

RAILROAD ACCIDENT INVESTIGATION

Report No. 4116

THE BALTIMORE AND OHIO RAILROAD COMPANY

TOLL GATE, W. VA.

FEBRUARY 24, 1967

DEPARTMENT OF TRANSPORTATION
Federal Railroad Administration

Washington, D. C.

Summary

DATE: February 24, 1967

RAILROAD: Baltimore and Ohio

LOCATION: Toll Gate, W. Va.

KIND OF ACCIDENT: Derailment

TRAIN INVOLVED: Passenger

TRAIN NUMBER: 31

LOCOMOTIVE NUMBERS: Diesel-electric units 4467,
6475, 6444, 1441

CONSIST: 5 cars

SPEED: 43 m.p.h

OPERATION: Signal indications

TRACK: Single; 6°00' curve; 0.3 percent
ascending grade westward.

WEATHER: Snowing

TIME: 6:35 a.m.

CASUALTIES: 4 killed; 50 injured

CAUSE: Overturning of a rail on a curve
due to inadequate maintenance of
the track.

RECOMMENDATION: That the Baltimore and Ohio
Railroad Company immediately
inspect all curves to ensure
that maximum authorized speeds
are consistent with existing
conditions of the track.

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION
RAILROAD SAFETY BOARD

RAILROAD ACCIDENT INVESTIGATION

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Synopsis

On February 24, 1967, a westbound passenger train of the Baltimore and Ohio Railroad Company derailed at Toll Gate W. Va., resulting in death to two employees and two passengers and in injury to 50 passengers and employees

The accident was caused by overturning of a rail on a curve due to inadequate maintenance of the track

Location and Method of Operation

The accident occurred on that part of the Monongah Division extending between Grafton and Parkersburg, W. Va., a distance of 103.6 miles. In the accident area this is a single-track line over which trains operate by signal indications of a traffic control system. At Toll Gate, 59.2 miles west of Grafton, a ballast-deck girder railroad bridge designated as bridge No. 26, 67 feet 6 inches long, spans the north fork of Hughes River. The rails on the bridge are approximately 37 feet above the river bed.

The derailment occurred on the main track at Toll Gate, 45 feet east of the east end of bridge No. 26.

Details concerning the main track, carrier's maintenance

-of-way rules, train involved, damages, and other factors are set forth in the appendix.

Description and Discussion

No. 31, a westbound first-class passenger train, left Grafton at 4:55 a.m., the day of the accident and stopped at Clarksburg, 22.7 miles westward. The train, consisting of 4 diesel-electric units and 5 cars, left Clarksburg at 5:45 a.m., 4 hours 20 minutes late. About 45 minutes later, as it approached Duckworth, 2.9 miles east of the derailment point, the engineer and fireman exchanged positions in the control compartment of the first diesel-electric unit, and the fireman, a qualified engineer, started to operate the locomotive. The train stopped at Duckworth to discharge a passenger, then continued westward

Soon afterward, about 6:35 a.m., as No. 31 was moving on a 6000' curve to the right at 43 miles per hour, as indicated by the speed-recording tapes after calibration of the speed recorders, it is apparent the rear wheel on the south, or left, side of each 4-wheel truck of the first diesel-electric unit derailed at or near the curve-to-spiral point at the east end of the curve. Both of these wheels later rerailed. The rear truck (6-wheel) of the fourth diesel-electric unit and all trucks of the five cars derailed in the area where the first diesel-electric unit had become derailed, resulting in separations between the 1st and 2nd cars and at both ends of the 4th car. The locomotive units and first car moved over bridge No. 26 and stopped on the track structure without incident. The second, third and fourth cars also moved over bridge No. 26. They overturned and stopped short distances west of the north fork of Hughes River. The fifth car also overturned. It stopped on the west bank of the river, parallel to bridge No. 26, with the rear end in the river.

