

INTERSTATE COMMERCE COMMISSION

WASHINGTON

INVESTIGATION NO. 3163

NORFOLK AND WESTERN RAILWAY COMPANY

REPORT IN RE ACCIDENT

NEAR MADISON, N. C., ON

FEBRUARY 6, 1948

SUMMARY

Railroad: Norfolk and Western
Date: February 6, 1948
Location: Madison, N. C.
Kind of accident: Derailment
Train involved: Passenger
Train number: 22
Engine number: 111
Consist: 5 cars
Estimated speed: In excess of 40 m. p. h.
Operation: Timetable, train orders and
automatic block-signal system
Track: Single; 11° curve; 0.07 percent
descending grade northward
Weather: Clear
Time: 3:27 p. m.
Casualties: 5 injured
Cause: Excessive speed on curve

INTERSTATE COMMERCE COMMISSION

INVESTIGATION NO. 3163

IN THE MATTER OF MAKING ACCIDENT INVESTIGATION REPORTS
UNDER THE ACCIDENT REPORTS ACT OF MAY 6, 1910.

NORFOLK AND WESTERN RAILWAY COMPANY

March 24, 1948

Accident near Madison, N. C., on February 6, 1948, caused
by excessive speed on a curve.

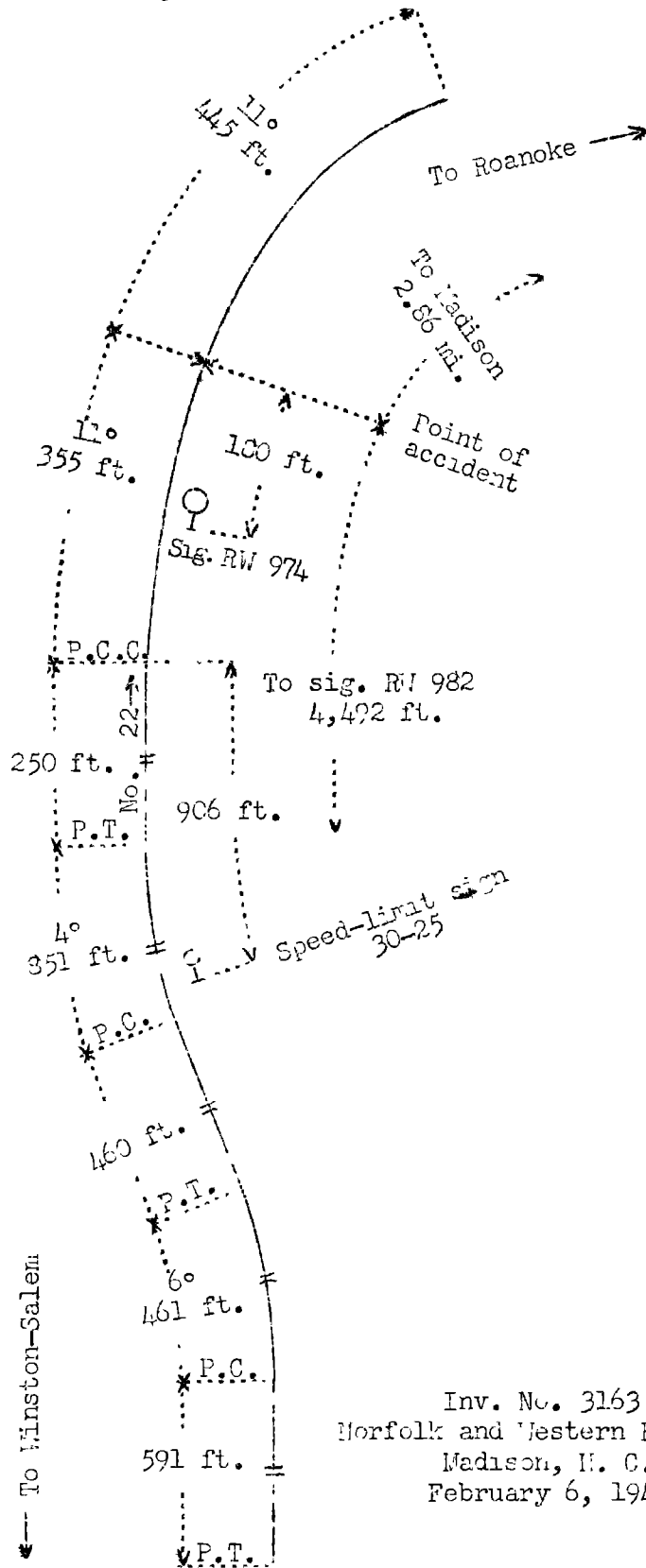
REPORT OF THE COMMISSION¹

PATTERSON, Commissioner:

