LONDON MIDLAND & SCOTTISH RAILWAY.

Ministry of Transport,
7. Whitehall Gardens, London, S.W. 1.
11th April, 1924.

SIR,

I have the honour to report for the information of the Minister of Transport, in accordance with the Order of the 17th March, the result of my Inquiry into the circumstances of an accident which occurred at 10.47 p.m. on Sunday, March 9th, at Southport, on the London Midland and Scottish Railway.

In this case, as the 10.45 p.m. passenger electric train from Southport to Crossens was travelling over the crossover road between the up fast and the up slow lines, all wheels of the second coach were derailed and the coach was tilted over to the left, finally coming to a stand at an angle of about 45 degrees. The train became divided between the first and second vehicles. As a result of the accident four passengers and a servant of the Company, travelling as a passenger, were injured and treated at the Southport Infirmary, being able, however, to proceed home after treatment. Four other passengers complained of shock.

The damage to the derailed coach was extensive and is included in the Appendix showing damage to the stock and permanent way.

The train consisted of four 8-wheeled bogie coaches, the leading and rear vehicles being motor equipped and the second and third being trailer coaches. Couplings were of the automatic type with short rigid side buffers. The trailer coaches were 61 feet 8 inches long overall and weighed 27 tons. The bogie wheel base is 8 feet, and the distance between bogie centres 40 feet 6 inches, the diameter of the wheels being 3 feet 6 inches. The train was fitted throughout with the vacuum brake operating blocks upon all wheels, the percentage of brake power to total weight being 82.5. Its total weight unloaded was 149½ tons.

The night in question was dark and cold, there being at the time probably a slight frost.

Description.

The railway near the scene of the derailment runs approximately from west to east ex Southport. There are four running lines; reading from north to south; up slow, down slow, up fast and down fast. The scene of the derailment is a through crossing to the up slow from the up fast line, the facing points on which are situated about 380 yards east of the starting signal on No. 2 platform of Chapel Street Station. The up fast line at the point where this through crossing diverges to the left is on a left-hand curve of approximately 20 chains radius, having a super-elevation at the facing points of 2¼ inches. The lead of the turn-out from the toe of the switch to the point of the crossing is 82 feet, and the radius of curvature of the turn-out at the point of derailment is just under 10 chains, the cant on the outside rail being 1½ inches. There is a length of check rail along the inside rail of the turn-out extending for 6 feet upon either side of a point opposite to the nose of the crossing. The railway is electrified on the 600 volt third rail system and at the actual scene of derailment there is a continuous live rail upon the north side of the through crossing and also a length on the south side of the up fast line, extending eastward for about 56 feet from approximately the heel of the switch rail. The points and signals in the locality are on the E.P. system worked from the power frame in St. Lukes Road signal box, the facing points of this through crossing being No. 55 and the trailing points on the up slow line No. 54. The permanent way was laid in 1917 with 95 lb. rails carried on cast iron chairs secured by two iron spikes and two oak trenails to sleepers and timbers of the usual dimensions. The ballast in the neighbourhood is broken stone.

The first mark of derailment which was visible at my Inquiry was on the seventh timber from the heel of the switch rail, that is, at a distance of about 32 feet from the toe of the points, and takes the form of a mark on the inside of the chair carrying the left-hand rail of the turn-out, evidently caused by the outside face of one of the left-hand wheels of the derailed coach. From this point in an easterly direction there were marks on the timbers running in the four-foot of the up fast line, and to the

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left of this in the six-foot between the up fast and down slow. In addition to the markings visible at the Inquiry, the evidence of the witnesses shows that there was a mark about 2 feet long on the table of the right-hand rail of the turn-out between the heel of the switch and the wing rail, the centre of this mark being about opposite the seventh timber from the heel of the switch. This mark was evidently caused by the flange of the right-hand wheel mounting the rail.

The right-hand rail between the heel of the switch and the wing rail was considerably side-worn, the maximum amount of wear being at the point of derailment, and amounting to about ½ inch at rail table level. This rail, which was originally 95 lb. section, is now calculated to weigh about 84 lbs. per yard.

