RAILROAD ACCIDENT INVESTIGATION,

REPORT NO. 4171,

NORFOLK AND WESTERN RAILWAY COMPANY

PEMBROKE, VA

AUGUST 19, 1970

FEDERAL RAILROAD ADMINISTRATION

BUREAU OF RAILROAD SAFETY,

Washington, D C 20590

Summary

DATE:	August 19, 1970	
RAILROAD:	Norfolk and Western	
LOCATION:	Pembroke, Va.	
ACCIDENT TYPE:	Head-end collision	
TRAINS INVOLVED:	Freight	Freight
TRAIN NUMBERS:	Extra 720 West	Extra 1529 East
LOCOMOTIVE NUMBERS:	Diesel-electric units 720, 366, 806, 353, 782	Diesel-electric units 1529, 926, 1752, 1547, 1751; Helper locomotive
CONSISTS:	200 cars, caboose	125 cars, caboose
SPEEDS:	40 m p h.	Slow
OPERATION:	Signal indications	
TRACK:	Single; tangent, level	
WEATHER:	Clear	
TIME:	9:45 a m	
CASUALTIES:	2 killed; 1 injured	
CAUSE:	Failure of engineer to properly control speed of the eastbound train after being delayed in block of a signal, resulting in train passing the next signal without stopping, as required	

DEPARTMENT OF TRANSPORTATION

FEDERAL RAILROAD ADMINISTRATION

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Synopsis

On August 19, 1970, a head-end collision occurred between two Norfolk and Western Railway freight trains near Pembroke, Va It resulted in death to two and in injury to one train-service employees

The accident was caused by failure of the engineer to properly control the speed of the eastbound train after being delayed in the block of a signal, resulting in the train passing the next signal without stopping, as required

Location and Method of Operation

The accident occurred on that part of the railroad extending westward from West Roanoke to Celco, Va , a distance of 68 0 miles In the accident area this is a single-track line over which trains operate by signal indications of a traffic control system Near Pembroke, 56 9 miles west of West Roanoke, a siding designated as Ripplemead, 3 9 miles in length, parallels the main track on the south Its east switch is 2214 feet west of the Pembroke station point

The collision occurred on the main track, at the point of the east switch of the Ripplemead siding

Track

From the east on the main track there are, successively, a tangent 624 feet long, a 990-foot compound curve to

the right having a maximum curvature of 3°00', and a tangent 573 feet to the collision point and 492 feet westward From the west on the main track there are, successively, a 2°00' curve to the right 792 feet long, a tangent 510 feet, a 2°00' curve to the left 905 feet, and the tangent on which the collision occurred

The grade is practically level in the collision area.

Time and Weather

The collision took place at 9:45 a m., under clear weather conditions.

Authorized Speed

The maximum authorized speed for freight trains in the collision area, including movements through the turnouts of the Ripplemead siding, is 50 m p.h However, solid trains of open-top cars loaded with mineral freight are restricted to a maximum speed of 35 m p h

