

Q. P. May

INTERSTATE COMMERCE COMMISSION

REPORT OF THE DIRECTOR OF THE BUREAU OF SAFETY IN RE INVESTIGATION OF AN ACCIDENT WHICH OCCURRED ON THE BOSTON & ALBANY RAILROAD NEAR WORCESTER, MASS., ON JUNE 5, 1924.

July 25, 1924.

To the Commission.

On June 5, 1924, there was a derailment of a passenger train on the Boston & Albany Railroad near Worcester, Mass., resulting in the death of 3 employees, and the injury of 30 passengers and 1 employee. This accident was investigated in conjunction with representatives of the Massachusetts Department of Public Utilities.

Location and method of operation.

This accident occurred on the Boston Division, extending between Boston and Springfield, Mass., a distance of 98.33 miles; this is a double-track line over which trains are operated by time-table, train orders and an automatic block-signal system. The initial point of derailment is about 6,335 feet east of Worcester passenger station, while the train came to rest in front of Tower 26, about 1,500 feet farther west. Approaching the point of derailment from the east there is a compound curve to the left, 4,524 feet in length, varying from 1°44' to 4°, followed by a tangent extending beyond Tower 26. The initial point of derailment was on the above curve at a point approximately 665 feet from its western end; at this point the track is in a rock cut from 15 to 18 feet in depth. The grade approaching the point of accident varies from 0.44 to 0.61 per cent ascending for westbound trains. The accident occurred just west of the center of a vertical curve 500 feet in length following which the grade descends, varying from 0.55 to 0.721 per cent. The track is laid with 105-pound rails, 33 feet in length, with about 20 oak and pine ties to the rail length, single-spiked, tie-placed, braced, and ballasted with rock. The weather was clear at the time of the accident, which occurred at 4.07 p. m.

Description.

Westbound passenger train No. 59 consisted of one baggage car, one smoking car, two coaches, three Pullman parlor cars and one coach, in the order named, all of all-steel construction, hauled by engine 562 and was in charge of Conductor Walsh and Engineman Staples. This train left Boston, its initial terminal, at 5 p.m., on time, passed North Grafton, the last reporting station, 5 1/4 miles east

of Tower 26, at 4 p. m., one minute late, and was derailed while passing through the rock cut east of Tower 26 while running at a speed estimated by employees to have been about 35 miles an hour.

From the initial point of derailment the train continued on for a distance of 1,244 feet, where it encountered a switch frog located 110 feet east of Tower 26. At this point the entire engine truck, engine and first four cars were fully derailed and ploughing through the ballast, ties and twisted rails, coming to rest with the forward end of the train about 412 feet west of the switch frog. At a point 237 feet west of the switch frog, the engine swerved to the right and overturned, coming to rest headed east on its left side, on the north side of the track; the tender came to rest on its side near the engine. The first four cars were derailed but remained upright while the four rear cars were not derailed. The employees killed were the engineman and fireman and an engineman who was qualifying on the road.

Summary of evidence.

At a point about 7,300 feet east of Worcester passenger station, about 200 feet west of the summit of the grade, where it is 0.72 per cent descending, and where the curvature is $4^{\circ}15'$, the rails bore flange marks where the lead wheels of the engine truck mounted the ball of the rail and ran diagonally along the rail for a distance of 13 feet 3 inches to where the wheels dropped off the rails, flange marks next being found on the rail braces on the north side of the high rail and similar flange marks on the inside of the low rail. These marks continued along on the ties until the switch frog was encountered east of Tower 26. At the initial point of derailment was found some crushed stone apparently of shale and trap rock strata, together with a very small quantity of stone dust on the top and base of the north rail.

