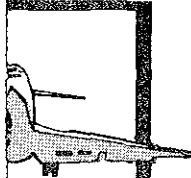
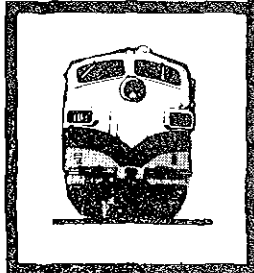


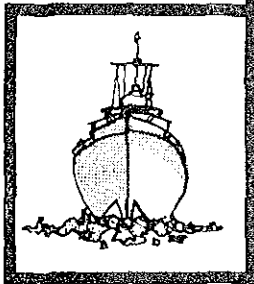
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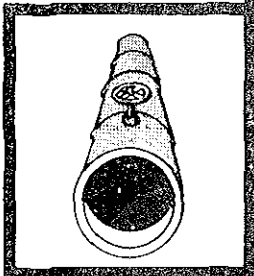


WASHINGTON, D.C. 20594



RAILROAD ACCIDENT REPORT

HEAD-ON COLLISION OF
BALTIMORE & OHIO FREIGHT TRAINS
EXTRA 6474 EAST AND EXTRA 4367 WEST
ORLEANS ROAD, WEST VIRGINIA
FEBRUARY 12, 1980



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16 Abstract About 5:55 a.m., on February 12, 1980, two freight trains operated by the Baltimore and Ohio Railroad Company collided head-on at Orleans Road, West Virginia. Extra 6474 East was on track No. 2 traveling at 38 miles per hour as it passed the stop-and-stay signal at Orleans Road and entered a compound curve to the right, where Extra 4367 West was approaching at a speed of 32 mph. The fireman of Extra 4367 West was killed and the engineer and head brakeman were injured; the engineer, conductor, and brakeman of Extra 6474 East were injured. Property damage was estimated to be \$1,688,200. The National Transportation Safety Board determines that the probable cause of this accident was the failure of the conductor of Extra 6474 East to see that the train was operated in accordance with the operating rules and the failure of the engineer and head brakeman to control the train as required by the signal at Orleans Road. Contributing to the accident was the absence of an adequate safety control device on the locomotive.					
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**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594**

RAILROAD ACCIDENT REPORT

Adopted: September 16, 1980

**HEAD-ON COLLISION OF BALTIMORE AND
OHIO RAILROAD COMPANY FREIGHT TRAINS,
EXTRA 6474 EAST AND EXTRA 4367 WEST,
ORLEANS ROAD, WEST VIRGINIA
FEBRUARY 12, 1980**

SYNOPSIS

About 5:55 a.m., on February 12, 1980, two freight trains operated by the Baltimore and Ohio Railroad Company collided head-on at Orleans Road, West Virginia. Extra 6474 East was on track No. 2 traveling at 38 miles per hour as it passed the stop-and-stay signal at Orleans Road and entered a compound curve to the right, where Extra 4367 West was approaching at a speed of 32 mph. The fireman of Extra 4367 West was killed and the engineer and head brakeman were injured; the engineer, conductor, and brakeman of Extra 6474 East were injured. Property damage was estimated to be \$1,688,200.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the conductor of Extra 6474 East to see that the train was operated in accordance with the operating rules and the failure of the engineer and head brakeman to control the train as required by the signal at Orleans Road. Contributing to the accident was the absence of an adequate safety control device on the locomotive.

INVESTIGATION

The Accident

At 2:20 a.m., February 12, 1980, Baltimore and Ohio Railroad Company (B&O) Extra 6474 East was assembled at Cumberland, Maryland. The train consisted of 2 locomotive units, 111 cars, and a caboose. An initial terminal-type inspection and brake test were performed by car department personnel and no exceptions were taken to the train's condition. The train departed Cumberland on No. 2 track at 4:55 a.m. for Hagerstown, Maryland. The engineer was in the lead locomotive unit on the south side; the brakeman was in the lead locomotive unit on the north side; the conductor was in the second unit on the north side, and the flagman was in the caboose. The flagman informed the engineer by radio when the rear of the train had left the yard, and the engineer acknowledged the transmission. The first scheduled stop was to be Hancock, West Virginia.

Between Patterson Creek and Green Spring, West Virginia, about 8 miles east of Cumberland, Extra 6474 East passed several trains westbound on track No. 1. The flagman informed the engineer by radio that all was well with the train when the rear of the train passed the Patterson Creek crossovers and the westbound trains. The flagman again informed the engineer that all was well when the rear of the train passed the Okonoko, West Virginia, crossovers, about 20 miles from Cumberland. The flagman said that the engineer always acknowledged his reports, but that none of the crewmembers in the locomotive ever informed him when they were approaching the crossover locations. He also did not know where the conductor was riding, and he did not communicate with the conductor during the trip. (See table on figure 3 for the locations of the towns.)

At Doe Gully, West Virginia, the approach signal for a home signal, 2.27 miles ahead at the Orleans Road crossovers, displayed an "approach" aspect. The engineer first called the approach aspect, and the head brakeman acknowledged by repeating "approach." Neither informed the conductor or flagman of the signal indication. The head brakeman said that he could not see the speedometers and did not know how fast the train was moving as it passed the approach signal. He also stated that the locomotive cab windows were closed, that the heater was on, and that it is possible he may have fallen asleep after passing the approach signal. He could not remember if the train brakes were ever applied to slow the train for the home signal at Orleans Road, or if the whistle was ever blown for the Orleans Road grade crossing. He said he was not aware of the indication of the home signal. The engineer has been unable to recall what occurred during the trip because of the injuries he sustained in the collision, resulting in amnesia.

The conductor stated that he did not see the approach signal indication at Doe Gully because at that point he was in the lavatory in the second locomotive unit. He said he returned to his seat in the second unit as the train was going through the Orleans Road crossover switches. He said he did not see the home signal. Upon taking his seat, he looked to see if the train was being crossed over to the No. 1 track, which is sometimes done at that location. When he saw that it was not, he moved to the north side of the cab facing rearward to inspect the rear of the train. The conductor did not remember the brakes being applied, the whistle being blown for Orleans Road crossing, or any radio communications.

About 4 a.m., February 12, B&O Extra 4367 West arrived at Brunswick, Maryland, en route to Chicago, Illinois. The arriving crewmembers reported no problems with the train. The relieving crew performed an airbrake test and inspection and found no defective conditions. The train departed at 4:21 a.m. with 2 locomotive units, 42 flat cars with trailers, and a caboose. The engineer, fireman, and head brakeman were in the lead locomotive unit, and the conductor and flagman were in the caboose. At Miller, West Virginia, about 33 miles west of Brunswick, Extra 4367 West was crossed over from the No. 1 to the No. 2 track, to clear track No. 1 for eastbound Amtrak passenger train No. 32. Stop signals had been displayed on track No. 2 at Orleans Road for both freight trains so that after the Amtrak train passed, Extra 4367 West could be crossed back to track No. 1 at Orleans Road to proceed westward. After passing Hancock at 5:35 a.m., the fireman relieved the engineer and took over the operation of Extra 4367 West, and the engineer moved to the fireman's seat on the left side of the cab behind the head brakeman.

