LANCASHIRE AND YORKSHIRE RAILWAY.

Railway Department, Board of Trade,
8, Richmond Terrace, Whitehall, London, S.W.
12th July, 1912.

SIR,

I HAVE the honour to report, for the information of the Board of Trade, in compliance with the Order of the 22nd June, the result of my Inquiry into the causes of the accident which occurred on the 21st June to an express passenger train which left the rails at Charlestown Curve, near Hebden Bridge, on the Lancashire and Yorkshire Railway.

In this case the 2.25 p.m. express train from Manchester to Leeds was entirely derailed and the second and third vehicles broken up.

Four passengers were killed and 60 injured, and the driver, fireman and guard were also injured.

The engine was a four-wheels-coupled radial tank engine, *i.e.*, one with a pair of leading and trailing wheels, each pair on a radial axle, and it was running chimney first at the time of the accident. It was fitted with the automatic vacuum brake working blocks on the four coupled wheels. Its weight in working order was 66 tons 9 cwt. distributed as follows, viz. :—

	tons.	cwt.
On the leading radial axle	12	16
,, driving axle	19	11
,, rear coupled axle	19	14
,, rear radial axle	14	8

The total length of the frame, excluding buffers, was 34 ft. 10 ins., made up as follows, viz. :—

	ft.	ins.
From front to centre of leading radial axle ...	5	6
,, leading radial axle to driving axle ...	7	$10\frac{1}{2}$
,, driving axle to rear coupled axle... ...	8	7
,, rear coupled axle to rear radial axle ...	7	$10\frac{1}{2}$
,, rear radial axle to end of frame	5	0

The diameter of the driving and coupled wheels was 5 ft. 8 ins., and of the radial wheels 3 ft. $7\frac{3}{4}$ ins. The centre of gravity was from 4 ft. 10 ins. to 5 ft. above rail level.

The engine was fitted with a superheater.

The train consisted of the following eight coaches, viz. :—

1. Bogie Compo. Van, Southport to Harrogate.
2. Six-wheeled Third Van, for Harrogate,
3. Bogie Third Van
4. Bogie Compo. } Leeds portion,
5. Bogie Third Van
6. Bogie Third Van
7. Bogie Compo. } Bradford portion,
8. Bogie Third Van

with brake blocks worked by the automatic vacuum brake on all wheels with the exception of the centre pair of the six-wheeled vehicle.

All the brakes are said to have been in very good order.

The six-wheeled vehicle was a special coach attached to the train, containing a coffin.

The length (excluding buffers), and weight of the coaches (unloaded) were as follows :—

				tons.	cwt.	qrs.
1.	Length 52 feet.	Weight		23	4	0
2.	,, 33 ,, ...	,,		12	18	2
3.	,, 54 ,, ...	,,		22	9	0
4.	,, 56 ,, ...	,,		25	6	3
5.	,, 54 ,, ...	,,		22	9	0
6.	,, 54 ,, ...	,,		24	17	3
7.	,, 56 ,, ...	,,		25	19	0
8.	,, 54 ,, ...	,,		24	17	3

Total length of train, over all, including engine, 479 feet, and total weight of engine and train, unloaded, 248 tons 10 cwt. 3 qrs.

Details of damage to rolling stock and permanent way are given in the Appendix.

Description.

The down line from the Todmorden end of Summit Tunnel to a point 77 yards past Dover Bridge signal-box is on a falling gradient all the way of 1 in 182, and the distance is about 5¼ miles.

The distances between the following intermediate points referred to in the evidence are as follows, viz. :—

	Miles	chains.
From Todmorden end of Summit Tunnel to Dobroyd crossing	2	4
From Dobroyd crossing to Todmorden West	0	12
From Todmorden West to centre of Eastwood Station ...	2	28
From centre of Eastwood Station to down advance signal ...	0	19
From Eastwood down advance signal to Dover Bridge signal-box	0	37
From Dover Bridge signal-box to Woodman Bridge	0	14

The gradient changes from 1 in 182 falling to 1 in 1886 rising at a point 77 yards past the Dover Bridge signal-box for a distance of 10 chains and then becomes 1 in 179 rising for a distance of 11 chains, and then 1 in 179 falling to Hebden Bridge, and then falls at varying gradients from 1 in 298 to 1 in 433 to Sowerby Bridge, except for a level length of 19 chains at the water troughs.

At Dover Bridge signal-box the down line is on a slight curve to the right of 90 chains radius, and at a point 130 yards east of the box a transitional curve 108 yards in length commences, ending in a curve to the right of 30 chains radius which is 128 yards in length, Woodman Bridge being at just about the centre of the 30 chain curve.

Beyond the 30 chain curve there is another transitional curve to the right 90 yards in length to a piece of straight line 23 yards in length, and then commences a transitional curve to the left leading to another 30 chain curve but to the left, but that part of the line is not concerned with the actual derailment.

The super-elevation of the outer rail commences some way back from the 30 chain curve and amounts to 2⅞ inches on the 90 chain curve and gradually increases to a maximum of 5 inches on the 30 chain curve, and then decreases again and dies out at the straight portion.

There is a speed restriction of 45 miles an hour round the curves.

Prior to the line being relaid in April, 1911, there was an inside check rail on the curve, which was then, I am informed, of about 27 chains radius and was not approached by transition curves as at present; so when the line was relaid and the curvature improved, the check rail was not considered necessary and was not renewed.

Evidence.

George Henry Medley states: I have been in the service 32 years and a registered driver 14 years. On June 21st I came on duty at 1.25 p.m. at Newton Heath and was working the 2.25 p.m. passenger train from Manchester to Bradford. We left Manchester to time and the first stop was Rochdale. I left Rochdale two minutes late, where we were booked to leave at 2.45, and my next stop would have been Halifax, where I was due at 3.14. I have not driven this particular train before but have worked other trains timed the same. I have generally had a bogie engine before. This engine was a four-wheels-coupled radial tank fitted with the automatic vacuum brake on the four coupled wheels. The brakes were in good order and I had a steady 20 inches of vacuum throughout. On leaving Manchester we had a clear road with the exception of a permanent way slack at Castleton, where I reduced speed to 15 miles per hour. After passing Rochdale the train seemed all right, and I felt no unusual motion on the engine. From Summit Tunnel there is a falling gradient all the way to Eastwood, and I emerged from the tunnel at about 45 miles an hour. The speed was accelerated up to 48 miles per hour approaching Dobroyd crossing, and I closed the regulator and allowed the train to run by gravitation through Todmorden, and clear of Hall Royd Junction. After the train had cleared the latter point I put on about half steam, pulled the wheel back to about quarter cut off. The regulator then remained in this position to a point about Eastwood advance signal, which is on the same post as Dover Bridge inner distant. At about that place I again closed the regulator and at this point I estimate the speed at about 50 miles per hour. Having a dry rail and only a light train I calculate the friction and the dryness of the rails would reduce the speed five miles per hour, seeing that I was running by gravity, and I should therefore be travelling about 45 miles an hour when I entered on the curve, and I estimate I was travelling at this speed when passing Dover Bridge box. The first intimation I had that anything was wrong was just as I was about three parts over the viaduct. I was standing with my left hand on the regulator when an incident occurred which caused me to turn my head sideways. This was through feeling a bit of a set back to the engine: also at the same moment a slight twist at my side. Next the engine took two or three very severe longitudinal swerves from the leading to the trailing end. I immediately applied the brake with full force, and all the air passed from the application valve into the train pipe, and the train to all appearances was intact at this moment. When I applied the brake the engine did not appear to be off the rails. For a moment or two we ran on and then we seemed to drop off the rails and then commenced to run on the side of the slope. Up to the time when I felt that something had gone wrong I had never applied the brake, as I do not believe in checking the speed when running over a curve. If I require to do any checking I do it before I enter on a

