

Inv-2353

INTERSTATE COMMERCE COMMISSION
WASHINGTON

REPORT OF THE DIRECTOR
BUREAU OF SAFETY

ACCIDENT ON THE
NORFOLK AND WESTERN RAILWAY

PEMBROKE, VA.

MAY 26, 1939

INVESTIGATION NO. 2353

SUMMARY

Inv-2353

Railway: Norfolk and Western
Date: May 26, 1939
Location: Pembroke, Va.
Kind of accident: Derailment
Train involved: Freight
Train number: Extra 1203 East
Engine number: 1203
Consist: 68 cars and caboose
Speed: 35-45 m.p.h.
Operation: Timetable, train orders, and automatic block-signal system
Track: Double; compound right curve $8^{\circ}08'$ and 1,020.2 feet to initial point of derailment; slightly descending grade
Weather: Clear
Time: 7:15 p.m.
Casualties: 2 killed
Cause: Excessive speed on sharp curve

Inv-2353

June 27, 1939.

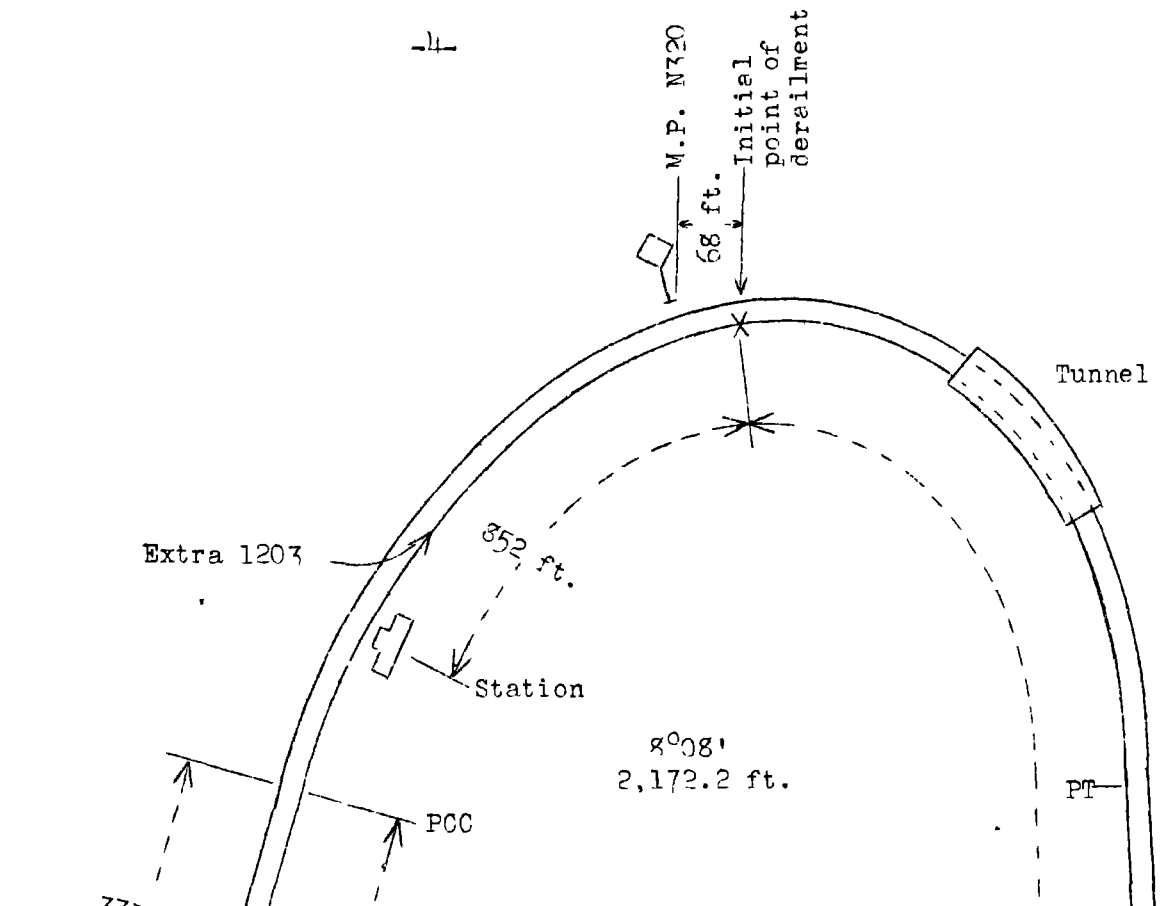
To the Commission:

On May 26, 1939, there was a derailment of a freight train on the Norfolk and Western Railway at Pembroke, Va., which resulted in the death of two employees.