The approach signal for the westbound home signal at the Orleans Road crossovers, located 2.0 miles east of the Orleans Road home signal, displayed an "approach" aspect. The head brakeman called this signal for the fireman and informed the conductor by radio of the approach signal, in compliance with the conductor's orders that the crewmembers inform one another of all signal aspects. The fireman applied the brakes to slow the train from about 45 mph to the required medium speed of 25 mph. When the train was 4,506 ft east of Orleans Road, it entered a 0.55-percent ascending grade on a 2° 45', 4° 15', 3° 45', 2° 52' compound curve to the left which ended at the Orleans Road crossover switches. The engineer said that as the train entered the curve, he, the fireman, and the brakeman, noticed the reflection of an approaching train's headlight on the rails. They assumed it was the eastbound Amtrak passenger approaching on the No. 1 track, and the fireman dimmed the headlight. The head brakeman said that within seconds he realized the approaching train was not on track No. 1 but was on his track and about 300 ft away. He immediately stood up in an attempt to escape before the trains collided. (See figure 1.) The engineer said he wondered why the head brakeman stood up, and he looked at the fireman and saw her cover her head as the train collided with oncoming Extra 6474 East. The engineer and head brakeman said they did not have time to evacuate their positions, and that the fireman did not have time to escape, to sound the whistle, or to apply the brakes in emergency before the collision. Immediately after the collision, the engineer again looked toward the right side of the cab, but that side had been torn away and the fireman was missing; she was later found dead in the wreckage. The engineer and head brakeman were seriously injured.

Unaware of the collision, the conductor of Extra No. 4367 West was not successful in radioing the crewmembers in the locomotive to determine why the train had stopped. He then walked toward the locomotive while having sent the flagman 1/2 mile east to protect the rear of the train. Meanwhile, the head brakeman found his portable radio and heard the Amtrak conductor on the radio ask if there had been a collision at Orleans Road; he replied that there had been. The engineer of Amtrak No. 32 heard the radio transmission while his train was several miles west of Doe Gully. The engineer stopped the passenger train at the eastbound signal at Orleans Road, which displayed a "stop" aspect due to the accident, and then moved the train, at less than 10 mph, close to the accident area so that his crewmembers could aid the injured.

The conductor of Extra 6474 East said that his first knowledge of the accident was when he felt the second locomotive unit derail. He immediately went to his lead unit and saw the head brakeman on the cab floor and the engineer lying on the outside walkway bleeding from his head. He then yelled to the crewmembers of No. 4367 and asked if they had any first aid experience. He then tried to stop the engineer's bleeding and kept him from falling off the walkway. He remained with the injured engineer until emergency personnel arrived about an hour later.

The flagman of No. 6474 radioed the crewmembers in his locomotive to determine why the train had stopped. He said that his conductor answered and told him that there had been a head-on collision and asked him to get emergency help.

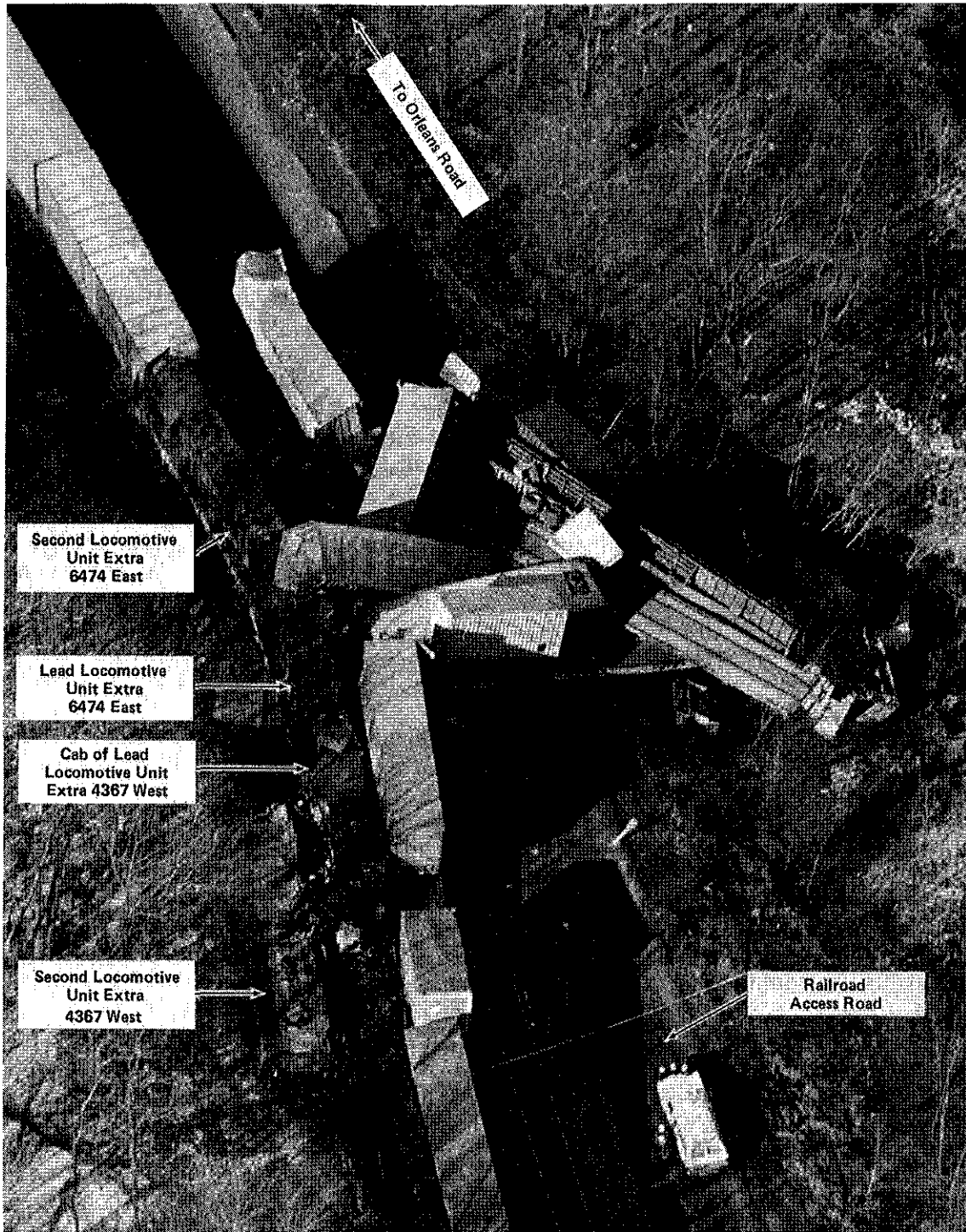


Figure 1.--Head-on collision of locomotives Extra 6474 East (top) and Extra 4367 West (bottom).

Since he knew the operator at Patterson Creek did not have a radio, the flagman immediately ran east from the caboose to use the B&O company telephone at Orleans Road. However, the telephone was not operable, so he ran to a nearby residence and used the telephone to notify emergency personnel and the B&O operator at Hancock Tower; the time was about 5:55 a.m.

The weather at Orleans Road was dark and cloudy with haze. The temperature was about 30° F and visibility was good.

Injuries to Persons

<u>Injuries</u>	<u>Crewmembers</u>		<u>Total</u>
	<u>Extra 6474 East</u>	<u>Extra 4367 West</u>	
Fatal	0	1	1
Nonfatal	3	2	5
None	<u>1</u>	<u>2</u>	<u>3</u>
Totals	4	5	9

Damage

Both locomotive units of Extra 6474 East were derailed but remained upright and parallel to the track after impact. The first through the fifth cars were derailed and upright parallel to and within the track structure. Both ends of each of these cars were crushed by the impact of the collision. The sixth through the eighth cars did not derail, and only the west end of the ninth car was derailed. The 10th through the 14th cars derailed and stopped in various positions on the track.

The lead locomotive unit of Extra 4367 West remained upright, and the second unit was overturned on the south side of the No. 2 track by the collision. The first through the third cars derailed and were on the bank on the north side of the No. 1 track. The fourth car derailed perpendicular to and across the No. 1 track and access road. The fifth car was on top of a walkway on the north side of the lead locomotive unit No. 4367 and was blocking the No. 1 track. The fifth car demolished the engineer's side of the locomotive cab. The sixth car derailed within the No. 2 track, and the seventh car had only its west end derailed. (See figure 2.)