curve, as I want my brakes off when passing over a curve. I think I felt the swerve just before I got to the old signal post on the up side of the line. I know there is a speed restriction of 45 miles per hour over the curve. When I felt the pluck I think the whole of the train, including my engine, was on the rails. The engine did not appear to have left the rails until we had got further up into the cutting. It would be a hard job to say how far my engine ran on the ballast after leaving the rails, but I should estimate we ran in that position about 20 or 30 yards. I do not think there was a wheel off until a little after I applied the brakes. After the longitudinal movements the engine seemed to gather itself again and advance along the rails. I did not feel any more pull after feeling the jerks, which I think I should have done had there been any wheels of the engine or train off the road. When I felt the pluck I did not look round to see if there was anything wrong as I was on the outside of the curve, and if I had looked back I should not have been able to see. I did not notice my engine give any swerve at all out of the ordinary after leaving Todmorden, as it rode like a carriage. After the train came to a stand I got down from the footplate and said to my mate "Run on to Hebden Bridge and stop anything coming in this direction by all possible means; also summon doctors and demand breakdown train." About 10 minutes or a quarter of an hour after the accident I saw the guard assisting the injured. I was able to judge the point where I felt the train commence to swerve by the position of Woodman Bridge. I have worked over this length of road both express and local trains for the greater part of 14 years, and the last time I was over before the accident was about a fortnight ago, when I ran a race special from Pendleton New to Leeds, Sowerby Bridge being my first stop. I have never perceived anything out of the ordinary when passing over this curve, and I consider it a very good curve to run over. I have travelled over the Charlestown curve on the down road with full steam on close upon 55 to 60 miles an hour on more than one occasion, but on the date in question I had no need to push as I had plenty of margin of power. This was the first time I have driven engine No. 276, but I have had its sister engine, No. 285, and I have been connected with four-coupled radial tanks ever since they were started. I have never travelled at a rate of 60 miles an hour with a four-coupled radial tank, as this happened when I have had a bogie tender engine, and it was also before I knew of the instruction respecting the speed.

Henry Hugh Broadbent states: I have been in the service since April, 1906, and a booked fireman from November, 1910. I signed off duty on Thursday, the 20th, about 12.50 a.m., and signed on on Friday at 1.25 p.m., and in the ordinary course should have finished at about 12.50 a.m. I was booked to work with driver Medley on this date and he signed on at the same time. We had engine No. 276, which is a four-coupled radial tank fitted with vacuum brake to the coupled wheels. We worked the 2.25 p.m. train Victoria to Leeds, and the engine was running chimney first. We left Manchester about two minutes late. We had a permanent way check at Castleton South and arrived at Rochdale 3½ minutes late. We passed Todmorden at 3.2 p.m. and I think we were still 3½ minutes late. All the signals were off for us and I consider we were running at about 55 miles an hour on passing Eastwood. The driver shut off steam when passing Todmorden and gave the engine a little steam again on passing through Horsfall tunnel. I think he closed the regulator again at Eastwood and he did not put steam on again between there and the point of accident. The driver was running with his hand on the brake handle from Eastwood and he did not apply the brake until I heard the first indication that something was wrong. I think this was when we were passing a point about 20 yards to the west of Woodman Bridge between Dover Bridge box and Charlestown curve. He then applied the brake fully. As regards the indication which I had that something was wrong, I can only say that the engine seemed to rock sideways and almost immediately afterwards we were off the road. I did not hear any particular noise before the engine came off the road. I had shut the injector off about Eastwood Station and after that I did not do anything further than keep a look-out on my side of the engine. I looked back as soon as I felt the engine shaking about and the whole of the train seemed to be on the road. Both the driver and myself kept on the footplate till the engine came to a stand and I then put the injector on and ran ahead to Hebden Bridge West box to protect the line. I was not injured but shaken by the accident. We did not seem to travel any faster on the Friday than on the previous day. On the Thursday the driver kept steam on until we arrived at or about Eastwood Station and then shut off steam until nearly at Hebden Bridge East box. The engine seemed to give a jerk and swerve from one side to the other two or three times when my driver put the brake on, but I did not take particular notice as to whether the engine seemed to steady itself afterwards. I felt the jerking before the swerving commenced. The jerk was just like a bit of a pluck. After two or three quick swerving motions and after the driver put the brake on we immediately came off the road. There was only a short interval between the engine swerving and the train coming off the road, but I cannot remember any particular period, neither can I say how far we travelled before coming off the road. I could not say how far the engine went after leaving the rails before it struck the bank. When I looked out on my side after the jerk the train appeared to be all right. After getting off the engine I ran ahead to Hebden Bridge West signal-box, and I did not meet anything coming on the up road. I do not think the engine regained itself after I felt the pluck. I think we were travelling about 50 to 55 miles an hour when passing about Eastwood Station, where the driver shut off steam. I cannot say what speed we were travelling at when passing over the bridge just after reaching Dover Bridge box. I did not feel any swerving of the engine before reaching Dover Bridge box. There was no oscillation of the engine between Manchester and the point where I felt the pluck. I have been over this road with this particular train regularly, but not with the same driver. The driver on the date in question ran at the usual speed drivers run at when working the same train. There was no difference with this particular driver to other drivers working the same train with the exception that he shut off steam twice approaching Eastwood instead of once. We did not pick up any time between Rochdale and Todmorden. At the time I looked back I think all the coaches were on the road.