On February 6, 1948, there was a derailment of a passenger train on the Norfolk and Western Railway near Madison, N. C., which resulted in the injury of two railway-mail clerks, one express messenger and two train-service employees.

¹
Under authority of section 17 (2) of the Interstate Commerce Act the above-entitled proceeding was referred by the Commission to Commissioner Patterson for consideration and disposition.

- o Roanoke, Va.
89.53 mi.
- o Madison, N. C.
2.86 mi.
- X Point of accident
5.48 mi.
- o Pine Hall
5.92 mi.
- o Walnut Cove
18.09 mi.
- o Winston-Salem, N. C.
(Union Station)



Inv. No. 3163
 Norfolk and Western Railway
 Madison, N. C.
 February 6, 1948

Location of Accident and Method of Operation

This accident occurred on that part of the Shenandoah Division extending between Winston-Salem, N. C. and Roanoke, Va., 121.88 miles, a single-track line, over which trains are operated by timetable, train orders and an automatic block-signal system. The accident occurred on the main track 29.49 miles north of Winston-Salem, at a point 2.86 miles south of the station at Madison. From the south there are, in succession, a tangent 591 feet in length, a 6° curve to the left 461 feet, a tangent 460 feet, a 4° curve to the right 851 feet, a tangent 250 feet and a compound curve to the right, the maximum curvature of which is 11°, 355 feet to the point of accident and 445 feet northward. The grade for north-bound trains is, successively, 0.07 percent ascending 300 feet, 0.27 percent ascending 200 feet, 0.09 percent descending 300 feet, 0.13 percent descending 200 feet, 0.34 percent ascending 200 feet and 0.07 percent descending 155 feet to the point of accident and 145 feet northward.

On the curve on which the accident occurred the track structure consists of 130-pound rail, 39 feet in length, rolled in 1927, and relaid in its present location during 1940 on 24 treated ties to the rail length. It is fully tieplated with single-shoulder canted tieplates, spiked with 3 spikes per tieplate, and provided with 6-hole joint bars 36 inches in length, and 6 rail anchors per rail length. It is ballasted with stone screenings to a depth of 12 inches. The specified superelevation on the 11° portion was 4-1/2 inches. At the point of derailment the superelevation was 4-1/2 inches, the gage was 4 feet 8-5/8 inches and the curvature was 11°.

Automatic signals RW 982 and RW 974 governing north-bound movements are, respectively, 4,492 feet and 180 feet south of the point of accident. These signals are of the position-light type, and are continuously lighted.

This carrier's operating rules read in part as follows:

DEFINITIONS

* * *

Fixed Signal--A signal of fixed location indicating a condition affecting the movement of a train or engine.

Note to Definition of Fixed Signal--The definition of a "Fixed Signal" covers such signals as * * * disc, * * *, or other means for displaying indications that govern the movement of a train or engine.

* * *

16(a). Track Signals

SIGNAL	LOCATION	INDICATION
* * *		
Disc ⊖	Located at the approach to curves where speed is restricted.	Curve over which speed must be reduced.

* * *

Note--This signal is a yellow disc bearing two sets of black figures, one set above the other, with a black horizontal line between, the top figures being the maximum speed for passenger trains and the bottom figures the maximum speed for freight and mixed trains. * * *

* * *

The maximum authorized speed for the train involved is 50 miles per hour on tangent track. The maximum authorized speed for passenger trains on the curve on which the accident occurred is 30 miles per hour. A speed-limit sign governing north-bound movements is located 12 feet 9 inches east of the centerline of the track and 906 feet south of the south end of the curve. This sign is a disc 20 inches in diameter and is mounted on a mast 6 feet 6 inches above the level of the tops of the rails, and bears the numerals "30-25" in black on a yellow background.