The engineer and fireman were unaware of anything being wrong until the locomotive lurched violently from side to side. The engineer then looked rearward, saw the cars derailing, and called a warning. The fireman was moving the handle of the automatic brake valve to emergency position, when the train brakes applied in emergency as a result of the derailment. The conductor was unaware of anything being wrong before the cars derailed.

The flagman, a train porter, and two passengers were killed. The conductor, 48 passengers, and one off-duty employee were injured.

Examination of the train equipment disclosed no defective condition which could have contributed to the accident. The front face of the rim of the rear wheel on the south side of each truck of the first diesel-electric unit bore heavy scrape marks, indicating that these wheels had dropped inside the south rail and that the rims had been in contact with the gage side of the head of that rail. The spring plank safety hanger on the south side of each truck of the

unit bore scrape marks on its bottom side. The pilot of the unit also bore light scrape marks on its bottom edge, at points about three inches south of the gage side of the south rail and three inches north of the gage side of the north rail.

Examination of the track structure disclosed that the first mark of derailment appeared on the west end of the curve, 195 feet east of the east end of bridge No. 26. It consisted of a flange mark on the gage side of the web of the south rail and extended 8 feet westward to a point where other flange marks also appeared on the web. Beginning 33 feet west of this point, wheel marks also appeared along the bottom edge of the head on the gage side of the south rail. The multiple flange marks on the gage side of the web of the south rail extended 111 feet westward to a point where scrape marks first appeared along the gage side edge of the base of the south rail. Beginning in the area of the first mark of derailment and throughout a distance of about 90 feet westward, the south rail was canted outward to a point where it was overturned on the tie plate. This rail was gradually displaced southward a few inches off the ends of the ties and then extended parallel to the track structure throughout a distance of about 1,040 feet between the east end of the bridge and the point where the rear end of the first car stopped.

Ten feet west of the first mark of derailment, a flange mark appeared on the ties about 8 inches south of the gage side of the north rail. Westward from this area, the ties were heavily scored by wheels on the north side of the derailed equipment. The north rail was displaced between points 57 and 252 feet west of the first mark of derailment. The north guard rail on bridge No. 26 was also displaced.

The first undisturbed rail joint east of the derailment area was 67 feet from the first mark of derailment. The track gage, at this joint was 57-9/16 inches and the elevation of the north rail was 5-5/8 inches. Throughout a distance of 300 feet eastward, the track curvature varied between 5°00' and 6°30', the elevation of the south rail varied between 5½ and 6-1/8 inches, and the gage varied between 56½ and 57-9/16 inches. The ties were in good condition. However, the heads of about one-half the single rail-holding spikes on the gage side of the south rail protruded approximately 1½ inches above the rail base. The head of the south rail was about 27 percent curve worn.

After the rails in the derailment area had been replaced, the track structure was examined to determine the approximate condition of the track alignment and elevation in this area prior to the derailment. The examination revealed that the spiral at the west end of the curve was about 150 feet long and that the elevation of the south rail decreased from 5½ inches to zero within a distance of 278 feet. The elevation of the south rail at the curve-to-spiral point was 3½ inches, due to the elevation run-off starting 93 feet east of the curve-to-spiral point instead of at this point.

The investigation disclosed that at the time of the derailment, No. 31 was moving at 43 miles per hour, 2 miles per hour less than its maximum authorized speed on the 6000' curve involved. According to the American Railway Engineering Association's Manual of Recommended Practice, a super-elevation of $8\frac{1}{2}$ inches is recommended for an equilibrium speed of 45 miles per hour on a 6000' curve. A super-elevation of $5\frac{1}{2}$ inches is recommended for comfortable speed on such curve. Examination after the derailment revealed that the elevation of the south rail on the curve apparently varied up to $2\text{-}7/8$ inches and was from $2\text{-}3/8$ to $5\frac{1}{4}$ inches less than the elevation recommended by the AREA for an equilibrium speed of 45 miles per hour on a 6000' curve. It varied from $5/8$ inch more to $2\frac{1}{4}$ inches less than the minimum elevation recommended for comfortable speed on a 6000' curve. The least elevation on the 6000' curve apparently was $3\frac{1}{2}$ inches, at the derailment (curve-to-spiral) point, due to the elevation run-off starting prematurely on the 6000' curve. The head of the south rail was about 27 percent curve worn and the track gage in the derailment area apparently was wide, as indicated by gage measurements taken nearby. In addition, approximately 50 percent of the single rail-holding spikes on the gage side of the south rail in this area were not adequately securing the base of that rail to the ties, apparently lessening the resistance of the rail to overturning.

