

PRR-162977



# NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

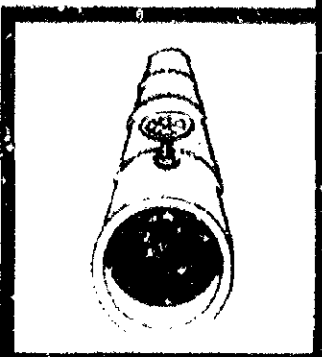
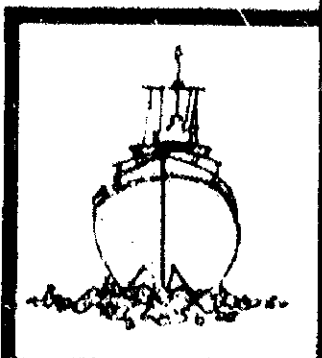
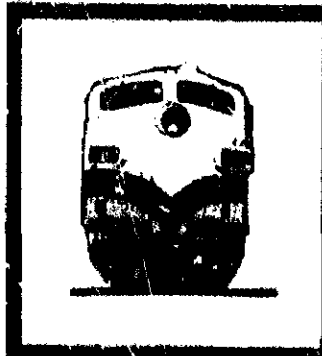
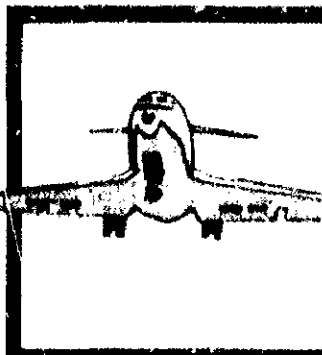
## RAILROAD ACCIDENT REPORT

REAR END COLLISION OF  
CONSOLIDATED RAIL CORPORATION  
FREIGHT TRAINS ALPG-2 AND APJ-2  
NEAR ROYERSFORD, PENNSYLVANIA  
OCTOBER 1, 1979

NTSB-RAR-80-2

UNITED STATES GOVERNMENT

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16. Abstract  About 5:16 a.m., e.d.t., on October 1, 1979, Consolidated Rail Corporation (Conrail) eastbound freight train ALPG-2 struck the rear of standing Conrail eastbound freight train APJ-2 on the No. 2 main track near Royersford, Pennsylvania. The engineer and conductor of ALPG-2 were killed. The locomotive unit of ALPG-2 was derailed and destroyed. The caboose of APJ-2 and a total of 20 cars were derailed. Damage was estimated to be \$662,000.  The National Transportation Safety Board determines that the probable cause of this accident was the failure of the conductor of train ALPG-2, who was operating the train without authority and under the influence of marijuana, to comply with a "stop and proceed" signal aspect located 3,600 feet from the collision site and to respond to flagging protection provided by the rear brakeman of train APJ-2 and stop the train. Contributing to the accident was the conductor's failure to perform his assigned duties by (1) ensuring that the head brakeman performed his duties in his assigned location in the locomotive; and (2) ensuring that the engineer was physically fit and capable of operating the train in conformity with all applicable rules and regulations. Also contributing was the absence of an adequate backup system to control the train in the event that the crew failed to do so.		
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## CONTENTS

SYNOPSIS . . . . .	1
INVESTIGATION . . . . .	1
The Accident . . . . .	1
Injuries to Persons . . . . .	3
Damage . . . . .	3
Crewmember Information . . . . .	7
Medical and Pathological Information . . . . .	8
Train Information . . . . .	8
Method of Operation . . . . .	9
Signals . . . . .	9
Meteorological Information . . . . .	10
Survival Aspects . . . . .	10
Tests and Research . . . . .	10
Other Information . . . . .	11
ANALYSIS . . . . .	12
CONCLUSIONS . . . . .	16
Findings . . . . .	16
Probable Cause . . . . .	17
RECOMMENDATIONS . . . . .	17
APPENDIXES . . . . .	19
Appendix A—Investigation . . . . .	19
Appendix B—Train Crewmember Information . . . . .	20
Appendix C—Excerpts from Conrail Reading Division Operation Rules . . . . .	22
Appendix D—Excerpts from Conrail Reading Division Timetable No. 1 . . . . .	25
Appendix E—Excerpts from 49 CFR . . . . .	26

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WASHINGTON, D.C. 20594  
RAILROAD ACCIDENT REPORT

Adopted: February 14, 1980

REAR-END COLLISION OF CONSOLIDATED RAIL  
CORPORATION FREIGHT TRAINS ALPG-2 AND APJ-2  
NEAR ROYERSFORD, PENNSYLVANIA  
OCTOBER 1, 1979

SYNOPSIS

About 5:16 a.m., e.d.t., on October 1, 1979, Consolidated Rail Corporation (Conrail) eastbound freight train ALPG-2 struck the rear of standing Conrail eastbound freight train APJ-2 on the No. 2 main track near Royersford, Pennsylvania. The engineer and conductor of ALPG-2 were killed. The locomotive unit of ALPG-2 was derailed and destroyed. The caboose of APJ-2 and a total of 20 cars were derailed. Damage was estimated at \$562,000.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the conductor of train ALPG-2, who was operating the train without authority and under the influence of marijuana, to comply with a "stop and proceed" signal aspect located 3,670 feet from the collision site and to respond to flagging protection provided by the rear brakeman of train APJ-2 and stop the train. Contributing to the accident was the conductor's failure to perform his assigned duties by (1) ensuring that the head brakeman performed his duties in his assigned location in the locomotive; and (2) ensuring that the engineer was physically fit and capable of operating the train in conformity with all applicable rules and regulations. Also contributing was the absence of an adequate backup system to control the train in the event that the crew failed to do so.

INVESTIGATION

The Accident

At 12:15 a.m., on October 1, 1979, eastbound Conrail freight train APJ-2, consisting of 4 locomotive units, 115 cars, and a caboose, departed Allentown, Pennsylvania, for Philadelphia. At 3:30 a.m., the train stopped at Cromby siding, 1 mile east of Royersford, to pick up the 5 locomotive units, a caboose, and four crewmembers of a unit coal train that had been relieved due to being on duty 12 hours. At 4:40 a.m., APJ-2 departed Cromby on track No. 2 and proceeded 1.7 miles to Phoenix, where it stopped at 4:55 a.m., to comply with the "stop" aspect displayed by signal L-60. The rear of the train stopped in a 2° right-hand curve about 3,600 feet east of signal 133 and 1,740 feet east of the west turnout of Cromby siding. The engineer and head brakeman were on the lead locomotive unit, the conductor was on the second locomotive unit, and the four off-duty crewmembers were on the fifth locomotive unit.

According to the engineer, signal 133 displayed an "advance approach" aspect 1/ as train APJ-2 approached and passed it at about 3:20 a.m. Because of the length of the train and the track curvature, the rear brakeman of APJ-2 could not see the signal before the locomotive passed it. However, he stated that he observed signal 133 continuously displaying a "stop and proceed" aspect 2/ after he was in a position to see the signal.

After APJ-2 stopped at signal L-60 at Phoenix, the rear brakeman alighted from the caboose and began walking west with flagging equipment. He stated that he placed two torpedoes 3/ on track No. 2 in the curve between signal 133 and the west turnout of Cromby siding - more than 2,000 feet west of his caboose. After placing the torpedoes, the brakeman began walking back to the train. When he was about 750 feet from the caboose, he saw the headlight of eastbound train ALPG-2 moving around the curve where he had placed the torpedoes. When the brakeman realized the oncoming train was running with power and was not braking, he lighted a fusee and began waving it horizontally - the hand signal to stop. Despite his effort to warn the train, ALPG-2 collided with the rear of APJ-2 at about 5:16 a.m. According to the brakeman, he did not hear ALPG-2 whistle an acknowledgement of the torpedoes nor did he notice any reduction in the speed or in the sound of the train's power. ALPG-2's brakes were not applied until after the collision.

At about 2:30 a.m., train ALPG-2, consisting of 1 locomotive unit, 10 cars, and a caboose, departed from Allentown Yard. The conductor and engineer were in the locomotive and the head and rear brakemen were in the caboose. En route, ALPG-2 stopped at 2:50 a.m., to set off four cars at Alburkis, 12 miles from Allentown, and at 4:30 a.m., to pick up 37 cars containing anthracite coal at Colebrookdale Junction (Pottstown), 54 miles from Allentown. During both stops, the brakemen directed the switching operations by using a portable radio to instruct the engineer. According to the brakemen, they only heard the conductor responding to these radio instructions. The brakemen never saw the engineer or heard his voice on the radio after ALPG-2 left Allentown.

At 4:55 a.m., ALPG-2 left Colebrookdale Junction for Philadelphia. Both brakemen, who were sitting in the rear of the caboose, facing the rear, stated that they observed no signal indications, heard no radio communication involving their train, and felt no slack action, slowing, or braking of their train after it left Colebrookdale Junction.

At about 5:14 a.m., ALPG-2 passed signal 131-B at Royersford station, 8.6 miles east of Colebrookdale Junction and about 1.9 miles west of the standing caboose of train APJ-2. A signal maintainer observed signal 131-B continuously display an "approach"

1/ "Advance approach" allows a train to proceed prepared to stop at the second signal ahead.

2/ "Stop and proceed" requires a train to stop, and then proceed at restricted speed.

