

Appendix No. 28.

Manchester and  
Leeds,  
(Now Lancashire  
and Yorkshire.)

APPENDIX No. 28.

## MANCHESTER AND LEEDS.—(Now Lancashire and Yorkshire.)

SIR,

September 22, 1847.

I HAVE to acknowledge the receipt of your letter of the 20th inst., conveying to me the directions of the Commissioners of Railways that I should examine into and report upon the causes of the accident upon the Lancashire and Yorkshire (late Manchester and Leeds) Railway on the 16th, and to state to you, for their information, that I yesterday examined and made a minute inspection of the place where the accident occurred, together with such inquiries as were necessary to enable me to arrive at a satisfactory conclusion. I first examined the position of the broken rail, which was a few yards to the east of the Luddenden foot station, the railway at that spot being laid on stone blocks 2 feet square, to which chairs (weighing 24 lbs. each) are fastened by iron bolts. The rails are of the T form, having a single flange at top  $2\frac{1}{2}$  inches broad by  $1\frac{1}{4}$  deep, and a centre rib  $\frac{3}{4}$  of an inch thick, the total depth of the rails being 5 inches, and are secured to the chair by means of balls and keys. They weighed, originally, 58 lbs. per yard lineal, but having been in use about seven years, with a very heavy traffic, I was informed by the inspector of permanent way that now they would not exceed 56 lbs. per yard.

The blocks are chiefly of sandstone, at central intervals of three feet, and have been travelled over since the first construction of the railway, which was opened in sections between the years 1839 and 1841. They are much worn, the chairs having bedded themselves from half an inch to one and a half inch in the stone. In order to counteract the loosening effect of this wearing of the stone, the holes in which are driven the bolts to secure the chairs to the blocks were made deeper than required at the time, so as to allow the tightening of these bolts as the stone wore away; but as this wear continues the bolts have to be withdrawn, and either shortened or the holes bored deeper, requiring both time and labour to readjust.

These blocks, moreover, having no lateral ties from one line of rail to the other, can be forced out of gauge, and require constant watching, more particularly in wet weather.

This old roadway is now in process of being removed and relaid with a very superior description of road. The rail, having top and bottom flanges, weighs 84 lbs. per yard, and is fixed into chairs of the form known as Ransom and May's Patent, weighing 40 lbs. each, by compressed deal keys, the chairs being secured to the sleepers by compressed oak trenails. The sleepers, six in number to each length of rail of 15 feet, are laid transversely as follows:—

The distance from the centre of the joint sleeper to the centre of the next is 2 feet, from that to the next  $2\frac{1}{2}$  feet, and thence to the adjoining one 3 feet, there being two central spaces of 3 feet, diminished to 2 feet again at the joint. All the sleepers are rectangularly sawn, those at the joints being 12" by 6", and the intermediate sleepers not less than 9" by 5".

The rail was found to have broken between the second and third block from the commencement of the renewed road nearly in the centre between the two bearing points, one of which was at a joint of the rail. It appeared a very fair rail of its sort, and very much less worn than the generality.

To the west of this spot, for 410 yards towards Manchester, the road is laid with these stone blocks. I examined it very minutely, applying a gauge-rod constantly, and found it in several places as much as half an inch wide of gauge, in one place one inch wide, and in others half an inch within the gauge. The blocks were very much worn, and the bolts not driven home, so that the chairs frequently yielded half an inch upon their beds on the passage of wheels, the fastenings being, in many cases, loose, and the ballast in such a state from want of renewal that in wet weather it must become mud, and cease to offer that resistance to the blocks which is necessary to ensure a firm and substantial road. To the west again of this stone block road, the railway was laid on transverse sleepers, consisting of round logs sawn in two, laid with the flat side downwards, at intervals of about three feet, the rails and fastenings being of the same description as on the stone blocks. This road has also been laid and run upon since the opening of the line, and is in a much better state than the stone block road, but the sleepers are beginning to perish, and in many cases are quite decayed to a depth of an inch under the seats of the chairs. The ballast also requires renewing for the same reason as on the stone block road. The railway, as far as I examined it, about half a-mile back or west from the broken rail, is on a curve of about a mile radius.

