RAILROAD ACCIDENT INVESTIGATION

REPORT NO 4104-
4113.

INTERSTATE RAILROAD

ARNO, VA.

OCTOBER 11, 1966

DEPARTMENT OF TRANSPORTATION

FEDERAL RAILROAD ADMINISTRATION

WASHINGTON

SUMMARY

DATE:	October 11, 1966
RAILROAD:	Interstate
LOCATION·	Arno, Va
KIND OF ACCIDENT:	Derailment
TRAIN INVOLVED·	Freight
TRAIN NUMBER:	Extra 6898 East
LOCOMOTIVE NUMBERS:	Diesel-electric units 6898, 2192
CONSIST·	18 cars, caboose
ESTIMATED SPEED:	35 - 40 m p h
OPERATION:	Train orders, special instructions
TRACK:	Single; 19°00' curve; 1.6 percent descending grade eastward
WEATHER:	Clear
TIME:	7:30 a.m
CASUALTIES	1 injured
CAUSE:	Excessive speed on a curve of train moving out of control on a descending grade as a result of materially reduced braking ratios of heavily loaded cars, inadequate brake pipe pressure on train and improper manipulation of brake controls by the engineer, and by failure of the carrier to prescribe and enforce proper rules and instructions for train operations on steep grades

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RAILROAD SAFETY BOARD

RAILROAD ACCIDENT INVESTIGATION

REPORT NO. 4104

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SYNOPSIS

On October 11, 1966, an Interstate Railroad freight train derailed at Arno, Va., resulting in the injury of one train-service employee.

The accident was caused by excessive speed on a curve of train moving out of control on a descending grade as a result of materially reduced braking ratios of heavily loaded cars, inadequate brake pipe pressure on train and improper manipulation of brake controls by the engineer, and by failure of the carrier to prescribe and enforce proper rules and instructions for train operations on steep grades.

LOCATION AND METHOD OF OPERATION

The accident occurred on that part of the railroad extending between Derby and Andover, Va , a distance of 2 7 miles. This is a single-track line over which trains operate by train orders and special instructions. There is no block-signal system in use

The derailment occurred on the main track, 1.6 miles east of Derby and 546 feet east of the station point at Arno.

Eastward on the main track from Derby the grade is, successively, 1 8 percent descending 270 feet, 4 0 percent descending 5,000 feet, 2 5 percent descending 2,000 feet, and 1.6 percent descending 1,346 feet to the derailment point and a short distance eastward

Details concerning the main track, train involved, damages, and other factors are set forth in the appendix.

DESCRIPTION AND DISCUSSION

About 6:08 a m the day of the accident, a westbound freight train engaged in mine-run service, left Andover without its brakes having been tested in accordance with requirements of Section 132 12(a) to (h) of the Power Brake Law of 1958. It passed Arno and arrived at Derby about 6:45 a.m., with the locomotive pushing a caboose and 14 empty cars. Upon arrival, the caboose was placed on an auxiliary track and the 14 cars were placed on the main track west of a coal tipple. The locomotive then began to assemble a train for the return trip to Andover It entered another auxiliary track and was coupled to the east end of a cut of four cars loaded with coal. After connecting the air hose of the locomotive and four cars, the front brakeman signalled the engineer to push the cars a few feet westward to a coupling with a cut of 14 cars loaded with coal The flagman, who had connected the air hose of the 14 cars, assisted the front brakeman in connecting the air hose between the two cuts of cars. The flagman and front brakeman then walked to the rear car

When the air hose between the fourth and fifth cars were coupled, the engineer cut in the dynamic brake on the locomotive, applied the independent brake, and placed the handle of the automatic brake valve in running position to charge the air brake system of the cars. He said the air pressure regulating device on the locomotive was set for 80 pounds brake pipe pressure and, about 10 or 12 minutes after the cut of 18 cars was assembled, he received a signal from the flagman to apply the brakes on the cars for a brake test. He said he made a 15-pound reduction of brake pipe pressure in response to the flagman's signal, then cut out the pressure maintaining feature on the locomotive and made a leakage test which disclosed air leakage of about 4 pounds per minute in the brake system.