3/ Torpedoes, or "caps" are small percussion-type charges designed for attachment to the top of rails which can be easily heard when locomotives ride over and detonate them. Conrail Reading Division rules define the explosion of torpedoes as a warning signal to be on the alert for obstruction or train ahead which must be acknowledged by two short blasts of the locomotive whistle.

aspect 4/ as ALPG-2 approached it. He stated that the train was running under power, without evidence of braking, at a speed he considered too high for the train to stop short of signal 133, 1.2 miles eastward. He also observed that ALPG-2 failed to whistle, as required, for the Main Street and Arch Street crossings east of Royersford station. Although the signal maintainer had a radio, he did not try to communicate with ALPG-2.

Signal 131-B can be seen from an eastbound train as soon as it passes the preceding signal 6,853 feet to the west. Signal 133 can be seen 3,200 feet to the west. East of signal 133, an eastbound train moves successively through a tangent for 291 feet, a 2° right-hand curve for 1,232 feet, and a tangent for 1,368 feet. The remaining 709 feet to the point of collision is through a 2° right-hand curve. (See figure 2.) The grade east of signal 133 descends at the rate of about 0.12 percent for 1,100 feet, then it is essentially level for 2,000 feet, and then it ascends the last 500 feet at about 0.05 percent.

#### Injuries to Persons

	<u>APJ-2</u> <u>Crewmembers</u>	<u>APJ-2</u> <u>Off-duty</u> <u>Crewmembers</u>	<u>ALPG-2</u> <u>Crewmembers</u>
Fatal	0	0	2
Nonfatal	0	0	0
None	4	4	2

#### Damage

The caboose and four rear cars of APJ-2 derailed and derailed. Although the caboose overrode the locomotive unit of ALPG-2, it remained upright. The bodies of the four rear cars of APJ-2 remained intact and came to rest parallel to and south of Cromby siding. (See figure 1.) The fifth, sixth, and seventh rear cars derailed but stopped perpendicular to and blocked the main tracks and siding.

The short hood and cab of ALPG-2's locomotive unit were demolished and torn loose by the caboose of APJ-2. These parts of the superstructure were found straddling Cromby siding, about 100 feet east of the point of impact. The unit's remaining superstructure and diesel engine were also separated from the cab and were found on track No. 2 about 325 feet east of the point of impact. The deck of the unit was found crosswise on track No. 1, opposite the engine and long hood portion of the superstructure. The 12 head cars of ALPG-2 derailed and most of these were scattered in varying attitudes on the main tracks north of APJ-2's cars and west of the wreckage of the locomotive unit. About 1,160 feet of track was destroyed.

4/ "Approach" requires that a train's speed be immediately reduced to 35 mph and that the train be prepared to stop at the next signal.

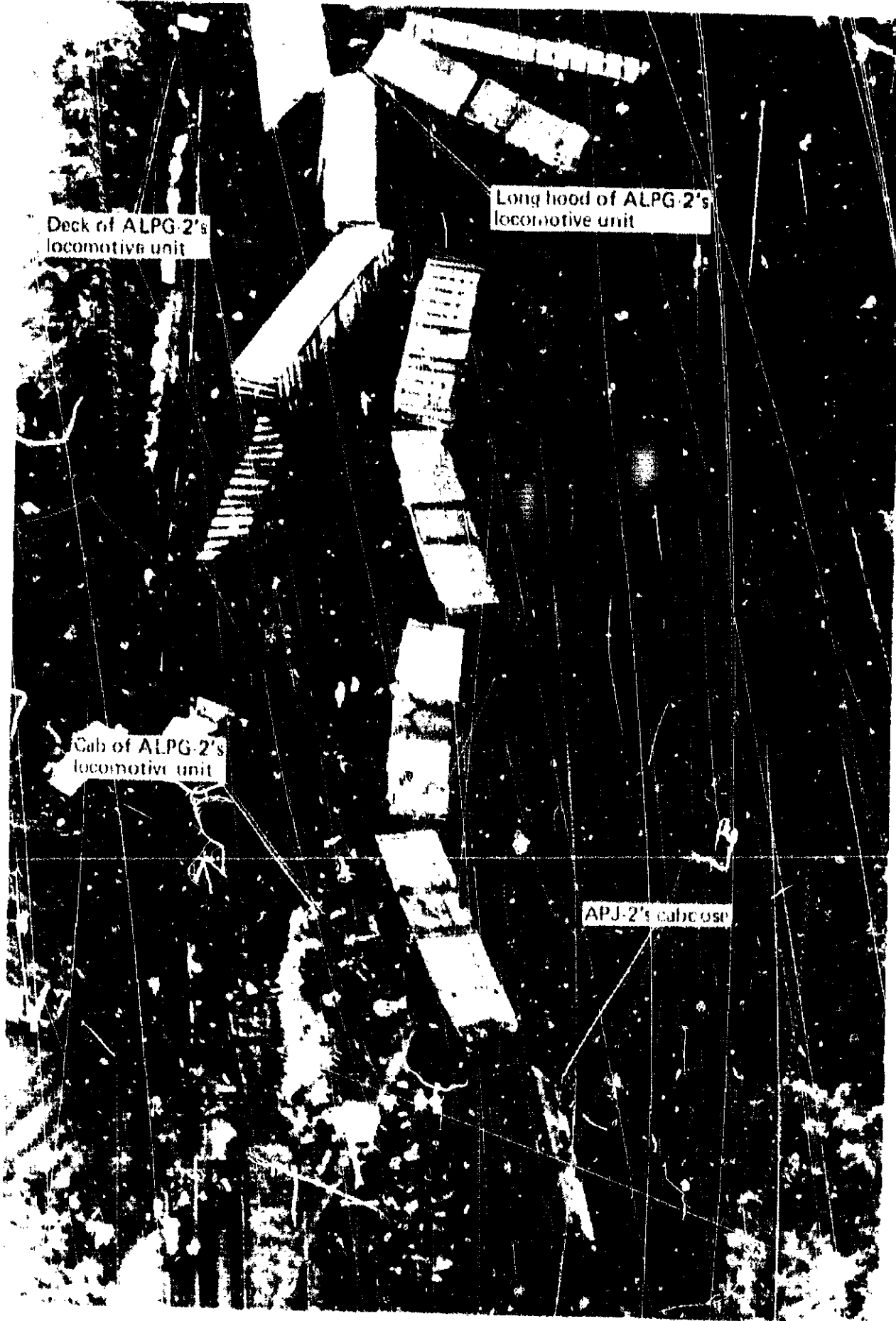
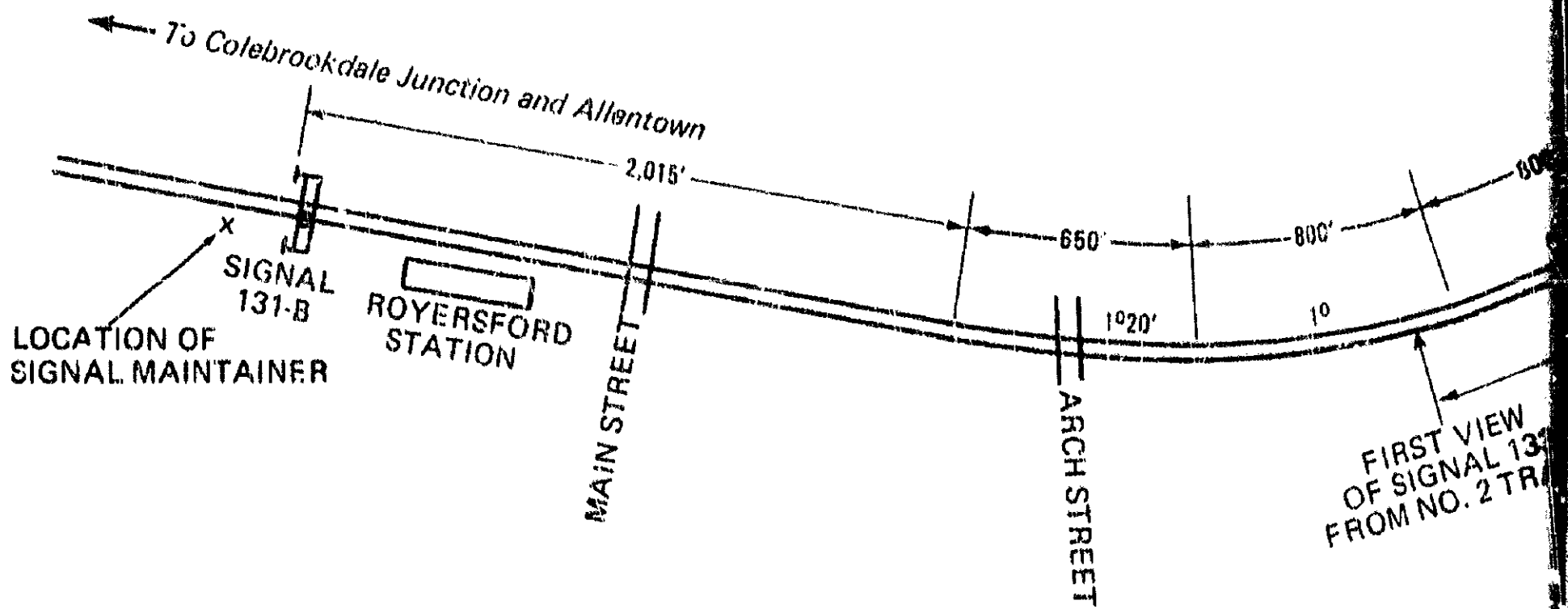
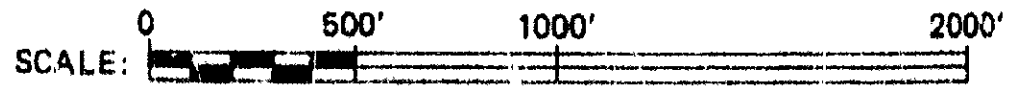