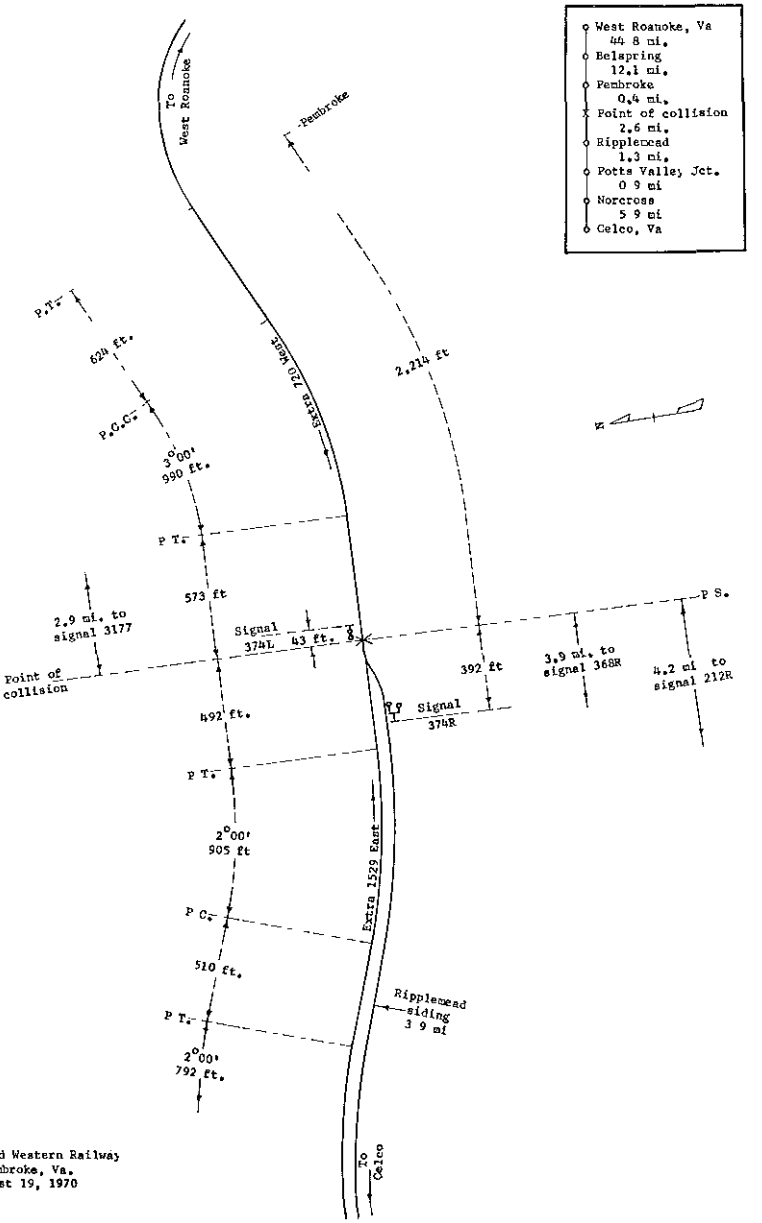
Signals

Automatic signal 3177 and controlled signal 374L, governing westbound movements on the main track, are 2 9 miles and 43 feet east of the collision point, respectively

Controlled signals 212R, 368R and 374R, governing eastbound movements on the main track, are 4.2 miles, 3 9 miles and 392 feet west of the collision point, respectively

The aforesaid signals are of the color-position-light type and are continuously lighted The applicable aspects, indications and names are as follows:

Signal	Aspect	Indication	Name
3177	2 yellow lights in diagonal position to the right over 2 yellow lights in vertical position	Proceed preparing to take diverging route beyond next signal at prescribed speed	Approach Diverging
374L 368R	2 red lights in horizontal position over 2 yellow lights in diagonal position to right	Proceed through turnout or turnouts at prescribed speed preparing to stop at next signal If exceeding medium speed, immediately take action to reduce to that speed	Diverging Approach



Norfolk and Western Railway
Pembroke, Va.
August 19, 1970

Signal	Aspect	Indication	Name
212R	2 red lights in horizontal position over 2 yellow lights in vertical position	Proceed through turnout or turnouts at prescribed speed	Diverging Clear
374R 374L	2 red lights in horizontal position over red marker light and No plate with letter "S"	Stop-and-stay	Stop-and-stay

The controlled signals and the switches of the Ripplemead siding are controlled from traffic control machines in the train dispatchers' office

The circuits are so arranged that when the route has been established for a westbound train to enter the Ripplemead siding and for an eastbound train to proceed on the main track to signal 374R, signals 3177 and 374L display Approach-Diverging and Diverging-Approach aspects, respectively, for the westbound train and signals 212R, 368R and 374R display Diverging-Clear, Diverging-Approach, and Stop-and-Stay aspects, respectively, for the eastbound train

In the event the route is so established and the eastbound train passes signal 374R, the aspect of signal 374L changes to Stop-and-Stay

Carrier's Operating Rules

Medium Speed - One-half the maximum authorized speed, but not exceeding 30 miles per hour.

Restricted Speed - A speed that will permit stopping short of train *** but not exceeding 15 miles per hour

Pilot - An employee assigned to a train when the engineman is not fully acquainted with the physical characteristics or rules of the railroad, or portion of the railroad, over which the train is to be moved

353 When a train or engine has passed a signal permitting it to proceed and is delayed in the block, it must proceed at restricted speed to the next signal

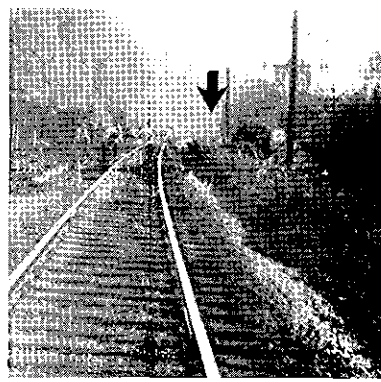
Power Brake Law of 1958

Sec 232 15 Double heading and helper service (a) When more than one locomotive is attached to a train, the engineman of the leading locomotive shall operate the brakes. On all other motive power units in the train the brake pipe cutout cock to the brake valve must be closed, the maximum main reservoir pressure maintained and the brake valve handles kept in the prescribed position ***