After the derailment, the train came to a stand with the leading end of the derailed vehicle rather under 100 yards from the facing points, that is about 88 yards from the point of presumed derailment. This vehicle was derailed all wheels, and the leading bogie was torn from the under frame and lying approximately at right angles to the direction of travel. It was separated by a distance of four or five yards from the leading vehicle.

Evidence.

The train in question had been running between Liverpool and Southport on March 9th, and was transferred to the service between Southport and Crossens, a distance of 3½ miles, at 9.25 p.m., the trip which terminated in the derailment being the last train booked on this service. Motorman Blundell took charge of the train at Southport that evening at 9.25 p.m., and made altogether three trips. Both the first and second double journeys were without incident and the running of the train was entirely normal. Between Chapel Street and St. Luke's, motormen are instructed not to pass the series position of their controller, and Blundell said that this regulation was duly observed by him on all three trips. The 10.45 p.m. train left Chapel Street No. 2 platform on time, with about 150 passengers, mostly in the leading and rear vehicles. It is of interest to note in connection with the resulting casualties that the derailed vehicle was only lightly loaded, in consequence of the objectionable conduct of one of the passengers. The train followed its usual route on to the up fast line and thence on to the up slow line over No. 55 through crossing.

Motorman Blundell first noticed that something was amiss by seeing some flashes from the permanent way. He therefore at once shut off the controller, and as soon as he had done so the break-loose occurred. The current went off the line at about the same time as the train came to a stand. Blundell at once got down on to the permanent way and saw the results of the derailment. He then put his short-circuiting bar between the live and running rails and went forward to the signal box to give information of the accident.

Guard Hemingway, in charge of the train, was riding at the rear end of the rear motor car. He confirmed his motorman's evidence that there was nothing unusual in the running on the two previous trips. On the third trip the first thing which he noticed was the application of the brake and the cutting off of the current by the motorman, and when the train came to a stand he noticed arcing which appeared to come from the rear shoe. There was no indication up to this moment of any derailment, and Hemingway's impression was that the live rail had been knocked over. When the train came to a stand he got on to the permanent way, and after attending to the passengers, telephoned to the Southport Station signalman explaining the circumstances and asking him to take the necessary steps for protection. He noticed a slight fire in the waste packed inside one of the axle boxes of the displaced bogie, which was subsequently extinguished by one of the extincteurs on the train. This fire was of little consequence and probably started by the short-circuiting of the live rail before the current was cut off by the opening of the circuit breakers in the sub-station.

Kitching, a porter employed at Southport who was travelling as a passenger in the derailed coach, said that the first indication he noticed of anything wrong was a bumping sound followed immediately by the turning over of the coach to the left. There was no jar before the bumping caused by the wheels on the ballast, and Kitching is sure that the derailment was not caused by running over any obstacle. It may here be mentioned that there is no evidence that any obstacle was present under the wheels of the train, and a search of the permanent way showed no trace of anything of the kind nor was any gear missing from the leading coach.

Evidence was also given by Station Inspector Pendlebury as to the loading of the train and its departure. His attention was first called to the fact that something unusual had occurred by the cutting off of the current from the line about two minutes after the train left, which was manifested by the lights going out in the 10.50 p.m. train, standing at the time in No. 1 platform. He telephoned to the station box, ascertained what had happened, and took steps, at the signalman's request, to send for the ambulance, police and doctors. He then went to the scene of the accident and examined both the train and the permanent way. He found the derailment as already described, and an examination of No. 55 facing points shewed that they were correctly set, fitting well and bolted. There is in fact no evidence to suggest that this was not the case.

