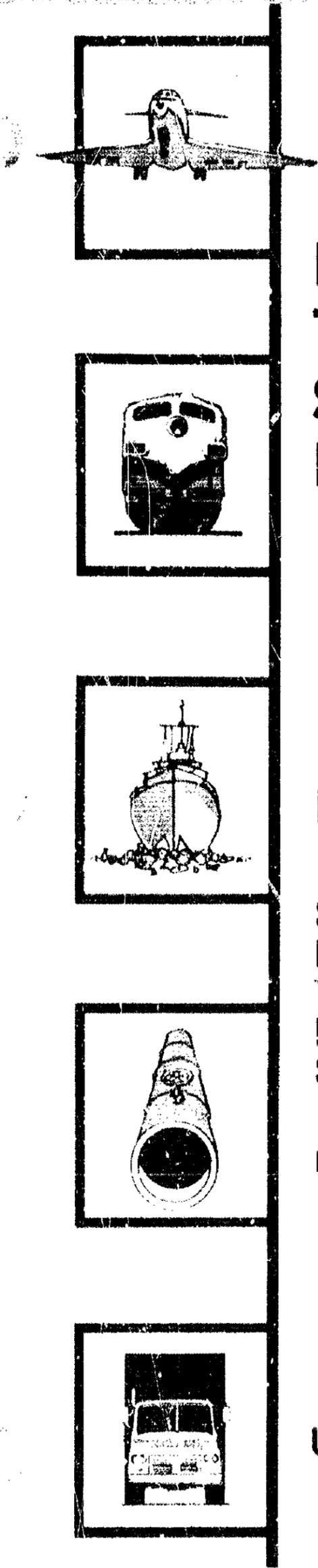


PB81-180093



# NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

## RAILROAD ACCIDENT REPORT

SIDE COLLISION OF  
NORFOLK AND WESTERN RAILWAY COMPANY'S  
TRAIN NO. 86 WITH EXTRA 1589 WEST  
NEAR WELCH, WEST VIRGINIA  
SEPTEMBER 6, 1980

NTSB-RAR-81-2

UNITED STATES GOVERNMENT

PRODUCT OF:  
NATIONAL TECHNICAL  
INFORMATION SERVICE  
U.S. DEPARTMENT OF COMMERCE  
SPRINGFIELD, VA. 22161

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. NTSB-RAR-81-2	2. Government Accession No. PB81-180093	3. Recipient's Catalog No.	
4. Title and Subtitle Railroad Accident Report--Side Collision of Norfolk and Western Railway Company Train No. 86 with Extra 1589 West, near Welch, West Virginia, September 6, 1980		5. Report Date March 4, 1981	
		6. Performing Organization Code	
7. Author(s)		8. Performing Organization Report No.	
9. Performing Organization Name and Address National Transportation Safety Board Bureau of Accident Investigation Washington, D.C. 20594		10. Work Unit No. 3192	
		11. Contract or Grant No.	
12. Sponsoring Agency Name and Address  NATIONAL TRANSPORTATION SAFETY BOARD Washington, D. C. 20594		13. Type of Report and Period Covered Railroad Accident Report September 6, 1980	
		14. Sponsoring Agency Code	
15. Supplementary Notes The subject report was distributed to NTSB mailing lists: 8A, 8D and 14A.			
16. Abstract  About 8:10 a.m., on September 6, 1980, while operating on the westbound main track, near Welch, West Virginia, eastbound Norfolk and Western Railway Company (N&W) freight train No. 86 collided with the sixth car of N&W Extra 1589 West. The accident occurred while Extra 1589 West was moving from the westbound main track onto an auxiliary center passing track at the east switch of the Farm Interlocking. The engineer, fireman, and front brakeman of train No. 86 were killed. Damage was estimated at \$1,446,553.  The National Transportation Safety Board determines that the probable cause of this accident was the failure of the head-end crew of train No. 86 to reduce the speed of the train in compliance with the indication of the signal which displayed an approach aspect, which made it impossible for the fireman to stop the train short of the East Farm interlocking home signal when it was seen to be displaying a stop-and-stay aspect.			
17. Key Words Freight trains, side collision, hazardous materials, approach signal, stop-and-stay signal, remotely controlled interlocking, alertness control device.		18. Distribution Statement This document is available to the public through the National Technical Information Service-Springfield, Virginia 22161 (Always refer to number listed in item 2)	
19. Security Classification (of this report) UNCLASSIFIED	20. Security Classification (of this page) UNCLASSIFIED	21. No. of Pages 31	22. Price

**CONTENTS**

<b>SYNOPSIS</b> . . . . .	1
<b>INVESTIGATION</b> . . . . .	1
The Accident . . . . .	1
Injuries to Persons . . . . .	3
Damage . . . . .	3
Crewmember Information . . . . .	6
Train Information . . . . .	6
Method of Operation . . . . .	7
Meteorological Information . . . . .	10
Medical and Pathological Information . . . . .	10
Survival Aspects . . . . .	10
Tests and Research . . . . .	10
Other . . . . .	13
<b>ANALYSIS</b> . . . . .	13
The Accident . . . . .	13
Supervision . . . . .	15
<b>CONCLUSIONS</b> . . . . .	16
Findings . . . . .	16
Probable Cause . . . . .	16
<b>RECOMMENDATIONS</b> . . . . .	16
<b>APPENDIXES</b> . . . . .	19
Appendix A--Investigation . . . . .	19
Appendix B--Crewmember Information . . . . .	20
Appendix C--Excerpts From N&W Rule Book and Current Timetable and Diagrams of Signal Aspects . . . . .	22
Appendix D--Speed Tape from Train No. 86 . . . . .	28
Appendix E--Report of Federal Railroad Administration's Signal Inspector . . . . .	29

**NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C. 20594**

**RAILROAD ACCIDENT REPORT**

**Adopted: March 4, 1981**

---

**SIDE COLLISION OF NORFOLK AND WESTERN  
RAILWAY COMPANY'S TRAIN NO. 86 WITH  
EXTRA 1589 WEST NEAR WELCH, WEST VIRGINIA  
SEPTEMBER 6, 1980**

**SYNOPSIS**

About 8:10 a.m., on September 6, 1980, while operating on the westbound main track, near Welch, West Virginia, eastbound Norfolk and Western Railway Company (N&W) freight train No. 86 collided with the sixth car of N&W Extra 1589 West. The accident occurred while Extra 1589 West was moving from the westbound main track onto an auxiliary center passing track at the east switch of the Farm interlocking. The engineer, the fireman, and the front brakeman of train No. 86 were killed. Damage was estimated at \$1,446,553.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the head-end crew of train No. 86 to reduce the speed of the train in compliance with the indication of the signal which displayed an approach aspect, which made it impossible for the fireman to stop the train short of the east Farm interlocking home signal when it was seen to be displaying a stop-and-stay aspect.