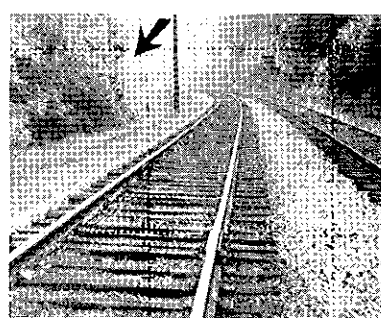
Radio Equipment

The locomotives and cabooses of both trains had radio telephones.

Plate No. 2



Westward signal 374L (arrow) from distance of about 1150 feet.



Eastward signal 374R (arrow) from distance of about 1175 feet Main track at left Applemead siding at right.

Sight Distances

Because of track curvature and trees along the north side of the track structure, signal 374L cannot been seen from an approaching westbound train at a distance greater than about 1150 feet For the same reason, signal 374R

cannot be seen from an approaching eastbound train at a distance more than approximately 1175 feet. (See Plate No 2 for views)

Circumstances Prior to Accident

Train Dispatcher

Approximately one hour before the accident, train dispatchers established the route for Extra 720 West to enter the Ripplemead siding at the east switch, and for Extra 1529 East to proceed on the main track to signal 374R

Extra 720 West

This was a westbound freight train consisting of 5 road-switcher type diesel-electric units, 200 empty open-top cars, and a caboose It left West Roanoke at 7:28 a m the day of the accident, after receiving the prescribed brake test The train passed Belspring, 12 1 miles east of Pembroke, at 9:23 a m Soon afterward, while moving westward on the main track, it approached signal 3177 and the east switch of the Ripplemead siding

The engineer and front brakeman were in the control compartment at the rear of the first diesel-electric unit The conductor and flagman were in the caboose.

Extra 1529 East

Extra 1529 East, an eastbound freight train consisting of 3 road-switcher type diesel-electric units, 159 open-top cars loaded with coal, and a caboose, left Celco, a crew-change point, at 7:40 a m the day of the accident The train then proceeded 5 9 miles eastward to Norcross on a portion of the main track formerly owned and operated by the Virginian Railway, before its merger with the N&W in December 1959 About 7:55 a m , Extra 1529 East stopped on the main track at Norcross short of a switch for an auxiliary track. At 8:45 a m , it resumed its trip eastward, passing signal 212R, which displayed a Diverging-Clear aspect Immediately after passing that signal, the train entered a section of the main track extending to Potts Valley Jct This portion of the main track previously served as a connecting track for the N&W and Virginian railroads

At Potts Valley Jct , Extra 1529 East began to pass signal 368R, which displayed a Diverging-Approach aspect Soon afterward, at approximately 8:55 a.m , the train stopped with its front portion in the block of signal 368R and its rear portion in the block of signal 212R, to reduce tonnage and to permit a helper locomotive be coupled to its rear end. The engineer and front brakeman were in the control compartment at the front of the first diesel-electric unit The conductor and flagman were in the caboose.

According to their statements, both the engineer and front brakeman had observed signals 212R and 368R displaying Diverging-Clear and Diverging-Approach aspects, respectively and had called those aspects to each other

Engineer and Front Brakeman - Extra 1529 East

The engineer was a former Virginian Railway employee According to his statements, he was unfamiliar with that part of the N&W extending from Potts Valley Jct to West Roanoke and had not known, when reporting for duty at Celco, his train would be routed over the aforesaid portion of the N&W

The front brakeman was inexperienced and unfamiliar with the application of the carrier's operating rules

The Accident

Extra 720 West

Signal 3177 apparently was displaying an Approach-Diverging aspect when Extra 720 West passed it while moving at a speed of 43 m p h , as indicated by the speed-recording tape when corrected in accordance with results of calibrations of the speed-recording device The train continued in the block of that signal at unreduced speed for a distance of about two miles, with the engineer apparently assuming that the route had been established for his train to enter the Ripplemead siding at the east switch and that he would see signal 374L displaying a Diverging-Approach aspect when it came into view About 0 7 mile from signal 374L the train began to reduce speed And as it moved on a curve to the right at a speed of approximately 40 m p h , the signal came into the engineer's range of vision at a distance of about 1150 feet