Costs of damages were estimated as follows:

Locomotives	\$1,200,000
Cars and trailers	378,550
Track	10,000
Removal of wreckage	<u>79,650</u>
Total	\$1,668,200

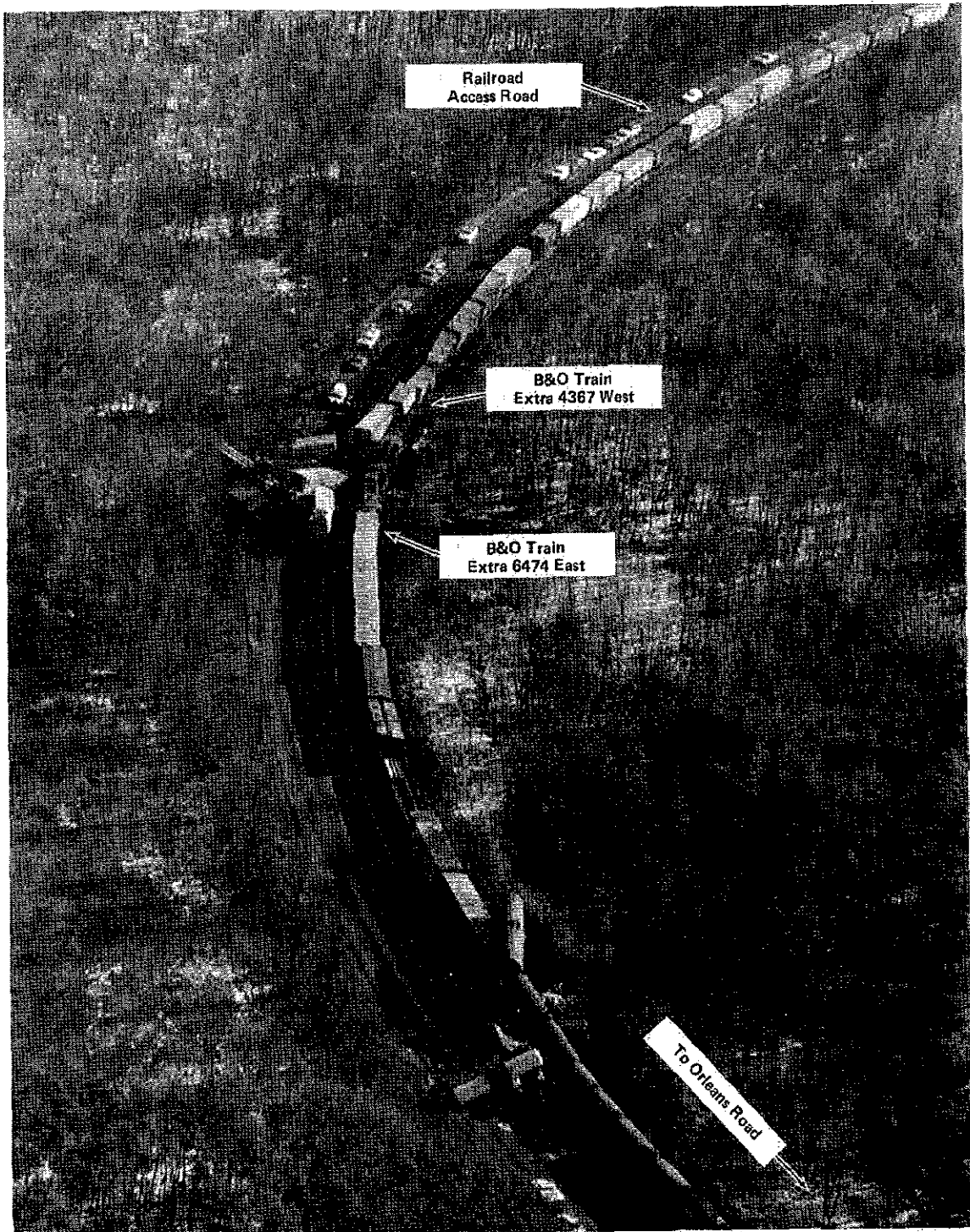


Figure 2.--Derailed cars of trains Extra 7467 West (top) and Extra 6474 East (bottom).

Crewmember Information

Extra 6474 East

The engineer, aged 61, lived in Hagerstown and was assigned to the Hagerstown work roster. He was called to report for work at Hagerstown on February 11, 1980, at 7:15 p.m., having been off duty the previous 28 hours. He was then driven in a taxicab to Cumberland for assignment. While resting at Cumberland, he was called to report to work at 2:20 a.m., February 12, as engineer for Extra 6474 East. The hotel clerk/cashier, who saw the engineer often, stated that he had breakfast about 1:00 a.m. and, when paying his bill, commented to her that he had not been feeling well the past couple of days. He appeared all right to her, but she thought he was not as talkative as usual. The conductor, who had previously worked with the engineer, talked briefly with him before boarding the train and did not notice anything unusual or abnormal in his manner or appearance. No supervising official was on scene to evaluate his appearance or physical condition. His last physical examination, in November 1979, indicated that he was fit for duty.

The head brakeman, aged 25, was first employed by the B&O track department for about a year before becoming a brakeman on April 28, 1979. He had received 3 days of classroom training and about 5 days of on-the-job training in the Cumberland yard before making a "student trip" with a regularly assigned crew. At the time of the accident, he was living in Keyser, West Virginia. He had been off work for about 2 days when called at 1:30 a.m., February 12, to report for work at 2:20 a.m. However, he had only obtained 1 hour of actual bed rest immediately before the call, because he had not gone to bed until after midnight. It then took him about 1/2 hour to drive to Cumberland, arriving at 2:20 a.m., just in time for the conductor to tell him to board the locomotive as head brakeman. He had not worked with the other crewmembers before, and he had not discussed with them the fact that he had only worked for the B&O about 10 months. He also did not tell them that he was feeling tired. His last examination on the operating rules was in April 1979 when he first became a brakeman and was not yet familiar with all signal indications and aspects, operating rule No. 34, or radio rule No. 54. His last physical examination indicated that he was in good health and fit for duty.

The conductor, aged 52, was hired as a brakeman on the B&O in September 1950, and was promoted to conductor in 1970. At the time of the accident, he lived in Lavale, Maryland. He had been off duty about 10 hours when called about 1:20 a.m., February 12, to report for work at Cumberland at 2:20 a.m. His last physical examination, in October 1979, indicated he was in good health and fit for duty.

The flagman, aged 50, was hired by the B&O track department in 1945. He became a brakeman in 1955 and was promoted to conductor in 1972. He had been off work about 10 hours when called about 1:30 a.m., February 12.

Extra 4367 West

The engineer, aged 27, had been off duty about 28 hours and had obtained about 6 hours of bed rest immediately before being called about 2:30 a.m., February 12, to report to work in Brunswick at 4:00 a.m.

The fireman, aged 25, had been off duty about 28 hours before being called about 2:30 a.m., February 12, to report to work in Brunswick at 4:00 a.m.

The brakeman, aged 38, had been off duty about 28 hours and had obtained about 12 hours of bed rest just before being called about 2:30 a.m., February 12, to report to work in Brunswick at 4:00 a.m.

The conductor, aged 53, had been off duty about 28 hours when called at home about 2:30 a.m., February 12, to report to work in Brunswick at 4:00 a.m.

The flagman, aged 27, had been off duty about 16 hours, and had obtained about 6 hours of bed rest just before being called at home about 2:30 a.m., February 12, to report to work in Brunswick at 4:00 a.m.

Track Information

The railroad in the Orleans Road area follows the meandering course of the Potomac River through the Appalachian Mountains. It is an east and west two-track system constructed at the foot of the mountains along the south bank of the river. The north track is designated as No. 1. The track approaching Orleans Road from the west is, in succession, a 4° curve to the right for 2,111 ft; a tangent for 1,984 ft; and a 2°10', 4°00', 1°00' compound curve to the left, 5,894 ft long, which ends at the road crossing at Orleans Road. Two sets of crossover switches are constructed in the following 1,482 ft of tangent track. The compound curve to the right in which the collision occurred is comprised of a 2°52' curve, 1,565 ft long; a 3°45' curve, 986 ft long; and a 4°15' curve, 822 ft long. This 4°15' curve includes the point of collision and continues 321 ft from the point of collision to a 2°45' curve, which is 790 ft long. A 2,180-ft tangent continues east from the curve to a 3,163-ft compound curve to the left. (See figure 3.) The track from Doe Gully is on an average 0.30-percent descending grade to the road crossing at Orleans Road. The track continues east on a 0.42-, 0.20-, and 0.55-percent descending grade to the point of collision. It then continues on an average 0.50-percent descending grade.