**INVESTIGATION**

**The Accident**

At 3:05 a.m., e.d.t., on September 6, 1980, eastbound Norfolk and Western (N&W) train No. 86, a high-priority, extra freight train consisting of a 4-unit diesel-electric locomotive, 52 loaded freight cars, 13 empty freight cars, and a caboose, for a trailing tonnage of 4,660, departed Portsmouth, Ohio, en route to Bluefield, West Virginia, a distance of 226 miles. The train had been inspected and the brakes tested, but no defects were found. The engineer and the fireman were in the cab of the lead locomotive unit, the front brakeman was in the cab of the second unit, and the conductor and the rear brakeman were in the caboose.

As the train approached the signal aspect at Williamson, West Virginia, an approach signal was displayed. The fireman, who was a qualified engineer and was operating the train, radioed the yardmaster to determine why the signal aspect was approach. He was advised that a westbound train was preparing to leave the yard but that it was being held until train No. 86 had passed.

After departing Williamson, the train continued to Lindsey, West Virginia, where the train was stopped at a hot-journal detector. At that time, the engineer was operating the train. The suspected car was inspected and when no exception

was made to the journal bearing temperature, the train continued en route. The last radio communication of record was made between the crew and an operator at Lindsey. This communication was recorded by a tape recorder at Bluefield. The enginecrew of Extra 1589 West overheard train No. 86 when the "inspect train" signal at Mohegan was called to each end.

According to the conductor, the fireman was again operating train No. 86 when it moved at 25 mph over a crossover from the eastbound to the westbound main track at Davy, West Virginia. After completing the move over the crossover, train No. 86 accelerated to 38 mph and maintained a speed of 38 mph thereafter. The maximum authorized speed in the area was 40 mph. The train passed over a hot-journal detection device at Davy about 8 a.m., and no faults were indicated. As the locomotive passed the "inspect train" signal associated with the detection device at Davy, the rear-end crew stated that the fireman radioed "Green Eye," indicating that the train was alright. The rear brakeman responded with "Green Eye, Charlie" as the caboose passed the same signal. However, the fireman did not respond to the rear brakeman's message.

At 6:40 a.m., on September 6, 1980, Extra 1589 West, consisting of a 4-unit diesel-electric locomotive, 174 empty coal hopper cars, and a caboose, for a trailing tonnage of 5,220, departed Bluefield, West Virginia, en route to Weller, Virginia. The engineer and the front brakeman were in the cab of the lead locomotive unit, and the conductor and the rear brakeman were in the caboose.

About 7:20 a.m., an eastbound coal train was halted on the eastbound main track in the vicinity of Welch, West Virginia, because the crew of the pusher locomotive assisting the train, had been on duty 12 hours, the maximum time allowed by the Federal hours-of-service regulation. The standing coal train was occupying one of the two main tracks at that location. Because of the delay involved in the crew change, the train dispatcher had directed the train dispatcher to direct the movement of eastbound train No. 86 from the eastbound main track to the westbound main track at Davy. The train dispatcher had planned to divert Extra 1589 West from the westbound main track onto a center passing track at the east end of Farm, a remotely-controlled interlocking. The move would have permitted train No. 86 to continue east on the westbound main track, around the standing coal train, after Extra 1589 West had cleared on the passing track.

Shortly after entering the center passing track at about 8 mph, at the east end of Farm, the engineer of Extra 1589 West observed the headlight of eastbound train No. 86. He stated that train No. 86 was moving at a speed he considered too fast to allow it to stop short of his diverging westward movement. The engineer also said that he did not believe that he had time to use the radio, so he immediately gave hand signals in an attempt to alert the fireman of train No. 86 of the impending danger and hopefully to cause him to set the train's brakes in an emergency application. The enginecrew of Extra 1589 West stated that they observed the operator of train No. 86 rise from his seat at the controls to a semi-erect stance, quickly look ahead, apparently position the automatic brake valve in the emergency position, and then sit down again. Immediately thereafter, they heard the sound of an airbrake emergency application emanating from train No. 86.

The head-end crew on Extra 1589 West testified that they saw only the fireman in the cab of the lead locomotive unit of train No. 86 and that the locomotive of train No. 86 was under power until the emergency brake application was made. The front brakeman of Extra 1589 West moved to the right side of the cab near the engineer and both looked rearward to watch the collision. As the two men watched, they noticed that a stop-and-stay signal aspect was displayed on the Farm interlocking home signal for the eastbound movement.

About 8:10 a.m., while moving at a speed of 38 mph, 180 feet east of the home signal and 1,359 feet into a compound curve to the left, the right front corner of the lead locomotive unit of train No. 86 collided with the sixth car behind the locomotive of Extra 1589 West as it was entering the passing track.

After colliding with Extra 1589 West, the lead unit of train No. 86 collided with a concrete pier supporting a railway trestle over the Tug River Fork and fell into the river between the west bridge abutment and the pier. (See figure 1.) The second unit also collided with the concrete pier and came to rest with the rear end resting on the lead unit and its deformed front end supported by the bridge abutment. (See figure 2.) The third unit came to rest on its side, north of and perpendicular to the track structure; the fourth unit derailed but remained upright. The first six cars of the train derailed. The first car came to rest with the front end resting on the side of the overturned third locomotive unit as did the second car in the train. The second through the fifth cars were derailed in accordion fashion. The sixth car was derailed but remained upright and in line with the track structure. (See figure 2.)

Oil from the damaged locomotive fuel oil tanks spilled into the river and ignited. Flames engulfed the trestle and the locomotive units. The burning fuel oil was carried downstream by the river current and burned foliage along the river bank for several hundred feet.

Of the eight empty coal-hopper cars of Extra 1589 West that were derailed, six were lying on or immediately to the south of the track structure. The two easternmost cars were still on the westbound main track and trestle.

Injuries to Persons

<u>Injuries</u>	<u>Crewmembers Train No. 86</u>	<u>Crewmembers Extra 1589 West</u>	<u>Total</u>
Fatal	3	0	3
Nonfatal	0	0	0
None	2	4	6
Total	5	4	9

Damage

The first three locomotive units of train No. 86 were destroyed, and the fourth locomotive unit was damaged heavily. The first and second derailed cars sustained heavy damage, and the third through the sixth cars were damaged substantially.



Figure 1. -Side collision of train No. 86  
(right) and Extra 1589 West (left).



Figure 2.--Wreckage of train No. 86 after it struck Extra 1589 West.

Eight cars of Extra 1589 West were derailed and received substantial damage. Three cars of the train, though not derailed, required a complete change of wheels because they had been subjected to extreme heat from the oil fire.

The trestle over the Tug River Fork was damaged heavily by the fire. The signal equipment and the track received significant damage because of the derailment and subsequent fire.

Locomotive	\$ 1,125,900
Equipment	93,500
Trestle	132,000
Signal	44,848
Track	20,305
Clearing wreckage	30,000
Total	<u>\$ 1,446,553</u>

#### Crewmember Information

The crew of train No. 86 consisted of an engineer, a fireman, a conductor, and two brakemen. Each man was qualified without restriction by the N&W standards for his position. The fireman had been off duty since August 29, 1980, before reporting for duty on the day of the accident. All crewmembers were in compliance with the rest requirements of the Federal hours-of-service regulation. They had reported for duty at 2:30 a.m., on September 6, 1980, and had been on duty for 5 hours 45 minutes when the accident occurred. The engine crew reported for duty at a location in Portsmouth where they were not observed by an operating department supervisor or their conductor before the train's departure.