Location and Method of Operation

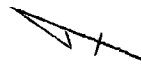
This accident occurred on that part of the Radford Division which extends between Bluefield, W. Va., and Roanoke, Va., a distance of 100.93 miles. In the vicinity of the point of accident this is a double-track line over which trains are operated by timetable, train orders, and an automatic block-signal system. The initial derailment occurred on the eastward main track at a point approximately 852 feet east of the station at Pembroke, and the final derailment occurred 1,959.3 feet beyond. Approaching from the west there is a series of short tangents and curves, followed by a tangent 373 feet in length, then a compound curve to the right 2,172.2 feet in length, including spirals; the accident occurred on this curve at a point 1,020.2 feet from its western end where the super-elevation is 5-9/16 inches and the gage 4 feet 8-9/16 inches. Beginning at the west end of the curve involved there is a spiral 168 feet in length followed by 286.5 feet of 7°03' curvature, 565.7 feet of 8°08' curvature to the initial point of derailment and 134.3 feet beyond, 350 feet of 8°14' curvature, 200 feet of 8° curvature, 192.7 feet of 8°03'30" curvature, and a spiral 275 feet long, beyond which there is a tangent 1,149 feet in length; the final derailment occurred on this tangent at a point 807.3 feet from its western end. The grade eastward is level about 1,900 feet, then 0.164 percent ascending 1,400 feet, 0.256 percent ascending 900 feet, 0.078 percent descending 1,100 feet, 0.575 percent descending about 68 feet to the initial point of derailment and 332 feet beyond, 0.293 percent descending 300 feet, then there is a vertical curve 200 feet long, followed by 0.294 percent ascending grade about 1,100 feet to the point of final derailment and about 900 feet beyond.

The track structure consists of 131-pound rail, 39 feet in length, laid on 24 treated oak ties to the rail length; it is fully tieplated, spiked with two plate-holding and two rail-holding spikes per plate, equipped with six-hole angle bars, fully bolted with bolt heads staggered, and 12 rail anchors per rail, ballasted with crushed stone to a depth of 4 feet 4 inches, and is well maintained. The rail was laid in April, 1937.



o	Roanoke, Va.
	58.16 mi.
x	Pembroke (P of A)
	10.16 mi.
o	Pearisburg
	7.61 mi.
o	Lurich
	2.15 mi.
o	Glen Lvn, Va.
	17.97 mi.
o	Blake, W. Va.
	8.88 mi.
o	Bluefield, W. Va.

Final point of derailment



Inv. No. 2353
 Norfolk & Western Ry.
 Pembroke, Va.
 May 26, 1939

In this vicinity the track parallels New River, is laid on a side-hill cut, and passes through a stone arch tunnel 290 feet in length, the west portal of which is located 319.7 feet east of the initial point of derailment. Guard rails are laid the entire length of the tunnel.

A speed board located 1,367 feet west of the curve involved limits the speed thereon of passenger and freight trains to 40 and 30 miles per hour, respectively. A provision in the timetable permits time-freight trains handled by engines of the type involved in this accident to observe the speed shown for passenger trains in this territory.

The weather was clear at the time of the accident, which occurred about 7:15 p.m.

Description

Extra 1203 East, a time-freight train, consisted of 68 cars and a caboose, hauled by engine 1203, and was in charge of Conductor Beller and Engineman Pile. This train left Bluefield at 5:40 p.m., according to the train sheet, made two stops en route, and while rounding the curve at Pembroke, 42.77 miles distant, was derailed while traveling at a speed estimated to have been between 35 and 45 miles per hour.

Engine 1203 and its tender stopped on their right sides south of and parallel to the tracks, 1,959.3 feet east of the initial point of derailment. The first 24 cars were derailed and stopped in various positions, 21 of them being destroyed; the first 14 cars were bunched at right angles to the tracks within a space of 106 feet behind the tender. The employees killed were the engineman and the fireman.