Train Information

Extra 6474 East consisted of 76 loaded cars and 35 empty cars with a trailing weight of 8,023 tons; it was about 6,200 ft long. The locomotive and caboose were equipped with operable radios. The lead locomotive was being operated with its long hood forward and had the engineer's controls on the right side. The two units of the locomotive were type GP-9, built by the Electro-Motive Division of General Motors Corporation. Each locomotive unit weighed about 256,000 lbs and was equipped with a 24-RL-type airbrake system. The leading locomotive unit was

CUMBERLAND SUBDIVISION
Westward Stations

Distance	Station	Distance	Station
5.7	Brunswick	67.2	Paw Paw
	5.7		2.8
0.0	Harpers Ferry Interlocking	70.0	Little Cacapon
	0.3		1.2
0.3	Harpers Ferry	71.2	Okonoko
	18.3		5.9
18.6	Martinsburg	77.1	Green Spring
	14.5		6.6
33.1	Miller	83.7	Patterson Creek
	8.6		
41.7	Hancock	86.6	Mexico
	0.1		2.2
41.8	HO Tower	88.8	West Hump
	14.3		1.5
56.1	Turkey Foot	90.3	Virginia Ave.
	2.0		1.1
58.1	Orleans Road	91.4	Cumberland
	2.3		
60.4	Doe Gully		
	6.8		

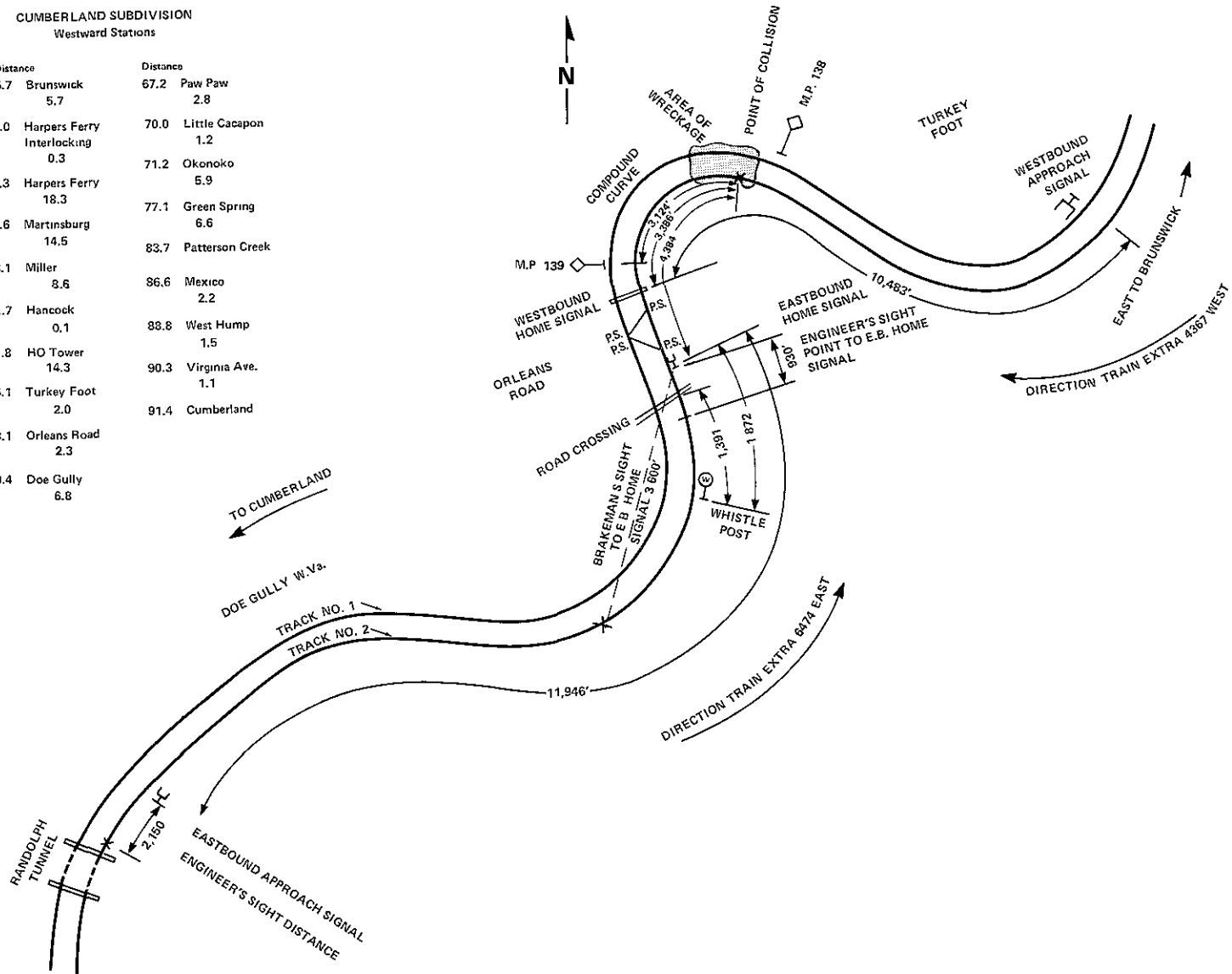


Figure 3.--Sketch of accident area.

provided with a speed indicator, speed recorder, dual brightness headlight, and air horn. It was equipped with a deadman safety control device, but it had been disconnected in compliance with instructions from the B&O management that this type of safety control should be disconnected on all freight locomotives.

Extra 4367 West had 42 flat cars loaded with truck trailers for a trailing weight of 3,430 tons; it was about 3,700 ft long. The locomotive and caboose were equipped with operable radios. The lead locomotive was being operated with its short, low hood forward and had the engineer's controls on the right side.

The two locomotive units were type GP-40-2 built by Electro-Motive Division of GM. Each locomotive unit weighed about 300,000 lbs and was equipped with a 26-L-type airbrake system. The leading locomotive unit was provided with a speed indicator, speed recorder, dual brightness headlight, air horn, and electronic alertness safety control device.

Method of Operation

Trains are operated through the accident area by signal indications of a traffic control system (TCS). The home signals for eastbound and westbound trains approaching Orleans Road and the crossover switches are remotely controlled by an operator at Patterson Creek. The operator receives instructions from the dispatcher at Cumberland. There are no radio facilities at Patterson Creek, so the operator cannot contact crewmembers on trains, except by telephone at crossover locations.

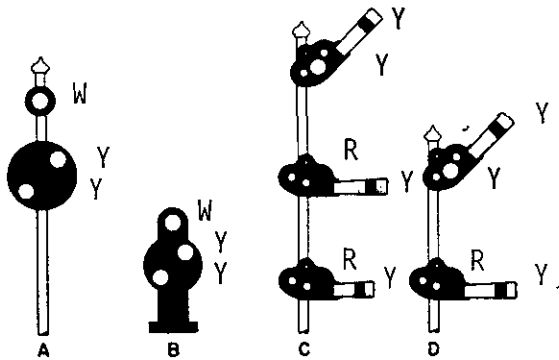
To control the movement of trains Extra 4367 West and Extra 6474 East as they both approached Orleans Road on the No. 2 track, the operator caused the home signals immediately east and west of the crossover switches to display "stop" aspects. The approach signals, located about 2 miles east and west of Orleans Road, automatically displayed "approach" aspects, which required trains to proceed at or below medium speed prepared to stop at the next signal. (See figure 4.) Medium speed is defined as one-half the maximum authorized speed, but not more than 30 mph. Maximum authorized speed in the area of Orleans Road is 50 mph.