The crew of Extra 1589 West consisted of an engineer, a conductor, and two brakemen. All were qualified without restrictions by carrier standards for their positions. Each man had been off duty under the applicable regulations before reporting for duty at 2:30 a.m. on the day of the accident. (See appendix B.)

#### Train Information

Train No. 86 was assembled at Portsmouth, Ohio. The locomotive consisted of one General Electric (GE) Model C-30-7 unit; one Electro-Motive Division (EMD), General Motors Corporation Model SD-45 unit; one EMD GP-38 unit; and one EMD Model GP-35 unit. N&W 8075, the lead unit, was designed with a low profile short hood at the cab end with the controls built at the right side. It was equipped with a speed indicator/recorder, a 26-L type air brake system, a radio, and an electronic crew-alertness control device. The total weight of the locomotive was 1,339,000 pounds.

The 32d car behind the locomotive in train No. 86 was a flatcar loaded with two trailers. Each trailer contained four cylinders of radioactive Uranium Hexafluoride, low specific activity containing 0.7 percent or less of U-235. (Uranium Hexafluoride is not irradiated nor does it require protective shielding.)

The lead locomotive unit of Extra 1589 West was an EMD-Model SD-40, built with dual control stations. It was designed with a low hood profile at the cab end

which was facing rearward at the time of the collision. The length of the train was 9,000 feet. Extra 1589 West was assembled at Norfolk, Virginia, and it was not altered at Bluefield, a crew-change point; therefore, a brake test was not required. However, the engineer used the automatic air brake to stop the train for a signal when it left Bluefield Yard. At the time of the service brake pipe reduction, an undetermined action in the train caused an undesired emergency brake application. The train operated from Bluefield Yard to the accident site without further incident.

### Method of Operation

The railroad in the vicinity of the accident follows a water grade route through the Allegheny Mountains, along the Tug River Fork. It is a two-track system extending east and west by timetable direction from the accident site. The north track is designated the westbound main track, and the south track is designated the eastbound main track. The impact occurred in a 4°42' and 5°38' compound curve to the left for train No. 86. The point of impact was at the clearance point in the switch leading from the westbound main track to the auxiliary track at the east end of Farm interlocking. (See figures 3 and 4.)

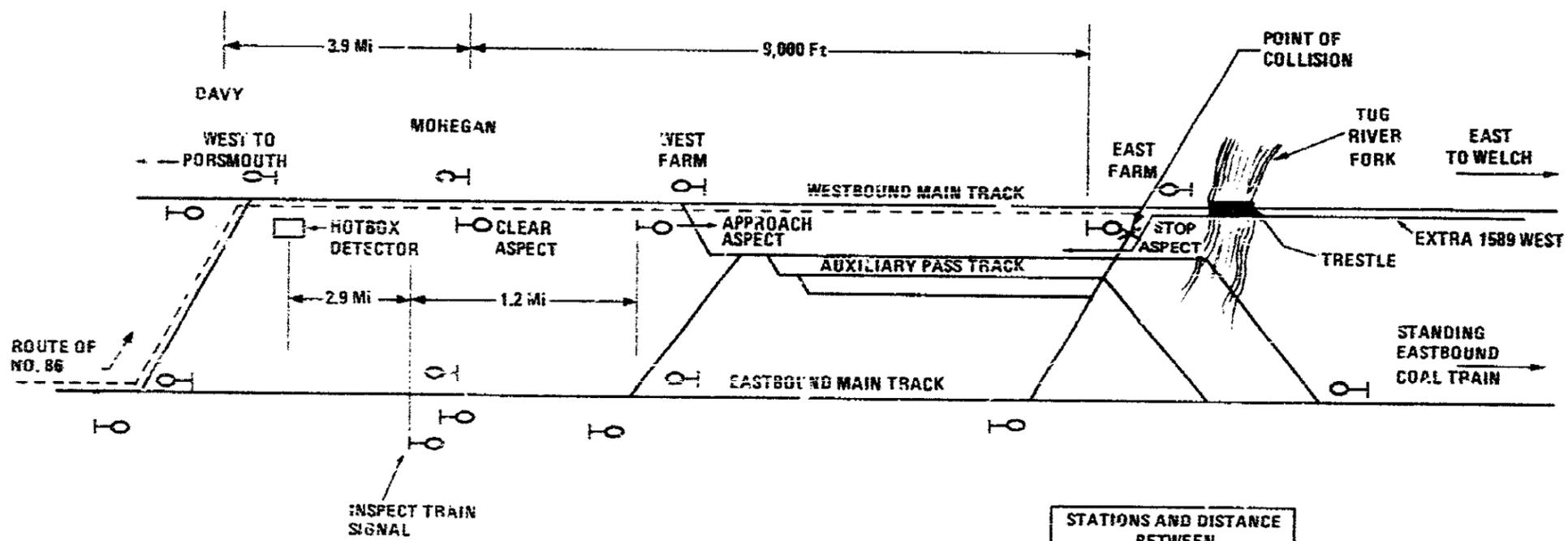
The two main tracks are signaled for train movement in either direction. The distance on the eastbound track between the signal bridge at Mohegan and the point of impact was 9,330 feet. In that distance, the track was a series of short tangent track sections and curves, varying from 0°30' to 6°29'. The power-operated track switches were equipped with dual control, electro-pneumatic switch-and-lock movements. The continuous-lighted, color position-light signals were arranged to display aspects in accordance with the carrier's operating rules. (See appendix C.) When the dispatcher operated the traffic control console to establish the routes of the trains at the east end of Farm, the signal aspects presented to train No. 86 in the direction of travel on the westbound main track would have been:

<u>Location</u>	<u>Name</u>	<u>Rule*</u>	<u>Aspect</u>
Mohegan	clear	281	green lights
west end of Farm	approach	285	yellow lights
east end of Farm	stop-and-stay	292	red lights

\*(See appendix C.)

Train operations are governed by timetable, train order, and the signal indications of an automatic-block and traffic-control system (TCS) which is controlled by the train dispatcher at Bluefield. A two-way radio system is used to supplement operations according to applicable operating rules.

Train No. 86 was considered by operating officers to be a priority train as well as being superior by timetable direction. The train dispatcher testified that he thought it unusual that the operator of train No. 86 did not contact him by radio to determine the reason for the "approach" indication at the west end of Farm, but he made no effort to contact the train.



STATIONS AND DISTANCE BETWEEN	
Portsmouth, Ohio	112.2 Miles
Williamson, W. Va.	27.1 Miles
Lindsey, W. Va.	15.1 Miles
Davy, W. Va.	4.9 Miles
Farm, W. Va.	3.5 Miles
Welch, W. Va.	