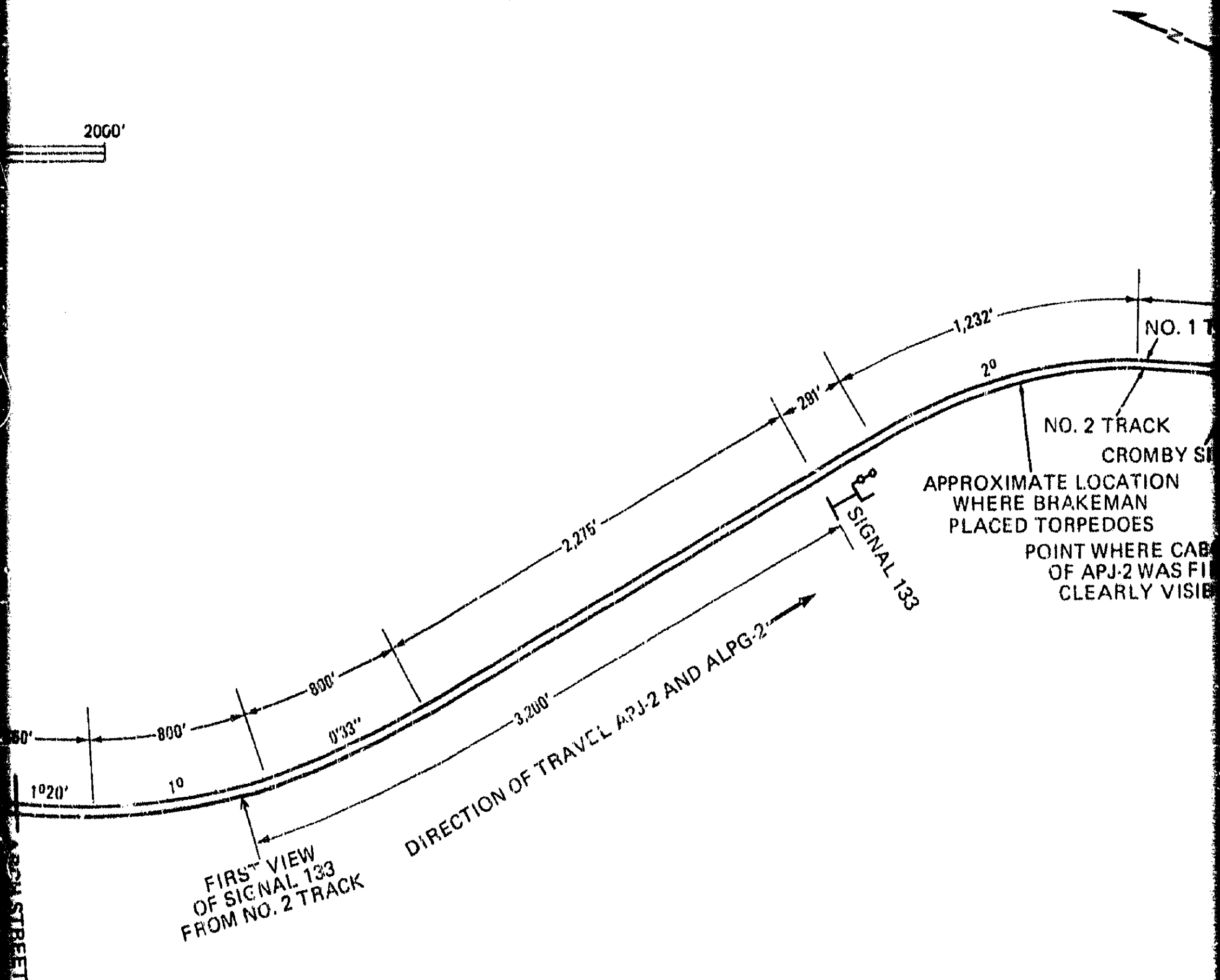
Figure 1. Aerial view of accident location from the west.



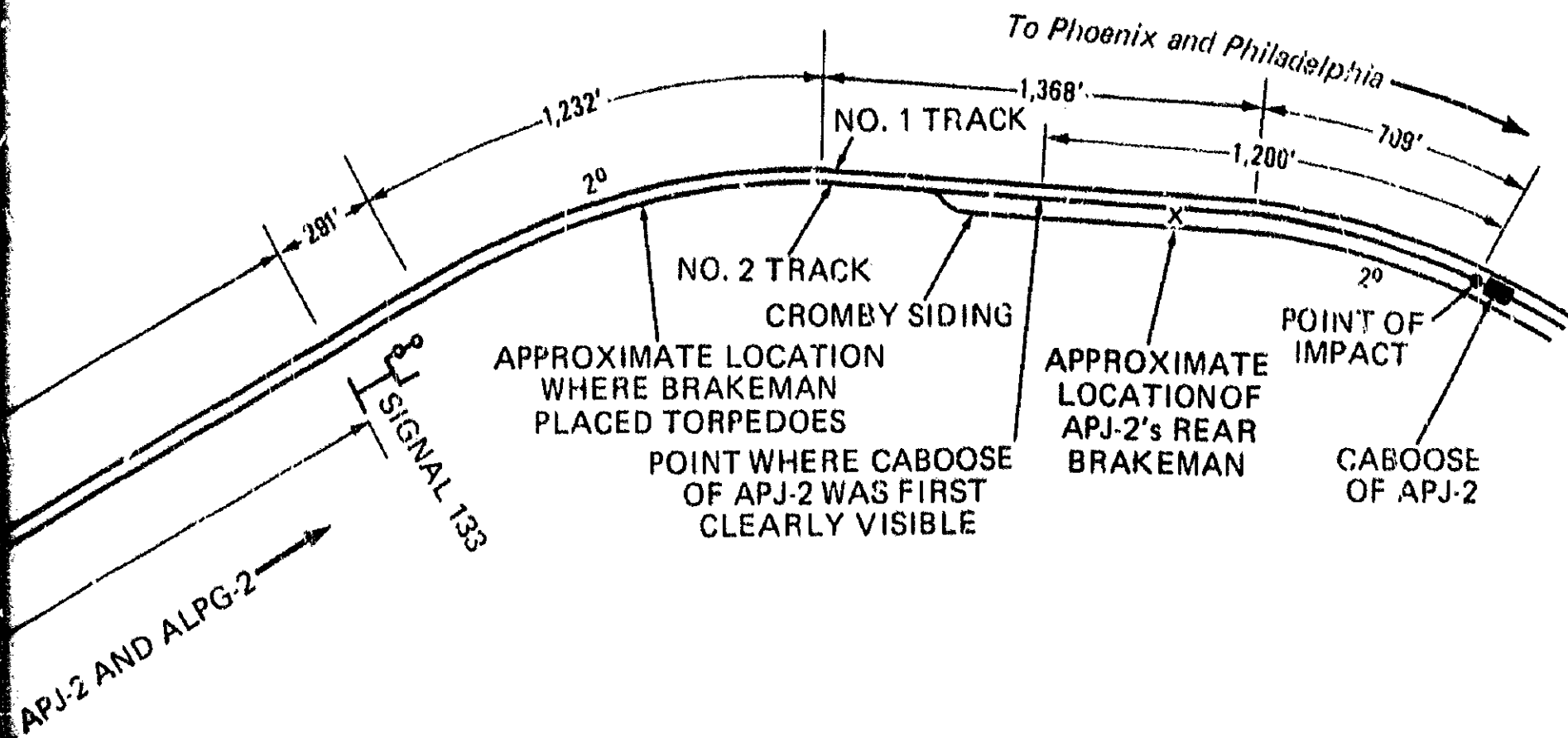
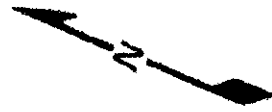


**Figure 2. Diagram of accident location**





**of accident location and approach from signal 131-B**



back from signal 131-B

Damage was estimated as follows:

Train Equipment	\$379,000
Train Lading	\$100,000
Track	\$ 9,000
Salvage and Wrecking	\$ 74,000
Total	\$562,000

Crewmember Information

Each train had an engineer, conductor, and two brakemen. All were qualified under Conrail operating rules without restrictions. (See appendix B.)

When the trains collided, the crewmembers of ALPG-2 had been on duty for 4 hours 18 minutes. Before reporting for duty at Conrail's Bethlehem, Pennsylvania, enginehouse at 1:00 a.m., they had been off duty for 14 hours 40 minutes. Since Bethlehem was their away-from-home terminal, the crew had been lodged in separate rooms at the Howard Johnson Motel on the north side of the city for all but the last hour and a half of their off-duty time. According to the motel room clerk, he called each crewmember in his room at about 11:30 p.m., on September 30. An hour later they were picked up by a taxicab and taken to their reporting point. In the interim, the crewmembers ate at a restaurant on the motel grounds. Neither brakeman had seen the engineer and conductor since checking into the motel and they knew nothing of what these men had done during that time.