Operating rule No. 34 requires the head brakeman and engineer to observe the indication of each signal affecting movement of their train and to inform each other and other crewmembers of the indications. Should the engineer fail to comply with the signal indication, the head brakeman must remind him and, if necessary, take action to insure the safety of the train. Rule No. 509 requires that a train be stopped before any portion of the train passes a signal displaying "stop." Rule No. 106 requires the conductor and engineer to see that the members of their crew are familiar with their duties and to instruct them when necessary. Radio rule No. 54 requires crewmembers in the locomotive to inform crewmembers in the caboose of the condition of their train at frequent intervals, but not more often than once every 15 minutes. Bulletin No. 1 requires crewmembers in the locomotive to converse via radio with crewmembers in the caboose before passing over main track crossovers or interlockings. (See appendix C.)

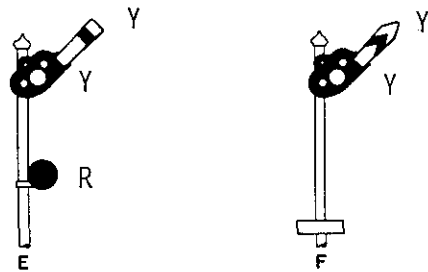
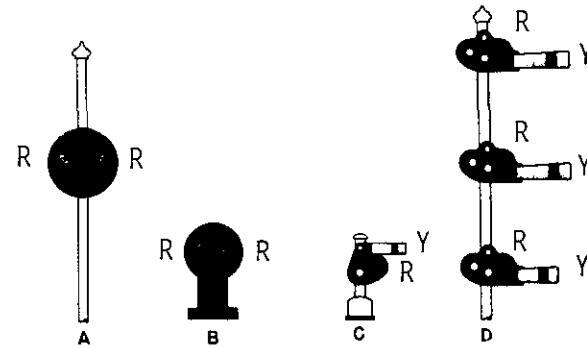
Excerpts from Chessie System Operating Rules (Effective April 12, 1969).

W - White color light
 Y - Yellow color light or staff
 R - Red color light

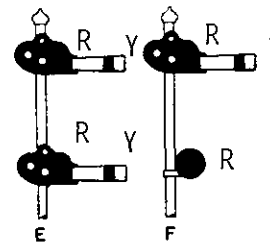
Rule B-285.



Rule B-292.



NAME—APPROACH
 INDICATION—PROCEED PREPARED TO STOP AT NEXT
 SIGNAL. TRAIN OR ENGINE EXCEEDING MEDIUM
 SPEED WHEN INDICATION IS SEEN MUST TAKE
 ACTION AT ONCE TO REDUCE TO MEDIUM SPEED OR
 SLOWER IF NECESSARY.



NAME—STOP
 INDICATION—STOP

Figure 4.--Signal aspects.

The B&O requires its officials to judge the condition of train crewmembers when they report to work only on an informal basis. The officials are required to perform on-the-job evaluations of crewmembers at least once every 6 months. Crewmembers are requalified on the operating rules in a discussion-type format once every 2 years. They also are required to have a physical examination once every 2 years. New train service employees are given 3 days of classroom training and about 5 days of on-the-job training in a classification yard. They then make one roundtrip with a road crew as a "student" before being assigned as a regular crewmember. They do not receive any scheduled followup training or evaluation as a new employee.

Medical and Pathological Information

The engineer of Extra 6474 East sustained a fractured skull, a concussion, and fractured mandible. There was also evidence of brain damage with complete amnesia. Two other crewmembers sustained contusions, abrasions, and muscle soreness.

The fireman of Extra 4367 West died from massive and multiple crushing injuries. The engineer and the brakeman sustained contusions and several fractures, sprains, and lacerations.

Survival Aspects

The collision occurred so quickly after the crewmembers of Extra 4367 West first saw Extra 6474 East approaching that they did not have time to evacuate the locomotive cab. As the second unit overturned to the south of the track and the following cars continued forward along the north side of the lead unit, the engineer's side of the cab was demolished and the fireman was killed as a result. The engineer and head brakeman were able to get out on the south side of the cab.

The two crewmembers in the lead locomotive of Extra 6474 East survived the collision without evacuating the cab; however, the engineer was injured severely. Neither leading locomotive unit overrode the other, and the cab of unit No. 6474 was not extensively damaged. The engineer was found lying on the walkway behind his seat location and his cab door was open. The head brakeman was thrown to the floor of the cab but was able to get out of the cab after the collision.

Emergency units from Hancock arrived at the scene about 6:36 a.m. Access to the scene was limited to the railroad roadway adjacent to the north side of the tracks. Upon arrival, emergency personnel found the less critically injured crewmembers walking around in a state of shock. About 7:30 a.m., the critically injured engineer was transported by helicopter to the county hospital at Hagerstown. Emergency personnel remained at the scene until about 7:30 p.m. during removal of empty tank cars; no fires resulted from the accident.

Tests and Research

Inspection of the lead locomotive unit of Extra 6474 East immediately after the accident disclosed that the throttle was in the No. 3 position, the transition lever was in the forward position, the independent brakes were released, the automatic brake valve was between service and emergency, the headlight was on bright, and the deadman's safety pedal was disconnected and inoperative. Inspection of the lead locomotive unit of Extra 4367 West disclosed that the throttle was in the off position, the independent brakes were applied, the automatic brake was in the service position, and the headlight was on dim.

Postaccident inspection of the damaged cars and locomotive equipment did not disclose any conditions which would have contributed to or caused the brakes on either train to malfunction. The speed recorders on the lead locomotive units of both trains were calibrated and found to be accurate.

Examination of the speed recorder tape from train Extra 6474 East indicated that the engineer had properly controlled the speed of the train before approaching the approach signal for Orleans. The speed of the train in the 1-mile before the approach signal was 28 mph. The tape further indicated that, after passing the signal, the speed of the train gradually increased to 38 mph as the train passed the home signal at Orleans Road. After Orleans Road, the speed of the train immediately began to decrease to 25 mph at the point of collision.

Examination of the speed recorder tape from train Extra 4367 West indicated that the speed of the train had been properly controlled from Brunswick to the point of collision. About 1 mile before the approach signal, the fireman started to reduce the train's speed from 50 mph, and it was 44 mph at the approach signal. The speed of the train then continued to be reduced and was 32 mph at the point of collision. (See appendix D.)

Train-handling and sight-distance tests were conducted using a test train of the approximate tonnage and similar locomotive-unit arrangement as that of Extra 6474 East. The eastbound approach signal could be seen from the engineer's side of the locomotive about 2,150 ft west of the signal. From the head brakeman's side of the locomotive, the home signal at Orleans Road could be seen continuously from about 3,600 ft before the signal; from the engineer's side, the home signal could be seen from about 930 ft in front of the signal. In order to duplicate the speed of Extra 6474 East approaching Orleans Road, it was necessary to keep the throttle continuously in the No. 8, full-power, position. A full-service application of the automatic brakes made on the test train moving at a speed of 38 mph after crossing the switches at Orleans Road stopped the train about 500 ft short of the point of collision.

Postaccident inspections and tests of the signal system indicated that the signals were operating properly immediately before the collision.

ANALYSIS

The Accident

Since the approach signal required the engineer of Extra 6474 East to take action to reduce the speed of the train to 25 mph in preparation to stop at Orleans Road and since the speed of the train actually increased to 38 mph by the time it had reached Orleans Road, the engineer must have taken no action to control the train after calling the signal's approach aspect to the head brakeman. The fact that the conductor did not hear the whistle blown for the Orleans Road crossing indicates that the engineer was not attentive to his duties. The warm cab environment could have been conducive to causing the engineer to doze off.