When the engineer made the 15-pound reduction of brake pipe pressure, the flagman saw the air brake apply on the rear car.

He and the front brakeman then walked forward alongside the cars and saw that the air brake on each car was applied After reaching the sixth car, the front brakeman continued forward to the locomotive The flagman returned to the rear car. While en route, he turned up the handles of the retaining valves on the rear cars to high pressure position, after noticing that the brakes on these cars were released When this was accomplished, the retaining valve handles on all the cars were in high pressure position, so that when the train left Derby and moved eastward on the descending grade a portion of the brake cylinder pressure would be retained to provide braking while brake pipe pressure was being restored after a brake release. Because of conflicting statements made by the crew members, it could not be determined when the handles of the retaining valves on the cars ahead of the rear four or five cars were turned up to high pressure position However, the statements indicate that the retaining valve handles on some of these cars had been turned up prior to or during the brake test After returning to the rear car, the flagman walked to the adjacent auxiliary track and boarded the caboose

The front brakeman said that after reaching the locomotive, he told the engineer that "everything was all right." The engineer said he then cut in the pressure maintaining feature, released the independent locomotive brake, and moved the handle of the automatic brake valve to release position. Soon thereafter, the locomotive and 18 cars moved eastward on the auxiliary track through the force of gravity, without power being applied, and proceeded toward the main track. While moving on the auxiliary track, they passed the caboose on the adjacent auxiliary track While the locomotive and 18 cars were moving to the main track, the engineer made two 10-pound reductions of brake pipe pressure to control the speed The conductor, who was on the caboose, said he noticed that the brake cylinder pistons on cars were extended and that handles of retaining valves on the cars were in high pressure position

Soon after the locomotive and cars entered the main track, the engineer also applied the independent brake and the movement stopped with the 18th car on the main track about 50 feet east of the auxiliary-track switch He then released the automatic brake A crew member released the hand brake on the caboose, which then rolled eastward, through the force of gravity from the other auxiliary track to the main track, and was coupled to

the 18th car The conductor said that soon after the air hose between the 18th car and caboose were connected, he radio-telephoned the engineer and told him the caboose air gauge indicated 73 pounds brake pipe pressure. He also told him "everything was all right," authorizing departure of the train from Derby. The engineer then released the independent locomotive brake and the train started to leave Derby, without its brakes having been tested in accordance with all the requirements of Section 132.12(a) to (h) of the Power Brake Law of 1958.

Extra 6898 East, consisting of 2 diesel-electric units, 18 cars and a caboose, left Derby about 7:26 a.m. According to the engineer, it moved eastward on the 4.0 percent descending grade at Derby through the force of gravity, without power being applied He said that soon afterward, when the train had accelerated to approximately 5 miles per hour, he operated the automatic brake valve and reduced brake pipe pressure about 10 pounds to control the speed, but found this was ineffective in retarding acceleration of the train on the descending grade. He said that when the train had increased speed to about 10 miles per hour, he made an additional 10- to 15-pound reduction of brake pipe pressure and found that this was also ineffective in controlling the speed. At this time, according to the engineer, the dynamic brake was fully applied and the independent locomotive brake was released He said that after the train moved about 1,200 feet farther eastward on the descending grade, its speed had increased to approximately 15 miles per hour. He said that he then made an additional 15-pound reduction of brake pipe pressure, applied sand to the rails, and made a 20- to 25-pound application of the independent locomotive brake. He said these actions reduced train speed to about 12 miles per hour. About this time, according to the engineer, the warning light associated with the dynamic brake became illuminated, indicating excessive braking current. He said he partially released the dynamic brake until the warning light went out, then fully reapplied that brake.