The conductor, engineer, and head brakeman were members of a regularly assigned pool crew. The rear brakeman regularly worked on another Conrail division but was filling a temporary vacancy. During the crew's trip from Philadelphia to Bethlehem on September 29-30, the rear brakeman and conductor rode together on the caboose. The conductor confided to the rear brakeman that the engineer had been displaced from his position due to his lack of seniority and was making his last round trip on that assignment. The conductor also told the brakeman that he and the engineer were close friends and that he intended to follow the engineer to his new assignment.

During the taxicab ride from the motel to the Bethlehem enginehouse, the engineer sat in the front seat with the driver and the conductor sat in the back seat behind the driver. The taxi driver stated there was no odor of alcohol from either man. However, the taxi driver remembered that the engineer, who was 5 feet 7 inches tall and weighed 250 pounds, seemed subdued and looked very tired. The rear brakeman described the engineer as seeming fatigued, very quiet, and listless -- "not his usual talkative self." The rear brakeman and the taxi driver heard the conductor say to the engineer, "Let's get high," and interpreted this to mean that they intended to use marijuana.

The crew of ALPG-2 rode together in the cab of their locomotive unit from Bethlehem enginehouse to Allentown Yard. According to the brakemen, the conductor operated the locomotive unit from the time it left Bethlehem to the time the brakemen alighted from it in Allentown Yard. The conductor was not qualified to operate the locomotive. At Allentown, the conductor insisted that the head brakeman ride in the

caboose despite the man's strenuous protests that he was required to be on the locomotive unit. Thereafter, neither brakeman saw who was operating the locomotive.

The crewmembers of APJ-2 had reported for duty at 10:00 p.m., on September 30, and had been on duty 7 hours 16 minutes when the accident occurred. The engineer had been off duty 17 hours 30 minutes before reporting, and the other crewmembers had been off duty 12 hours 45 minutes.

#### Medical and Pathological Information

Two postmortem toxicological screens which were performed on the blood and tissue of the engineer did not identify any toxic quantities of alcohol, other volatile intoxicants, or extractable organic poisons, such as cannabinoids (marijuana constituents). The postmortem toxicological examination of the conductor was negative for alcohol, amphetamines, and barbiturates. However, blood levels of 5.2 nanograms delta-9-tetrahydrocannabinol (THC), marijuana constituent, and 5.3 nanograms delta 9-THC-carboxylic acid (marijuana metabolite) were found. Urine levels of delta 9-THC and its metabolite were 38.2 and 16.3 nanograms, respectively. The laboratory report commented that a usual marijuana cigarette delivers 5 to 10 mg delta-9-THC for absorption resulting in sedation, euphoria, hallucinations, and time distortion; peak blood levels of delta-9-THC occur within 10 minutes of smoking, and after a "usual" smoke, range from 20 to 30 nanograms. By 2 hours after smoking, delta-9-THC blood level tends to be around 5 nanograms. In conclusion, the report stated that the concentrations and distributions of delta-9-THC and its metabolite in the conductor's blood and urine were indicative of marijuana usage in pharmacologically active amounts at least within 24 hours before he died. The toxicologist for Toxicon Associates, who performed the tests, stated that it was reasonable to assume that the conductor had smoked a marijuana cigarette after ALPG-2 left Allentown. Toxicon's findings were based on extract analyses by computer-controlled gas chromatography, thin-layer chromatography with sequential fluorogenic and chromogenic detection, fluorescent spectrofluorometry, and microchemical color tests.

#### Train Information

At the time of the accident, ALPG-2 consisted of one General Motors Model GP38-2, 2,000 hp diesel-electric locomotive unit, 43 cars, and a caboose. The train had a trailing weight of 4,090 tons and a nominal length of 2,268 feet. The locomotive unit had the short, low-profile hood forward and controls on the right, or south side. A full-width front cab window permitted an unobstructed view from both sides of the cab. The unit had a functioning dual sealed-beam headlight, a speed indicator, a radio, an emergency brake valve on the left side of the cab, and a floor-mounted, air-operated deadman pedal. The pedal consisted of ordinary bar stock which required 3 pounds of pressure to activate. ALPG-2's unit was equipped with a recorder which was inoperable. The train's caboose was equipped with an operable radio, an emergency brake valve, and a bay window on each side.

APJ-2 had an operable radio on the lead unit but none on the caboose. The caboose had flashing amber electric marker lights facing the rear which were lighted before and at the time of the accident.

### Method of Operation

The accident occurred on the former Reading Company mainline. Trains are operated by the indications of wayside automatic block signals. There are two main tracks, numbered 1 and 2 from north to south, except for a short section of single track through a tunnel at Phoenix which is controlled by a tower operator.

Maximum authorized speed for freight trains is 50 mph except for a 1-mile section at Royersford where speed is restricted to 40 mph. This section extends for 1/2 mile on each side of Signal 131-B.

### Signals

The signal system is basically a two-block system with approach-lighted searchlight-type signals with rotating color discs. Track No. 2 is signaled for eastbound movement only. Signal 131-B at Royersford is mounted above track No. 2 on a signal bridge which spans both tracks. Signal 133 is mounted on a high bracket-mast to the field side of track No. 2.

If the block governed by signal 133 is occupied by a train, the signal will display the following aspect:

<u>Aspect</u>	<u>Name</u>	<u>Indication</u>
Red	Stop and Proceed	Stop, then proceed at restricted speed.

If the block governed by signal 133 is occupied by a train, signal 131-B will display the following aspect:

<u>Aspect</u>	<u>Name</u>	<u>Indication</u>
Yellow	Approach	Proceed prepared to stop at next signal. Train exceeding medium speed must at once reduce to that speed.

If home signal L-60 at Phoenix displays a "stop" aspect, Signal 133 will display the following aspect:

<u>Aspect</u>	<u>Name</u>	<u>Indication</u>
Yellow over Yellow	Advance Approach	Proceed prepared to stop at second signal.

"Medium" speed is defined as "not exceeding 35 mph," and "restricted" speed is defined as "proceed prepared to stop short of a train, obstruction, or switch not properly lined, looking out for broken rail, not exceeding 15 mph." (See appendix C.)

Conrail rules governing operations on the line involved in this accident (1) require that road freight conductors normally ride in their locomotives, (2) require that head

brakemen normally ride in the cab of the lead locomotive unit, and (3) prohibit the use or possession of narcotics on duty or being under the influence of narcotics when reporting for duty. There is no rule which requires train crews to inspect their trains en route, but Rule 34 requires crewmembers on the rear of moving freight trains to observe the aspects of signals which govern their train to see that they change to their most restrictive aspect after being passed by the front end of the their train. Rule 99 stipulates that flag protection against following trains is not required in automatic block signal territory, but the practice is not prohibited. (See appendix C.) During the investigation, the Safety Board learned that flagging against following trains is commonly done on the line involved, particularly where visibility is restricted by curves and terrain.

#### Meteorological Information

At the time of the accident, it was dark and overcast with light, intermittent rain and patches of mist. According to the rear brakeman of APJ-2, visibility was good at the accident location. The temperature was about 56° F.

#### Survival Aspects

The overriding of ALPG-2's locomotive unit by the caboose of APJ-2 destroyed the unit's cab and other superstructure, all of which was separated from the deck. The engineer and conductor were ejected from the unit's cab and both died instantly from massive traumatic injuries. The conductor's body was found on the siding south of track No. 2 about 50 feet east of the point of impact. The engineer's body was found on the alignment of track No. 2 about 150 feet east of the conductor's body.

There were no injuries to the other 10 men on the trains involved. Although the collision caused APJ-2 to surge forward, there was no violent slack action on the head end. The brakemen on the caboose of ALPG-2 had no warning of the impending collision before their train went into emergency braking and stopped abruptly. The rear brakeman of APJ-2 was on the ground and a safe distance west of the point of impact.

#### Tests and Research

APJ-2's caboose could have been first clearly visible from ALPG-2's locomotive unit when they were 1,200 feet apart. West of that point, a pole line south of the tracks partially obscured the caboose's location.

When the control stand from ALPG-2's locomotive was found in the general wreckage, the throttle was in the 8th position. The dynamic brake was badly battered but appeared to be in the "off" position. The headlight switch was on "bright" and the engine bell switch was on "off." When the air brake stand was found under a derailed car about 9 hours after the collision, the automatic brake valve was in full release with the handle broken off. The independent brake handle was dislodged but the valve was in the release position. The deadman cutout cock was open, which indicated the device was operable at the time of the accident.

There was no operable speed recorder on ALPG-2's locomotive unit and none of the witnesses could give a firm estimation of the train's speed. However, ALPG-2's run from Colebrookdale Junction to the accident location was recreated by a Train Operation



Simulator, using the precise geometry of that portion of the railroad and the known characteristics of the train. The simulator demonstrated that the train's elapsed running time over the 10.6 miles was 21 minutes 4 seconds. After leaving Colebrookdale Junction, acceleration of the heavy train was slow, and it required 2 minutes to reach 10 mph with the throttle advanced one position at a time in 15-second intervals to the 8th or full throttle position where it was left for the remainder of the run. In the simulation, the train passed signal 131, 16 1/2 minutes after starting, at a speed of 40 mph. Signal 131-B would have then lighted displaying an "approach" aspect and would have been immediately visible from the head-end of the train. On tangent track and a .22 percent descending grade, the train accelerated to 45 mph as it reached signal 131-B, 18 minutes 41 seconds after leaving Colebrookdale Junction. Speed remained at 45 mph to the point of impact.

The instrument cases for signals 131-B and 133 were sealed following the accident. On October 2-3, inspections and testing of the relays and track circuits were performed in the presence of a Federal Railroad Administration (FRA) inspector. The relays and circuitry were found to be free of defects and functioned as intended. The signals displayed the proper aspects during the tests.