Since the speed tape from Extra 6474 East indicated an immediate reduction in train speed from 38 mph after passing Orleans Road to 25 mph at the point of collision and since the automatic brake handle was found in a full-service application, the Safety Board concludes that the engineer became aware of the need to apply the brakes after passing over the switches at Orleans Road. However, he had passed the stop signal. The engineer may have become responsive because of the jostling of the locomotive as it went through the switches. Also, since the engineer did not see the stop signal at Orleans Road, he may have assumed that the No. 2 track beyond Orleans Road was clear. This possibility could explain (1) why the engineer did not use the radio to alert any trains ahead on track No. 2, (2) why he did not blow the whistle, and (3) why he did not immediately make an emergency application of the trains brakes. Consequently, Extra 6474 East continued to move around the curve to a point where the engineer could see the pending collision which prompted him to run from the cab.

Extra 4367 West was operated in compliance with B&O operating rules from Brunswick to the point of collision at Orleans Road. When the head brakeman called the signal aspects for the engineer and fireman and then informed the conductor in the caboose of those signal aspects, he was enabling the conductor to monitor the alertness of the crewmembers in the locomotive. This method of communicating signal aspects, imposed by the conductor on the head brakeman, is a way by which the conductor asserts his authority for management of the train. Had the conductor of Extra 6474 East imposed this requirement on the head brakeman in order to keep himself informed about wayside signals, the head brakeman may have been more conscientious and may not have dozed off between Doe Gully and Orleans Road.

In the warm and closed cab environment, the front brakeman had no physical activity to perform to help him stay alert. His major duty was to assist the engineer to see that the train was handled safely. Usually, the front brakeman is junior to the engineer both in age and experience and is always junior in rank. It is not unusual for a front brakeman to be reluctant to interject himself in the operation of the train, or even to question the engineer except as a last resort. Therefore, a requirement for the communication of signal aspects would have provided a way for the conductor to exert his authority as well as keeping the conductor and other crewmembers in the caboose alert to the need to stop their

train at the eastbound home signal at Orleans Road. Operating rule No. 34 and radio rule No. 54 require communications between the crewmembers on the locomotive and caboose. These rules were not observed by the crew of Extra 6474 East. B&O supervisors should strictly enforce them so that crewmembers on all trains follow the requirements.

As a result of its investigation of an accident at Pettisville, Ohio, 1/ on February 4, 1976, the Safety Board recommended that the Federal Railroad Administration (FRA):

"Promulgate rules to require engine crews to communicate fixed signal aspects to conductors while trains are en route on signalized track. (R-76-50)"

The FRA replied that,

"Historically the exchange of signals between train and engine crews and wayside employees has been common practice in the railroad industry. It still is. However, to transform a common practice into a meaningful regulation, FRA must be able to monitor compliance with the provisions of the regulation. The obvious difficulties which would be encountered by FRA inspectors in conducting unannounced observations render ineffective a regulation requiring the exchange of hand signals. Therefore, FRA believes this is an inappropriate area for Federal regulation. We are, however, recommending that the Association of American Railroads (AAR) amend the Standard Code of Operating Rules to include a provision for the exchange of signals between train and engine crews and/or wayside employees."

The AAR Operating Rules Committee, however, does not consider the recommended rule to be feasible, primarily because high train speeds combined with conditions of limited visibility would render such a rule ineffective or impossible for crews to comply with. The Safety Board is holding the recommendation in an "open acceptable alternate action" status, pending results of an FRA analysis to determine what minimum testing and training programs should be required of railroad employees by Federal regulation.

Safety Controls on Locomotives

The locomotive units of Extra 6474 East had been equipped with a safety control device which required a floor pedal to be depressed while the unit was being operated. Release of the pedal resulted in the actuation of a warning whistle and, if the engineer did not take corrective action within a specified time, the

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

brakes of the train would be applied; however, the device on this locomotive had been previously disconnected. The B&O is now equipping recently purchased locomotive units with the alerter-type safety device, which requires the engineer to touch metal about every 40 seconds. However, the B&O has not replaced the pedal-type device on older locomotive units with the newer alerter-type safety device. An alerter-type safety device on Extra 6474 East would probably have kept the engineer responsive, even if he was extremely fatigued, and the collision could have been averted.

As a result of its investigation of an accident at Herndon, Pennsylvania, on March 12, 1972, 2/ the Safety Board recommended that the FRA:

"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 installations, use, and maintenance of such a device. (R-73-8)

"Include in its present investigation of the safety of locomotive-control compartments a study of environmental conditions that could distract crews from their duties or cause them to fall asleep at the controls. Regulations should be promulgated to correct any undesirable conditions disclosed. (R-73-9)"

The FRA replied that it would study these problems on locomotives at the Pueblo Transportation Test Center and hoped to complete the study by 1976. These recommendations were also reiterated by the Safety Board after investigation of the collision at Pettisville, Ohio, on February 4, 1976, and after investigation of the collision at Muncy, Pennsylvania, on January 31, 1979. 3/ The Safety Board believes that the FRA has delayed unduly the study of these obvious problems, and urges that FRA act on these recommendations as soon as possible.

Supervision and Training

When the brakeman reported for work on Extra 6474 East with only 1 hour of bed rest, he was not well rested and should have asked the crew caller to call someone else. However, not having worked the previous 2 days he was reluctant to do so. Likewise, when the engineer for Extra 6474 East was called for work while apparently not feeling well, he should have asked the crew caller to call someone else. In both instances, these crewmembers reported for work without a railroad official evaluating their fitness for duty. Since the conductor had not worked

2/ Railroad Accident Report - Head-on Collision of Two Penn Central Freight Trains at Herndon, Pennsylvania, on March 12, 1972.

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

with the brakeman before and had only limited experience with the engineer, he too was unable to accurately evaluate their fitness for the job, particularly with the short notice for reporting to work and the last minute arrival of the brakeman. However, if B&O officials had been aware of the brakeman's and the engineer's conditions, these men probably would not have been permitted to work. Consequently, the Safety Board believes that the B&O should develop a method by which crewmembers are evaluated by their supervisors either before, or while reporting for, work on a round-the-clock basis.

Since a conductor should be able to assume any crewmember called for work was adequately trained and knew all the rules, he normally would not be expected to quiz an oncoming crewmember about his knowledge of his job. Then, he would only find out the crewmember's shortcomings during the course of the work assignment, possibly too late to prevent the crewmember from injuring himself or causing an accident. Likewise, when neither the brakeman nor engineer talk with one another, it is essential that new employees be well trained and be knowledgeable of all rules. Only with a training program, whereby new employees are actually quizzed on their knowledge of rules and are adequately evaluated by officials through a frequent followup program, will new employees know how to properly carry out their job responsibilities. The brakeman did not receive adequate training and followup evaluations and advice.

In its recent special study of railroad training programs, ^{4/} the Safety Board concluded that the continuing occurrence of accidents involving human error suggests that all of the critical knowledge and job skill factors are not known, that some important elements in the qualification of trainees have been overlooked, and that some railroad employees are not receiving the training they need.

CONCLUSIONS

Findings

1. Extra 4367 West was operated in compliance with B&O operating rules.
2. Neither Extra 4367 West or Extra 6474 East crewmembers were aware of the pending collision in time to take preventive action.
3. There were no mechanical malfunctions or defects which adversely affected the performance of either Extra 4367 West or Extra 6474 East.
4. The engineer and front brakeman of Extra 6474 East may not have been physically fit for duty when they reported to work.
5. Extra 6474 East was not operated in compliance with operating rule No. 34 and radio rule No. 54 from Cumberland to the point of collision.

^{4/} "Special Investigation Report - Results of a Survey on Occupational Training in the Railroad Industry, September 5, 1979 (NTSB-SIR-79-1)."