Measurements taken every two rail lengths on both tracks for curve, elevation and distance between track centers, starting from a point 40 rail lengths east of the initial point of derailment from a point just east of an overhead bridge at Plantation Street showed the following:

Track 1.			Track 2.		
Curve	Elevation	Track Centers	Curve	Elevation	
1° 30'	5 3/8 in.	13 ft.	2° 15'	4 1/4 in.	
2° 15'	5 "	13 ft.	1° 30'	3 "	
*2° 45'	4 3/4 "	11 " 10 1/2 in.	3° 30'	2 5/8 "	
3° 30'	4 5/8 "	12 " 1/4 in.	3° 50'	4 "	
4° 15'	5 1/4 "	12 " 1/4 in.	4° 45'	4 1/8 "	
3° 15'	4 1/2 "	13 " 1-1/2 in.	5°	3 3/4 "	
3° 30'	4 1/8 "	13 " 3 1/4 in.	3° 30'	5 1/8 "	
4°	3 7/8 "	12 " 5 3/4 in.	4° 15'	5 "	
4° 15'	4 1/4 "	12 " 7 1/2 in.	4°	4 5/8 "	
3°	4 1/8 "	12 " 8 3/4 in.	3° 45'	5 "	
3° 45'	3 5/4 "	12 " 10 1/4 in.	3° 45'	3 7/8 "	
3° 15'	4 "	13 " 9 1/2 in.	4° 30'	4 1/4 "	
3° 15'	4 5/8 "	15 " 1/4 in.	3° 30'	4 7/8 "	
4°	5 "	13 " 1 in.	4°	5 3/8 "	
5°	4 1/2 "	15 " 3/4 in.	4° 30'	5 1/4 "	
4° 15'	4 1/2 "	13 " 3/4 in.	4° 15'	5 1/8 "	
4° 15'	4 1/4 "	13 " 1 in.	4° 30'	5 1/4 "	
**4° 15'	5 5/8 "	13 " 1 in.	3° 15'	4 1/8 "	
4° 45'	2 "	13 " 3 1/2 in.	4° 30'	4 1/8 "	
5° 15'	3 1/3 "	13 " 1 in.	5°	4 5/8 "	

* Point under Plantation Street Bridge.

** Initial point of derailment.

The cut was made through the ledge in the year 1833 and it is apparent by reason of the irregularity of the curve that it is difficult to maintain proper elevation and at the same time provide for proper clearances; in fact, at one point under Plantation Street bridge, on the twelfth stone from the ground on the east end of the south abutment, marks were observed which appeared to have been caused by cars scraping at their eaves. The track is laid through a solid ledge and the presence of stagnant water in the ditches on either side of the tracks, the rock cut being characteristically wet, indicates a lack of efficient drainage through the cut. The physical characteristics through the cut are such that seepage would be from south to north and it was observed on track 2 in about the middle of the cut that a 2" x 18" shim was used.

Conductor Walsh said the proper air-brake test was made before leaving Boston and that at the time of the accident he was riding in the fifth car of the train, his first intimation of anything wrong being when the brakes were applied as if in a service application while running at a speed of about 35 miles an hour at a point about midway

between the end of the cut and point where the general derailment occurred, followed soon afterward by what appeared to have been an application of the air brakes accompanied by the buckling of the train. He thought the emergency application was made at a point about half-way between where the first marks appeared on the ties and the point where the engine went down the embankment. Assistant Conductor Thomas, who was riding in the rear coach, said the train was being operated at its usual speed when the brakes went on suddenly as if an emergency application of the air brakes had been made.

Baggage Apts. Brakeman Meredith and Harvey and Flagman King estimated the speed to have been between 20 and 35 miles an hour when the emergency application was made. Brakeman Harvey thought the emergency application was made 9 or 10 car lengths from where the cars came to rest. Flagman King said that on his way back to flag he looked for marks on the track and observed flange marks on the ties but did not see any stones or indications of crushed stone on the rails or track, although he was looking for something of that kind, nor did he see any one on or about the tracks.

Towerman Young, on duty at Tower 26, stated that train No. 59 struck the bell on approach on track 1 at 4.05 p. m., and he threw the levers which placed the indication of the distant and home signals at clear and caution, respectively, and after the train passed the distant signal, the home signal was cleared. He waited until he saw the train come into sight and noted the time as 4.06 30 p. m., and made the entry in his block record as passing the tower at 4.07 p. m. He noticed nothing unusual in the operation of the train approaching the tower and his first intimation of anything wrong was when the derailment occurred at the switch frog; he estimated the speed of the train at about 30 miles an hour.