Sargeant Mawson states: I have been in the service about 29 years, and a regular guard about 4½ years. On June 21st I came on duty at 9 a.m. and expected to finish about 7.15 p.m. I

left duty the day before at this time. I was in charge of the 1.40 p.m. Liverpool to Leeds express and have worked this train for 2½ years in my turn every eighth week. Before leaving Liverpool I examined the train, which was formed with six bogie vehicles, and tested the vacuum. I started with 18 inches. At Manchester the engine was changed, and the through Southport to Harrogate coach and a corpse van for Harrogate were attached in front, and the formation of my train from there was as follows :—

Engine No. 276 (radial tank).
Bogie Compo. Van No. 625 (Southport to Harrogate).
Six-wheeled Third Van No. 1967 (loaded with corpse).
Bogie Third Van No. 911 }
Bogie Compo. No. 936 } Leeds portion.
Bogie Third Van No. 912 }
Bogie Third Van No. 894 }
Bogie Compo. No. 1070 } Bradford portion.
Bogie Third Van No. 833 }
8 vehicles, equal to 11½.

I tested the vacuum again before leaving Manchester, where we left two *minutes late*, at 2.27 p.m. We had one minute delay at Castleton by permanent way operations, one minute over time at Rochdale dealing with luggage, leaving at 2.49 four minutes late, and we were 4½ minutes late passing Todmorden at 3.1 p.m. Nothing unusual occurred on the journey from Liverpool to Eastwood, and just after passing there I was sorting the parcels and mail bags, of which I had a large quantity, in readiness for transfer at Halifax, our next stop, when I was thrown about in the van. This was the first intimation I had that anything was wrong, and I rushed to apply the vacuum, but it had already been destroyed. I at once alighted from the van and ran back towards Dover Bridge cabin to tell the signalman to block both roads. I placed some detonators down and when I was about half way to the cabin the signalman heard my whistling and noticed the motioning of my arms to stop the traffic. After telling him what had occurred I returned to the train to see how the driver and fireman were, and ascertain if the up road had been protected. My van was off the road but upright, and the two next vehicles to it were also off, but upright, on the down side and clear of the up main line. The fourth one was leaning towards the up main and was foul, but it was standing on its wheels. The fifth was leaning on its side on the up line and the next two were all mixed up, the corpse van being broken to pieces. The leading vehicle was upright, but badly damaged. When I was passing the vehicles next to my van I saw the passengers helping one another out. I estimate the speed of the train at 40 miles an hour at the time of the occurrence although I did not take any special notice of the speed we were travelling at. When passing Dover Bridge box I heard a crack, which seemed to come from the front of the train, and after this I think we should travel about 100 yards before the coaches left the rails. The driver shut off steam between Eastwood and Dover Bridge. I have never noticed anything out of the ordinary when passing round this curve with this train. When there has been a clear road I have occasionally noticed that the vacuum has been reduced by the driver between Todmorden and Hebden Bridge, but I have not looked specially at the gauge to see if the speed was checked. On one or two occasions this week the vacuum has been reduced about Eastwood, but on the date of the accident I did not notice there was any reduction in the speed between Todmorden and the place where the train came to rest. There was nothing in the speed of the train on this occasion to cause me to watch the gauge. I have not seen the instruction in the Supplement dated January, 1911, to the Working Time Table Appendix in which the speed of trains travelling over the down line round Charlestown curve is restricted to 45 miles per hour. The crack I heard near to Dover Bridge might have been caused by the engine leaving the road. I have not had the same engine and driver all the week, as I started on the Monday with No. 689, driver Powell; on the Tuesday and Wednesday, engine No. 480, driver Burton; Thursday No. 276, driver Powell, and on the day of accident the same engine and driver Medley. All these engines are the same class, and the train has been run with this class of engine for some months. I did not notice the exact time of the accident.

Edgar Ewart Haigh states : I have been in the service about 12 years, and a signalman about four years, having been in Dover Bridge box about two years. I signed on duty at 2 p.m. on Friday, June 21st, for eight hours, and finished duty at 10 o'clock the night before. I got the "Is line clear?" signal from Eastwood for the 1.40 p.m. Liverpool to Leeds express at 3.1 p.m.; the train was running about a minute late. I offered the "Is line clear?" signal to the box in advance at the same time and it was acknowledged immediately. I received "Train entering section" signal from Eastwood Station box at 3.3 p.m. An up train was passing at the same time as I received the "Train entering section" signal from Eastwood. I watched the Leeds train as it was passing my box and I gave the "Train out of section" signal to Eastwood at 3.4 p.m. as soon as I saw the tail lamp. I then heard a rumbling noise after 10 to 20 seconds, and, looking in the direction of the train, I saw the guard coming back towards my box motioning with his arms and whistling. I thought there was something wrong, and at once gave the "Obstruction danger" signal. I could see the rear two carriages clearly from my box and they appeared to be off the road. In my opinion there was nothing exceptional about the appearance of the train or of the speed at which it was travelling, and it seemed to pass me in the usual way. I could not tell if the driver was slackening speed for the curve on approaching my box, as it is difficult to form an opinion on this.

Irving Hey, foreman platelayer, Todmorden, states : I have been in the service about 12 years, a foreman 3½ years. I was standing on the viaducts between Walsden and Todmorden when the 2.25 p.m. passenger train, Manchester to Leeds, passed on June 21st. It seemed to be travelling about 50 or 60 miles an hour, and I heard a throbbing noise, and the engine seemed to jump. The train seemed to me to be travelling rather faster than usual, and I have never noticed other engines jump as this one seemed to do. I was on the up line watching it approach. When I got down to Dobroyd cutting I told platelayer Heyworth that the down express came along at a rare speed, and he also said the engine seemed to be jumping. I did not hear of the accident until about 3.35 p.m. I should be about three-quarters of a mile above Todmorden when the train passed me. I have never noticed anything unusual about the running of this train. From the position in which I stood on the up side of the line I could not say whether the knocking noise which I heard was from the engine or not. As the train approached me I noticed that it appeared to be heaving, which is something I have not observed before. When the train passed me on the day before the accident I was at Todmorden

Junction, and I did not notice it as particularly as I did on the Friday.

Arthur Heyworth, platelayer, states: I have been in the service about 12 months. At about 2.30 p.m. on June 21st I was working in Dobroyd Cutting between Todmorden and Walsden. I along with others stepped clear of both roads as the 2.25 p.m. express from Manchester passed. I noticed that when the train entered the top end of the cutting it started to jump as if some of the wheels had left the metals. There were three of us working together, and the other two said that the engine seemed to lift from the metals as it was running, and they said they had never noticed anything like it before. I mentioned it to my foreman afterwards how the train appeared to be running, and at that time I did not know that there had been an accident. As the train approached me the wheels of the engine appeared to be moving up and down at the front but not at the back, and when I noticed this I should be about 50 yards away. The movement was up and down only.