The engineer said the speed had increased to 15 or 18 miles per hour when the train reached a point about 3,600 feet east of Derby, although the dynamic brake and independent locomotive brake were applied and brake pipe pressure had been reduced 35 to 40 pounds He said the dynamic brake warning light again became illuminated and he reduced dynamic braking until the warning light went out, then fully reapplied the dynamic brake.

Immediately thereafter, the dynamic brake warning light became illuminated for the third time, and the engineer again reduced dynamic braking According to the engineer, the speed had increased to between 20 and 25 miles per hour by this time, and he realized the train was moving out of control on the descending grade He said that he then moved the handle of the automatic brake valve to emergency position and, in rapid succession, depressed the quick release bail on the independent brake valve; reduced the independent locomotive brake application to about 10 pounds brake cylinder pressure; closed the double-heading cock, and then moved the automatic brake valve handle to running position in an effort to recover the PC functions and resume dynamic braking Under these circumstances, however, the engineer could operate the independent locomotive brake, but the dynamic braking was annulled and the emergency application of the automatic brake on the locomotive was released The emergency application of the brakes on the cars was not affected

The train continued eastward on the descending grade at accelerating speed and passed Arno. Shortly afterward, at approximately 7:30 a m , it entered the 19°00' curve involved at excessive speed and out of control By this time, the engineer, fireman and front brakeman had left the control compartment and had proceeded rearward to the running board located on the south side of the locomotive The fireman alighted from the locomotive. A few moments later, as the train moved on the curve at 35 or 40 miles per hour, as estimated by the crew members, the 1st to 13th cars, inclusive, derailed 1.6 miles east of Derby and 546 feet east of the Arno station point. The engineer then re-entered the control compartment and stopped the locomotive, by use of the independent brake, 934 feet east of the derailment point.

The fireman was injured when he alighted from the locomotive

The conductor and flagman said that when they reboarded the caboose after coupling it to the train at Derby, they noted that the caboose air gauge was indicating 73 pounds brake pipe pressure They said that soon after the train started to move on the descending grade, they saw the brake pipe pressure had been reduced about 20 pounds as indicated by the caboose air gauge, and they felt the brakes retarding the train slightly for a few moments They said that shortly thereafter, when the

train had increased speed to approximately 15 miles per hour, the caboose air gauge indicated an additional 20-pound reduction of brake pipe pressure They said that they became alarmed at this time as the caboose air gauge indicated only 32 or 33 pounds brake pipe pressure remaining, and as the train continued to increase speed they applied hand brakes on the caboose and rear car Soon afterward, when the caboose was about 2,700 feet east of Derby, the conductor realized the train was moving out of control and called a warning over the radio-telephone. He said that he did not hear the train brakes apply in emergency. The flagman said he heard the brakes apply in emergency shortly after the second 20-pound brake pipe reduction, while he was applying the hand brake on the rear car. He said the derailment occurred soon afterward.

The structure of the main track was heavily damaged or destroyed in the derailment area

Examination of the locomotive after the accident disclosed no defective condition which could have contributed to the cause of the accident The derailed cars were damaged to the extent that their air brake systems could not be tested However, the service and emergency portions of the control valves in the air brake system of those cars were removed and shop tested The tests disclosed no defective conditions that would have contributed to the accident The air gauges from diesel-electric unit 6898 and the caboose were tested and were found to be, respectively 2 1/2 psi over and 3 1/2 psi. under in accuracy Tests also disclosed that the air pressure regulating device on the locomotive was set for 77 pounds brake pipe pressure

According to carrier officials, it was common practice to set air pressure regulating devices on locomotives operating in the coal mine service involved at 90 pounds. However, the investigation disclosed that the carrier had not promulgated instructions concerning the setting of such devices It also disclosed that the crew members involved were unfamiliar with the provisions of the Power Brake Law of 1958 and that the carrier had not promulgated any instructions relating thereto.