Henry Mercer, the ganger in charge of the length, was off duty on the day in question and received information of the accident at about 11.20 p.m. He at once proceeded to the scene and made an estimate of the material required for renewal. He found that the first sign of damage was between the sixth and seventh timbers from the heel of the points, and on the seventh timber found a mark on the chair on the left-hand side in the direction of travel. He found the fastenings of this chair correct and did not mark any for renewal. The fastenings were also correct on the right-hand chair of this timber. The left-hand chair on the eighth timber from the switch heel was broken, but the fastenings he said were all right and were not marked for renewal. The eighth chair on the right-hand side was broken and the fastenings of this chair were worn and loose and marked for renewal. He noticed on examination that this chair had been moving outwards about $\frac{1}{4}$ inch. Both chairs were broken on the ninth timber, and the fastenings on the right-hand side were marked for renewal, but were all right on the left-hand side. At the tenth timber the chair on the right-hand side was broken and this chair had been moving about $\frac{1}{8}$ inch. The fastenings were worn and slightly loose. He found other broken chairs ahead of the scene of the derailment. After having made this examination and brought up material for renewal, Mercer put the gauge on the line near the seventh timber from the heel of the points and found it $\frac{3}{4}$ inch wide to gauge. He also gauged the road at other positions, with the following results: At the facing points true to gauge; at the second timber from the heel of the points, $\frac{3}{4}$ inch wide; at the twelfth timber from the heel of the points $\frac{1}{4}$ inch wide; at the crossing, true to gauge. On the up fast road ahead of the facing points the gauge was about $\frac{1}{16}$ inch wide all along. He found, he said, the right-hand rail between the switch and the wing rail badly side-worn. This he had noticed before the derailment, but did not report it, as in his opinion the rail was fit to run for another two months. He added that the fastenings, except those mentioned above as having been marked for renewal, were "fairly tight," and that all trenails had to be cut except one, on the right-hand chair on the eighth timber, which was broken off. There were no keys missing. Next morning he noticed that between the seventh and eighth timbers the rail was kinked outward for a length of about a foot to an extent of about $\frac{1}{16}$ inch. The fishplates and bolts were all in good order and were not replaced.

Permanent Way Inspector Robert Ashton arrived on the scene of the derailment at about 11.40 p.m., where he found the length ganger, Mercer, on the spot. No work had been done prior to his arrival. Inspector Ashton found, in addition to the other indications of derailment, a mark on the top of the right-hand rail about 2 feet long, in the neighbourhood of the seventh timber from the heel of the switch. This mark was evidently caused by the mounting of the right-hand rail by a wheel flange. He then gauged the permanent way at the point of derailment and found it $\frac{3}{4}$ inch wide to gauge. Inspector Ashton said that he examined all the fastenings and that these were all right, nor did he find any sign of chairs having been moving at all. When the ganger and his men were ready to work they commenced replacing broken chairs and pulling the road into gauge where it was wide. After the chairs had been taken away in order to plug the holes ready for the new fastenings, Ashton found some of the old spikes slightly bent. He added that the right-hand rail was side-worn, but had in his judgment at least two or three months more life. He confirmed ganger Mercer's evidence in regard to the presence of the kink in the rail ahead of the point where the wheel flange mounted. The fishplates and bolts were in order and the expansion joints correctly open, nor was there any sign of rail creep.

In regard to the condition of the trailer coach in question, evidence was given by foreman Heckenbottom, Carriage and Wagon Department, Southport, who

examined the bogies of the derailed car at 7.30 a.m. on the following morning. He found the leading wheels of the leading bogie out of truth to the extent of ¼ inch each way due to a bent axle. The trailing wheels of this bogie were to gauge and the axle straight. The leading pair of wheels of the trailing bogie were out of truth to the extent of about ⅛ inch, also due to a bent axle, and the trailing wheels of that bogie were to gauge. The tyres were all in good running order and had been re-turned during the complete overhaul of both bogies completed on the 17th January of this year. There was no sign on any of the eight wheels of any movement of the axle. Heckenbottom is of opinion that both axles were bent as the result of the derailment, prior to which they had been running true. If this had not been the case there would have been distinct marks on the tread of the tyres showing irregular running, an effect which he has found in other cases as being evident when wheels have been running with bent axles. The springs were in good condition and unbroken. Heckenbottom's evidence on these points was confirmed by my examination of the bogies at the Inquiry. The pin of the leading bogie was found by the breakdown gang in the casting on the top of the bogie, the top casting into which it fits having been torn away from the coach. This pin was badly bent, and also showed considerable side cutting for a distance of about 1½ inches from the underside of the head to a maximum depth of about ⅛ inch. Foreman Heckenbottom said that he had seen similar cases of the same sort of wear but not, he thinks, quite so deep as in the case of this pin. He attributed it to the holes of the top casting and of the plate not being quite opposite to one another. There were no signs of this pin having run dry nor was there any indication of heating of any of the journals of the eight wheels.