Division Engineer Knight said that between a point 2,467 feet east of the point of derailment, near the overhead bridge at Plantation Street, and the point of the general derailment, the curve compounds itself six times, varying in curvature from $1^{\circ} 44'$ to 4° and in elevation from $3 \frac{1}{2}$ to $4 \frac{3}{8}$ inches and that to eliminate this condition it would be necessary to resort to blasting of the ledge in order to make a simple curve through this portion of the cut. While Mr. Knight said he experienced no greater difficulty in maintaining track on this curve than elsewhere, he also made the statement that about three months after the occurrence of a previous derailment at about the same point under almost identical circumstances it was deemed

necessary by reason of the irregularity of the curve and the difficulty in maintaining elevation to place a speed restriction of 25 miles an hour through the cut, which speed restriction existed at the time of this accident.

Supervisor McKenna said he arrived at the scene of the accident shortly after its occurrence; he followed the cuts on the ties to the initial point of derailment and observed crushed stone on the base and top of the high rail for a distance of about 18 inches, near which point the rail bore flange marks where the truck wheels had climbed the rails, starting from the gauge side of the rail and extending diagonally across the rail for a distance of about 17 feet to where the wheels dropped off on the north side. He inspected the surface and gauge and found them to be in good condition. He knew of no trouble in maintaining elevations in proportion to curvature, and considered that the elevation as maintained was even and properly proportioned against the degree of curvature and sufficient for the speed allowed, and that the center line clearances were ample, although he attributed the marks of scraping on the Plantation Street bridge abutment to the straying of cars or lumber in passing trains. Supervisor McKenna further said that there was some water in the cut and while there was no system of underdrainage, no difficulty was experienced in securing good drainage at the point of accident, which was near the top of a slope where the drainage is in both directions. Assistant Supervisor Foley said that in maintaining elevations no trouble was experienced in getting required clearances for track centers.

Foreman Diggins said he arrived at the point of accident about 4.30 p. m., and made an inspection of the track in company with Plumber's Helper McGuire. He observed stone dust on the top and base of the north rail as well as the flange marks on the rail and ties, and further stated that there were several children about the spot where the stone dust was found on the rail who were brushing the dust off the rail and who ran away upon their approach. Plumber's Helper McGuire corroborated Foreman Diggins' statements; he observed pieces of crushed shale and trap rock on the track, about the size of a marble, together with a small quantity of stone dust on the north rail.

Engine 582 is of the 4-6-3 type, with a combined weight, engine and tender, of 539,100 pounds. Superintendent of Motive Power Butler said this engine came out of the West Springfield Shop on May 14, 1924, after receiving class 4 repairs, and after completing 1,383 miles on trial trips and assignments was assigned to the Boston Division.

He made an examination of the engine after the accident, found nothing wrong, and said he did not think an engine working stiff as a result of recent heavy repairs would contribute to the derailment.

Westbound extra 1301 passed Tower 26 at 3.54 p. m., about 10 minutes before the passage of train No. 59; the engine crew of that train did not notice any stones on the track.

Representatives of the railroad and Worcester police departments apprehended two small boys, 6 and 8 years of age, who admitted placing some stones on the rail which were kicked off by a sister of one of the boys, but that they again placed three stones on the rail and when the train came along and, as they expressed it, bumped up and down. Efforts to arrive at an approximation of the size of the stones placed on the rail failed by reason of the variance in their statements and by reason of their extreme youth, and but little value can be attached to their statements in this respect, when interviewed by the Commission's inspectors, however, they were asked to pick up stones of the size they placed on the track, and none of those picked up weighed more than an ounce.

Conclusions.

This accident is believed to have been caused by excessive speed and irregular superelevation, possibly superinduced by striking small stones which had been placed on the track.

It is believed that the leading wheel of the engine truck was the first to be derailed as it rounded the 40° 15' curve on a 0.55 per cent ascending grade, near the point where it changes to a 0.72 per cent descending grade, accompanied by a change in elevation of the north rail from 4-1/4 to 3/58 inches, and that the irregularities in curvature and elevation, coupled with high speed and the action of the stones on the track, raised the right forward engine-truck wheel so that the flange mounted the north rail, resulting in the derailment.

