LONDON MIDLAND AND SCOTTISH RAILWAY.

Ministry of Transport,
4, Whitehall Gardens,
London, S.W.1.

16th August, 1932.

SIR,

I have the honour to report for the information of the Minister of Transport, in accordance with the Order of the 14th June, the result of my Inquiry into the derailment which took place at about 11.55 a.m. on 12th June, 1932, near Wardleworth on the Rochdale-Bacup line of the London Midland and Scottish Railway.

An empty carriage train proceeding from Rochdale to Bacup was derailed when passing through the scissors crossing, immediately north of Wardleworth Station, on to the Wardleworth-Bacup single line. The engine, after travelling on the sleepers for a distance of about 96 yards, fell over on its right-hand side and came to rest lying across the running line and two adjacent sidings. The leading coach left the rails but remained upright; the second coach was not derailed.

I regret to report that the driver, W. Howarth, died from his injuries. He was pinned under the engine, and, although medical aid was available within 15 minutes of the accident, he died before he could be extricated. The fireman and guard also complained of shock.

The train was drawn by 2-4-2 type radial tank engine No. 10859, class 2 P, running chimney first, which weighed in working order about 59 tons. It consisted of two "motor trailer" 8-wheeled bogie passenger coaches, equipped for reversible working. The total weight including engine was about 111 tons, and the overall length about 154 ft. The coaches had steel underframes, shock absorbing buffers, and wooden bodies. They were lighted by gas, but there was no fire.

The automatic vacuum brake was in use on the coupled wheels of the engine and on all wheels of the train.

The damage to the engine was extensive, the most important item being the trailing coupled axle, which was found badly flawed and broken close to the inner edge of the right-hand journal. The leading coach was considerably, and the rear coach slightly damaged. The damage to permanent way was not very serious.

The weather was fine, hot and dry.

Description.

The Company's line from Rochdale (south-east) to Bacup (north-west) is double as far as Wardleworth signal box, which is situated close to the 12th mile post and about 300 yards north of the station of that name; the line is single beyond. Immediately north of this signal box, which is on a gantry spanning the tracks, down trains pass over a scissors crossing to reach the single line, which is in continuation of the up road of the double line. The other part of the scissors crossing makes a trailing connection in the up line leading to sidings on the down side of the single line.

The whole line at this point is on a curve of large radius, right-handed for the train in question. The gradient is level through the station, but begins to rise at 1 in 62 in the down direction from a point about 80 yards south of the signal box.

Wardleworth box has a down distant, and down outer, intermediate, and inner home signals. The down inner home signal is fixed on the gantry above the box.

The single line section is worked on the miniature electric staff system; the tokens being handed to the enginemen by the signalman, who lowers them from the gantry in a leather pouch on a long wooden handle.

The approximate distances from the centre of Wardleworth signal box are :—

Down distant signal	1,030 yards	south
Down outer home signal	355 ,,	,,
Down intermediate home signal	245 ,,	,,
Facing points of scissors crossing leading to single line	25 ,,	north
First mark of derailment	45 ,,	,,
Point at which engine came to rest	145 ,,	,,

Report and evidence.

The down empty passenger train involved in this accident was on its way to go into service at Bacup. It had therefore not been stopped, as is otherwise usual, at Wardleworth Station. Signalman Ballantyne, who was on duty in Wardleworth box, said that all signals were off, and that he handed the staff to the driver on the fireman's (right-hand) side of the engine in the usual way. He did not notice anything unusual in the speed of the train after the staff was taken, but could not see much of it previously, as he had his back to it when handling the staff. Ballantyne actually saw the derailment, and said that his impression was that the engine had got as far as the crossing, when it turned to the left as if it was going into the siding parallel to, and on the left of, the single line. He said that the engine kept upright after turning to the left, ploughed up the track, and finally turned over on its right side.

Fireman Wright said that he was on the right-hand side of the engine when he took the staff, and that driver Howarth was beside him to see that he got it. Wright estimated the speed at 10 miles an hour, the regulation maximum through the crossing being 15 miles an hour. When he told his driver that he had got the staff, the latter opened the regulator and blew the brake off. After that, he said, the engine seemed to swing and it felt as if it was jumping something. Wright said that previously the engine had been riding all right, and the driver had made no complaint about it. He and his driver had prepared it before taking it out.

After the derailment the regulator was found open, the reversing lever notched up in forward gear as if for running up the bank, and the vacuum brake handle was found between the " shut " and " running " positions.

The guard of the train, W. Coupe, who was travelling in the front end of the leading coach, from which he had a good view of the engine, said that he had noticed nothing unusual in the handling of the train. He estimated the speed through Wardleworth Station at 15 to 20 miles an hour, and 10 miles an hour when picking up the staff. He was thrown down on his back by the derailment.

The track material at the point of derailment was 95 lb. R.B.S. on stone ballast, and was in good order when inspected by me. It had been relaid just a year before the accident. The super-elevation was stated to have been $\frac{3}{4}$ in. at the time of the accident, but this had been increased to $1\frac{1}{8}$ in. during the repairs made subsequently.