6. Extra 6474 East did not slow after the approach signal 2.27 miles before the Orleans Road crossovers, as required, but rather, increased speed.
7. The brakeman of Extra 6474 East dozed off as a result of inadequate rest before reporting for duty, failure to radio crossover locations to the conductor, and the warm cab environment.
8. The engineer of Extra 6474 East failed to take the required actions to control the train as it approached Orleans Road either because he dozed briefly or his attentiveness was impaired by illness.
9. Extra 6474 East went by the stop signal at Orleans Road at 38 mph.
10. The engineer of Extra 6474 East probably awoke after passing over the switches at Orleans Road and began to brake the train, although a full service brake application was not made until it was too late to stop the train before the collision.
11. If the lead locomotive unit of Extra 6474 East had been equipped with an operable alerter-type safety device, the accident could have been prevented.
12. The B&O's system for training employees and for evaluating their knowledge and application of the operating rules is inadequate.
13. The B&O's informal system for evaluating the physical fitness of employees when they report for work is not adequate.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the conductor of Extra 6474 East to see that the train was operated in accordance with the operating rules and the failure of the engineer and head brakeman to control the train as required by the signal at Orleans Road. Contributing to the accident was the absence of an adequate safety control device on the locomotive.

RECOMMENDATIONS

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

-to the Baltimore and Ohio Railroad Company of the Chessie System:

"Implement a system of training and examination in operating rules which will insure that each employee subject to those rules demonstrates satisfactorily his/her knowledge and understanding of the current operating rules. (Class II, Priority Action) (R-80-39)

"Establish supervisory procedures at crew-change terminals to insure that all operating department employees coming on duty at any hour of the day are physically fit and capable of complying with all pertinent operating rules. (Class II, Priority Action) (R-80-40)"

In addition to these recommendations, the Safety Board reiterates and reemphasizes the importance of the following recommendations which were made to the Federal Railroad Administration as a result of other train collisions:

"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 installations, use, and maintenance of such a device. (R-73-8)

"Include in its present investigation of the safety of locomotive-control compartments a study of environmental conditions that could distract crews from their duties or cause them to fall asleep at the controls. Regulations should be promulgated to correct any undesirable conditions disclosed. (R-73-9)

"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)"

"Promulgate rules to require engine crews to communicate fixed signal aspects to conductors while trains are en route on signalized track. (R-76-50)"

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ PATRICIA A. GOLDMAN
Member

/s/ G. H. PATRICK BURSLEY
Member

ELWOOD T. DRIVER, Vice Chairman, and FRANCIS H. McADAMS, Member, did not participate.

September 16, 1980

APPENDIXES

APPENDIX A

INVESTIGATION

The National Transportation Safety Board was notified of the accident about 7:40 a.m., on February 12, 1980. The Safety Board immediately dispatched an investigative team from Washington, D.C., to the scene. The team arrived during the early afternoon and established groups to investigate operations, vehicle factors, signals and track, and human factors. Depositions were taken in Cumberland, Maryland, on April 1, 1980.

APPENDIX B

BALTIMORE AND OHIO RAILROAD COMPANY CREWMEMBER INFORMATION

Extra 6474 East

Engineer Robert M. Cavanaugh, 61, was first employed by the Western Maryland Railroad at Hagerstown, Maryland, as a fireman on February 11, 1941, and was promoted to engineer on December 30, 1946. He was qualified to operate trains on the B&O on May 23, 1975. The engineer's last operating and radio rules examination was in September 1978, and no exceptions were taken to his knowledge of the rules. His last on-the-job evaluation by a B&O supervisor was in June 1979, and he received a favorable rating.

Brakeman Lindsay T. Bryan, 25, was first employed by the B&O track department in 1978 before becoming a brakeman on April 28, 1979.

Conductor William P. Merritt, 52, was employed as a machinist on the B&O, on August 19, 1943. He resigned in January 1944, and was rehired as a brakeman on September 13, 1950. His last examination on the operating rules was in April 1977.

Flagman Eugene W. Light, age 50, was first employed by the B&O track department on March 17, 1945. He became a brakeman July 10, 1955, before being employed as a fireman on June 29, 1963. He left service in February 1964 and rehired as flagman July 15, 1968. His last examination on the operating rules was in April 1977. His last physical examination, in March 1979, indicated that he was in good health and fit for duty.

Extra 4367 West

Engineer Charles M. Adam, 27, was hired as a fireman on the B&O June 29, 1971, and was promoted to engineer on August 1, 1976. At the time of the accident, he lived in Cumberland, but because of a previous work assignment was staying in Brunswick. His last operating and radio rules class in January 1980, and he passed his last physical examination in November 1978.

Fireman Barbara J. Hopkins, 25, was hired as a fireman on the B&O on September 12, 1977, and was promoted to engineer on May 11, 1979. At the time of the accident, she lived in Cumberland, but because of her previous work assignment was staying in Brunswick. Her last operating and radio rules class was in February 1980, and she passed her last physical examination in September 1977.

Brakeman James K. McKenzie, Jr., 38, was hired as a brakeman on July 2, 1975, and was promoted to conductor in November 1979. At the time of the accident, he lived in Frostburg, Maryland, but because of a previous work assignment was staying in Brunswick. His last operating and radio rules class was in February 1980, and he passed his last physical examination in August 1977.

Conductor William N. Roelkey, 53, was hired as a yard helper on March 14, 1947, became a brakeman in April 1962, and was promoted to conductor in April 1968. At the time of the accident, he lived in Knoxville, Maryland, about 4 miles from Brunswick. His last operating and radio rules class was in February 1980, and he passed his last physical examination in September 1979.

Flagman Joseph J. Cucchiara, 27, was hired by the B&O track department in August 16, 1974. He became a brakeman in January 1975, and was promoted to conductor in November 1979. At the time of the accident, he lived in Frederick, Maryland, about 15 miles from Brunswick. His last operating and radio rules class was in April 1977, and he passed his last physical examination in April 1979.

APPENDIX C

EXCERPTS FROM BALTIMORE AND OHIO OPERATING RULES

34. All members of engine and train crews must, when practicable, observe and then communicate to each other by its name the indication of each signal affecting the movement of their train or engine when the signal becomes clearly visible, and observe the signal again just before passing it.

Should the Engineer fail to comply with the signal indication displayed, other members of the crew will remind him and, if necessary, take action to insure safety of the train.

Note. In multiple track territory, track number must also be called.

* * * * *

106. Both the Conductor and the Engineer are responsible for the safety of the train and engine and the observance of the rules, and, under conditions not provided for by the rules, must take every precaution for protection.

Persons employed on the train will obey the instructions of the Conductor. When there is no Conductor, or he is disabled, the Engineer will have charge of the train.

The Train Dispatcher must be advised as promptly as practicable, by the Engineer or Conductor, of any condition that will delay the train or engine or prevent it from making the usual speed.

Conductors and Engineers must see that the members of their crew are familiar with their duties and instruct them when necessary in the proper observance of the rules and safe performance of their work.

* * * * *

509. A train or engine must stop before any part of engine, train or car passes a signal displaying a STOP or STOP AND PROCEED indication. When STOP indication is displayed, it must not proceed except as provided by rules 509-A, 509-B, 509-C, 509-D, 509-E and 607.

* * * * *

Radio Rules

54. Employees on head-end and rear of train will communicate with each other the condition of their train at frequent intervals which will not be less than every fifteen (15) minutes.