Description of Accident

No. 22, a north-bound first-class passenger train, consisted of engine 111, a 4-8-2 type, one mail car, one express car, two coaches and one sleeping car, in the order named. All cars were of steel construction. This train

passed Pine Hall, the last open office, 8.34 miles south of Madison, at 3:23 p. m., 2 minutes late, passed signals RW 982 and RW 974, which displayed proceed, passed the speed-limit sign, and while it was moving at a speed estimated to have been in excess of 40 miles per hour the engine, the tender, the first three cars and the front truck of the fourth car were derailed.

The engine overturned to the left, continued in a tangential line and stopped on its left side, with the front end 172 feet north of the point of derailment and 20 feet west of the centerline of the main track. The engine truck became detached, as a result of a new break in the right safety chain, and stopped adjacent to the front end of the engine. The trailer truck was torn loose, and stopped against the engine truck. The left side of the engine was badly damaged, and the cab was torn loose. The tender remained coupled to the engine and stopped on its left side at the rear of the engine, with the rear end 15 feet west of the track. Both trucks were torn loose and stopped between the engine and the tender, and near the track. The shank of the coupler at the rear of the tender was broken, and the front coupler of the first car was torn out. Separations occurred at each end of the first two cars. The cars were not equipped with tightlock couplers. The first car stopped west of the main track and at an angle of 15° to it, with its front end about 19 feet west of the centerline of the track and 88 feet north of the front end of the engine. The second car stopped on its right side, about 8 feet east of the centerline of the track and parallel to it, with its front end 22 feet north of the engine. The third car stopped upright on the roadbed, with its front end about 13 feet north of the south end of the second car. The first car was demolished, and the second and third cars were considerably damaged.

The engineer and the fireman were injured.

The weather was clear at the time of the accident, which occurred at 3:27 p. m.

The total weight of engine 111 in working order is 353,900 pounds, distributed as follows: Engine truck, 53,030 pounds; driving wheels, 240,700 pounds; and trailer truck, 60,170 pounds. The specified diameters of the engine-truck wheels, the driving wheels, and the trailer-truck wheels are,

respectively, 33, 70 and 42 inches. The driving wheelbase is 18 feet 9 inches long, the total length of the engine wheelbase is 40 feet 5 inches, and the total length of the engine and tender is 94 feet 2-3/4 inches. The engine is equipped with a non-recording speedometer.

The tender is rectangular in shape, and is equipped with two 6-wheel trucks. Its capacity is 26 tons of coal and 18,000 gallons of water. The weight of the tender loaded is 314,340 pounds.

The last class 2 repairs were completed on January 28, 1948. The last trip inspection and repairs were completed at Winston-Salem at 3 p. m., on February 5, 1948. The accumulated mileage since the last class 2 repairs was 500 miles.

The center of gravity of the engine is 84 inches above the top of the rails. The center of gravity of the tender, with the calculated amount of fuel and water remaining at the time of the accident, was estimated as 80 inches above the top of the rails. The calculated equilibrium, safe and overturning speeds for engine 111 moving on an 11° curve having a superelevation of 4-1/2 inches are, respectively, 25, 37 and 56.6 miles per hour.

Discussion

No. 22 was moving on a compound curve to the right at a speed estimated to have been in excess of 40 miles per hour when it was derailed. The maximum authorized speed for this train was 50 miles per hour on tangent track and 30 miles per hour on the curve involved.

As No. 22 was approaching the curve, the throttle was open sufficiently to admit valve-chamber pressure of about 80 pounds, and the reverse lever was in position for 15 percent cut-off in forward motion. The enginemen were maintaining a lockout ahead. The conductor and the flagman were in the third car. The engine and the cars had been riding in a normal manner prior to the accident. The engineman said that when the engine was about 750 feet south of the south end of the curve the speed was about 50 miles per hour, and he made a 15-pound brake-pipe reduction, which was not released. He thought that when the engine entered the curve the speed was about 32 miles per hour. The first he knew of anything being wrong was when he felt the right side of the engine rise, then the engine overturned to the left. The fireman was injured in the accident and was

not available for questioning during the investigation. The conductor and the flagman estimated the speed as about 40 miles per hour at the time of the accident. A mail clerk who was in the first car said that immediately prior to the derailment he became alarmed because the speed was excessive. The brakes of this train had been tested and had functioned properly en route.