I found the gauge about $\frac{1}{8}$ in. slack at the toe of the facing switch, and nearly $\frac{3}{16}$ in. slack at the running-on end of the check rail, where the first mark of a flange mounting it was found on the right hand side. The check rail clearance was $1\frac{7}{8}$ in. There was no sign of serious creep, or of buckling having occurred due to heat.

Mr. N. J. Brooks, permanent way Inspector, said that he last saw this crossing on 4th June, and found it in order; he had had no trouble in maintaining this crossing.

The ganger in charge of the length, J. Thompson, said that he saw the crossing on the morning before the derailment and found it in perfect order. He had had no trouble from creep at this place.

Mr. I. E. Mercer, District Locomotive Superintendent, said that engine No. 10859 last had heavy repairs in 1930; since then it had run 63,325 miles to the time of derailment. It was sent to Horwich shops for service repairs and came out again on 12th April, 1932; since then it had run 5,298 miles up to the time of derailment. The only serious defect recorded since the latter repairs was the breakage of the right trailing coupled spring, which was replaced on 10th June without weighing the engine, for which there were no facilities available. This was the spring of the journal where fracture occurred. On 6th, 7th, 8th and 9th June the radial check nuts were found to have worked loose and they were tightened on those dates, the trouble being principally at the trailing end. The routine shed examination was made, with the engine over a pit, by fitter J. O. Ashworth on the morning of the accident. No defect was reported.

Mr. G. N. Shawcross, Mechanical Engineer, Horwich, said that the engine was built in December, 1900, and had been through Horwich shops on 15 separate occasions, on each of which the axle was under observation. The broken axle was put under this engine in 1902. The identification marks were clearly visible. It was made at Horwich from acid open hearth steel to a specification of 28/32 tons per square inch tensile strength, with 25 per cent. elongation on a length of 3 ins. The analysis showed that it contained .27 per cent. carbon, .11 per cent. silica, .04 per cent. phosphorus, .55 per cent. manganese. Mr. Shawcross said that present day specifications have a slightly higher tensile strength than this, but do not allow sulphur or phosphorus to exceed .04 per cent. According to the very complete records which he produced, twelve axles were made from the same cast, of which 10 had been withdrawn in the ordinary course, their diameters having been reduced by wear and turning below the standard, and one was being called in for examination. The axle which is the subject of this report had run 784,473 miles in its life of 30 years.

Conclusion.

The marks on the rails showed that derailment occurred just before the engine reached the first crossing of the scissors, and this fact seemed at first to suggest that the breakage of the axle was the result, and not the original cause, of the accident. But a careful examination of the track and the evidence of the permanent way inspector and the ganger concerned leave no doubt that, although there was a slight slackness of gauge, there was nothing in the state of the track which could by itself have caused derailment, and it is therefore necessary to look for the cause in the engine itself.

The tyre profiles were all so good that they could not have caused the wheel to climb. The breakage, only two days before the accident, of the spring carrying the journal where fracture subsequently occurred, and its replacement without checking, as is in my opinion desirable, the distribution of weights over the various wheels, may have thrown an unusually severe load on to this weak axle just as it was approaching the crossing. Such an unfortunate combination of circumstances might have caused fracture to occur just where and when it did, but the main cause of the accident was clearly the breakage of this defective axle just inside the right-hand journal.

The examination of the broken axle made by the Company's officers at my request showed that it had an axial piping cavity of a total length of about $10\frac{3}{4}$ ins. and covering about $1\frac{3}{4}$ in. by 1 in. of its cross-section, extending at one end some 2 inches into the right hand journal. There were also three fatigue flaws approximately $\frac{3}{4}$ in. deep by $\frac{3}{4}$ in. wide, $\frac{5}{16}$ in. deep by 1 in. wide, and $\frac{1}{8}$ in. deep by $\frac{1}{2}$ in. wide, on the circumference of the fractured surface and centred about 120 degrees in advance of the crank pin of the right-hand coupled wheel. A sulphur print of the fracture showed bad segregation.

It is thus quite clear that fracture was due to defective material, and it is indeed remarkable that this axle had lasted so long. Its diameter at the point of fracture was $7\frac{1}{8}$ ins. and the designed load on it was 17 tons 8 cwt. No practical means of detecting such an internal flaw at this depth under workshop conditions existed when it was made, or indeed exists to-day; the fatigue flaws also were of such a nature and in such a position that their detection during

normal examinations was practically impossible. The rareness of such an accident is shown by the fact that during the year 1931 there were reported in the whole country only 6 breakages of leading or trailing engine axles, which fact indeed also shows the great care bestowed on their manufacture at every stage.

I have the honour to be,

Sir,

Your obedient Servant,

E. P. ANDERSON,

Lieut.-Colonel.

The Secretary,
Ministry of Transport.

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