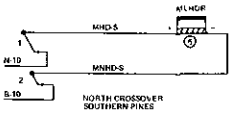


When relay No 4, MNHDR, is energized and poled reverse it causes positive battery to be applied to the positive controls of relay No 5, MLHDR

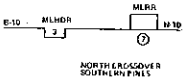


When relay No 5, MLHDR is energized and poled normal, a combination of the neutral and polar contacts light the green lamp in the home signal at north crossover, Southern Pines

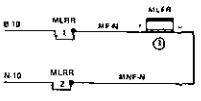
After a northward train passes signal 222 4, relay MNHDR is deenergized and the neutral contact causes the red lamp to light When the train passes Fleet, Negative battery is still caused to be applied to north crossover, Southern Pines



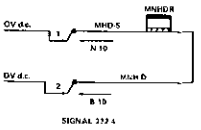
To the positive control of relay No 6, MLHDR which becomes energized and poles and polar contacts reverse (actually, they remained reversed)



When relay No 6, MLHDR, is energized, it causes relay No 7, MLRR to be energized



When relay No 7, MLRR, is energized, it causes positive battery to be applied to the positive control of relay No 3, MFLR, which is energized and the polar contacts poled normal



When relay No 3, MLFR is poled normal, the negative battery is removed from the positive control of relay No 4, MNHDR, and zero or no voltage is applied The polar contacts remain poled reverse