#### Other Information

When the crew of ALPG-2 was making its previous trip from Philadelphia to Allentown on September 30, the train passed a stop signal at Burn Tower near Allentown yard. To stop, the engineer applied the train's brakes in emergency. Later, the crew noticed that the wheels of the locomotive units and the caboose had flat spots, but no one reported the incident, and the Bethlehem enginehouse had no record of the flat wheels. Consequently, there was no supervisory investigation or handling of the incident.

On the night of the collision, no supervisor was on duty at Bethlehem enginehouse when the crews of APJ-2 and ALPG-2 reported for duty. Although a road foreman of engines was assigned to this location, he normally worked a daylight tour of duty. No surviving crewmember could recall having seen a supervisor at Bethlehem at night.

The engineer of APJ-2 recalled that a road foreman of engines had ridden with him several times while he was qualifying on the Reading lines in 1977. None of the other surviving crewmembers could recall when a supervisor had last ridden with him on a train.

Title 49 CFR 217.9 requires each railroad to conduct operational tests periodically to determine the extent that employees comply with operating rules, timetables, and special instructions. (See appendix E.) The tests must conform to a program filed with the FRA, which also must be informed of changes in the program. Each railroad is also required to record each test, keep the records of tests for 1 year, and make records available for FRA inspection. There are no requirements for the type of tests to be conducted, frequency of testing, nor designation or qualification of persons who are to conduct the tests.

Title 49 CFR 217.11 requires each railroad periodically to instruct employees in train service on the operating rules. Each railroad must conform to the program it files with FRA, but there are no specific requirements as to the methodology, frequency of instructions, or qualification of instructors.



### ANALYSIS

The crewmembers of train ALPG-2 were provided with suitable lodging at Bethlehem and had ample time to get proper rest and nourishment before reporting for duty. Nevertheless, while the engineer was en route to report for duty, he appeared to the taxi driver and the rear brakeman to be fatigued. The engineer was more than 100 pounds overweight and may have had other physical problems, although they were not disclosed by the autopsy. It is unusual for a healthy 24-year-old man to appear to be so obviously tired after a normal period of bed rest.

During the cab ride to the Bethlehem enginehouse, the conductor did not exhibit any abnormal conduct or appearance which might have suggested that he was then under the influence of narcotics. However, the rear brakeman and the taxi driver overheard the conductor suggest to the engineer that they "get high" and understood this to mean he was referring to marijuana. The Safety Board believes that, based on current colloquial usage, the conductor's statement indicated that he possessed marijuana at the time and intended to use it on the return trip to Philadelphia. The Toxicon Associates laboratory report stated that the concentrations of delta-9-THC and its metabolite in the conductor's blood and urine were such that he could have smoked a marijuana cigarette as recently as 2 hours before the accident. The toxicologist further stated that: (1) it was reasonable to assume that the conductor smoked a marijuana cigarette while ALPG-2 was en route; (2) that it is reasonably certain that the conductor was under the influence of the potent hallucinogen delta-9-THC; (3) at the detected blood levels of the drug the conductor's behavior was probably radically modified from his normal, nondrugged state; and (4) such modified behavior would be consistent with an inability to react to danger or the warning signs of danger.

Since the engineer and conductor of ALPG-2 were close friends, they may have decided before reporting for duty that the conductor should operate the train while the engineer rested. Although a rule required the conductor to normally ride the locomotive, he did not do this on the crew's previous trip, the night before. On the night of the collision, however, he elected to ride in the locomotive. Despite the rule requiring the head brakeman to ride in the locomotive, the conductor overruled the man's strenuous objections and ordered him to ride in the caboose. When ALPG-2 left Allentown, the crew was under orders to set out cars en route; this could be best accomplished by the head brakeman working from the locomotive. These circumstances suggest that the conductor did not want the brakemen to observe his actions on the trip to Philadelphia.

Although the conductor was not qualified to operate the locomotive of ALPG-2, only he was seen operating it on the night of the collision. When stops were made to set off and pick up cars, it was the conductor, not the engineer who responded to radio instructions from the brakemen. Following the accident, the relative locations of the bodies of the conductor and the engineer suggest that the conductor may have been on the engineer's side of the cab when the trains collided. Individually, these facts are not sufficient to support a conclusion that the conductor was operating the locomotive when the trains collided. However, the Safety Board believes that, collectively, the facts are sufficiently compelling to indicate that he was. In any event, the conductor was in charge and was in a position to ensure compliance with the signal indications and the rules.

The brakemen on the caboose of ALPG-2 should have been able to observe the "approach" aspect displayed by signal 131-B continuously for more than a mile before the

locomotive reached it. The computer simulation indicated that during this time, the train would have been picking up speed rather than slowing; this should have indicated to the brakemen that neither the engineer nor the conductor were responding to the signal. The brakemen should have tried to communicate by radio with the engineer and conductor, and if this failed to produce a satisfactory response, they should have applied the train's brakes in emergency and stopped the train. However, after leaving Colebrookdale Junction, the brakemen were seated facing to the rear and did not comply with the rule requiring them to observe the signals.

ALPG-2 required about 21 minutes to cover the 10.6 miles from Colebrookdale Junction to the collision site. The Safety Board doubts that the engineer or conductor on the locomotive took any responsive action to control the train's operation after the first 2 to 3 minutes during which the throttle was progressively advanced to the full power position. The conductor and engineer should have seen signal 131-B displaying an "approach" aspect when it was 1.3 miles away. At the time, ALPG-2 was traveling at about 40 mph. To comply with the signal indication, the engineer should have reduced the throttle and probably should have made a brake application. However, no action was taken and the train accelerated on the descending grade to about 45 mph when it reached the signal. Still running with full throttle, ALPG-2 continued at about that speed until it struck the rear of APJ-2.

A signal maintainer observed ALPG-2 pass signal 131-B under power and running at a speed he thought was too fast for the train to stop short of the "stop and proceed" aspect being displayed by signal 133. The entire train passed him without a brake application or other evidence of slowing. By the time the caboose passed the maintainer, the head end of ALPG-2 had covered more than one-third of the distance to signal 133. The maintainer knew that APJ-2 had passed Royersford earlier and should still be occupying the block of signal 133. In addition, he was alarmed that ALPG-2 had not whistled for the Royersford crossings and he should have suspected that something was wrong on the train. Although he had a radio, he did not try to contact the train's crew.

The signal maintainer's failure to warn the crew of ALPG-2 may have been the result of a reluctance to tell the crewmembers how to operate the train. Had the maintainer succeeded in contacting the brakemen in ALPG-2's caboose, they may have been able to apply the train's brakes to either stop it before it collided with APJ-2 or to slow it sufficiently to lessen the collision speed.

Signal 133 displayed a "stop and proceed" aspect and could have been seen from the locomotive of ALPG-2 when it was 3,200 feet away. Moreover, the rear brakeman of APJ-2 had placed torpedoes on the rails beyond the signal. ALPG-2 did not respond to the signal, the torpedoes, the brakeman's hand signals to stop with a lighted fusee, or, finally, the flashing marker lights on APJ-2's caboose. The Safety Board believes that it is inconceivable that the engineer and conductor could have been in conscious control of their train without responding to any of these warning signals. In all probability, the train's speed was governed by the profile of the railroad and the resistance of the relatively heavy trailing tonnage.

The rear brakeman of APJ-2 was an older, experienced employee. He observed the aspects displayed by signals 131-B and 133. After APJ-2 stopped for signal L-60 at Phoenix, he walked a considerable distance west and placed torpedoes to protect the

train. While returning to the caboose, he observed the oncoming ALPG-2 and gave stop signals with a fusee. The rules did not require him to protect his train but he did this because he thought the curves at Cromby reduced sight distance to the point where flagging was justified. Although this action did not prevent the accident, it may have saved his life. Had he been seated at the bay window in the middle of his caboose, he might not have perceived the danger soon enough to escape.

ALPG-2's locomotive was equipped with a floor-mounted deadman pedal which could be sufficiently depressed by the weight of a man's foot or any object weighing 3 pounds or more. The locomotive was not equipped with an "alerter" or other device which would have required a periodic conscious response from the engineer or with Train Control which would have caused the brakes to apply if the engineer failed to respond to a restrictive signal indication.

This accident is the most recent in a series of train collisions demonstrating the inadequacies of placing absolute reliance on the ability of engineers to operate their trains in accordance with signal indications. In this instance, the failure to operate in compliance with properly-functioning signals was shared by the conductor. Uniquely, flagging protection was also provided but this proved no more effective than the signaling. The brakemen on the rear of ALPG-2 were probably reluctant to second guess their engineer and conductor. Such reluctance to interfere is as human as the failures which lead to accidents, all of which makes it imperative that locomotives be equipped with backup devices which are more sophisticated than "deadman" pedals that will stop trains when human failures occur. The Safety Board has repeatedly emphasized this need to the Federal Railroad Administration.