Summary of Evidence

Head Brakeman Wheaton was in the look-out shelter on top of the tender looking backward over the train; from this shelter he could not see ahead. Approaching Pembroke tunnel he said the speed was about 35 or 40 miles per hour; he did not feel any air-brake application. He had no knowledge of anything being wrong until passing through the tunnel when it seemed that the front end of the engine was on the ground. Emerging from the tunnel he stepped outside the shelter and looked over the top of the engine about 10 seconds, during which time it seemed to him that the engineman shut off the steam; he re-entered the shelter for protection and remained there until the engine turned over. He said that at Bluefield and Glen Lyn the engineman appeared normal.

Conductor Beller stated that at Bluefield the air brakes were tested. At Glen Lyn, 22.85 miles east of Bluefield, the train stopped because of sticking brakes. The train passed Lurich, 2.15 miles beyond, at 6:50 p.m., at a speed of about 35 or 40 miles per hour. No air-brake application was made after leaving Glen Lyn. Approaching Pembroke, 17.77 miles east of Lurich, he was standing on the rear of the caboose with the flagman, at which time the speed was between 35 and 45 miles per hour. When the caboose was about 150 or 200 feet east of the station the rear portion of the train made a quick stop. He immediately went forward and on the way he found that numerous angle-bar bolts were broken which he thought was a result of the accident because all were fresh breaks. He did not see the engineman prior to the accident. He could not advance any opinion as to what caused the accident.

Flagman Iseley stated that there was no slack action in the train prior to the accident. He estimated that the speed was between 35 and 40 miles per hour when the accident occurred.

Dispatcher Wohlford stated that the first knowledge he had of the accident was when the wires failed which was at 7:15 p.m.

Operator Dillow, at Pearisburg, located 10.16 miles west of Pembroke, stated that Extra 1203 passed his office at 7:02 p.m. He noticed nothing wrong with the condition of the train, but it seemed to be running faster than usual for eastward time-freight trains, and he estimated that the speed was about 45 or 50 miles per hour.

Clerk Tilley, at Pembroke, was on the station platform. He said that as Extra 1203 approached, the engineman permitted the train to drift as far as the curve west of the station and then opened the throttle just after leaving that curve. He did not observe any sparks flying from the wheels or anything to indicate that the brakes had been applied in preparation for the curve on which the accident occurred. The engineman waved to him when passing. In his opinion the speed was faster than usual and he estimated that it was from 35 to 45 miles per hour. When the caboose was opposite the station he observed that the air brakes were being applied, and after traveling about 300 or 400 feet the train stopped.

Section Foreman Smith, of the Virginian Railway, also was on the station platform at Pembroke when Extra 1203 passed, at which time the engineman waved. The speed was from 38 to 40 miles per hour and he made a remark to the clerk about it. There was nothing unusual about the condition of the train. He thought that when approaching the curve the engine was working steam. It appeared that the air brakes became applied just before the caboose reached the station or when about opposite

it; the caboose stopped about 600 feet east of the station. He proceeded eastward and observed that angle bars and bolts were sheared as a result of the accident. It was his opinion that track conditions did not cause the derailment.

Assistant to General Manager Derrick arrived at the scene of the accident about 3 hours after its occurrence. Examination of the track disclosed that at a point 852 feet east of the station at Pembroke there appeared the first mark on the rail which was a tread mark extending from a point near the outer edge to the gage side of the high rail. Marks then appeared on the inside of the high rail and the outside of the low rail; angle bars and bolts to the point where the track was torn up were sheared. The track was intermittently forced out of line toward the north approximately 2 to 2½ inches. The distance from the initial point of derailment to the point where the track was torn up was about 1,700 feet. About 305 feet of the eastward track was torn up. From the initial point of derailment to the point where the equipment stopped there was neither an obstruction on the track that might have contributed to the accident nor any marks on the ties.