Joseph Tasker states: I have been in the service nine years, and am located in the Goods Department at Todmorden. I was in the Goods Yard on the west side of the Station, and was standing on the up side about 15 to 20 yards from the up main line. I had a clear view of the 2.25 p.m. express from Manchester as it was approaching. I watched it pass and I thought it was travelling faster than usual. I heard a shaking noise as if there was something loose on one of the coaches. I also noticed one of the long springs at the trailing end of the second coach or the leading end of the third one was hanging loose. The spring seemed to be fast at one end and the other appeared to be sloping downward, but it was not projecting at the side. I am quite sure the spring was not in its proper position, and I was telling another clerk about the incident about five minutes afterwards when someone else came into the office to acquaint us of the accident. The front end of the spring was fixed, but the rear end was loose.

Arthur Holden states: I have been five years nine months in the service, a foreman five years, all the time on Charlestown Curve. My section of line is between Eastwood and Hebden Bridge, about two miles in length. I was at Eastwood when the 2.25 p.m. train from Manchester passed on June 21st, and I was at the east end of the station at the time. I had walked down the main line from Charlestown Old Cabin, past the place of accident. My estimation of the speed of the train was that it was travelling at about 60 or 70 miles an hour. I specially notice the speed of trains as they pass over the Charlestown Curve. This particular train was travelling very fast but it looked to me like an ordinary express. It was not, in my judgment, travelling any faster than other expresses on the down road between Eastwood and Hebden Bridge. I did not notice anything peculiar in the appearance of the train. The signalman at Eastwood informed me of the accident just afterwards, and I was on the scene about 15 minutes after it happened. I saw nothing wrong with the road as I passed it prior to the accident at about 2.45 p.m. On my return I found the line waved but there was nothing broken and no mark on the rails until the point where something appears to have mounted the rails, and beyond that place to where the train stopped the rails were all crumpled up. The road was newly relaid last summer. When I examined the down road at 2.45 p.m. on the day of the accident, I thought it advisable, in view of the temperature of the day, to slacken off one or two joints. It had not been necessary to do this any day previously during the week. During last summer, which was exceptionally hot, the down road did go out of line as near as I can say about two inches from a point three lengths on the Eastwood side of Woodman Bridge to the Dover Bridge down advance signal, but the road has not been out of line, due to expansion this year. This was about the place where I saw the waviness of the line on the day of the accident. On June 21st the sun was shining from 2 o'clock to about 3. Nobody had touched any of the permanent way up to the time I arrived at the scene of the accident, and I was the first to slew the line afterwards. As far as I know, there have been no broken fishplates at or about Woodman Bridge since the line was relaid. When I have observed drivers exceeding the speed limit, I have not reported them, although I have mentioned the matter to Inspector Wright. When I passed over the length just before the accident, I slackened two bolts at the joint on the east side of Woodman Bridge, *i.e.*, in the rail over the bridge. I did this because the sun was out at the time. There was a quarter inch gap between the rails at that time. For the 45 feet, five-eighths inch gap; for the 60 feet, five-eighths inch gap; and same fishplates used. The superelevation is 5 inches on the 30 chain curve, and dies away to ½ inch at the level joint. I slackened two of the fish bolts at the joint of the rail on the east side of Woodman Bridge. There was a gap of about a quarter of an inch between the ends of the rails at the time. Nothing passed this length of line from the time I examined it prior to the train which met with the accident. The same fishplates are used for 60 feet rails as 45 feet rails. I only slackened the bolts a square down, or a quarter of a turn of the nut, and the rails did not move when I slackened the joints. I found the road in proper line as I walked along, and there were no tools lying about. When the road got out of alignment last year it was owing to the ballast not having got settled, but since it has become settled there has been no question of the road being out of line. I did not notice the train as it was coming along, but simply as it was passing. I slackened these particular joints because, being 60 feet rails, I consider they are more liable to expansion in hot weather than 45 feet rails, and I therefore specially watch them.

Inspector *Wright*, Permanent Way Department, states: I travelled over this length the day before the accident and also walked it, when I found the road in very good condition. I did not notice that any of the joints were tight and we have had no trouble with expansion this year. The joints were slackened for expansion in April or the beginning of May last. When over the road on Thursday I looked at both lines and specially examined the joints of the sixty feet rails over Woodman Bridge and found them right, and nothing has been done there since my inspection. I do not know that the road was out of line at this place last year. I have noticed drivers pass over this curve at a high rate of speed, but I have never reported them for disobeying the restriction. I have cautioned them by hand signal on more than one occasion. The road has been pulled back since it was relaid, once last year and once this year in May to give the proper clearance between the rails. I am not aware that the ganger slackened any joints at Woodman Bridge on the afternoon of the accident, and I do not consider that the weather on that date was hot enough to require any slackening of

joints. I should not say that the waviness of the line was due to expansion, and I would not say that it was necessary for me to provide for expansion at and about Woodman Bridge on account of the heat of Friday last. With regard to my statement that trains have passed over the curve at excessive speed, I do not think the rate at which I have seen some trains travel was sufficiently dangerous to cause an accident.

Mr. W. H. Coomber, assistant engineer, states: I produce a list shewing the extent of the damage to the permanent way, together with particulars of the permanent way and the date the road was last relaid, and a plan of the place of accident. Pieces of metal of various thicknesses are provided to enable proper expansion being left when relaying the road according to the temperature at the time the work is carried out. We use similar fish plates for 60 feet as 45 feet rails, and there is the same space allowed between 60 feet as between 45 feet rails, but the 60 feet rails are not used generally, but merely for spanning bridges which 45 feet rails will not span.