On March 14, 1973, as a result of its investigation of an accident at Herndon, Pennsylvania, 5/ the Safety Board recommended that:

"The Federal Railroad Administration, in cooperation with the Association of American Railroads, develop a fail-safe device to stop a train in the event that the engineer becomes incapacitated by sickness or death, or falls asleep. Regulations should be promulgated to require installation, use, and maintenance of such a device." (R-73-8)

This recommendation has been reiterated four times since 1973, following Safety Board investigations of train accidents at Indio, California, on March 20, 1974; 6/ Pettisville, Ohio, on September 10, 1976; 7/ Lewisville, Arkansas, on December 7, 1978; 8/ and Muncy, Pennsylvania, on August 2, 1979. 9/

5/ Railroad Accident Report - Head-on Collision of Two Penn Central Freight Trains, at Herndon, Pennsylvania, March 12, 1972 (NTSB-RAR-73-3).

6/ Railroad Accident Report - Rear-End Collision of Two Southern Pacific Transportation Company Freight Trains, Indio, California, June 25, 1973 (NTSB-RAR-74-1).

7/ Railroad Accident Report - Head-On Collision of Two Penn Central Transportation Company Freight Trains, Near Pettisville, Ohio, February 4, 1976 (NTSB-RAR-76-10).

8/ Railroad Accident Report - St. Louis Southwestern Railway Company Freight Train Derailment and Rupture of Vinyl Chloride Tank Car, Lewisville, Arkansas, March 29, 1978 (NTSB-RAR-78-8).

9/ Railroad Accident Report - Rear-End Collision of Two Consolidated Rail Corporation Freight Trains, Muncy, Pennsylvania, January 31, 1979 (NTSB-RAR-79-6).

On December 30, 1975, as a result of its investigation of a train collision at Meeker, Louisiana, 10/ the Safety Board made the following recommendation to FRA:

"Promulgate regulations to require an adequate backup system for mainline freight trains that will insure that a train is controlled as required by the signal system in the event that the engineer fails to do so." (R-76-3)

This recommendation was reiterated twice by the Safety Board, during 1979, following investigations of rear-end collisions at Muncy, Pennsylvania, 10/ and Ramsey, Wyoming. 11/

In response to Recommendation 73-8, FRA advised on July 6, 1973, that a study was being conducted by the Transportation Systems Center (TSC) which included evaluation of alerting devices then used by some railroads, as well as new designs of potential value, and that regulations would be considered on completion of the study. On May 13, 1977, FRA reported that it had received and was evaluating the TSC study and that it was in the process of procuring a research locomotive and train-handling evaluator to provide controlled test conditions for studying human-factor, safety-related issues. On March 28, 1979, FRA advised that acquisition of the locomotive and train-handling evaluator had been proposed, but that it would not be operational before 1982, and no regulations could be considered before that time.

In response to Recommendation 76-3, FRA advised that it considered improved training and testing of employees preferable to the adoption of mechanical "fail-safe" devices. No regulations were ever promulgated. FRA's present philosophy regarding mechanical safeguards may well be at the heart of its slow paced response to the 1973 recommendation.

FRA has promulgated regulations requiring the railroads to periodically instruct and test employees on operating rules and timetable instructions. However, it is the railroads' responsibility to decide when and how the instruction and testing are done. They are not specifically required to make fitness checks nor are there any requirements as to designation and qualification of those persons who test employees. Each railroad is free to decide how comprehensive its program of training and testing will be. As long as the railroad conforms to its program, it has fulfilled the intent of the FRA regulations.

Conrail had a program for training and testing employees in train service. All crewmembers involved in this accident had periodically received company physical examinations and had been examined on the operating rules within the previous 2 years. All crewmembers of train ALPG-2 had been promoted and should have been familiar with the operating rules. However, the Safety Board believes that a good knowledge of the rules in itself will not guarantee compliance without adequate supervision.

10/ Railroad Accident Report - Rear-End Collision of Two Texas and Pacific Railway Company Freight Trains, Meeker, Louisiana, May 30, 1975 (NTSB-RAR-75-9).

11/ Railroad Accident Report - Rear-End Collision of Two Union Pacific Freight Trains, Ramsey, Wyoming, March 29, 1979 (NTSB-RAR-79-9).

As with numerous recent train accidents investigated by the Safety Board, the crewmembers of ALPG-2 reported for duty at night, and there was no supervisor working at the reporting point at night. Similarly, it does not appear that Conrail supervisors ride with crews or board trains en route with any regularity. Crewmembers are not going to be concerned about their own fitness, much less the fitness of the men they work with, when there is little probability that they will encounter a supervisor where they report for work or on the job.

As long as mainline operations are conducted 24 hours a day, supervision of train crews should be provided on a 24-hour basis. No supervisory program of testing for rules compliance can be effective if it is conducted on a part-time basis. The crew of ALPG-2 had failed to stop the train short of a stop signal on their previous trip. This serious violation also occurred at night. The incident or resultant damage to the equipment was not reported. Apparently, division supervisors were not aware of that incident.

### CONCLUSIONS

#### Findings

1. The wayside block signals which governed the movement of train ALPG-2 functioned as intended.
2. The engineer and conductor of ALPG-2 failed to comply with restrictive aspects displayed by wayside signals 131-B and 133.
3. The rear brakeman of APJ-2 placed torpedoes and used a lighted fusee to protect the rear of his train.
4. The engineer and conductor of ALPG-2 failed to take action to stop the train after it had passed over the torpedoes and the location where they should have seen the rear brakeman and caboose of APJ-2.
5. The brakemen of ALPG-2 failed to observe the wayside signals, as required, which precluded their realizing that the engineer and conductor were not complying with the "approach" aspect displayed by signal 131-B.
6. The crew of ALPG-2 was afforded ample time for proper bed rest during the layover at Bethlehem.
7. The engineer was not rested and may not have been fit to operate the train.
8. The conductor of ALPG-2 rode the locomotive of his train, as required, but he would not allow his head brakeman to take his proper station on the locomotive.
9. The conductor was not qualified or authorized under the rules to operate the locomotive but was the only member of the crew known to have operated it on the night of the collision. He may have been so engaged at the time of the accident.



10. The floor-mounted deadman pedal of ALPG-2's locomotive unit was not an adequate safeguard if the engineer or conductor failed to respond to restrictive signals and other warnings of danger.
11. The conductor probably smoked a marijuana cigarette while en route from Allentown to the accident location. The concentration of the active constituent of marijuana and its metabolite in his system probably modified his behavior to the degree that he did not respond to danger warnings.
12. The crewmembers of ALPG-2 were not checked for fitness when they reported for duty or while they were en route to the accident location.
13. There was no supervisor on duty at Bethlehem enginehouse at night, and night time supervisory checks were rarely made at this location.
14. The crew of ALPG-2 had failed to stop their train short of a stop signal on their previous trip. The incident was not reported and division supervisors were not aware that it had occurred.

#### Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the conductor of train ALPG-2, who was operating the train without authority and under the influence of marijuana, to comply with a "stop and proceed" signal aspect located 3,600 feet from the collision site and to respond to flagging protection provided by the rear brakeman of train APJ-2 and stop the train. Contributing to the accident was the conductor's failure to perform his assigned duties by (1) ensuring that the head brakeman performed his duties in his assigned location in the locomotive; and (2) ensuring that the engineer was physically fit and capable of operating the train in conformity with all applicable rules and regulations. Also contributing was the absence of an adequate backup system to control the train in the event that the crew failed to do so.

#### RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board made the following recommendation to the Consolidated Rail Corporation:

"Provide adequate supervision of night train operations and include in supervisory efficiency checks, periodic checks of train crewmembers' fitness for duty at reporting points and on trains en route. (Class 'I, Priority Action) (R-80-5)"

In addition, the National Transportation Safety Board reiterates the following recommendation which was made to the Federal Railroad Administration on December 30, 1975, as a result of its investigation of a train collision at Meeker, Louisiana:

"Promulgate regulations which require an adequate backup system for mainline freight trains that will insure that a train is controlled as required by the signal system in the event that the engineer fails to do so. (R-76-3)"

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING  
Chairman

/s/ ELWOOD T. DRIVER  
Vice Chairman

/s/ FRANCIS H. McADAMS  
Member

/s/ G. H. PATRICK BURSLEY  
Member

PATRICIA GOLDMAN, Member, did not participate.

February 14, 1980



APPENDIX A  
INVESTIGATION

Investigation

The National Transportation Safety Board was notified of the accident at 7:05 a.m., on October 1, 1979. The Safety Board immediately dispatched an investigative team from Washington, D.C., to the scene. The investigation was completed with assistance from Federal Railroad Administration signal specialists and Conrail personnel.

APPENDIX B

TRAIN CREWMEMBER INFORMATION

ALPG-2

Conductor Anthony J. Dobin II

Conductor Anthony J. Dobin II, 28, was employed as a trainman by Penn Central on March 14, 1973, and was promoted to conductor by Conrail on May 21, 1976. On June 14, 1976, he qualified on the former Reading lines of Conrail. At the time of the accident, he was regularly assigned to pool freight service. Dobin passed a company physical examination on March 17, 1976, and he was last examined on the operating rules on November 23, 1977. There is no record of his having ever been examined on air brake rules. Dobin was not restricted in any way. Dobin's service record shows he was reprimanded on September 13, 1976, and was suspended for 2 days on December 14, 1977, for rules violations concerning derailments. On July 27, 1979, he was suspended for 30 days for failure to protect his assignment on 5 successive days. There is no record of his having been checked on compliance with rules.