Chief Chemical and Test Engineer Coddington arrived at the scene of the accident about 3-3/4 hours after its occurrence. He stated that it was apparent that an engine driving-wheel was off the track from the initial point of detailment, because the markings on the track were confined to abrasions on the angle bars, bolts and rail anchors. He said that the pedestal binder permits the drivers to drop only a short distance, which is regulated by the thickness of the tires. There were no marks on the ties; had the engine truck been derailed there would have been marks on the ties. There were definite indications that the front drivers were the ones that were derailed during the initial derailment. These indications were marks which were on the outside of the left front driver where it contacted the angle bars on the inside of the high rail of the curve, and also on the inside of the right front driver where it fouled the angle bars on the outside of the low rail of the curve. He said that there was evidence of high speed; the fact that the first 14 cars were bunched within a space of 106 feet and none piled on top of each other indicated considerable kinetic energy.

Assistant Superintendent Altizer furnished measurements taken at stations 31 feet apart over a distance of 930 feet, from the initial point of derailment westward. The super-elevation varied from 4-3/16 inches to 6-1/8 inches, the greatest difference in elevation between any two adjacent stations being 7/16 inch. The gage varied from 4 feet 8-7/16 inches to 4 feet 9-1/8 inches. At the initial point of derailment the superelevation was 5-9/16 inches and the gage 4 feet 8-9/16 inches.

According to the train sheet, Extra 1203 passed Pearisburg at 7:02 p.m. The distance between Pearisburg and the point of final derailment is approximately 10.69 miles.

Engine 1203 is a 2-6-6-4 simple articulated locomotive. Its total weight is 570,000 pounds, distributed as follows: engine truck, 30,300 pounds; first pair of drivers, 71,700 pounds; second pair of drivers, 71,700 pounds; third pair of drivers, 71,200 pounds; fourth pair of drivers, 72,100 pounds; fifth pair of drivers, 71,900 pounds; sixth pair of drivers, 71,500 pounds; and each pair of trailer-truck wheels, 54,800 pounds. The engine truck wheels are 36 inches in diameter, the driving wheels 70 inches and the trailer truck wheels 42 inches. The tender, which is rectangular, has two six-wheel trucks with 33-inch wheels. The tender has a capacity of 26 tons of coal and 22,000 gallons of water. The weight of the tender loaded is 378,600 pounds. The wheel base of each unit of driving wheels is 12 feet 4 inches in length; the distance between the engine truck and the third pair of drivers is 21 feet 10 inches, and the total engine wheel base length is 60 feet 4-3/4 inches. The total wheel base length of the engine and the tender is 102 feet 7 1/4 inches, and the overall length is 120 feet 7 1/2 inches; the overall height is 16 feet.

According to data furnished by the railroad, in January 1939, engine 1203 was reported as riding roughly and was shopped at Shafers Crossing Shop, Roanoke, Va. No report since that time had been made of any rough riding condition. It was again in the same shop for repairs from May 15 to May 20, at which time the Nos. 1, 4 and 6 driving wheels were removed and the bearings re-worked. From May 20 to the day of the accident, this engine had made 2,216 miles, including two round trips over the track involved in this accident.

Observations of the Commission's Inspectors

The Commission's inspectors observed that there was no flange mark on the low rail at the initial point of derailment where the flange of the right driver became derailed to the outside of the low rail of the curve. There was a diagonal mark about 10 inches in length, beginning near the outer edge and extending to the gage side, across the top of the high rail preceding a rail joint located about 850 feet east of Pembroke station; this mark evidently was made by the left No. 1 driving wheel which became derailed at this point. Several light scar marks appeared on the adjoining rail on the gage side near the top of the ball. From this point eastward all angle bars on the gage side of the high rail and the outside of the low rail were considerably sheared. The nut ends of from one to three angle-bar bolts were sheared off on each angle bar on the inside of the high and the outside of the low rails to a point about

300 feet west of the point of general derailment. Deep indentations were found on the top of the high rail made by the counter balance of the left front driving wheel striking and bending the rail.

The eastward main track was intermittently forced out of alinement to the outside of the curve. From the initial point of derailment to a point 100 feet east thereof it was forced out a maximum of $2\frac{1}{4}$ inches; for the next 30 feet the track was not disturbed; for the next 89 feet it was out a maximum of $2\frac{1}{4}$ inches; for the next 361 feet it was not disturbed; for the next 105 feet it was out a maximum of $2\text{-}3/4$ inches; for the next 27 feet it was not disturbed; for the next 94 feet it was out a maximum of $2\text{-}3/4$ inches; for the next 29 feet it was not disturbed; for the next 100 feet it was out a maximum of $2\text{-}3/4$ inches and from this point eastward the track was not disturbed a distance of about 300 feet to the point where the general derailment occurred.