A test train, consisting of the two diesel-electric units and the caboose of Extra 6898 East, and 18 loaded cars of the same type and capacity involved in the derailment, was assembled at Derby the day after the accident for a brake performance test on the descending grade involved The pressure regulating

device on the locomotive was set for 90 pounds brake pipe pressure and the handles of the retaining valves of the cars were placed in high pressure position After its brakes were tested on the load track, the test train left Derby with the dynamic brake applied and moved down the descending grade without incident Shortly after leaving Derby, the engineer operated the automatic brake valve and initiated a 10-pound reduction of brake pipe pressure, which was effective in maintaining the speed below 10 miles per hour When the train was about one mile east of Derby, its speed had increased to about 11 miles per hour and the engineer made an additional 6-pound reduction of brake pipe pressure With a total brake pipe reduction of 16 pounds and the dynamic brake applied, the train came to a stop at the derailment point

The five non-derailed cars of Extra 6898 East were weighed after the accident and their loads were found to have weights varying between the capacity weights and slightly over the load limit weights stencilled on the cars. Computations based on the gross rail load of the cars and 50 psi. brake cylinder pressure indicate that of the 18 cars, the braking ratio of only one car met the Association of American Railroad's minimum braking ratio standard of 18 percent of gross rail load All the other cars had braking ratio percentages substantially below the AAR minimum standard, resulting in reduced effectiveness of the train air brake system on a tons per operative brake basis. The setting of the locomotive air pressure regulating device at 77 pounds brake pipe pressure, instead of 90 pounds, contributed further to the reduction in effectiveness of the air brake system. It is apparent that because of the combination of the foregoing factors, the effectiveness of the train air brake system was reduced to the extent that the engineer could not properly control the speed of the train on the heavy descending grade by operation of the automatic air brakes and the dynamic brake. The effectiveness of the train braking system was further reduced when the engineer depressed the quick release bail on the independent brake valve after initiating the emergency brake application, as this prevented application of the automatic air brake on the locomotive and resulted in loss of the considerable braking effort that brake affords

After the accident, the carrier issued a new timetable containing special instructions which require a train departing from Derby to have its air brake system charged to 100 pounds

brake pipe pressure for 20 minutes before a brake test is made. It further requires that after the brakes have been tested, the train will not depart until its air brake system has been recharged to 100 pounds brake pipe pressure, as indicated on the gauge of the locomotive, for five minutes. Before descending the grade, all retaining valves handles must be placed in high pressure position As the train begins to move, the dynamic brake must be applied in full

FINDINGS

It is apparent that most of the cars of Extra 6898 East were loaded to extents which resulted in a high ratio of tons per operative brake and the effectiveness of the train air brake system was considerably reduced, for operation on the heavy descending grade The locomotive air pressure regulating device was set at only 77 pounds brake pipe pressure. Because of the high ratio of tons per operative brake and the relatively low air brake pipe pressure, the engineer was unable to control the speed of the train on the descending grade by service applications of the automatic brake in conjunction with use of the dynamic brake and the independent locomotive brake When the engineer realized the train was moving out of control, he initiated an emergency application of the automatic brakes, depressed the quick release bail on the independent brake valve, reduced the independent locomotive brake application to about 10 pounds brake cylinder pressure, closed the double-heading cock, and then moved the handle of the automatic brake valve to running position This procedure in an emergency situation not only nullified the dynamic braking, but also released the emergency application of the brake on the locomotive, resulting in loss of the considerable braking effort this brake affords. Hence, the engineer's actions taken at the time he realized the train was moving out of control were ineffective in reducing the train speed The train continued eastward on the descending grade at accelerating speed, then entered the curve involved at excessive speed, resulting in the derailment.