Engineer Francis R. Thompson

Engineer Francis R. Thompson, 24, was employed as a passenger trainman by the Reading Company on August 20, 1974, and was furloughed on January 3, 1975. On February 10, 1975, he re-entered service as a shop laborer and was qualified as a hoister on multiple-unit passenger equipment by Conrail on January 19, 1977. Thompson's position was changed to fireman on April 11, 1977, and he was promoted to engineer on May 18, 1978, after completing Conrail's engineer training course at Wilmington, Delaware. He qualified as an engineer on the former Reading lines on July 26, 1978, and at the time of the accident, was regularly assigned to pool freight. Thompson passed a company physical examination on May 26, 1978, and was last examined on the operating rules and air brake rules on March 15, 1979, and February 16, 1979, respectively. He was not restricted in any way. Thompson was assessed a 30-day suspension for his failure to comply with a stop signal on August 13, 1979. He was last checked on his compliance with the operating rules on February 22, 1979.

Head Brakeman William J. Gillen

Brakeman William J. Gillen, 45, was employed as a brakeman by the Reading Company on February 15, 1956, and was promoted to conductor on February 26, 1974. At the time of the accident, he was regularly assigned to pool freight service. Gillen passed a company physical examination in 1978. He was last examined on the operating rules on May 10, 1979, and in the air brake rules on April 7, 1977. He was not restricted in any way. Gillen's service record shows three reprimands for: failure to properly secure a car in 1963, failure to protect his assignment in 1967, and leaving an assignment without permission in 1976.

Rear Brakeman Garth B. Shannon, Jr.

Brakeman Garth B. Shannon, Jr., 37, was employed as a brakeman by the Pennsylvania-Reading Seashore Lines on July 11, 1974, and was promoted to conductor on April 14, 1977. In 1976, he worked briefly as a passenger trainman on the former Reading

lines before returning to Conrail's Seashore District. At the time of the accident, he was filling a temporary vacancy on a regular Reading lines pool crew. Shannon passed a company physical examination in August 1978. He was last examined on the Reading lines operating rules on December 29, 1976, on the air brake rules on June 13, 1977, and on the Seashore District operating rules on September 27, 1979. He was not restricted in any way. Shannon's service record was free of discipline. He was last checked on his compliance with the rules on February 6, 1979.

APJ-2

Conductor Thomas J. Murphy

Conductor Thomas J. Murphy, 55, was employed by the Reading Company as a brakeman on January 23, 1957, and was promoted to conductor on August 9, 1960. He passed a company physical examination on February 23, 1978, and was last examined on the operating rules on December 13, 1978. At the time of the accident, he was regularly assigned to pool freight service.

Engineer William J. Griffiths

Engineer William J. Griffiths, 45, was employed by the Delaware, Lackawanna & Western Railroad as a fireman on July 2, 1960. He was promoted to engineer by the former Erie-Lackawanna Railroad on July 11, 1968. On September 22, 1977, he transferred to Conrail's Reading lines and was examined on the Reading rules on September 30, 1977. Griffiths passed a company physical examination on September 15, 1977. At the time of the accident, he was assigned to the extra board and was filling a temporary vacancy on a regular pool crew.

Head Brakeman William A. Miklos

Brakeman William A. Miklos, 51, was employed by the Reading Company as a brakeman on January 28, 1952, and was promoted to conductor on March 24, 1977. He passed a company physical examination on February 23, 1978, and was last examined on the operating rules on May 24, 1978. Miklos was regularly assigned to pool freight service.

Rear Brakeman George W. Haupt

Brakeman George W. Haupt, 55, was employed as a brakeman by the Reading Company on July 10, 1962, and was promoted to conductor on February 13, 1969. From 1953 to 1962, Haupt was employed as a brakeman on the Philadelphia, Bethlehem & New England Railroad. He was last examined on the operating rules on September 6, 1978. At the time of the accident, he was regularly assigned to pool freight service.

APPENDIX C

Excerpts from Conrail Reading Division Operating Rules

G. Being under the influence of alcoholic beverages or narcotics when reporting for duty, or their use or possession while on duty, is prohibited, and is sufficient cause for dismissal.

**Medium Speed.**—A speed not exceeding 35 miles per hour, unless otherwise restricted.

**Restricted Speed.**—Proceed prepared to stop short of a train, obstruction, or switch not properly lined, looking out for broken rail, not exceeding 15 miles per hour. Speed of train must not be increased until entire train has passed signal displaying a more favorable indication.

FUSEES AND TORPEDOES.

11. A train or engine finding a red fusee burning unattended on or near its track will proceed at restricted speed until the main track is seen or known to be clear by signal indication or otherwise.

Fusees must not be used on wooden bridges or structures liable to be damaged by fire.

The explosion of torpedoes is a warning signal to be on the alert for obstruction or train ahead. The explosion of one torpedo will indicate the same as two, but the use of two is required.

The explosion of torpedoes must be acknowledged as prescribed by Rule 14(g).

13. Any object waved violently by anyone on or near the track is a signal to stop.

14. ENGINE WHISTLE OR HORN SIGNALS.

Note: The signals prescribed are illustrated by "o" for short sounds; "—" for longer sounds. The sound of the whistle or horn should be distinct, with intensity and duration proportionate to the distance signal is to be conveyed.

Sound.	Indication.
(g) oo	Answer to any signal not otherwise provided for.

34. Employees located in the operating compartment of an engine must communicate to each other in an audible and clear manner the name or aspect of each signal affecting movement of their train or engine, as soon as the signal is clearly visible or audible. It is the responsibility of the engineer to have each employee comply with these requirements, including himself.

It is the engineer's responsibility to have each employee located in the operating compartment maintain a vigilant lookout for signals and conditions along the track which affect the movement of the engine or train.

If a crew member becomes aware that the engineer has become incapacitated or should the engineer fail to operate or control the engine or train in accordance with the signal indications or other conditions requiring speed to be reduced, other members of the crew must communicate with the crew member controlling the movement at once, and if he fails to properly control the speed of the train or engine, other members of the crew must take action necessary to ensure the safety of the train or engine, including operating the emergency valve.

Members of crew on rear of moving freight trains must, when possible, observe the aspect of signals which govern the movement of their train, to see that they change to their most restrictive indication after passage of the front portion of the train.

35. The following signals will be used by employees performing flagging duties:

Day signals—A red flag, or fusees, and torpedoes.

Night signals—A white light, torpedoes and fusees.

99. Unless otherwise provided, trains and engines must be given flag protection as follows:

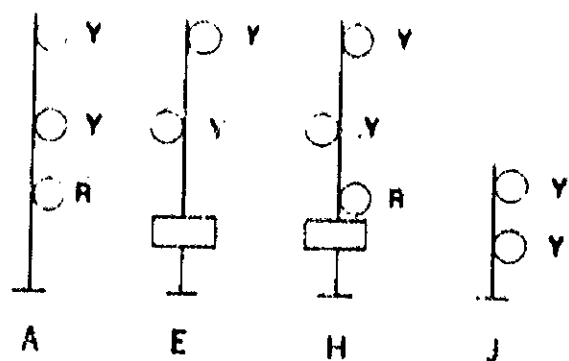
When stopped under circumstances whereby they may be overtaken by another train or engine on the same track, a member of the crew must go back immediately with flagging signals a sufficient distance to insure full protection. When conditions require he will display lighted fusees and when necessary, in addition, place two torpedoes.

Note: When trains or engines are operating under Automatic Block Signal, Traffic Control or Interlocking system rules, flag protection against following trains or engines on the same track is not required.

106. The conductor, engineer and pilot are responsible for the safety of the train and the observance of the rules, and, under conditions not provided for by the rules, must take every precaution for protection.

This does not relieve other employes of their responsibility under the rules.

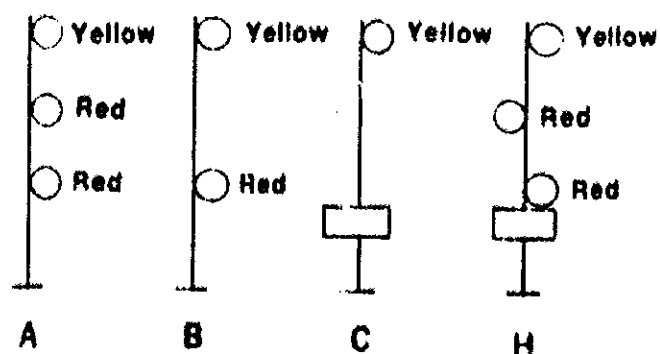
RULE 282A



Name Advance approach.

Indication. Proceed prepared to stop at second signal.

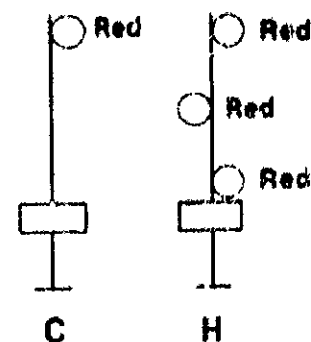
RULE 285



Name Approach.

Indication: Proceed prepared to stop at next signal. Train exceeding medium speed must at once reduce to that speed. If the next signal in advance is seen to indicate "Clear", normal speed may be resumed unless otherwise restricted.

RULE 291



Name: Stop and Proceed.

Indication Stop; then proceed at restricted speed

ENGINEERS.

1400. Engineers report to the trainmaster. They will comply with instructions of road foremen of engines pertaining to engine operation, and with instructions issued by the Chief Mechanical Officer on mechanical matters. They will comply with instructions of stationmasters, yardmasters and train dispatchers within their respective jurisdictions, and instructions of conductors in the general management of their train, consistent with the rules and safety.

In the absence of the conductor they will have charge of the train and must be governed by rules prescribed for conductors.