Figure 3.—Plan view of accident area and route of train No. 86 - not to scale.

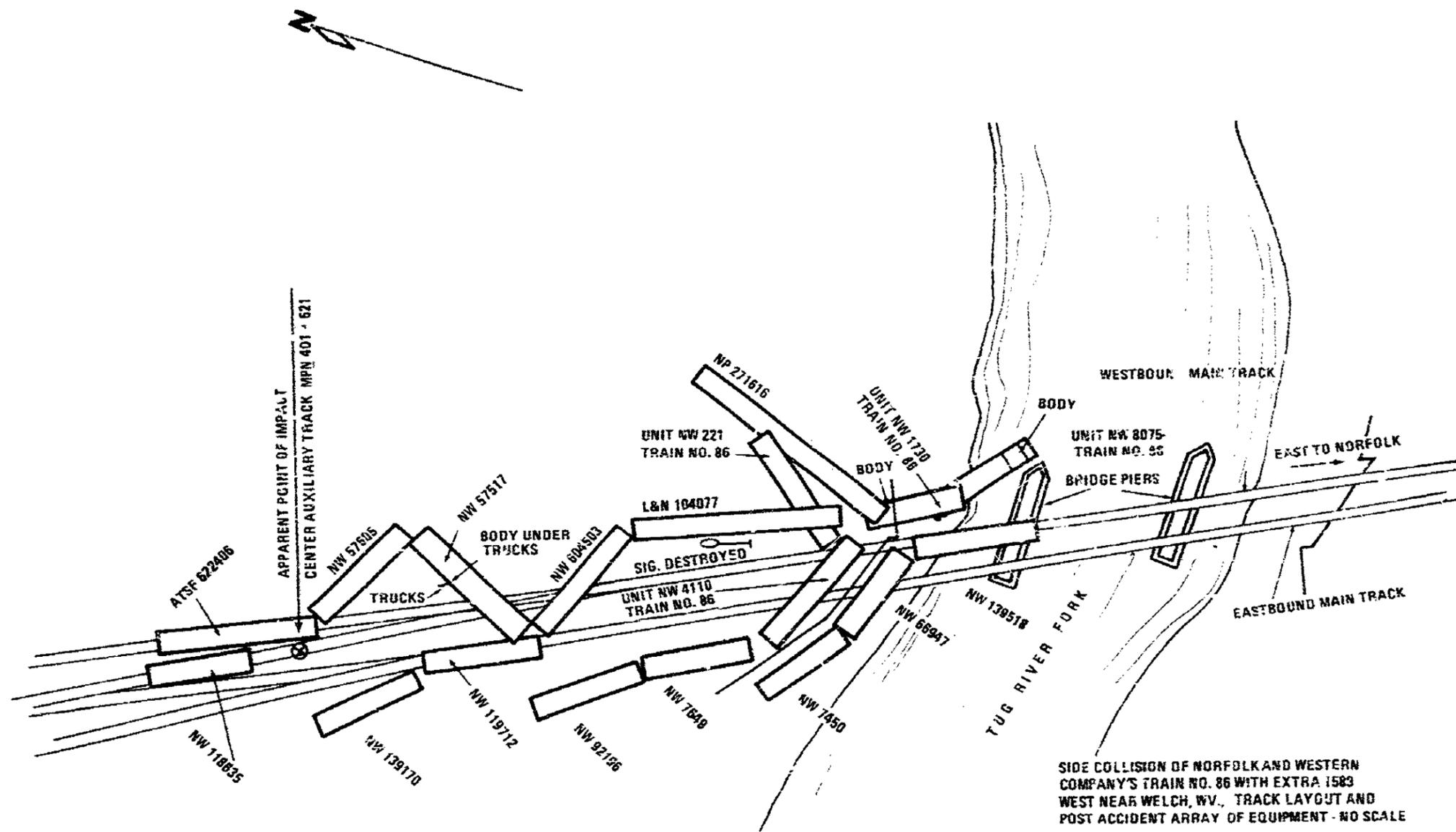


Figure 4.—Track layout and postaccident array of equipment.

### Meteorological Information

A Federal Aviation Administration Flight Service Station located in Bluefield (approximately 30 miles east of the accident site) recorded the weather as cloudy, a temperature of 64° F, and visibility at 1/8th mile at 8:00 a.m. Surviving crewmembers indicated that visibility at the accident site was clear.

### Medical and Pathological Information

Postmortem and toxicological tests of the fatally injured crewmembers were conducted by the State of West Virginia, Office of the Chief Medical Examiner. The autopsies did not indicate any systemic failure that would have caused impairment. Results of the toxicological tests were:

	<u>Percent of Alcohol</u>	<u>Carbon Monoxide</u>	<u>Drugs</u>
Engineer	Negative	Normal	Negative
Fireman	0.01% <u>1/</u>	Normal	Negative
Front brakeman	Negative	50% saturated <u>2/</u>	Negative

### Survival Aspect

The engineer's body was found lying under a freight car truck several feet north of the track structure and about 60 feet east of the point of impact. It could not be determined whether he had tried to evacuate the cab before the collision. The fireman's body was found in the crushed cab of the lead locomotive unit. The front brakeman was lodged in the crushed cab of the second locomotive unit. He survived the crash but died as a result of burns and smoke and soot inhalation from the postcrash fire that engulfed the locomotive. The crew of Extra 1589 West was not injured.

The Welch Fire and Rescue Department was notified of the accident at 8:20 a.m., and responded to the scene at 8:26 a.m. The surrounding communities of Davy, Roderfield, Kimball, and Cary, West Virginia, responded immediately to the call for help from the Chief of the Welch Fire Department. After the fire was extinguished, the fire chief used a geiger counter to check radioactive material reported to be on the train. He found the containers to be intact and without leakage.

### Tests and Research

The extensive damage sustained by the locomotive units of train No. 86 precluded any testing of the air brake systems. The automatic and independent brake valves from the lead unit were recovered from the river and both portions functioned as designed. The electronic alertness control module and associated

1/ The trace of alcohol found in the blood sample could not be traced to recent alcohol consumption. A reading of 0.01% is within the margin of error of analysis.

2/ This is an indication that the front brakeman survived the crash and may have died from the effects of the fire.

whistle were also recovered from the lead unit and, after minor repair of accident damage, they were found to function properly.

Each locomotive unit in train No. 86 was equipped with a speed indicator/recorder. The only legible speed tape was removed from the trailing locomotive unit. The accuracy of the indicator/recorder could not be checked because of damage sustained during the crash. The carrier's maintenance records indicated that the accuracy of the unit was tested on June 27, 1980, at Decatur, Illinois, and at the time, it was found to indicate 3-percent fast. The tape indicated that the train's speed was 38 mph when it collided with the side of Extra 1589 West. (See appendix D.) The tape also indicated that the train had been operated in compliance with the 25-mph speed restriction as it crossed from the eastbound to the westbound main track at Davy.