Mr. Geo. Hughes, chief mechanical engineer, states: I hand you a diagram of the engine No. 276 which worked this train, and another shewing the condition of the tyres after the accident. The engine is a radial tank passenger engine, of which we have 330. It is a new engine, that is to say it was sent out into traffic last November. Since then it has run 20,000 miles. This class of engine works a considerable amount of passenger traffic. In fact, it works 80 per cent. of the passenger workings. It runs 61 per cent. of the passenger engine miles. We run quite a number of express trains with this particular class of engine, and I hand to you the workings for this particular engine for the week of the accident, from which you will observe that it works some fast trains. Also on the same sheet I give you an indication as to what repairs were carried out to the engine on account of the daily reports of the drivers, which you will notice are only minor shed repairs arising from ordinary running, and were attended to. Driver Medley is a good driver, and a most steady man, and nothing of a serious nature has been reported against him. I may say that he takes a great interest in the training of the younger men. I think I arrived at the scene of the accident at about 6.30 p.m., and when I got there the approach portion of the road between Dover Bridge and the scene of the accident had been straightened up. As far as it was possible for me to do I made an examination of the locomotive and carriage stock, and I find that several parts of the engine were missing, but most of these have since been found within 50 yards of the engine. Broadly speaking, the leading wheels of the engine were in excellent order. The leading axle is bent, which I conclude to be the result of the accident. There was an indentation on the flange on one of the driving wheels ⅛ in. deep. The trailing wheels had one or two slight indentations. The wheels, however, were true to gauge, and the engine was afterwards sent to Newton Heath on its own wheels. From the extent of the damage to the wheels it is clear that it did not travel very far off the road. The motion of the engine was intact, and the leading radial axle boxes had been displaced and broken up into several pieces. The radial spring has not been found, and we have not found a portion of the bolt which goes through. The other portions were all found in the neighbourhood of the second coach. The springs of the engine were all in position excepting the left leading spring, and this was found immediately opposite to the engine where it had dropped off. I hand you a list of the portions of the engine which were damaged. The general brake power of the train is such that it would hold the engine back and would not allow the train to crowd on to the engine, and it would not allow the vehicles to buffer up. I estimate theoretically that the train would have to be moving at the rate of 125 miles an hour to cause the engine to mount the rails at this curve, and if you take into consideration the down course of the road it would bring it to about 118 miles an hour. I have also taken into consideration the speed required to cause a six-wheeled coach to leave the rails, and it works out at the same figure. I have examined the wheels of the carriage stock, and there is not the slightest indication of the wheels having shifted on the axles. The whole of the 330 tank engines are not loaded in the same way as this engine, but the fact that it is a super-heated engine makes it heavier. I cannot imagine a spring getting into the position mentioned by the goods clerk from Todmorden hanging at an angle across the axle box. If it were possible, however, for the loose end of the spring to go up and rest in the angle of the frame of the bogie above the spring and remain there, I should have expected to find a considerable abrasion in the angle, but I have examined several and have not found the slightest indication of this character. If the latter did happen it would not lock the bogie in any way, and in my opinion if one end of the spring had gone the other end would also have gone. The cause of the accident is an absolute secret to me.

Mr. F. E. Gobey, assistant carriage and waggon superintendent, states: I have already handed in drawing No. 8,005 shewing the diagram of the train in the accident at Charlestown on June 21st, and now put in a statement shewing the extent of the damage to the carriage stock. I have had the question of the examination of the train gone into, and there is no doubt whatever that it was thoroughly examined before leaving Manchester, and at other prior points on the same day. In consequence of the comment that has been passed with regard to one of the side bearing springs being loose, I made a special investigation as to the exact location of each spring as far as possible, and this diagram shews the result. It will be seen by the diagram that six springs were missing completely out of position after the accident; twelve springs were loose at one end, and each of these are shown on the plan in diagram; the remaining forty-four springs were intact. Between the third and fourth vehicles on the up side of the line you will see that there are three bearing springs absolutely intact at both ends and one spring at the trailing end, the leading end of which was loose; the four bearing springs were in position, but one auxiliary spring and washer were missing of the one spring, with the eye-bolt secure. There are three auxiliary springs missing on the train, which have not been found. The whole of the side bearing springs were found at the point of the accident, and they were all complete springs with the exception of one, and that belonged to the first vehicle in the train; it was a rather different type of spring from those used on the other vehicles in the train which makes it clear that it came from that vehicle. This spring was broken, and six out of the eight plates have been found; there was a broken piece off one of the eyes of the spring, and there is a slight flaw in the broken section at the bottom side of the plate which is about ¼-inch deep. This spring was found at the point of accident,

and if the spring had left its position due to the broken eye I should expect to find the spring eye bolt intact. There is an eye bolt intact on the first vehicle and it is on the opposite side of the train to that described by the witness from Todmorden. The broken spring, in my opinion, came to grief at the point of accident. I have also examined the whole of the wheels, and they are perfectly sound, and have not shifted on their axles. From an examination of the first two bogies on the first vehicle it is very evident that something has swept underneath that vehicle, all the ironwork of the two bogies being bent in an upward longitudinal direction, and the vacuum chamber and brakework completely displaced, but this may be entirely due to sleepers and ballast after the carriage left the road.

Conclusion.

The circumstances attending the actual derailment of this train are given in the evidence of driver Medley and fireman Broadbent. They are briefly to the effect that, whilst running at a speed of from 45 to 50 miles an hour, at a point about 20 yards before reaching Woodman Bridge, the engine first received a small "pluck" or set-back, with a slight twist, and then took two or three very severe swerves from the leading to the trailing end, and after a very short interval it left the rails and ran into the side of the cutting. The condition of the permanent way, as found for a distance of 175 yards behind the first mark of derailment, would account for the swerves, but the points to be ascertained are, (1) whether the line was in that condition before the engine passed over it, or whether it was produced by the engine in so passing; and (2), if produced by the action of the engine, whether it was due to some weakness in the permanent way, or to some exceptional condition existing in the engine or carriages of the train at the time.

The permanent way was relaid in April, 1911, with rails B.S. 95 lbs. section in lengths of 45 feet, present weight about 93½ lbs. per yard. Seventeen sleepers are used in a rail length, the joint sleepers being 9 feet × 12 inches × 5 inches, and the ordinary sleepers 9 feet × 10 inches × 5 inches. There are two 60-feet rails at Woodman Bridge of the same section. The chairs are of cast-iron, 56 lbs. each, fastened by two spikes and two treenails; fish plates 32 lbs. per pair with four fish bolts $\frac{15}{16}$ inch diameter, $5\frac{15}{16}$ inches in length. Weight of bolt, nut and washer, 2¼ lbs.

The road is ballasted with broken limestone boxed up level with top of sleepers and for 12 inches outside them, depth of stone under sleepers from 4 inches to 5 inches, and 12 inches of ashes under the stone ballast. Underneath the ballast the subsoil on the bank between Woodman Bridge and the cutting is earth and stone from the adjoining cutting. The gap left for expansion in the joints of the rails when laid down in April last year was $\frac{3}{16}$ inch, and on May 19th this year the whole of this length was gone through and the rails pulled back to give the $\frac{3}{16}$ inch clearance between the rails, and the fish plate bolts were loosened for expansion in the middle of April.

With regard to the state of the permanent way before the engine passed over it, there is the evidence of A. Holden, the foreman in charge of the section of line concerned, and of inspector Wright, in whose district that portion of line is situated. Holden walked over the down main line past the site of the derailment about a quarter of an hour before it actually occurred, and no other train passed over the line from that time until the train in question arrived. He states that he saw nothing wrong with the road, but he thought it advisable, as the sun was out, to slacken off the bolts of the fish-plates at one or two joints. One of these places was the joint of the two 60-feet rails just on the east side of Woodman Bridge. In slackening the bolts, a quarter of a turn of the nut was made. He says there was a gap of about a quarter of an inch at the time between the ends of the rails, and the rails did not move when he slackened the joint. The reason he slackened this particular joint was because these rails are 60 feet long, and therefore more liable to expansion than the ordinary 45 feet rails. It may be noted that the reason for using 60 feet rails at this point is to avoid having a joint on Woodman Bridge, and Holden states that he specially watches these rails.