Conclusion.

The evidence shows clearly that the derailment resulted from the mounting of the right-hand rail of the through crossing by one of the right-hand wheels, no doubt the leading one of the front bogie of the second coach. The curvature at this point is considerable and the side pressure on the right hand rail necessarily heavy. This, of course, accounts for the side wear on the rail, and no doubt also for the spreading of the gauge referred to in the evidence of the Permanent Way Inspector and the ganger. This condition was evident at my Inquiry from the markings on the timbers outside the right-hand rail, which, as the road had then been re-set to gauge, were plainly visible. There was a distinct burr on the timbers outside the old bed of the chairs near the scene of the derailment, and the distance of this burr from the new line of the chairs tended to confirm ganger Mercer's evidence that, in addition to the ⅜ inch wideness to gauge found after the derailment, the fastenings had allowed some further movement while the side pressure was actually being exerted by the wheel flanges.

There is nothing in the condition of the stock to lead to the conclusion that this was in any way contributory to the derailment. The cutting of the bogie pin referred to, although it had the appearance of having been caused by wear, may possibly have been brought about before the bogie was wrenched away from the frame after the derailment. In any case, owing to the comparative slackness of the fit of this pin in the casting on the coach, it is doubtful whether, even had this wear been due to some degree of out of line in the original fitting, it would have caused sufficient out of truth or stiffness in the working of the bogie to have contributed to the derailment. Nor is there any evidence that the speed of the train was at all higher than usual. It is possible with electric trains of similar make-up to determine speed over a given route with tolerable accuracy, and trials carried out after the accident with a similar four coach set shewed an average speed over this turn-out of between 17 and 18 miles an hour with the controller in the last of the series notches.

I have no doubt that the spreading of the road, which would, as the fastenings yielded, tend to become progressively worse, combined with the side wear of the right-hand rail (which was most pronounced at the point where the flange mounted) is a sufficient explanation of this derailment, which must therefore be attributed entirely to defective permanent way at the point.

(2) The responsibility for the maintenance of a length of road in a safe and efficient running condition rests primarily upon the length ganger in charge. In this case ganger Mercer had been absent from his work owing to sickness for some

eight weeks and had only re-joined a few days before the accident. Although, therefore, he had walked the length, which included this crossover, after his return, he had not gauged the road since before his illness in January. It was then about ¼ inch wide, and the fastenings he said were very good.

Young, the sub-ganger, who had been acting for Mercer during the latter's absence, said that he last gauged this crossover on February 11th or 12th, and found it a shade under ¼ inch slack. Young cannot remember when the gang last did any work on the chair fastenings on this particular section, but added "it cannot have been for some time, or I should have remembered."

Permanent Way Inspector Ashton took charge of his district, totalling about 39 miles, on January 1st last, having prior to that date been sub-inspector for the area which includes this length. In his opinion the length (equivalent to 12½ miles of single running line and sidings and including 173 sets of points) is a very busy one for the men employed, that is the ganger and five men, including the sub-ganger, but Inspector Ashton said that he has not had any report about there being insufficient men for the work. His last visit to the length in question was on the day before the accident. He found nothing amiss, and had no reason to suppose at the time that the sub-ganger was getting behind with his work.

(3) In a case of defective maintenance of this kind the responsibility for a consequent accident must in a measure be shared by all the permanent way officials concerned. Primarily, it rests upon the ganger in charge of the length. In this case, however, Mercer had been absent for some weeks and there is no evidence to shew that it was in other than safe condition when he left. On the other hand, he returned in time, had he observed the conditions, to have had the matter rectified. Some degree of responsibility for the accident must therefore be taken by him, but in the main it rests upon sub-ganger Young, who for the two months prior to the accident was in immediate charge of the maintenance of this length. It contains a large number of points and crossings and the work is no doubt heavy, particularly with one man short owing to the ganger's illness. Sub-ganger Young did not, however, make any report of inability to get through the work in consequence, nor make any definite request for an extra man. Young has 23 years' service with the Company, and has been a sub-ganger for eight years, six of which he has spent on this length.