Postcrash testing of the signal system was performed by N&W personnel and witnessed, in part, by a Signal and Train Control Inspector from the Federal Railroad Administration (FRA). No defects were found in the signal system. During the postcrash inspection, the signal block repeater relay at the west end of Farm indicated that "approach" was the last signal aspect displayed. According to the circuit design, this relay would not have changed position after train No. 86 operated past it into the signal block. (See appendix E.)

Sight distance tests were conducted at the accident site under lighting and weather conditions similar to those at the time of the accident. The same number and type of locomotive units were set up in the same configuration as those of train No. 86. The tests were conducted under static conditions to determine the earliest possible sighting from the various positions on the eastbound locomotive. The tests showed:

Lead Unit Operator's Seat Position South Side	Lead Unit Fireman's Seat Position North Side	Second Unit Side of Cab	
		North	South
Available sight distance to "inspect train" signal at Mohegan = 1,046 ft	1,046 ft	1,051 ft	
Available sight distance to signal at Mohegan = 1,295 ft	1,295 ft	1,317 ft	926 ft
* Available sight distance to west end of Farm signal = 414 ft	438 ft	97 ft	405 ft
Available sight distance to east end of Farm signal = 457 ft	457 ft	448 ft	151 ft
Available sight distance to fouling point, east end of Farm (Westbound and middle track) = 637 ft	637 ft		

\*(See figure 5.)



Figure 5.--Eastbound operator's first available sighting of the "approach" signal at the west end of Farm.

### Other

Electronic Crew Alertness Device--The electronic crew alertness device is standard equipment for the N&W's locomotive fleet. A flexible stem is attached to the face of the locomotive control stand adjacent to the operator's seat position. The movement of this stem by an operator's action resets the timing cycle of the equipment. The timing circuitry allows 42 seconds to elapse until a light mounted on the control stand is illuminated. The indicator lamp remains illuminated for a period of 10 seconds, at which time a whistle in the cab will begin and continue to sound for 6 seconds. At the end of about 6 seconds, a full service application of the train's air brake system will be initiated. The total time required for a complete cycle is about 60 seconds before a penalty brake application is made. The brake application can be forestalled at any point during the cycle before the initiation of the brake application by the operator's manipulating the flexible stem. Each movement begins a full timing cycle. A fully applied independent brake, or the positioning of the automatic brake in "suppression," will also forestall the alertness device brake application.

### ANALYSIS

#### The Accident

Train No. 86 had been operated in compliance with applicable regulations and operating rules from Portsmouth through the crossover at Davy. The radio communication between the crewmembers on the locomotive and the caboose regarding the "inspect train" signal near Davy, indicated that the operator was alert at that point. However, the fireman, who was operating the train, did not respond to the message from the caboose when it passed the signal. It is reasonable to assume that after crossing from the eastbound to the westbound track at Davy, the fireman believed that his train was being run around a stopped train or one of lower priority which was occupying the eastbound main track. The clear signal indication at Mohegan, the fact that his train was superior by timetable direction and by its lading, and the fact that it was seldom delayed may have caused the fireman to draw a false conclusion about the dispatcher's planned routing of his train. He did not confirm or question the dispatcher about his train being switched from the eastbound to the westbound main track at Davy. Usually, the engineer of a high priority train will question an unusual or unexpected move, especially if it is likely to result in a delay to the train. The radio inquiry from train No. 86 at Williamson concerning the signal indicates that the fireman of train No. 86 operated in this manner. Also, the dispatcher expected the engineer to question the approach aspect at the west end of Farm, and he was surprised that the inquiry did not come.

Despite the river grade route which the railroad follows through the Allegheny mountains, the many curves in the roadway causes some signals to present a very short approach sight distance. The approach sight distance is further reduced in many instances by the high-rock banks or walls where the roadway is built on sidehill cuts.

The 414-foot maximum clear sight distance between the position of the operator's seat of train No. 86 and the approach signal at the west end of Farm

allowed a maximum viewing time of 8.5 seconds at a train speed of 35 mph. (See appendix D.) At this speed, the cab of the lead unit would have passed both the clear signal at Mohegan and the approach signal at the west end of Farm, a distance of 1,149 feet, in about 22 seconds. The transit time for these distances is considerably less than the total 60-second timing cycle of the crew alertness device.

The alertness control device is a good backup for the operator in helping him to maintain an alert posture. However, the approximate 60-second cycle is sufficient time for an engineer to momentarily doze, or become distracted, and not receive an alarm or penalty from the device. Since the alertness control does not respond to the location or aspect of a wayside signal, the engineer could become preoccupied and pass a restrictive signal without seeing it because of a short approach view. He would then be at a disadvantage when the next signal is viewed, again, because of a short approach view to that signal. If he misses an approach aspect and the next signal displays a stop aspect, he may not be able to stop the train before passing the signal even if he is fully alert at the first sighting of the stop aspect. The alertness control device does not ensure that other persons present in the operating cab are alert.

In an area, such as the one where the accident occurred, with short sight distances to signals available because of sharp curves and high embankments, an engineer must remain alert. The approach aspect displayed by the signal at the west end of Farm should have alerted the operator of train No. 86 to take action to reduce the speed of the train to the required medium speed (20 mph) in preparation for a stop at the next signal. Had either the engineer or fireman in the cab of the lead locomotive unit been alert and complying with the requirements of Operating Rule No. 34, the approach indication would have been complied with. The fireman should have seen and properly interpreted the approach signal aspect at the west end of Farm and should have controlled the speed of the train so it could have been stopped at the signal at the east end of Farm. His continued operation of the train without a reduction in its speed is evident from the speed tape obtained during the accident investigation. Since he did not question the dispatcher relative to the restrictive indication or slow his train, he may have been anticipating a nonrestrictive signal indication at the east end of Farm. Therefore, the lack of a radio inquiry or a train speed reduction suggests that the fireman did not perceive the approach indication, that he anticipated a nonrestrictive signal, or that a "false clear" signal indication occurred at the west end of Farm. The state of alertness of the front brakeman, who was in the cab of the second locomotive unit, in terms of his observation of wayside signals as required by Operating Rule No. 34, is questionable.

The position of the block repeater relay indicates that an "approach" aspect was the last aspect displayed by the signal at West Farm. The lack of any evidence of defective conditions with the signal system makes it unlikely that a "false clear" aspect was displayed. traffic density, the acceptable operating practices, and the physical characteristics of the railroad should preclude an engineer's predicting a clear signal indication following a restrictive one. For one to operate in such a manner is tantamount to suicide and it is not a reasonable assumption. Therefore, the Safety Board must conclude that the enginecrew of train No. 86 was not fully alert as the train passed the approach signal at the west end of Farm.

The Safety Board cannot be certain that the fireman of train No. 86 would have seen an advance approach aspect if one had been presented to the train at Mohegan. However, such a signal would provide an approach view of about 1,300 feet and provide more time for it to be perceived from an approaching train. If the fireman had received an advance approach at Mohegan, he may have stopped the train at the east end of Farm, short of the stop-and-stay signal. Without question, he would have had more opportunity to respond to a restricting signal.