Signal 374L evidently had been displaying a Diverging-Approach aspect However, apparently shortly after it came into view, the aspect of the signal changed to Stop-and-Stay due to Extra 1529 East having proceeded eastward on the main track beyond signal 374R and the fouling point of the turnout at the east end of the Ripplemead siding From all indications, the engineer promptly applied his train brakes in emergency when he saw Extra 1529 East ahead and the Stop-and-Stay aspect displayed by signal 374L A few seconds later, at 9:45 a m , Extra 720 West passed this signal before its speed was reduced materially and struck the locomotive of Extra 1529 East, at the point of the east switch of the Ripplemead siding

The conductor and flagman of Extra 720 West, the only surviving crew members of their train, said they were unaware of anything being wrong before they heard the brakes of their train apply in emergency shortly before the collision

Extra 1529 East

Upon arrival at Potts Valley Jct , Extra 1529 East stopped with the front portion in the block of signal 368R and the rear end at Norcross The crew then set out the last 34 cars on an auxiliary track at Norcross by leaving the caboose on the main track and making a reverse movement which did not cause the front of the train to move back a sufficient

distance to leave the block of signal 368R After the 34 cars were set out, the locomotive with 125 cars (12,950 tons) picked up the caboose on the main track The reassembled train then moved a short distance eastward and again stopped with the front portion in the block of signal 368R. A helper locomotive comprised of two diesel-electric units approached the train from the rear soon afterward and was attached to the caboose. The air hoses of the caboose and helper locomotive remained uncoupled Consequently, when the train proceeded eastward the engineer at the front end had no control over the brakes of the helper locomotive, as required by Section 232 15 of the Power Brake Law.

Immediately after his locomotive was coupled to the caboose, the helper engineer notified the road engineer of this fact by radio Both engineers then opened their respective throttles and Extra 1529 East began to proceed eastward on the main track, alongside the Ripplemead siding and in territory not thoroughly familiar to the road engineer

The train started to leave Potts Valley Jct at approximately 9:35 a m , after having been delayed in the block of signal 368R for approximately 40 minutes At that time, and while delayed in the block of signal 368R, neither the road engineer nor the front brakeman was able to see the next signal ahead (signal 374R) because of track curvature and trees alongside the track structure Therefore, under the existing circumstances, the train was required by the carrier's rules to proceed to signal 374R at a speed not exceeding 15 m p h , prepared to stop short of a train or obstruction Except for the occasion when he was notified by radio of the helper locomotive having been coupled to the rear of the train, the road engineer had no radio communication with anyone concerning the operation of the train leaving Potts Valley Jct

While departing from Potts Valley Jct., the train proceeded in the block of signal 368R at increasing speed The road engineer stated that he shut off power when a speed of about 20 m.p h was attained, and that the train continued eastward under power supplied by the helper locomotive only However, the speed tape shows (after corrected in accordance with calibrations) a decline in the rate of speed increase beginning at 25 m.p.h , indicating the road engineer might not have shut off power before the train attained that speed The helper engineer said he increased power by advancing the throttle to Run 5 position when the train reached a speed of about 24 m p.h , and that he left the throttle in that position while the train increased speed further His statements indicate that he had not been concerned about the speed due to feeling it was the road engineer's responsibility to control the speed properly. They further indicate that he was unfamiliar with the application of the carrier's operating rule No 353 governing operation of a train delayed in the block of a signal

The road engineer said that because of watching ahead for signal 374R he did not look at his speed recorder while moving in the block of signal 368R Although the train was evidently moving at a considerably higher speed, the road engineer stated he thought it never exceeded approximately 20 m p h while approaching signal 374R The front brakeman took no exception to the speed of the train leaving Potts Valley Jct

As Extra 1529 East neared the east switch of the Ripplemead siding and was about to enter a curve to the left, signal 374R came into view at a distance of approximately 1175 feet Both the road engineer and front brakeman saw that it displayed a Stop-and-Stay aspect and, moments later, also saw Extra 720 West closely approaching the east switch of the siding At that time, their train was moving at a speed of 41 m p h , as indicated by the speed-recording tape The road engineer immediately applied the train brakes in emergency when he saw signal 374R displaying a Stop-and-Stay aspect, then called a warning over the radio to the helper locomotive In response to that call, the helper engineer promptly moved the throttle of the helper locomotive to idle position, shutting off power