When engine 111 was examined after the accident the throttle lever was in half-open position, the reverse lever was in position for 15-percent cut-off in forward motion, the automatic brake-valve was in release position, and the independent brake-valve was in running position. The engine truck and the driving-wheel assemblies were in good condition. The trailer-truck assembly was badly damaged during the derailment. All wheels were tight on their axles and all tires were tight on their wheel centers. Measurements of the tires, the wheels and the lateral motion were within the prescribed limits. The driving-box shoes and wedges and the radial buffer-castings were well lubricated and moved freely. The spring arrangements were maintained in good alignment, and there was no indication of unequal distribution of weight. Both tender trucks were in good condition, and there was no indication of improper side-bearing clearance. The inner surface of the flanges of the left Nos. 1 and 2 driving-wheel tires were abraded at intermittent locations. The longest mark on the No. 1 flange was 12 inches, and the longest mark on the No. 2 flange was 24 inches. There were numerous marks in the throats of the flanges of both the Nos. 1 and 2 tires. There was no mark of derailment on the flanges, treads or side surfaces of any other wheel of the engine or the tender.

Examination of the track throughout a distance of one mile southward from the point of derailment disclosed that there was no mark on the track structure indicating dragging equipment, or of any obstruction having been on the track. The first mark of derailment was a flange mark on the top surface of the high, or west, rail. This mark started at the inside edge of the head of the rail at a point 355 feet north of the south end of the curve and it extended diagonally outward 39 inches to the point where a wheel dropped to the base of the rail. At this point the outer edge of a rail anchor and the top of a spike were scarred. At a point 38 inches northward a tread mark appeared on the top of a tie 7-1/2 inches outside the high rail. Rim marks appeared on the tops of five successive ties and they extended diagonally outward at an angle of about 15 degrees to the end of a tie 9 feet northward. From this point northward the track was torn up throughout a distance of 82 feet. There was no wheel mark between the rails or on the low rail.

At the point of derailment the curvature was 11° , the gage was 4 feet $8\frac{5}{8}$ inches, and the superelevation was $4\frac{1}{2}$ inches. The greatest variation in superelevation between stations 19.5 feet apart was $\frac{1}{4}$ inch, and the greatest variation in curvature between stations 31 feet apart was $\frac{1}{2}$ degree. The track was well maintained for the maximum authorized speed.

The marks on the track structure and on the back surfaces of the flanges of the left Nos. 1 and 2 driving wheels indicate that these wheels were the first to be derailed. The marks on the throats of the flanges of these wheels indicate that considerable force had been exerted against the high rail. The bolster assembly and the swing hangers of the engine truck are arranged to resist lateral movement with respect to the center bearings proportionate to the force required to deflect the engine from a tangential line. However, in this case it is apparent that the lateral restraint of the engine truck was insufficient to deflect the engine from a tangential line. Under these conditions, since the engine was moving on a curve to the right, a force greater than normal would be exerted at the point of contact between the flange of the left No. 1 driving wheel and the high rail. At the point of derailment the calculated overturning speed for engine 111 was 56.6 miles per hour, and the maximum safe speed was 37 miles per hour. Apparently the speed of the train was somewhat less than overturning speed for the engine, but was considerably greater than the maximum safe speed, as the left No. 1 driving wheel flange was in contact with the top of the high rail as the engine leaned to the left. The drawbar and the safety bar between the engine and the tender were twisted as the tender was pulled from the track by the engine. The engineer said that the engine appeared to be stiff as it rounded curves, and the engine entered the curve on which the derailment occurred with the brakes applied. These conditions combined with a speed somewhat less than overturning speed were sufficient to cause the right side of the engine to rise high enough for the left front driving wheel to pass over the top surface of the high rail.

Cause

It is found that this accident was caused by excessive speed on a curve.

Dated at Washington, D. C., this twenty-fourth day of March, 1948.

By the Commission, Commissioner Patterson.

(SEAL)

W. P. BARTEL, .
Secretary.