The observations by the head-end crew of Extra 1589 West regarding the movements of the fireman of train No. 86 before the collision exclude the possibility of his being totally incapacitated. This is further supported by the fireman's actions when he apparently became aware of the efforts of the crew of Extra 1589 West to attract his attention. His actions are more nearly described as a man perhaps who may have been preoccupied.

The fact that the locomotive of train No. 86 was observed to be operating under power until the emergency brake was applied further supports that the engine crew of train No. 86 was not fully alert. Postaccident inspections and tests failed to reveal any condition that would have reduced significantly the train's braking capability.

#### Supervision

Since the enginecrew reported for duty at a location where they were not observed by an operating department official, their fitness for duty is unknown. A 226-mile interdivisional run over a railroad with the curvature and short sight distance typical of the area in which the accident occurred places increased demands on the crew to stay alert. Such demands can only be met by crewmembers who are physically and mentally fit. Safety Board investigations of other train collisions have revealed that in such instances, crewmembers have reported for work without a railroad official evaluating their fitness for duty. 2/ The conductor of train No. 86 did not have face-to-face contact with the enginecrew at any time before or during the trip from Portsmouth, Ohio, to the point of collision. Even though the toxicological tests were negative, no one with authority could attest to the physical fitness and alertness of the head-end crewmembers.

Although it allowed him increased freedom of movement from one side of the cab to the other for the purpose of train inspection, the front brakeman's location in the cab of the second unit of the locomotive consist removed him from the surveillance of any on-train authority that could have insured continued alertness throughout the run. His position in the cab of the lead unit would have made him

2/ Railroad Accident Report-"Rear-end Collision of Two Southern Pacific Transportation Company Freight Trains, Indio, California, June 25, 1973 (NTSB-RAR-74-1); 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); and Railroad Accident Report-"Head-on Collision of Baltimore and Ohio Freight Trains Extra 6474 East and Extra 4367 West, Orleans Road, West Virginia, February 12, 1980" (NTSB-RAR-80-9).

more a part of the crew and would have allowed the crew to function more as a team.

## CONCLUSIONS

### Findings

1. The enginecrew of train No. 86 failed to comply with Operating Rule No. 285 when the train was not slowed prepared to stop at the east end of Farm, and were then unable to comply with Operating Rule No. 292, the stop-and-stay aspect displayed at the east end of Farm.
2. Train No. 86 had been operated in compliance with carrier rules and specific instructions for train movement until it passed the approach signal at the west end of Farm.
3. The locomotive electronic alertness control device did not insure that the crew was alert.
4. The fireman, the engineer, and the front brakeman of train No. 86 were not alert enough to perceive and respond to the approach signal at the west end of Farm.
5. The fitness for duty of the enginecrew was not determined by a responsible company official when they reported for duty.
6. Extra 1589 West was being operated in compliance with the carrier's rules and special instructions.
7. Had the signal system been designed so that an advance approach aspect had been displayed at Mohegan when an approach aspect was displayed at the west end of Farm, the accident may have been prevented.
8. The collision caused the derailed locomotive units of train No. 86 to collide with a concrete bridge pier and made the crash and resulting deformation of the lead unit's cab unsurvivable for its occupant.

### Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the head-end crew of train No. 86 to reduce the speed of the train in compliance with the indication of the signal which displayed an approach aspect, which made it impossible for the fireman to stop the train short of the east Farm interlocking home signal when it was seen to be displaying a stop-and-stay aspect.

## RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board made the following recommendation to the Norfolk and Western Railway Company:

Modify existing signals so that an "advance approach" aspect will be displayed for eastbound trains on both tracks at Mohegan when an "approach" aspect is displayed on either track at the west end of Farm. Where similar conditions exist at other locations, also provide an advance approach aspect. (Class II, Priority Action) (R-81-37)

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-81-38)

In addition to this recommendation, the Safety Board reemphasizes the importance of the following recommendation which was made to the Federal Railroad Administration as a result of other collisions: 3/

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)

**BY THE NATIONAL TRANSPORTATION SAFETY BOARD**

s/s JAMES B. KING  
Chairman

s/s ELWOOD T. DRIVER  
Vice Chairman

s/s FRANCIS H. McADAMS  
Member

s/s G.H. PATRICK BURSLEY  
Member

PATRICIA A. GOLDMAN, Member, did not participate.

March 4, 1981

3/ Railroad Accident Report--"Head-on Collision of Two Penn Central Freight Trains at Herndon, Pennsylvania, March 12, 1972" (NTSB-RAR-73-3); Railroad Accident Report--"Rear End Collision of Two Texas and Pacific Railway Company Freight Trains, Meeker, Louisiana, May 30, 1975" (NTSB-RAR-75-9); and Railroad Accident Report--"Rear End Collision of Southern Pacific Transportation Company Freight Trains 02-HOLAT-21 and 01-BSMFK-20 Thousand Palms, California July 24, 1979" (NTSB-RAR-80-1).

APPENDIXES

APPENDIX A

INVESTIGATION

The National Transportation Safety Board was notified of the accident about 10:30 a.m., on September 6, 1980. Three investigators from the Atlanta field office of the Safety Board were dispatched to the scene. A public hearing was not held, and depositions were not taken.

APPENDIX B

NORFOLK AND WESTERN RAILWAY COMPANY  
CREWMEMBER INFORMATION

Train No. 86

Engineer John Wallace Reed, Jr.

Engineer Reed, 59, has been employed by the N&W in engine service for 34 years. He began as a fireman and was promoted to locomotive engineer during January, 1953. His last biennial physical examination\* was on July 30, 1979. His personnel records indicated that he had been disciplined for his responsibility in a train collision in 1948, for passing a stop-and-stay signal in 1961, for his responsibility in a collision on a yard track in 1966, and for his responsibility in a derailment in 1974. He passed his last operating rules examination in September 1979.

Fireman Charles A. Basore

Fireman Basore, 40, had been employed by the N&W in engine service for 15 years. He began his railroad service as a fireman and was promoted to locomotive engineer on March 13, 1969. He had successfully passed an operating rules examination on February 15, 1980. He was examined during a carrier-sponsored eye examination program on August 30, 1979, and was not restricted. His personnel record indicates that he had not been disciplined since he began employment with the N&W.

Front Brakeman Marvin Cheek

Front Brakeman Cheek, 61, had been employed by the N&W for 37 years. With the exception of 8 months, all railroad experience had been in train service. He passed his last operating rules examination on February 5, 1980. His most recent biennial physical examination was May 7, 1979, and he was not restricted. His personnel record indicates that he had not been disciplined since he began employment with the N&W.

Conductor Jeffrey M. Preston

Conductor Preston, 27, had been employed by the N&W in train service for 9 years and was promoted to conductor in July 1974. He was last successfully examined on operating rules on September 26, 1979. He had been off duty for 12 hours 40 minutes before reporting for duty on the day of the accident.