Although carrier officials stated that it was common practice for trains to leave Derby with the locomotive air pressure regulating devices set at 90 pounds brake pipe pressure, the investigation disclosed the carrier had not promulgated any instructions concerning the setting of such devices and that it

was also common practice to operate with lower brake pipe pressures as in the instant case It also disclosed that the carrier had not properly instructed train-service employees as to the requirements of the Power Brake Law of 1958, and that it had not provided enginemen with adequate instructions relating to the handling of train brakes on heavy grades After the accident, the carrier issued special instructions governing brake tests trains must be given before leaving Derby The procedures specified for testing the brakes of cars on the load track are similar to those prescribed by the Power Brake Law for initial terminal road train air brake tests It is also required that air brake systems of trains leaving Derby to be charged to 100 pounds brake pipe pressure Had such instructions been in effect on the day of the accident, the pressure regulating device on the locomotive of Extra 6898 East would probably have been set for 100 pounds brake pipe pressure and the train brake system adequately charged Thus, the brake pipe pressure would have been sufficient for the engineer to properly control the train speed on the descending grade, and the derailment would probably have been avoided

Appropriate action has been initiated in connection with the violations of the Power Brake Law of 1958, as disclosed in this case

CAUSE

This accident was caused by excessive speed on a curve of train moving out of control on a descending grade as a result of materially reduced braking ratios of heavily loaded cars, inadequate brake pipe pressure on train and improper manipulation of brake controls by the engineer, and by failure of the carrier to prescribe and enforce proper rules and instructions for train operations on steep grades.

Dated at Washington, D C , this 18th *day of* April 1967.
By the Federal Railroad Administration,
Railroad Safety Board

BETTE E. HOLT
Acting Executive Secretary
FEDERAL RAILROAD ADMINISTRATION

APPENDIX

Track

From the west on the main track there are, in succession, a series of short tangents and curves throughout a distance of 1.2 miles, then a tangent 380 feet in length, a 17° curve to the left 422 feet, a tangent 118 feet, a 17° curve to the right 800 feet, and a 19° curve to the left 446 feet to the derailment point and 64 feet eastward

The structure of the main track in the derailment area consists of 100 pound rail, 33 feet in length, relaid in 1963 on an average of 19 treated ties per rail length It is fully tie-plated with single-shouldered tie plates, spiked with 4 rail-holding spikes per tie plate, and is provided with 4-hole, 24-inch joint bars and an average of six rail anchors per rail. It is ballasted with crushed rock to a depth of 12 inches below the ties.

Train

Extra 6898 East consisted of road-switcher type diesel-electric units 6898 and 2192, coupled in multiple-unit control, 18 cars and a caboose

Diesel-electric units 6898 and 2192 were provided with 24-RL and dynamic brake equipment A dynamic brake interlock was provided which functions automatically to prevent the simultaneous application of the automatic air brakes and dynamic brakes of the units during service applications. During an emergency application of the air brakes, the dynamic brake operation is nullified and the air brakes of the diesel-electric unit are permitted to apply. Operation of the independent brake valve to apply or release the brakes of the locomotive is not effected by the dynamic interlock.