Due to insufficient braking distance, Extra 1529 East was unable to stop short of signal 374R or the fouling point of the east turnout of the Ripplemead siding Its speed was apparently reduced to approximately 10 or 15 m p h when the front end passed the signal and about that time the front brakeman jumped from the locomotive A few seconds later, as Extra 1529 East was moving at slow speed, its front end was struck by the opposing train at the point of the east switch of the Ripplemead siding

As Extra 1529 East moved eastward in the block of signal 368R and approached signal 374R, the conductor was seated at his desk in the caboose and the flagman was in the cupola According to their statements, neither took exception to the speed of his train in the block of signal 368R The flagman statements indicate he felt no concern about the speed because of being unfamiliar with the application of the carrier's operating Rule No 353. The conductor alleged that he thought the train proceeded in the block of signal 368R at a speed not exceeding 15 m p h , as required, and that he had been unable to judge whether it exceeded that speed

Casualties

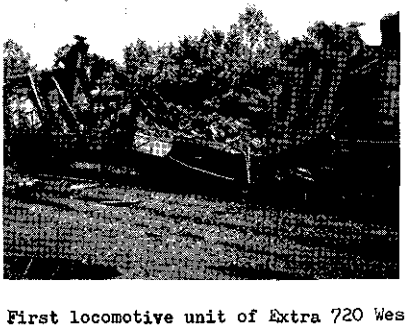
The engineer and front brakeman of Extra 720 West were killed The front brakeman of Extra 1529 East was slightly injured as a result of jumping from the locomotive before the collision The engineer remained on the locomotive and escaped injury

Damages

Extra 720 West

The train stopped with the front end 39 feet west of the collision point. The 1st, 2nd and 4th diesel-electric units, and the 13th to 24th cars, inclusive, were derailed The 1st and 4th diesel-electric units stopped upright on and in line with the main-track structure, and with the west end of the first unit against the front of the first locomotive unit of Extra 1529 East The 2nd diesel-electric unit rose from its trucks; overrode the rear, or east, end of the 1st unit, demolishing the control and engine compartments of that unit, (see following photograph); overturned, and stopped about 55 feet north of the main track Five of the derailed cars stopped upright on and in line with the main-track structure The other seven derailed cars buckled from the train and stopped in various positions on or near the main-track structure.

The first two diesel-electric units were destroyed; the other three units were slightly damaged Of the derailed cars, seven were heavily damaged, four were slightly damaged, and one was undamaged.



First locomotive unit of Extra 720 West. Derailed trucks of second unit shown in vertical position between 1st and 3rd units.

Extra 1529 East

Only the front truck of the first car in this train was derailed The three diesel-electric units at the front of the train, and the first car, were moderately damaged.

Cost of Damages

According to the carrier's estimate, the total cost of damages to the track structure, and signal and train equipment, was $196,950

Train Crews' Hours of Service

Extra 720 West

At the time of the accident, all the crew members of this train had been continuously on duty four hours, after having been off duty over 15 hours

Extra 1529 East

All the crew members of this train had been continuously on duty 2 hours 46 minutes at the time of the accident, after having been off duty for eight hours or more

Engineer and Front Brakeman - Extra 1529 East

Engineer

The engineer, age 54, was first employed by the Virginian Railway as a fireman in June 1945, and was working in that capacity when the Virginian and the N&W merged in December 1959 He was promoted to engineer in June 1965, and was last examined on the carrier's rules in December 1969 His record as an engineer was clear

According to his statements, the engineer had made several westbound trips from West Roanoke to Potts Valley Jct prior to the day of the accident, but had never made a working or qualifying eastbound trip between those points

Front Brakeman

This employee, age 34, was first employed by the railroad as a brakeman on July 5, 1970 He was furloughed on July 17 and was recalled to service about one week before the accident His record was clear

According to his statements, the front brakeman had never been on that part of the railroad between West Roanoke and Potts Valley Jct before the day of the accident His statements further indicate that he was unfamiliar with the application of the carrier's operating rule No. 353, governing the operation of a train delayed in a signal block

Post-Accident Examinations

Signal System

The portion of the signal system involved was tested and was found to be functioning properly

Radio Equipment

Tests revealed the radio equipment of the leading locomotive, caboose, and helper locomotive of Extra 1529 East was functioning properly

Brakes of Extra 1529 East

Tests and examinations revealed that the brakes of this train were functioning properly, except for three cars brakes which apparently leaked off after being applied