Flagman Jesse Parsely

Flagman Parsely, 60, had been employed by the N&W for 34 years in train service. He was a promoted conductor but had relinquished his conductor's

\* N&W requires employee over 50 years of age to submit to a biennial physical examination.

seniority to hold the interdivisional run as a regular brakeman. He had been off duty for 38 hours 38 minutes before reporting for duty on the day of the accident.

Extra 1589 West

Engineer L. L. G. Croy

Engineer Croy, 33, has been employed by the N&W for 9 1/2 years and was promoted to engineer on April 11, 1973. He was last examined on operating rules during the spring of 1930.

Front Brakeman Anthony A. Dillard

Front Brakeman Dillard, 25, has been employed by the N&W in train service for 4 1/2 years.

Conductor Ralph D. Ryburn

Conductor Ryburn, 46, has been employed by the N&W in train service for 24 years and was promoted to conductor during January 1964.

Flagman Joseph P. Borich

Flagman Borich, 27, has been employed by the N&W in train service for 2 years 10 months.

**APPENDIX C**

**EXCERPTS FROM N&W OPERATING RULE BOOK AND CURRENT TIMETABLE  
AND DIAGRAMS OF SIGNAL ASPECTS**

The following have been excerpted from N&W Operating Rule Book and Current Timetable:

N&W Timetable No. 7, Special Instructions,

**General**

No. 6 Eastward or northward trains are superior to trains of the same class in the opposite direction.

Rule 34, Book of Rules, is changed to read as follows:

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 engine man to have employees comply with these requirements, including himself.

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

Crewmembers not located in the operating compartment of the engine, who are in a position to see or hear signals affecting the movement of their train or engine, must do so, and if other crewmembers are present, must communicate to them, in an audible and clear manner, the name or aspect of each signal.

If a crewmember becomes aware that the engineman has become incapacitated or should the engineman fail to operate or control the train or engine in accordance with the signal indication or other conditions requiring speed to be reduced, other crewmembers must communicate with him at once, and if he fails to properly control the speed of the train or engine, they must take action necessary to ensure the safety of the train or engine, including operating the emergency valve.

**Signals:**

N&W Operating Rule 281

Name - Clear

Indication - Proceed at prescribed speed.

N&W Operating Rule 285

Name - Approach

Indication - Proceed preparing to stop at next signal. If exceeding

medium speed immediately take action  
to reduce to that speed.\*

\*Definition - One-half the maximum authorized speed, but not  
exceeding 30 miles per hour.

N&W Operating Rule 292

Name - Stop and Stay

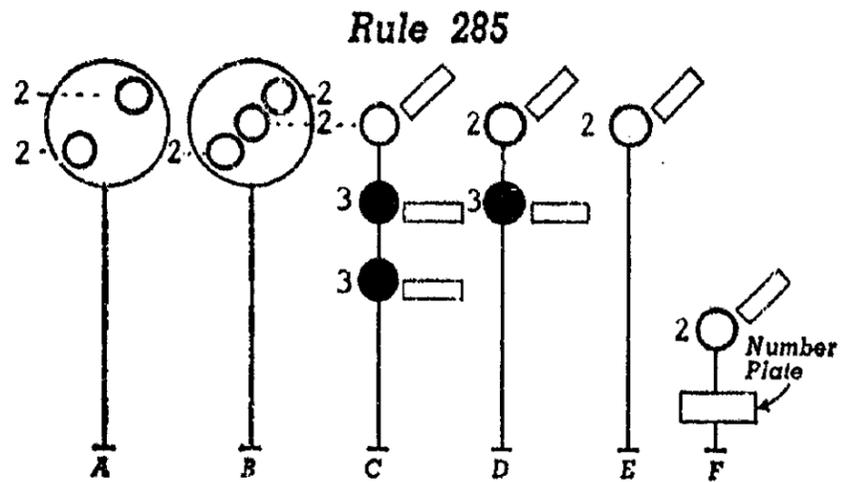
Indication - Stop and Stay.

N&W Operating Rule 582 - Enginemen

Enginemen must keep a vigilant lookout in the direction of  
movement for signals and obstructions and look back at frequent  
intervals for any defects in their train.

N&W Operating Rule 340

When a signal indicates stop, stop must be made before  
reaching the signal, except that trains approaching meeting or  
passing points and finding a signal displaying "stop and proceed"  
indication may proceed at restricted speed without stopping for  
such signal when the signal is located at or near the pull-in  
switch, provided the pull-in switch is open and proceed signal is  
given by person handling the switch.

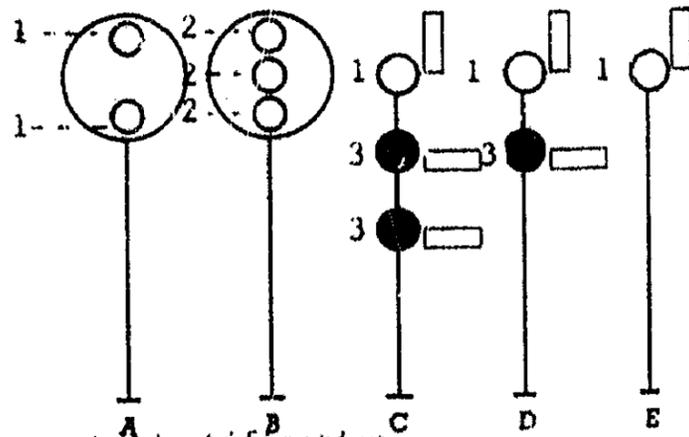


**Indication**—Proceed preparing to stop at next signal. If exceeding medium speed immediately take action to reduce to that speed.

**Name**—Approach.

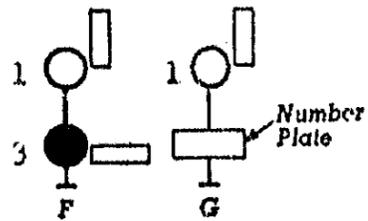
For report identification  
 1=Green  
 2=Yellow  
 3=Red

**Rule 281**



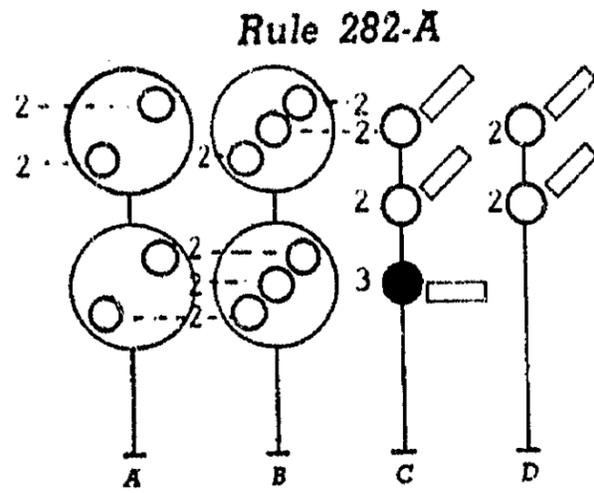
For report identification

1=Green  
2=Yellow  
3=Red



Indication—Proceed at prescribed speed.