Inspector Wright was over this length of line the day before the accident occurred, and he found the road in very good condition. He did not notice that any of the joints were tight, and he states that there has been no trouble owing to expansion this year.

The day in question was not a hot one, and there have been many this year of a higher temperature, so I think it fairly certain that the condition in which the permanent way was found after the derailment was not due to expansion of the rails from the heat (on account of insufficient gaps being left between them), before the engine passed over it, nor even that there was any tendency for the road to be forced out of alignment by the rails being butted up by expansion when the engine did pass over them; so this, which would be the simplest explanation of the accident, cannot be regarded as the probable one.

After the derailment the down line was found to have been forced outwards bodily in

places, sleepers and all, for a length of about 175 yards, after which it was entirely destroyed, the rails of the latter portion being bent into all sorts of shapes, some quite doubled up. The displacement of the road began just at the commencement of the 30-chain curve, and at a point 40 feet from the commencement of that curve it was 3 inches out of alignment; at 90 feet there was no movement; at 140 feet it was 4 inches out of alignment and this is the point where the driver thinks he felt the first pluck; at 230 feet there was no movement and this is the joint between the 60-feet rails where the nuts where loosened by the ganger; at 260 feet it was 5½ inches out; at 300 feet there was no movement; at 380 feet it was 4 inches out, this is just at the end of the 30-chain curve and the commencement of the transitional curve, and after that there was no movement until where the line was entirely broken up which was at a point 130 feet beyond the end of the 30-chain curve. The portion of the permanent way from the commencement of the 30-chain curve to the point where it was broken up was not damaged in the slightest beyond being out of alignment; no fishplates had been broken nor rails bent, and after being forced back into alignment again it was just as it was before the derailment occurred. There were no marks of any wheels having mounted the rails, except just at the end of the last rail left in position, where there was a slight mark on the head of the outer rail, 2 feet 9 inches in length, where a single wheel appears to have mounted it and dropped on the outside. The commencement of this mark was just 20 feet from the end of the rail, and none of the chairs ahead of it appear to have been touched. I think it may probably have been caused by a wheel of the six-wheeled coach when derailed. The line ahead of the joint of this last rail was entirely torn up for a length of 150 yards.

Before the line was relaid in April, 1911, there was an inside check rail round this curve, but the old road was of a sharper curvature (about 27 chains), and this curvature was not approached by transition curves as is now the case. But it will be seen from the description of the condition of the line after the accident, that the derailment was due to the road being bodily shifted, and not to a wheel mounting a rail on the curve, so the fact that there was no check rail does not bear on the question, as the same outward pressure would have been brought on to the sleepers if there had been a check rail inside the right-hand rail.

It will be seen in Mr. Hughes' evidence that theoretically the engine would have to travel at a speed of about 120 miles an hour to cause the engine to mount the rails at this curve from flange pressure due to centrifugal force.

A six-wheeled coach would require to run at the same speed to cause it to mount the rails from flange pressure.

With regard to the speed of the train, which normally consists of seven bogie coaches, and which is booked to call at Rochdale only, after leaving Manchester, before reaching the place of derailment, the schedule time allowed between Rochdale and Todmorden West is 12 minutes, and the distance 8 miles 1230 yards, or an average speed of 43·49 miles per hour; and between Todmorden West and Sowerby Bridge No. 2 signal-box, 11 minutes for a distance of 9 miles 841 yards, or an average speed of 51·69 miles per hour. This is not, however, the fastest train running over this route. The 11.40 a.m., Liverpool to Leeds, with similar stops, has a schedule time of 10 minutes between Todmorden and Sowerby Bridge, which is an average speed of 56·86 miles per hour; and the 2.10 p.m., Liverpool to Hull, with a load of 9 bogie coaches, is allowed 9 minutes, which gives an average of 63·18 miles per hour. On the four previous days of the week prior to June 21st, the time taken by this train between Todmorden West and Sowerby Bridge No. 2 box was on three occasions 11 minutes, and on one occasion 12 minutes, and on the 21st, according to the train registers, the time taken between the various signal-boxes as far as Dover Bridge was the usual amount, but as half-minutes are not booked, it is not perhaps possible to judge of the actual speed of the train, owing to the short distances between the signal-boxes; it works out at quite 60 miles an hour, however, between Dobroyd crossing and Dover Bridge signal-boxes, a distance of 3 miles 16 chains.

As to the speed of the train between Walsden and Todmorden, about 4 miles from the place of derailment, there is the evidence of foreman platelayer I. Hey, who thought it was going faster than usual, between 50 and 60 miles an hour, and who states that he heard an unusual noise, and that the engine appeared to be jumping. This jumping was also noticed by another platelayer, A. Heyworth, at a short distance away, and he describes it as if the front wheels of the engine were jumping up and down.

As to the speed of the train when passing Eastwood, there is the evidence of A. Holden, the foreman platelayer, who estimated it at 60 to 70 miles an hour, but the fireman H. Broadbent, who worked on the same train the previous day, considers the speed to have been about the same on the 21st, and estimates it at 55 miles an hour. Driver

Medley estimates the speed at Eastwood at about 50 miles an hour. He also says he had about half steam on up to Eastwood advance signal, which is 37 chains from Dover Bridge south box, and that then he closed the regulator and calculated that, having a dry rail and only a light train, the speed would be reduced to 45 miles an hour when he got to the curve. But driver Medley states that he had *half steam on from* Holroyd Junction to Eastwood advance signal, a distance of two miles on a falling gradient of 1 in 182, and yet did not increase his speed above 50 miles an hour, or about the same speed as when passing Todmorden, and that he never applied his brake at all during that portion of the journey.

I may say here that driver Medley bears an excellent character, and gave his evidence in a most straightforward manner, but I am quite sure he is mistaken as to the speed of his train not exceeding 45 miles an hour when coming to the curve just beyond Dover Bridge signal-box.

This being a well laid out curve, some drivers apparently do not regard a speed reduction necessary, and there is the evidence of Inspector Wright and A. Holden that the authorised speed is exceeded. I think it is difficult for drivers to estimate the speed of trains in miles per hour, and that they can only very roughly adhere to slight speed restrictions like 45 miles an hour; and to avoid too high a speed at such curves as this one, some very marked reduction in speed should be made, so that the driver should be compelled to check the speed of his train by the continuous brake, before reaching the length covered by the restriction, and then release his brakes before coming on to the curve.