Findings

It is evident that No. 31 was moving slightly below its maximum authorized speed as it proceeded westward on the curve; and that the track on the curve was not adequately maintained for such speed. Due to the existing unfavorable track conditions, the south rear wheels of the first diesel-electric unit derailed. Immediately afterward, all wheels of the rear truck of the fourth diesel-electric unit and all wheels of the following equipment became derailed.

Cause

This accident was caused by overturning of a rail on a curve due to inadequate maintenance of the track.

Recommendation

It is recommended that the Baltimore and Ohio Railroad Company immediately inspect all curves to ensure that the maximum authorized speeds are consistent with existing conditions of the track.

Dated at Washington, D. C., this 26th day of October 1967.
By the Federal Railroad Administration,
Railroad Safety Board.

(SEAL)

Bette E. Holt
Acting Executive Secretary

Appendix

Track

From the east on the main track there are, in succession, a short tangent, a spiral 132 feet, a compound curve, having a maximum curvature of $6^{\circ}00'$, 2,604 feet to the derailment point, a spiral 150 feet, and a tangent 1,110 feet. From the east, the grade is successively 0.9 percent descending throughout a considerable distance, and then 0 3% ascending 2,004 feet to the derailment point and a short distance westward.

The structure of the main track in the derailment area consists of 112-pound rail, 39 feet long. The north rail was laid new in 1947 and the south (high) rail was relaid in 1962 on an average of 23 treated ties per rail length. It is fully tie-plated with double-shoulder tie plates, spiked with 2 rail-holding spikes per tie plate and an average of 2 plate-holding spikes in every other tie plate. The rails are provided with 6-hole, 36-inch joint bars and 8 rail anchors per rail. It was ballasted with crushed slag to a depth of 16 inches below the ties.

The track was spot surfaced on January 13, 1967, and was last inspected on February 16, 1967, by a track supervisor on a passenger train.

Carrier's Maintenance of Way Rules and Instructions

900. Frequent and careful inspection must be given to all rail in track, particularly on curves, *** and on bridges.

1255 Regauging of rail *** is not considered advisable *** on curves until the gauge has reached four feet nine and one-half inches ($4'9\frac{1}{2}"$). It must not be permitted to exceed this limit.

1263 The spikes must fully engage the base of the rail. They must be driven vertically and not slanted under the rail or bent against the rail when driving. ***

1265. When double shouldered tie plates are used on main tracks ***, double spiking is unnecessary, but two anchor spikes shall be used to anchor the tie plate to the tie on curves over two (2) degrees.

Train

No. 31 consisted of car-body type diesel-electric unit 4467, road-switcher type diesel-electric units 6475 and 6444, and car-body type diesel-electric unit 1441, coupled in multiple-unit control, 1 baggage car, 1 combination coach-baggage car, 2 coaches and 1 pullman-observation car, in that order. The cars were of all-steel construction. The rear car was equipped with a tighlock coupler on the west end.

As the train approached the derailment point, the engineer and fireman were in the control compartment of the first diesel-electric unit. The fireman was operating the locomotive. The conductor was in the third car, and the flagman was in the rear car. The train brakes had been tested and had functioned properly. The headlight was lighted.

Damages

The train stopped with the front end 1,393 feet west of the derailment point. The rear truck of the 4th diesel-electric unit and all trucks of the five cars were derailed. Separations occurred between the 1st and 2nd cars and at both ends of the 4th car. The 4th diesel-electric unit and the 1st car stopped upright on and in line with the track structure. The 2nd, 3rd, 4th and 5th cars overturned and stopped on their south sides as shown by the sketch appended to this report.