Name—Clear.



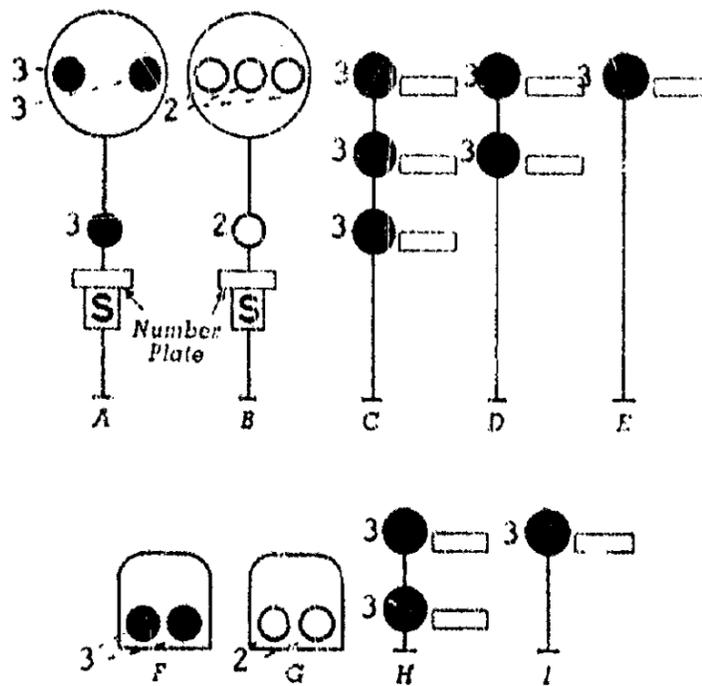
**Indication**—Proceed preparing to stop at second signal.

**Name**—Advance approach.

For report identification

- 1=Green
- 2=Yellow
- 3=Red

Rule 292



Indication--Stop and stay.

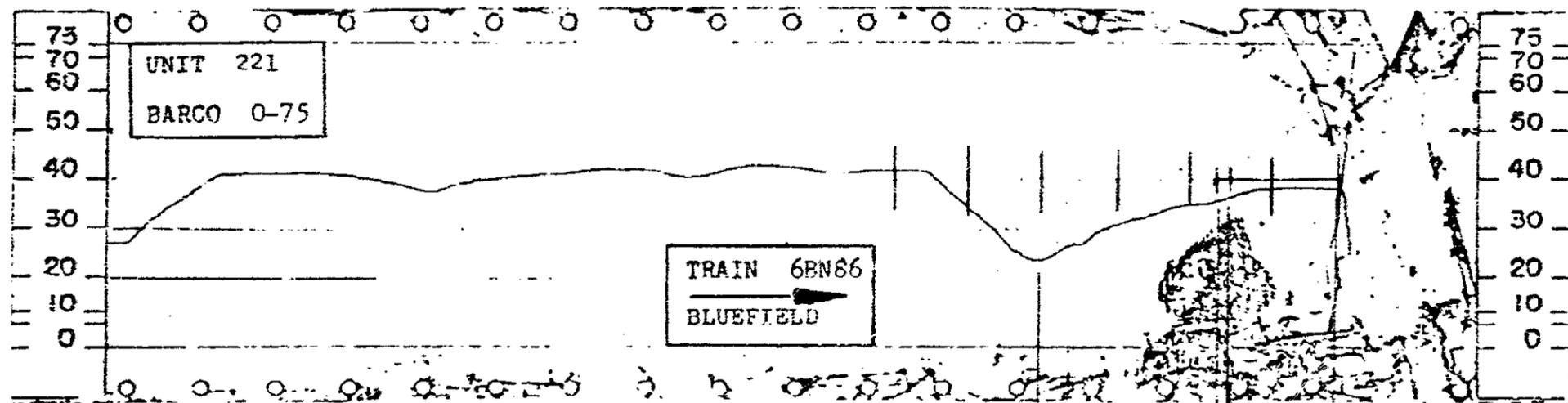
Name--Stop and stay.

For report identification

1=Green

2=Yellow

3=Red



DERAILMENT - TRAIN 6BN86	SEPTEMBER 6, 1980
POCAHONTAS DIVISION	FARM, W. VA.
LOCOMOTIVE 8075 - 1730 - 4110 - 221	
53 LOADS	13 EMPTIES
	4660 TONS

OFFICE OF GENERAL MANAGER MOTIVE POWER AND EQUIPMENT  
 ROANOKE, VIRGINIA

SPEED TAPE FROM TRAIN NO. 86

APPENDIX D

APPENDIX E

REPORT OF FEDERAL RAILROAD ADMINISTRATION'S SIGNAL INSPECTOR

SUMMARY OF SIGNAL TESTS FOLLOWING ACCIDENT AT FARM, W. VA.

Saturday, September 1980

Tests conducted by Norfolk and Western personnel were under the direction of or supervised by the assistant chief engineer of signals and communications and the Pocahontas regional engineer of signals and communications who was assisted by various system personnel as well as division personnel. I participated or witnessed the tests as indicated below.

Saturday Afternoon, September 6, 1980

1. Insulation resistance test and proving of LA52BP control circuit between east end Farm and west end Farm by railroad personnel.

Saturday Night, September 6, 1980, and Sunday Morning, September 7, 1980

- \*2. Insulation resistance tests of all cable conductors between east end Farm and west end Farm. (No exceptions taken)
- 3. Testing of all relays involved in circuitry for control of signal 52L west end Farm and 48L east end Farm. (No exceptions taken)
- \*4. Track circuits east end Farm to west end Farm proved and tested for shunting sensitivity. (No exceptions taken)
- \*5. East end Farm time locking. (No exceptions taken)
- \*6. East end Farm route locking. (No exceptions taken)
- \*7. Tests for grounds east end Farm. (No exceptions taken)
- 8. Tests for grounds west end Farm. (No exceptions taken)

Tests 7 and 8 further substantiated Test 2.

Sunday Afternoon, September 7, 1980

\*9. Operational tests simulating actual train movements were made between west end Farm and Welch including east end Farm on No. 1 track. These tests were made by simulating crossover 47 at the east end Farm as the main line switch and turnout were destroyed by the accident. The tests were run from the equipment house at the east end of Farm using telephones or radio for communicating with other locations. A speaker phone was used at this location so incoming as well as outgoing conversations could be monitored by everyone at this location. No exceptions were taken of the operations of the signal system in this vicinity.

\*FRA inspector participated or witnessed entirely.

\*\* FRA inspector participated or witnessed portions of tests.

**APPENDIX E**

Tuesday, September 9, 1980

- \*10. Examination records of tests of signal equipment in this vicinity at Bluefield office.

Thursday Morning, September 11, 1980

- \*\*\*11. Sight test of preview of signal 52L west end Farm and 48L east end farm.  
(No exceptions taken)

- \* FRA Inspection participated or witnessed entirely
- \*\*\* FRA Inspector and NTSB Investigator participated or witnessed entirely.