The following special speed restrictions are set forth in time-table No 102, effective April 27, 1925:

"1.214 feet west of Mile Post 42 - Western limits of interlocking at Tower 28 (permanent boards)...35"

The territory in which this accident occurred is within the limits defined in the above rule. It appears from the train sheet, however, that train No. 59 passed North Grafton, 5.4 miles east of Tower 26, at 4 p. m., and according to the testimony of Towerman Young, who is perhaps best qualified to state, struck the bell circuit at the distant signal, 1.84 miles east of the tower, at 4:05 p. m., and covered this distance in from 1-1/2 to 2 minutes, which would indicate a speed in the vicinity of 55 miles an hour. A resident of the locality said she saw the train as it passed her window, at which time the engineer was leaning out of the cab window looking at the driving wheels, this being at a point about 400 feet east of the switch frog and at the approximate location where the employees said the emergency brake application was made. The distance the cars moved after the brakes were applied, and the condition of the wreckage, tend to corroborate the idea that the speed was high at the time the initial derailment occurred.

On August 8, 1922, there was a derailment of a passenger train on this railroad which occurred under almost identical circumstances on the same curve and on the same track within a distance of 135 feet of this accident, which accident was investigated by this Commission and which was stated to have resulted from the engine striking rocks on the track. On October 25, 1922, bulletin order No. 71 was issued restricting the speed of all trains on both tracks through the cut to 55 miles an hour, occasioned, according to the testimony of Division Engineer Knight, by the irregularity of the curve and difficulty in maintaining elevations. The same physical conditions were present at the time of the investigation of this accident as obtained in the previous accident, consisting of a great many variations in curvature and elevation, and poor drainage, and until they are remedied it is believed that the speed of trains moving around this curve should be further restricted and that strict adherence to such restrictions should be enforced. The necessity for maintaining track conditions in the best possible manner is emphasized by the density of traffic, which consists of about 180 train movements each 24 hours on the two tracks.

Attention is also called to the fact that at the time of this investigation it appeared that this cut is used more or less as a dump ground by people in the vicinity, among the rubbish observed being bicycle frames, rubber hose, automobile tires, iron beds, iron frames of children's sleds, tin cans, etc. The erection of a suitable fence along the right of way in this vicinity would eliminate this element of danger and also prevent the use of the railroad company's property as a public highway.

All of the employees involved were experienced men and at the time of the accident none of them had been on duty in violation of any of the provisions of the hours of service law.

Respectfully submitted,

W. P. BORLAND,

Director.

necessary by reason of the irregularity of the curve and the difficulty in maintaining elevation to place a speed restriction of 35 miles an hour over the cut, which speed restriction existed at the time of this accident.

Supervisor McKenna said he arrived at the scene of the accident shortly after its occurrence; he followed the marks on the ties to the initial point of derailment and observed crushed stone on the base and top of the high rail for a distance of about 18 inches, near which point the rail bore flange marks where the truck wheels had climbed the rails, starting from the gauge side of the rail and extending diagonally across the rail for a distance of about 15 feet to where the wheels dropped off on the north side. He inspected the surface and gauge and found them to be in good condition. He knew of no trouble in maintaining elevations in proportion to curvature, and considered that the elevation as maintained was even and properly proportioned against the degree of curvature and sufficient for the speed allowed, and that the center line clearances were ample, although he attributed the marks of scraping on the Plantation Street bridge abutment to the straggling of cars of lumber in passing trains. Supervisor McKenna further said that there was some water in the cut and while there was no system of underdrainage, no difficulty was experienced in securing good drainage at the point of accident, which was near the top of a slope where the drainage is in both directions. Assistant Supervisor Toley said that in maintaining elevations no trouble was experienced in getting required clearances for track centers.

Foreman Diggins said he arrived at the point of accident about 4.50 p. m., and made an inspection of the track in company with Plumber's Helper McGuire. He observed stone dust on the top and base of the north rail as well as the flange marks on the rail and ties, and further stated that there were several children about the spot where the stone dust was found on the rail who were brushing the dust off the rail and then ran away upon their approach. Plumber's Helper McGuire corroborated Foreman Diggins' statements, he observed pieces of crushed shale and trap rock on the track, about the size of a marble, together with a small quantity of stone dust on the north rail.

Engine 562 is of the 4-3-3 type, with a combined weight, engine and tender, of 539,100 pounds. Superintendent of Motive Power Butler said this engine came out of th