**THE BALTIMORE AND OHIO RAILROAD COMPANY
OFFICE OF ROAD FOREMEN OF ENGINES
OFFICE OF THE TRAINMASTERS
MARYLAND DIVISION
MOUNTAIN SUBDIVISION - CUMBERLAND SUBDIVISION**

MISCELLANEOUS NOTICE NO. 1

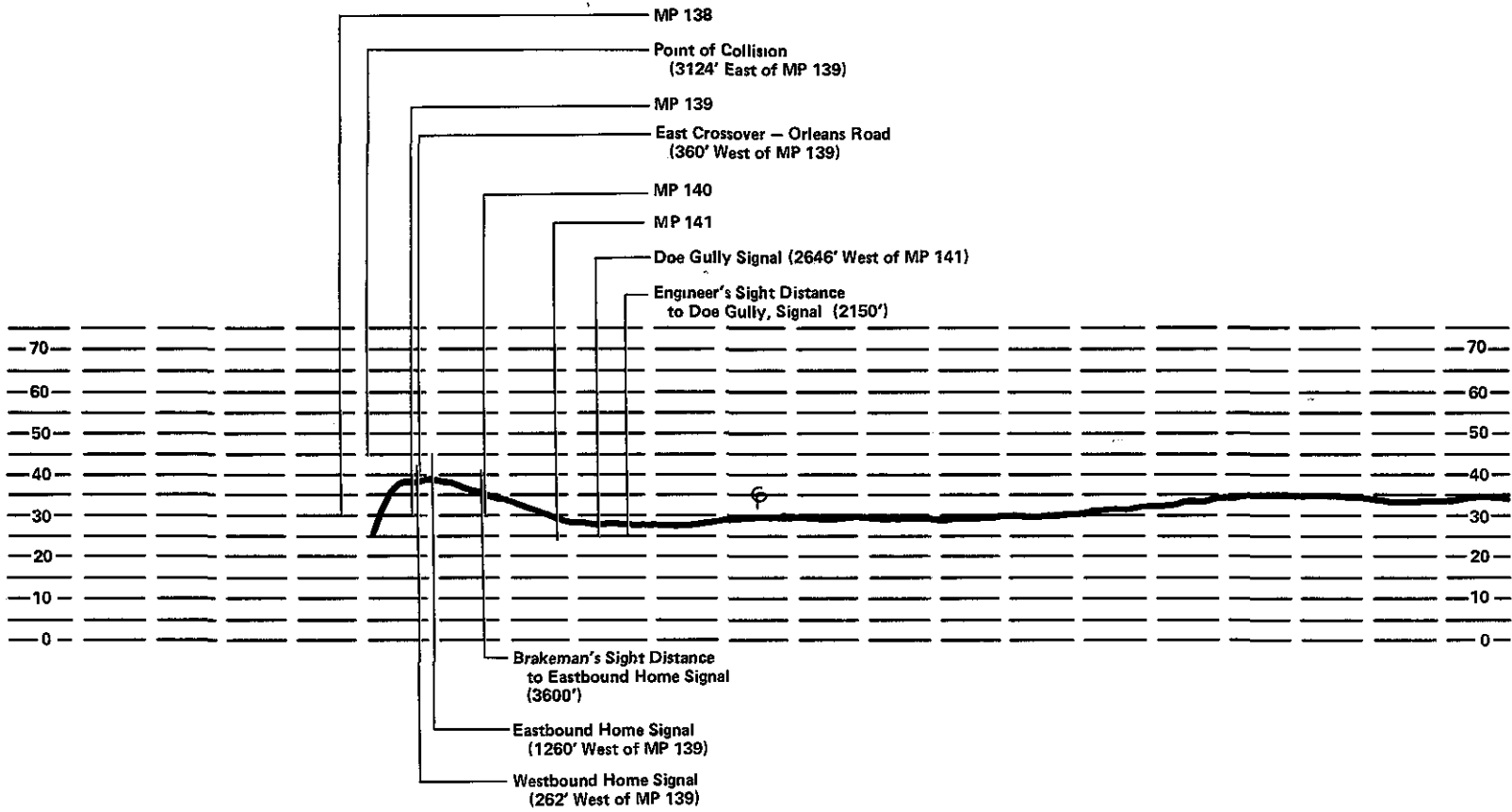
**Cumberland, Maryland
January 3, 1979**

ALL CONCERNED:

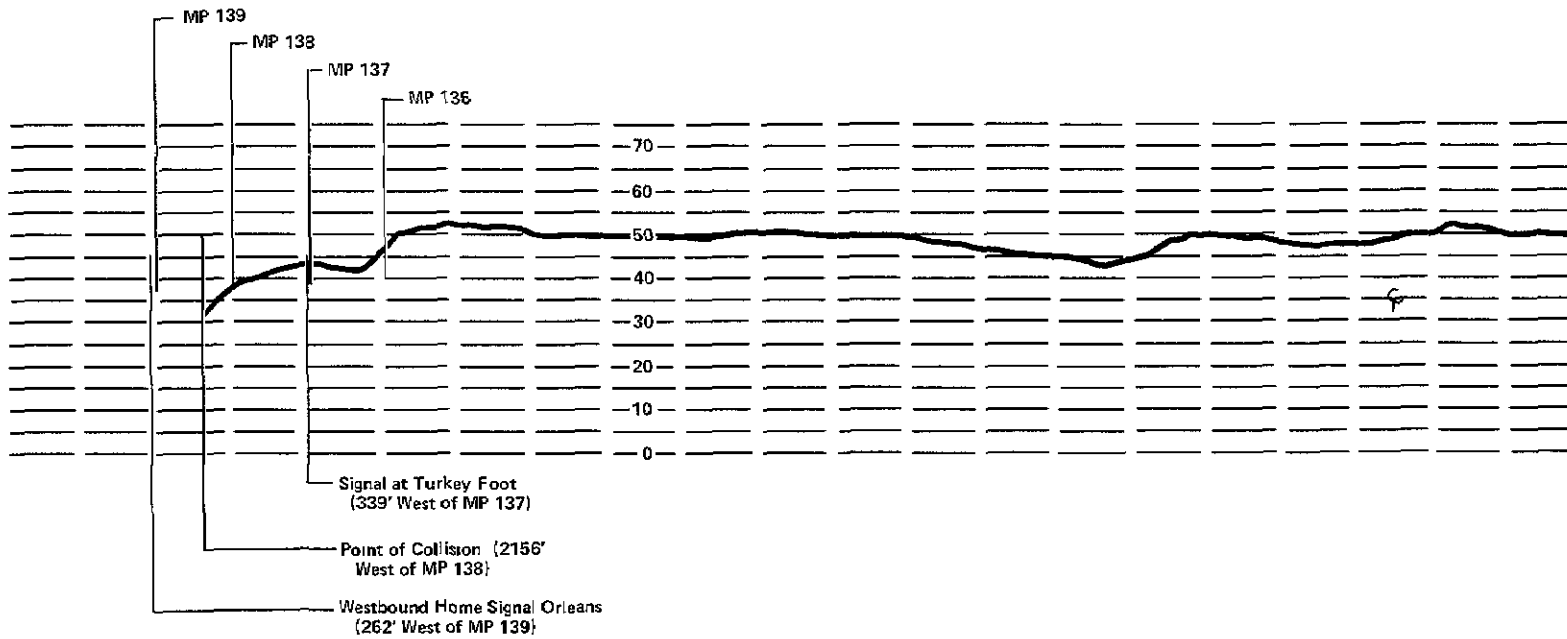
IN ADDITION TO THE PROVISIONS OF RULE 54, CDT-74, AND RULE 811, CDT-29 (Par. 2), TRAIN AND ENGINE CREWS WILL ARRANGE TO CONVERGE VIA RADIO PRIOR TO PASSING OVER MAINTRACK CROSSOVERS OR INTERLOCKINGS.

ANY QUESTIONS ARISING FROM THIS NOTICE, PLEASE CHECK WITH THE UNDERSIGNED OFFICERS.

H. A. Snoots, Trainmaster
C. B. Welch, Jr., Trainmaster
I. C. Geiger, Road Foreman
Engines
D. D. Pryor, Road Foreman
Engines



SPEED TAPE REMOVED FROM THE LEAD UNIT OF EXTRA 6474 EAST AT ORLEANS ROAD



SPEED TAPE REMOVED FROM THE LEAD UNIT OF EXTRA 4367 WEST AT ORLEANS ROAD