With regard to the composition of the train, the engine was a radial tank passenger engine, the details of which are given above. This class of engine is largely used on the Lancashire and Yorkshire Railway for passenger traffic, including fast trains. Its condition after the derailment is given in the evidence of Mr. Hughes, the chief mechanical engineer. The damage was chiefly to the leading radial axle boxes and castings, which were broken up, and the radial spring has not been found, so presumably it must have been broken into very small pieces and buried in the ballast, and therefore nothing can be stated as to its condition.

A few years ago, after some derailments of trains drawn by tank engines, the Board of Trade asked the Associated Railway Companies to appoint an expert committee to enquire into the question of the behaviour of tank engines under different conditions of speed. A return was also asked for and presented to Parliament, as to the respective numbers of tender engines and tank engines derailed in the 20 years ending 31st December, 1904. As a result the Associated Companies replied, on the 10th February, 1906, that the derailments reported to the Board of Trade during the past 20 years were becoming fewer in number, and that there was nothing to indicate that there is any greater danger with a tank engine than with a tender engine, and they did not consider that there could be any advantage in any further investigation of the matter at that time.

But the point raised by this derailment is whether this type of tank engine, *i.e.*, one with a leading and a trailing radial axle, is suitable for drawing high speed trains. Personally, I consider that tank engines with a leading bogie are far less severe on the permanent way than tank engines with a leading radial axle, and that the former class is far preferable for use with fast trains. I think the behaviour of the radial axle boxes may be uncertain, and one might become stuck in its guides, with the result that the fixed wheel base would become 16 feet 5½ inches instead of 8 feet 7 inches, and though there are engines with this amount of fixed wheel base, they are not suitable for use with high speed passenger trains. The function of the radial spring is to bring the axle box back again to its normal position after leaving a curve, and consequently to reduce flange friction as quickly as possible. If it broke it would allow the axle boxes to move free laterally 1½ inches on either side of the centre position.

In this case (assuming that the line had not become warped by expansion due to heat, which I consider is practically certain), the permanent way, which was almost new and of the best class, was forced bodily out of alignment by this type of engine, in the manner described above, and this can only have happened owing to some unusual conditions existing in the engine or train.

Assuming the evidence of J. Tasker to be correct, I do not think the fact that a side spring of a bogie being broken in the third carriage (none were broken or out of position in the second coach,) would account for the behaviour of the engine, as described by driver Medley.

Nor do I think that the fact of the second vehicle being a six-wheeled one had any connection with the cause of the derailment, as the brakes were not applied until the engine was on the point of leaving the road, and then possibly the light six-wheeled

coach was nipped between the heavy coaches immediately in front and behind, and lifted off the rails, as it must have been oscillating and rocking severely, from the road being so much out of alignment.

I may state here that in looking through the list of derailments of engines belonging to the Lancashire and Yorkshire Railway for a period of 27 years, ending 31st December, 1911, there have been only five previous cases in which an official inquiry has been held*. These are as follows :—

Engines with tenders :

November 8, 1890, ran into a mass of clay, which had fallen on to the line in a cutting.

May 28, 1903, trailing wheels of tender derailed owing to high speed at a crossing from fast to slow lines, the driver being misled by signals.

Tank engines :

November 15, 1900, engine derailed when setting back at runaway catch points.

July 15, 1903, Waterloo ; probable cause, loss of spring of right trailing coupled wheel.

February 15, 1911, Wyre Dock ; probable cause, loss of spring of right hand driving wheel, which was never found.

Of these, the two derailments of tender engines and the first of these three tank engines needed no special explanation. In the other two cases, there was considerable doubt as to the actual cause, but in each case the probable cause was a defect in this same type of engine causing in the first case the engine to leave the rails, and in the second good permanent way to be forced out of alignment and broken up.

As regards the marshalling of the carriages of the train, it was most unfortunate that a six-wheeled coach had to be attached to the train. It was a special carriage going to Harrogate, and so was attached at Manchester next to the Southport to Harrogate coach. The train usually consists of seven bogie coaches, and the three rear ones are detached at Low Moor for Bradford, and the leading four go on to Leeds, where an engine is backed on to them and works them by Holbeck on to the North Eastern line forward to Harrogate. If the six-wheeled coach had been put on to the rear of the Bradford coaches, it would have entailed much delay and shunting at Low Moor to have detached it and then placed it at the rear of the Leeds portion, and from Leeds to Harrogate it would have been next the engine, as no shunting is able to be done at Leeds.

It is, of course, undesirable to place a light coach between heavy ones, especially as, in case of a collision or derailment, the light coach is almost invariably forced upwards, and the coach next behind it is driven under the light one. This happened in this case, the frame of the six-wheeler being found to be on top of the third carriage, and it was in this latter coach that the dead and badly injured were found. There were no passengers in the six-wheeled coach.

The position of the engine and carriages (the latter having been examined by the carriage examiners at Manchester and found correct in every way), was, after the derailment, as follows :—The engine was to the left of the down road, and had scraped along the side of the cutting for a short distance ; the first coach was derailed, with its leading end to the left and its trailing end to the right of the down line. The second and third coaches were both to the left of the line, the frame of the third being under that of the second, and both carriages entirely broken up. The fourth coach was on its right side, lying across both down and up lines. The fifth coach was derailed, with its leading end to the right. The sixth, seventh, and eighth coaches were all derailed, but in line with the rails of the broken up road. The engine and five leading coaches were on the transition curve to the left, just short of the 30 chain curve to the left. The sixth was on the short portion of straight line between the two transition curves, and the seventh and eighth were on the transition curve beyond the first 30 chain curve. The rear of the eighth coach was 32 feet ahead of the point where the road began to be entirely broken up.

All the side bearing springs of the carriages were found at the site of the derailment, though three auxiliary springs are missing ; and no wheels had shifted on their axles, though several of the latter were bent.

The couplings between the engine and leading coach were intact, but were broken between the next five. All appear to have been derailed to the left, but bogie carriages will take any position when running over a broken up road.

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* In the derailments at Poulton and Preston on the joint lines, the engines concerned belonged to the London and North Western Railway.

Nothing can of course be said as to the exact spot where the derailment occurred, but most probably the swerving of the engine burst a joint just abead of the last rails left in position, and the fishplates being broken may have caused the loud crack heard by the guard. It may be said here that, although the rails of the broken road were bent into all kinds of shapes, yet there was not a flaw or crack visible in any of them, shewing that they were of the highest quality.

Nor can it be stated definitely whether the engine first left the rails, or whether the six-wheeled coach was jerked or lifted off when the brakes were suddenly applied, but as parts of the leading axle-hoxes were found 60 yards from where the engine came to rest, it is evident that it was off the road for at least that distance, and probably for a longer one, though the tyres are very little marked, showing that it was clear of the rails and chairs. I think the engine probably left the road first, as the guard felt no oscillatiou before the rear coach left the rails.