The 4th diesel-electric unit and 1st car were slightly damaged. The remaining four cars were heavily damaged.

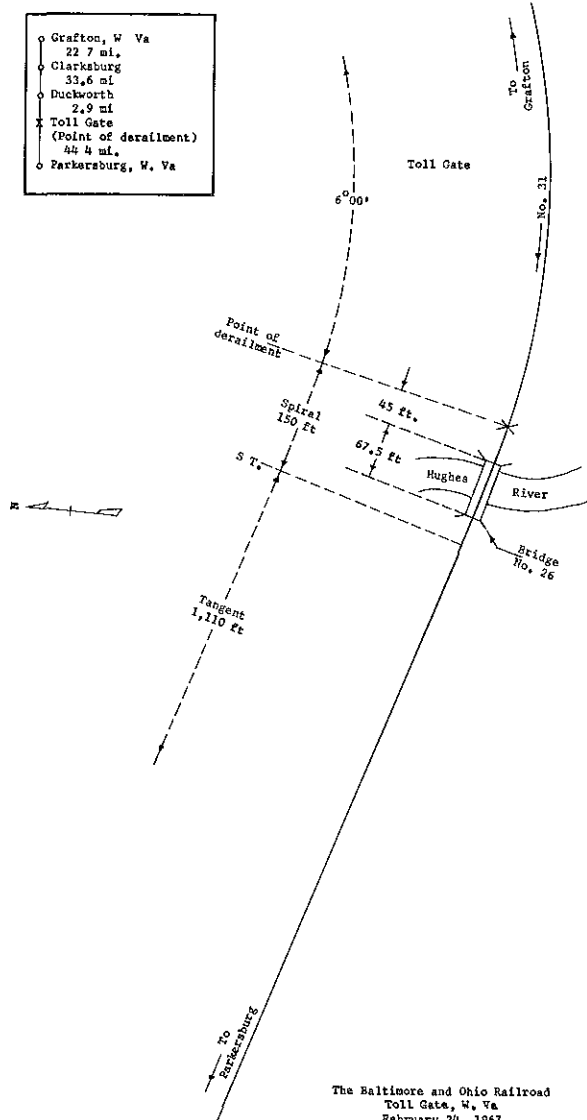
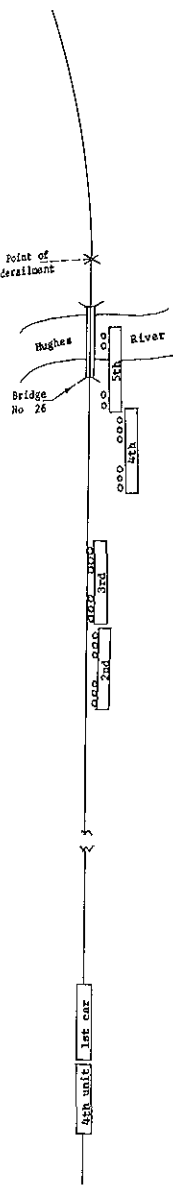
Other Factors

The accident occurred at 6:35 a.m., under snowing weather conditions.

The maximum authorized speed for passenger trains in the accident area is 45 miles per hour.

According to their daily time returns, the engineer of No. 31 had been on duty 2 hours 55 minutes at the time of the accident after having been off duty 11 hours 58 minutes; the fireman had been on duty 13 hours 35 minutes in the aggregate after having been off duty 22 hours 31 minutes, and the conductor and flagman had been on duty 2 hours 45 minutes after having been off duty 21 hours 10 minutes and 14 hours 10 minutes, respectively.

○	Grafton, W Va
○	22.7 mi.
○	Clarksburg
○	33.6 mi
○	Duckworth
○	2.9 mi
✕	Toll Gate
✕	(Point of derailment)
○	44.4 mi.
○	Parkersburg, W. Va



The Baltimore and Ohio Railroad
 Toll Gate, W. Va
 February 24, 1967