The chief defect in the road was the insecurity of the fastenings which allowed the right-hand rail to spread outwards. With the coach screw type of chair fastening now adopted by the Company, and used at this point after the accident to replace the original spikes and trenails, the security against spreading should be considerably greater than before. As to the side wear on the rail, it is the general experience among Railway Companies that side cutting is very much more pronounced in the case of lines used for electric traction than with steam-hauled stock. Both the Permanent Way Inspector and the ganger considered, as stated in their evidence, that this particular rail still had a few months safe life, and I understand that the Company's executive officers concur in this view, since the rail was still in position at my Inquiry after the repairs had been carried out to the road. The extent to which side wear on a rail in this position may safely be allowed to develop before it is replaced must be entirely a matter of opinion. No doubt experience of similar conditions elsewhere led the Company's officers to form the conclusion that the condition of this rail was not in itself dangerous. However this may be it was undoubtedly a contributory cause of the derailment, and the fact that it was known to be in this condition and near the end of its life should have occasioned more particular attention on the part of the maintenance gang to the gauge and fastenings at this point.

It is also for the Company's consideration whether more complete checking is not desirable along the inside rail of a turn-out at a running junction where the curvature is so pronounced as it was in this case. It is a not uncommon practice on some British Railways under similar conditions to extend the check rail as far back as possible from the point opposite to the crossing, and in some cases it is carried even as far back as the heel of the switch, the check rail being scarfed for the purpose. This should not only prevent spreading and check side cutting but safeguard the risk of derailment where, as in this case, side cutting has already developed.

In regard to the adequacy of the gang allowed to this length, ganger Mercer, who, out of a total of 33 years' service has been 23 years a ganger, stated that he told the Permanent Way Inspector that the work is too much for his gang, the last time he did so being about two years ago, though no formal report in the matter seems

to have been made. Last year Mercer had a serious accident, having been knocked down by an electric train, and was absent altogether 17 weeks between January 1st and May 3rd. No definite request for an extra man appears either then or during his illness this year to have been made by his sub-ganger, and the gang has therefore been one man short for a considerable proportion of the last 15 months. In view of the defects in maintenance brought to notice by this accident, the Company will no doubt reconsider the question of the adequacy of the gang for the work on the section and the desirability of maintaining it at full strength during the temporary absence of any of its members.

I have the honour to be, Sir,

Your obedient Servant,

G. L. HALL,

Major.

The Secretary,
Ministry of Transport.

APPENDIX.

No. and Description of Vehicle.	*Particulars of Damage.*
L. & Y. Third Motor No. 3016	One steel headstock and one auto-coupler drop pin lever rod bracket broken ; auto-coupler displaced.
L. & Y. Third Trailer No. 3102	Electric cable boxes, wood pattress, two emergency lights and frames, three side lights, three gangway door lights, vacuum main train pipe, one top foot-board, one body truss rod, two feet of bottom panelling, all bottom panel mouldings on one side, emergency ladder, one vestibule door light, six axleboxes, one pair of vacuum brake fishplates, two bolster centre castings, one corner plate, two bogie check chains, one bogie check chain stud, one brake block hanger carrier, broken ; one axleguard and tie rod broken ; two bottom footboard leg irons, body solebars, two steel headstocks, four bogie solebars, bolster cradle, three brake truss bars and hangers, two axleguards, three longitudinals, one bogie tie rod and support, bent ; one brake block hanger carrier bracket bent and broken ; wheel tyres and flanges bruised.
L. & Y First Trailer No. 411	One vestibule canvas torn and frame bent ; electric bell cable damaged.

List of Materials damaged in Permanent Way.

3 45-ft. Rails slightly bent.	17 8-in. Chairs broken.
2 42-ft. Rails slightly bent.	5 6-in. Chairs broken.
2 Wing Rails badly bent.	8 Bridge Chairs broken.
1 15-ft. Switch blade bent.	9 P & C Timbers broken.
1 Obtuse Point bent.	51 P & C Timbers slightly damaged.
1 12-ft. Check Rail bent.	7 Sleepers slightly damaged.
3 Point Chairs broken.	6 Ordinary Insulators broken.
2 Check Chairs broken.	3 Anchor Insulators broken.
1 Second Chair broken.	130 feet Guard Boards broken.
2 Heel Chairs (No. 3 & 4) broken.	30 Guard Board Blocks broken.