From what has been stated above, I think the general conclusion must be that the derailment was most probably caused by the train being drawn by a heavy tank engine at too high a speed, for that particular type of tank engine, round a moderate curve of 30 chains radius. I eonsider that this type of tank engine throws too great a strain on to the permanent way when running at high speeds, and that in this case there was nothing out of order in the permanent way, which was of a high class.

I think that if this particular type of tank engine is continued to be used for high speed trains, speeial speed restrictions are necessary on curves, and that at this particular reverse curve the speed should be reduced to less than 45 miles an hour, while agreeing that 45 miles an hour is not an unsafe speed for an engine with a leading bogie. As it is evident that this speed restriction of 45 miles an hour is constantly exceeded, it would be well for the speed round this and other curves at the end of long gradients to be sometimes recorded by instruments, or by speed recorders placed on the engines, so that drivers could be told when they exceeded the authorised speed, and taught what a speed of 45 miles an hour and other speeds really are, as it must be difficult for them to discriminate between such speeds as 45, 50, and 55 miles an hour, especially on good roads and on steep gradients.

I have, &c.,
E. Druitt, *Lieut-Col.*

The Assistant Secretary, Railway Department,
Board of Trade.

APPENDIX.

Particulars of Damage to Rolling Stock.

Engine No. 276.—Leading radial casting and cross frames broken; leading buffer beam torn and bent; vacuum pipe engine end broken; both leading life guards off; all mud cocks broken from cylinders; right-hand outside rod bent; left-hand outside slide bar bent and slide block broken; motion stay plate bent; both main framings bent against the leading radial horns; right-hand leading sand-box and pipes and cross stay broken; left-hand leading radial spring off; both leading and both trailing brake hangers and crossbars and coupling rods broken and twisted; both left-hand footsteps off; waterscoop damaged; left-hand leading sand-box broken; main vacuum broken at back of left-hand trailing footstep; left-hand trailing sand-pipe off; right-hand trailing buffer and vacuum pipe off; both trailing rail guards bent; both left-hand little end bolts broken; both injector feed pipes damaged; leading radial eradle and brasses damaged.

Bogie composite van, No. 625.—Two underframe headstocks, one crossbar, two longitudinals, two diagonals, one bolster, top and bottom footboards broken; van end projection and two folding doors broken in; also one cant rail, eleven side panels, and end of coach at compartment end damaged; horizontal vacuum and Westingbouse cylinders broken; brakework, trussrods, buffers and underframe fittings generally damaged; two bogies badly damaged; gas cylinders moved. All wheels to gauge and flanges good but leading wheel flanges cut.

Tbird van, No. 1967.—Broken up. One pair of wheels right to gauge; one pair $\frac{3}{8}$" wide; one pair badly bent; all flanges good but one pair cut.

Bogie third van, No. 911.—Broken up. All wheels to gauge and flanges good but leading pair of wheels cut.

Bogie composite, No. 935.—Two underframe solebars, one headstock, one bolster, and underframe ironwork broken; dynamo, cell-boxes, and vacuum cylinder damaged; three body side panels, two bottom sides, one end rail, one arch rail and footboards broken; two bogies badly damaged. All wheels right to gauge and flanges good.

Bogie third van, No. 912.—One underframe, headstock, footboards, dynamo, and cell-boxes broken; one panel, bottom side, and end rail damaged; one body end broken in; two bogies badly damaged. Trailing right wheel $1\frac{1}{2}$" out of gauge; other wheels to gauge and all flanges good.

Bogie third van, No. 894.—Footboards and three

axle-boxes broken, and brakework displaced; one body end broken in; one bogie with bent frame. All wheels to gauge and flanges good.

Bogie composite, No 1070.—Footboards broken and gas cylinder moved. All wheels to gauge and flanges good.

Bogie third van, No. 833.—Footboards broken; gas cylinders moved; one bogie frame bent, and one axle-guard sheared off. All wheels to gauge and flanges good, but end trailing wheels slightly indented.

DAMAGE TO PERMANENT WAY.

Nine 45 feet rails bent, unfit for use; 190 sleepers (including 13 on up road) broken; 340 chairs broken; 10 pairs of fish-plates and bolts broken.

Printed copies of the above Report were sent to the Company on the 7th August.

METROPOLITAN RAILWAY.

Board of Trade (Railway Department),
8, Richmond Terrace, Whitehall, S.W.,
17th June, 1912.

SIR,

I HAVE the honour to report, for the information of the Board of Trade, in accordance with the Order of the 29th May, the result of my inquiry into the circumstances attending the collision, which occurred on the 28th May, about 12.5 a.m., between a passenger train and an electric locomotive, at Baker Street East Station on the Metropolitan Railway.

The 11.38 p.m. up train from Willesden Green was approaching No. 2 platform road under clear signals, when it struck the locomotive which was standing on the down line, foul of a crossing connecting the up line with the down line. Five passengers and the motorman of the train suffered minor injuries in the form of contusions, or from the effects of shock. A second motorman, who was on the ground, tripped, or fell, presumably in trying to avoid being run over. His head was cut and his hands burnt by coming into contact with a positive conductor rail.

The passenger train comprised six 8-wheeled passenger cars; the leading and trailing vehicles being fitted with electric motors, the remainder without. The train was equipped with the Westinghouse continuous air-brake, working blocks upon all wheels. The brake was controlled by a single valve from the motorman's (front) compartment, and could also be applied from the rear compartment by the head guard, and from other positions on the train.

The front bogie of the leading motor-car was derailed; the front of the car was crushed, and the underframe bent. The left trailing buffer, and a window of the locomotive were broken.

The damage to permanent way was slight; a number of insulators and one slide chair were fractured, and one running-rail bent.

Description.

Extensive alterations in the lay-out at Baker Street East Station are now in hand. The first (temporary) stage in the work, which included alterations in the connections and interlocking, was completed and brought into use on Monday, 27th May, about 8 a.m., sixteen hours prior to the collision.

The up and down approach roads had been moved slightly, about 18 inches, westward. Nos. 2 and 3 terminal platform roads had been shortened from 30 to 40 feet at their southern extremities, and lengthened a corresponding distance northward. The facing connection from the up to the down line (No. 2 platform road) had also been moved northward about 50 yards.

The main new feature in the lay-out comprised a new down loop line, on the west of the down main line, which extends northward, from the facing points at the north end of No. 1 platform road, a distance of about 115 yards, where it terminates by a trailing junction with the down main line. Access to the west engine siding is now obtained from this new loop, instead of from the down road. At the north end of the yard there is a new trailing crossover between the up and down main lines.

Measured from the signal-box, which still occupies its old position at the north end