An inspection was made of engine 1203 at the scene of the accident and later at the shops at Roanoke, Va. The left front driving wheel showed deep marks around the full circumference of the outside of the tire and the right front driving wheel showed deep marks on the flange of the tire for the full circumference. These marks evidently were made in the shearing of angle bars and bolts from the initial point of derailment to the point of general derailment. The tread and the flanges of the driving-wheel tires showed practically no wear. The engine-truck wheels were equipped with roller bearings. All driving wheels were equipped with roller bearings and full floating axles. The front and the rear units had cast-steel bed plates, with cylinders cast integrally; the front unit was equipped with sliding saddles between the boiler and the frame. All working parts were well oiled and there was nothing about the engine to indicate the cause of the front driving wheels becoming derailed.

The cistern of the tender was torn loose from the under-frame at the rear end and the top of the cistern at the rear of the coal space was badly damaged. Splash plates inside of the cistern were intact except at the places where torn loose by the accident. The tender wheels were equipped with roller bearings.

Discussion

There was no indication that a mechanical failure of the engine, dragging equipment, or any obstruction on the rails contributed to or caused the derailment. The gage of the track varied from 4 feet $8\text{-}7/16$ inches to 4 feet $9\text{-}1/8$ inches. The

superelevation varied as much as 7/16 inch between two adjacent stations 31 feet apart.

The air brakes had been tested and functioned properly en route except that at a point about 20 miles west of Pembroke some brakes were sticking. According to the evidence, there was no slack action just prior to the derailment. The evidence established the fact that the front pair of driving wheels were the only wheels to be derailed at the initial point of derailment, and that they then intermittently forced the rails to the high side out of alignment until the general derailment occurred a considerable distance beyond. This was definitely determined by the marks on the outside face of the left front driver where it contacted the angle bars on the gage side of the high rail of the curve, and by the marks on the inside of the right front driver where it fouled the track structure on the outside of the low rail.

The speed of an engine of the type involved was restricted on this curve to 40 miles per hour. According to the evidence the speed of this train averaged 49 miles per hour from Pearisburg to Pembroke, a distance of 10.69 miles. The three surviving-members of the crew variously estimated the speed at the time of the accident to be from 35 to 45 miles per hour. A clerk on the platform at Pembroke station said that the train entered the curve at a higher rate of speed than customary for similar trains. The evidence was to the effect that steam was being used when the train entered the curve and that the first brake application occurred about the time of the general derailment. Why the engineman did not enter the curve at a lower rate of speed is not known as he was killed in the accident. No doubt the excessive speed caused the engine to thrust first to the high side and then to the low side, resulting in a lateral rocking motion being set up which became great enough to raise the flange of the right front driver above the ball of the low rail without making a mark on that rail at the point where the wheel dropped outside. It is probable that the irregularities in the elevation of the rails augmented the rocking motion.

The distance from the centers of the engine-truck wheels to the centers of the rear drivers of the forward driving unit is 21 feet 10 inches. The wheel base of the forward driving unit is 12 feet 4 inches long. In rounding this sharp curve to the right the tendency of the right forward driving unit would be to tram in a tangent with the engine-truck wheels, thereby causing the right leading driver to crowd the low rail and the left rear driver to crowd the high rail. Since the right forward driver probably was in tension against the low rail, it follows that the instant the flange of that wheel was raised as high as the top of the ball of the rail it would spring to the

outside of the rail, the ordinate being sufficient to permit this to occur. The companion driver traveled only about 10 inches during the process of derailment, as indicated by a tread mark on the high rail, which indicates that the driver on the low side moved suddenly to the outside of the rail.

The investigation disclosed that the head brakeman knew that there was something wrong with the front end of the engine. However, from his look-out shelter on top of the engine he was unable to take any action toward stopping the train, as there was no emergency air-brake valve in the shelter. Had the look-out shelter been equipped with an emergency air-brake valve or means to transmit a signal to the engineman, the head brakeman could have taken action to stop the train, which possibly would have forestalled the general derailment.

Conclusions

This accident was caused by excessive speed on a sharp curve.

Respectfully submitted,

W. J. PATTERSON,

Director.