1401. Engineers will not leave their engines while on duty except when necessary in the discharge of their duties. When practicable, a competent person will be left in charge.

Engineers are responsible for the proper care and handling of the engine and must not permit unauthorized persons to move or run it. An employe who is promoted as an engineer may operate the engine under the supervision of the engineer who will assume full responsibility.

**CONDUCTORS AND TRAINMEN.**

**1450.** Conductors and trainmen report to the trainmaster. They will comply with instructions of stationmasters, yardmasters, train dispatchers and agents within their respective jurisdictions. Conductors must comply with instructions pertaining to conductors' duties issued by heads of departments. Trainmen must comply with the instructions of conductors.

**1477.** Conductors must see that the trainmen are ready for duty. They must have the proper waybills for the cars to be moved, and assist in making up their trains, when necessary. They must see that trainmen occupy their proper places on the train. They must see that cars are handled with care, using every effort to prevent loss or damage to lading. They must not permit unauthorized persons to enter the cars or to ride upon the train, and they must submit all records prescribed by current instructions.

**1481.** Conductors will see that subordinates are familiar with their duties, and instruct them in the performance of their work. They are responsible for the movement, safety and proper care of their trains, and for the vigilance and conduct of the men employed thereon. They must report any misconduct or neglect of duty to the trainmaster.

Except in local freight, road drill, traveling shifter, mine run and work train service, road freight conductors will normally ride the locomotive between points enroute.

**1482.** Trainmen on duty are under the direction of the conductor. They must assist in making up their trains, as required. They will provide themselves with, take care of, and properly display signals.

**1483.** In road service, when not engaged in duty elsewhere, they must occupy the post assigned them. The post of the rear trainman is normally on the last car. The post of the head trainman is normally in the cab of the lead unit. They must immediately protect the train, where the rules require it, without waiting for signal or instructions to do so.

APPENDIX D

Excerpts from Conrail Reading Division Timetable No. 1

**MAIN LINE**  
**Falls-Pottsville**

Falls to Pottsville is Westward

Grade	Distance from Philadelphia	Interlocking (Rules 645-672)	Train Order Office	Method of Operation	STATIONS	No. of Main Tracks	Location of Signals and Clearing Signal on 30 ft. Cars
	5.4	X		Automatic Block Signal System See Note	FALLS	2	E 102
	6.7				PENCOYD		
	7.9				WEST MANAYUNK	1	
	8.7	X			ROCK		
	9.8				GLADWYNE	2	
+0.05	12.0				WOODLANE		
+0.05	13.6				W. CONSHOHOCKEN	2	
+0.09	15.0				SWEDELAND		
+0.01	17.0				BRIDGEPORT	4	
+0.01	18.0	X	X		NORRIS		
+0.02	19.1				ABRAMS	3	
+0.10	20.5				NORTH ABRAMS		
+0.16	21.3				VALLEY FORGE PARK	4	
+0.16	24.0				PERKIOMEN		
+0.16	27.5	X			PHOENIX	1	
+0.01	27.7				PHOENIXVILLE		
+0.01	30.6				CROMBY	2	
+0.21	32.0				ROVERSFORD		
+0.22	34.4				LINFIELD	2	
+0.18	40.5				POTTSTOWN		
+0.18	40.8				COLEBROOKDALE JCT.	W126	
+0.18	42.2				STOWE		
+0.11	47.1				MONOCACY	2	
+0.08	48.0	X			MONA		
+0.08	49.5				BIRDSBORO	W217	
+0.08	49.5	X			BIRD (W&N Jct)		
+0.16	50.3	X		LORANI	2		
+0.16	52.3	X		KLAPPERTHAL JCT.			
+0.34	58.0	X		READING (FRANKLIN ST.)	2		
+0.03	58.1	X		WALNUT			
	58.6	X		OLLY	2		
	59.1	X	X	PIKE			

**EAST PENNSYLVANIA BRANCH**  
**Burn - Pike**

Burn to Pike is Westward

Grade	Distance from Reading	Interlocking (Rules 645-672)	Train Order Office	Method of Operation	STATIONS	No. of Main Tracks	Location of Signals and Clearing Signal on 30 ft. Cars
+0.84	35.4			Auto. Block Signals Rules 261-264	BURN	2	E & W 83
+0.81	31.7				EMMAUS JCT.		
+0.80	30.1				EMMAUS		
+0.58	26.6				MACUNGIE		
+0.71	24.0	X			ALBUKTI9		
+0.44	21.5				SHAMROCK		
+0.70	20.5				MERTZTOWN		
+0.56	19.7				HANCOCK		
+0.67	18.7				TOPTON		
+0.43	16.1				BOWERS		
+0.47	15.1				LYONS		
+0.84	11.3				FLEETWOOD		
+0.46	7.9	X			BLANDON		
+0.51	4.9	X			TEMPLE		
-1.00	1.9	X		HILL			
-1.10	1.1	X		PIKE			

NOTE: The following location is controlled from "R" Tower, Burn

**1. Maximum Speed of Trains On Main Tracks, Unless Otherwise Restricted.**

	Miles Per Hour			
	Pass. and Frgt. Train E&P	Symbol. and Fr. Extra Trains	Refr. Trains	All Trains
<b>Between Falls and Norris</b>				
Norris:				
Movements to and from No. 3 Track				25
Movements from No. 4 Track to Norristown Branch				25
Movements from No. 4 Track to No. 2 Track Main Line				35
Movements from No. 1 Track to No. 1 Track and movements from No. 2 Track to No. 2 Track				25
Movements to and from Seaboard yard				10
Other diverging routes				15
<b>Between Norris and Klappertal Jct.</b>	50	10	25	
No. 1 Track to Abrams and westward running track to a point 3350 feet west of Port Kennedy	35	35		10
No. 1 Track 3350 feet west of Port Kennedy and Phoenix	35	35		
No. 2 Track Phoenix and Norris	35	35		
<b>Valley Forge Park</b>				
Nos. 3 and 4 Tracks—on Curve between Pole 23/25 and Pole 24/05	55			
No. 2 Track between Perkiomen Station and Pole 25/35	40	40		15
<b>Phoenix</b>				
Between Phoenixville station and Pole 29/30	35	35	20	15
Other diverging routes				15
Between Pole 31/22 and Pole 32/22	40	40		
Between Pole 33/40 and Pole 35/05	50	45	20	
Between Pole 36/25 and Pole 35/35	55	45	20	
Between Pole 37/10 and Pole 37/45	55	45	20	
Between Pole 40/05 and Pole 43/45	40	40		
<b>Bird and W &amp; N Jct.</b>				
All diverging routes				15
No. 2 Track within interlocking limits	45	45		
Between Pole 55/01 and Klappertal Jct.	35	35	20	
Klappertal Jct.				
To and from Reading Belt Branch				25

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APPENDIX E

Excerpts from Title 49  
Code of Federal Regulations  
Ch. II - Federal Railroad Administration

**§ 217.9 Program of operational tests and inspections; recordkeeping.**

(a) Each railroad to which this part applies shall periodically conduct operational tests and inspections to determine the extent of compliance with its code of operating rules, timetables, and timetables special instructions in accordance with a program filed with the Federal Railroad Administrator.

(b) Before March 1, 1975, or 30 days before commencing operations, whichever is later, each railroad to which this part applies shall file with the Federal Railroad Administrator, Washington, D.C. 20590, three copies of a program for periodic conduct of the operational tests and inspections required by paragraph (a) of this section. The program shall—

(1) Provide for operational testing and inspection under the various operating conditions on the railroad;

(2) Describe each type of operational test and inspection adopted, including the means and procedures used to carry it out;

(3) State the purpose of each type of operational test and inspection;

(4) State, according to operating divisions where applicable, the frequency with which each type of operational test and inspection is conducted;

(5) Begin within 30 days after it is filed with the Federal Railroad Administrator; and

(6) Include a schedule for making the program fully operative within 210 days after it begins.

(c) Each amendment to a railroad's program for periodic conduct of operational tests and inspections required under paragraph (a) of this section shall be filed with the Federal Railroad Administrator within 30 days after it is issued.

(d) **Records.** Each railroad shall keep a record of the date and place of each operational test and inspection performed in accordance with its program. Each record must provide a brief description of the operational test or inspection, including the characteristics of the operation tested or inspected, and the results thereof. Records must be retained for one year and made available to representatives of the Federal Railroad Administration for inspection and copying during regular business hours.

**§ 217.11 Program of instruction on operating rules.**

(a) To ensure that each railroad employee whose activities are governed by the railroad's operating rules understands those rules, each railroad to which this part applies shall periodically instruct that employee on the meaning and application of the railroad's operating rules in accordance with a program filed with the Federal Railroad Administrator.

(b) Before March 1, 1975 or 30 days before commencing operations, whichever is later, each railroad shall file with the Federal Railroad Administrator, Washington, D.C. 20590, three copies of a program for the periodic instruction of its employees as required by paragraph (a) of this section. This program shall—

(1) Describe the means and procedures used for instruction of the various classes of affected employees;

(2) State the frequency of instruction and the basis for determining that frequency;

(3) Include a schedule for completing the initial instruction of employees who are already employed when the program begins;

(4) Begin within 30 days after it is filed with the Federal Railroad Administrator;

(5) Provide for initial instruction of each employee hired after the program begins.

(c) Each amendment to a railroad's program for the periodic instruction of its employees required under paragraph (a) of this section shall be filed with the Federal Railroad Administrator within 30 days after it is issued.