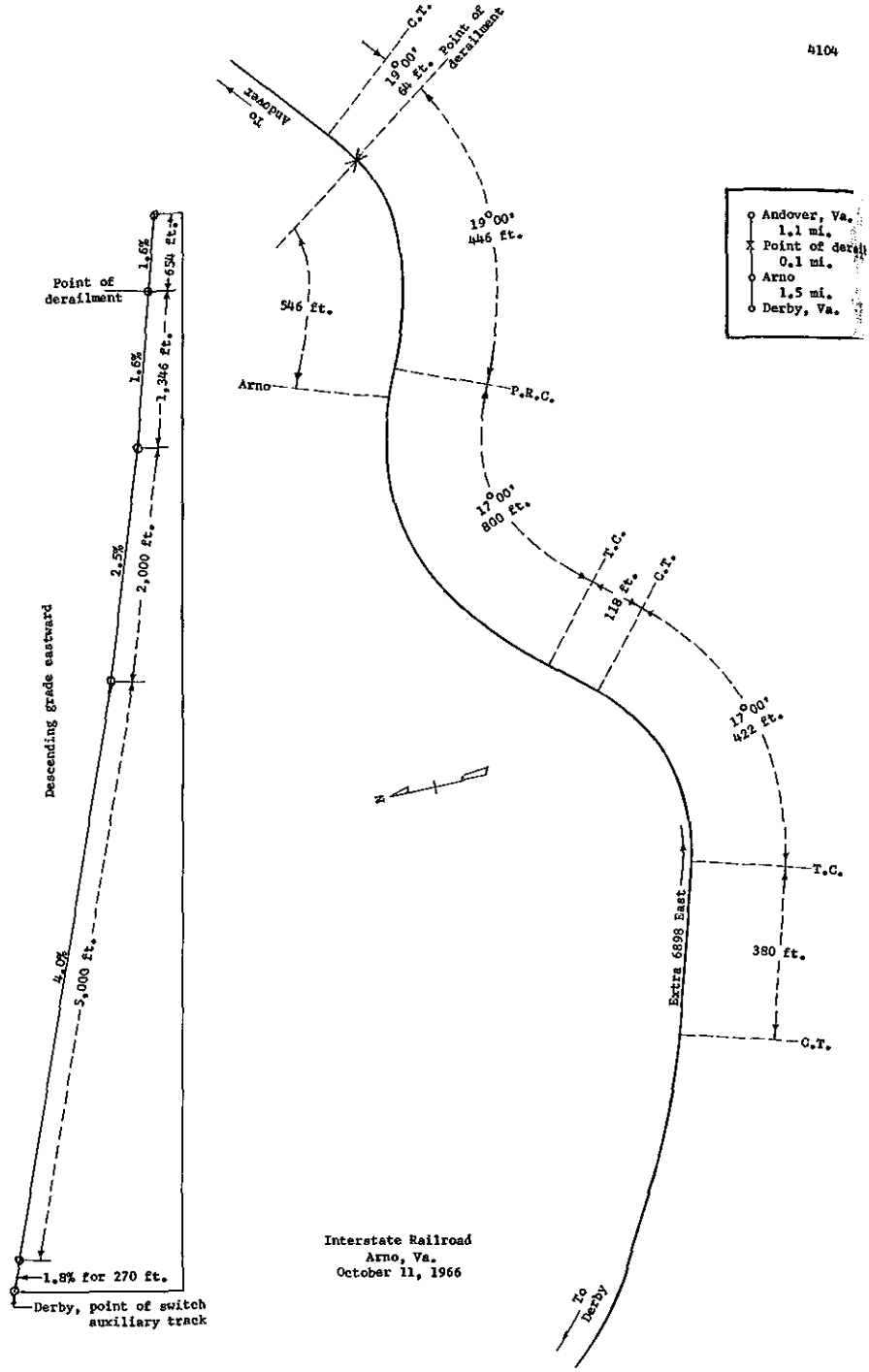
Damages

The train stopped with the front end 934 feet east of the derailment point. The 1st to 13th cars, inclusive, were derailed and stopped in various positions on or near the track structure. They were destroyed

Other Factors

The derailment occurred about 7:30 a m , in clear weather. The maximum authorized speed for all trains in the territory involved is 10 miles per hour

According to their daily time returns, all the crew members of Extra 6898 East had been on duty 2 hours at the time of the accident. With the exception of the fireman, they had previously been off duty 16 hours 30 minutes. The fireman had been off duty 12 hours 25 minutes



Interstate Railroad
Arno, Va.
October 11, 1966

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION

NOTICE

Under authority of Public Law 89-670, enacted October 15, 1966, all railroad safety functions assigned to the Interstate Commerce Commission were transferred to the Department of Transportation on April 1, 1967 Therefore, Railroad Accident Investigation Reports now are prepared and distributed by the Federal Railroad Administration The service list previously maintained by the Commission for distribution of these reports was transferred to the Department of Transportation This list will be used for distribution of future reports All communications relating to these reports should be directed to the Federal Railroad Administrator, Washington, D C , 20591

Issued at Washington, D C., on May 11, 1967.

A Scheffer Lang
Administrator