Stopping Distance

After the accident, a test train with a helper locomotive at the rear end was assembled for tests to determine stopping distances for Extra 1529 East Except for the first three diesel-electric units and first car, the test train was comprised of the equipment of Extra 1529 East, including the helper locomotive units. Its tonnage was about the same as Extra 1529 East

In three instances, the test train approached signal 374R at a speed of 32 or 33 m p h and the engineer at the front end applied the brakes in emergency when the signal came into view. In all instances, the front of the train ran by signal 374R and the east switch of the Ripplemead siding, stopping 394 to 535 feet beyond signal 374R In the first instance, the air brake systems of the train and helper locomotive were not coupled, and the helper engineer was not notified by radio that the train brakes had been applied in emergency In the second instance, the air brake systems of the train and helper locomotive were not coupled, and the helper engineer shut off power when notified by radio of the emergency brake application In the third instance, the air brake systems of the train and helper locomotive were coupled, resulting in the helper locomotive brakes being applied also when the train brakes were applied in emergency In this instance, the train stopped in the shortest distance (front end 394 feet beyond signal 374R).

In one other test, the test train approached signal 374R at a speed of 15 m p h and without the air systems of the train and helper locomotive being coupled When the signal came into view the engineer at the front of the train initiated a 23-pound reduction in brake pipe pressure, and the train stopped with the front end 331 feet short of signal 374R

Considering that the investigation revealed Extra 1529 East was moving at a speed of 41 m p h when the engineer sighted the Stop-and-Stay aspect displayed by signal 374R and applied the brakes in emergency, it is evident from the stopping distance tests that the train could not have stopped short of signal 374R and the east switch of the Ripplemead siding, regardless of whether the brake systems of the train and helper locomotive were coupled

Findings

1 The route had been established for Extra 720 West to pass signal 374L and enter the Ripplemead siding at the east switch, and for Extra 1529 East to proceed eastward on the main track to signal 374R

2 Extra 720 West approached signal 374L in accordance with applicable rules and regulations. Due to insufficient braking distance, it was unable to stop short of signal 374L when the aspect of that signal unexpectedly changed to Stop-and-Stay

3. After entering the block of signal 368R, Extra 1529 East was delayed in that signal block for approximately 40 minutes, due to setting out cars and then waiting for a helper locomotive to be attached to its rear end As a result of the delay, the train was prohibited by the carrier's rules from proceeding to the next signal (374R) at a speed in excess of 15 m p h

4 After being delayed in the block of signal 368R, Extra 1529 East proceeded to signal 374R at increasingly excessive speed It was moving at 41 m.p h when signal 374R came into view a relatively short distance ahead and was seen to be displaying a Stop-and-Stay aspect

5. Because of its excessive speed when signal 374R came into view, Extra 1529 East had insufficient braking distance to stop at that signal, as required As a result, the front of the train passed signal 374R and the fouling point at the east turnout of the Ripplemead siding, causing the collision with the opposing train at the east switch of the siding

6 The primary causal factor in the accident was failure of the road engineer to control the speed of Extra 1529 East in the block of signal 368R as required after experiencing a delay in that signal block

7 Significant causal factors apparently were ---

(a) Unfamiliarity of the road engineer of Extra 1529 East with the territory involved insofar as eastbound train operations are concerned

(b) Lack of arrangements for a pilot to be assigned to Extra 1529 East for the operation of that train on a portion of the railroad where the road engineer was not fully acquainted with the physical characteristics related to eastbound operations.

(c) Unfamiliarity of the road engineer of Extra 1529 East with the application of the carrier's operating rule No 353, governing operation of a train delayed in the block of a signal

(d) Failure of other crew members of Extra 1529 East, including those of the helper locomotive, to call the road engineer's attention (by use of the radio) to the fact that their train was moving at excessive speed in ap-

proach to signal 374R after being delayed in the block of signal 368R This failure appears to have been the result of unfamiliarity with the application of the carrier's operating rule No 353

8 Extra 1529 East proceeded in the block of signal 368R without the air brake systems of the train and helper locomotive having been coupled, as required by the Power Brake Law The investigation revealed it was common practice for helper locomotives to push trains without the aforesaid systems being coupled The FRA has taken appropriate action with respect to this matter

Dated at Washington, D C , this 25th day of August 1971
By the Federal Railroad Administration

Mac E Rogers, Director
Bureau of Railroad Safety