The road to the eastward of the broken rail was relaid, as stated above, and exhibited evident signs of a pair of wheels having been off the rails and running over the sleepers and chairs, generally over the heads of the outside bolts or trenails used to secure the left rail; but occasionally diverging as much as 10 inches. These marks were traceable up to the Sowerby Bridge station, a distance of two miles, of which the last 800 yards is through a tunnel.

On coming out of the tunnel it was perceived that the last carriage was not in its proper position, and a signal made to the driver to stop; but at the velocity at which he was travelling, he had not time to do so before the carriage had come in contact with an ash-pit, at which it was stripped of its wheels, and the three passengers in the front coupé were thrown out, one being killed on the spot, another is since dead, and the third is not much injured. The passengers in the rear coupé were only shaken; and a second-class passenger in the middle body of the same carriage, which was constructed of both classes, was not hurt.

The train was drawn by one of a new class of engines made in the workshops of the company, having six wheels, the driving wheels in the middle. Its weight was stated to be about

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22 tons, and it works with outside cylinders. The carriage to which the accident happened was last in the train; it ran on four wheels, and was not provided with brakes or a guard. Its construction is peculiar, and to it I attribute the fact of its having run such a distance with one pair of wheels off the rails, and having left such light traces of the occurrence, not a single sleeper being broken, but only slightly marked scarcely to the depth of the flange.

The buffers at each end are placed on a beam which presses the ends of a curved spring, the summit of which is against the rear of the carriage frame; the drawbar from the front passed through the buffer beam at the tail of the carriage upon which it drew, so that, supposing the fore wheels to have been off the line, the weight would have been in a great measure supported upon this drawbar; and such must have been the case, for one pair of wheels are notched as if they had run on the chairs and ballast a long distance, the other having very few marks. The damage to the line was so light that the traffic was not in the least impeded. The broken rail was discovered by the passage of the next train, conveying goods, which passed safely over it. The driver, however, felt something wrong in the road, and informed a porter, and a new rail was immediately substituted. This happened at the Luddenden Foot Station, before they were aware of the accident at Sowerby Bridge.

The above are the details of the accident, with its calamitous results, which I conceive to have arisen from the following causes:—From my own examination of the railway preceding the position of the broken rail, as well as from the statement of one of the passengers, as given to me by the manager of the line, I feel convinced that there must have been a violent movement going on at the time probably throughout the whole length of the train. The road was in such a state, as much to aggravate the known tendency to lateral oscillation of outside cylinder engines; and, moreover, from the looseness of the chairs on their beds, it might be expected to receive a jumping motion. These two combined, or even singly, might have produced the partial fracture of the rail, which would have increased by the passage of each carriage till the last, which might have completed the fracture, and thus been thrown off the line. Or even supposing the engine to have caused the whole damage, the fore part of the train might easily be conceived to have passed in safety, having weights behind to steady the leading carriages, for want of which, in express trains, it is well known that the last carriage is by far the most unsteady. I am induced to think that the engine caused the injury, as the carriage is so light that it could scarcely have broken the rail, the greatest weight on any pair of wheels being only 2½ tons, and the angle at which it would impinge upon the rail so very acute.

The jury, in their verdict, have “suggested the necessity of having a luggage-van attached to the end of each express train, as an additional security to the passenger carriages, and to obviate the dangers arising from the great oscillation of the last carriage;” upon which subject I beg to refer the Commissioners to the printed Reports of the Officers of the Railway Department of the Board of Trade for 1840, by which it will be seen that it is strongly recommended that the last, and, at least, every fourth carriage in every train by which passengers are conveyed, should be provided with a proper break, of course involving a man to work it. This accident only proves the great necessity of this recommendation being carried out both as to the number and position of the brakes. In some cases as in the present, the arrangement may be productive of inconvenience and delay in the re-marshalling of trains at stations where the same train is broken up and detached in several directions; but this should be allowed for in the time-tables, and convenient contrivances provided to shorten delays instead of neglecting the precaution.

It seems extraordinary that the driver should not in two miles have perceived by the additional resistance that a carriage was off the line. It was an exceedingly boisterous day, and if he failed to remark the first jerk, it is possible that his engine, being very powerful in comparison to the weight and speed of the train, which consisted of seven carriages in all, and subject to oscillation, that he might not have remarked it afterwards, only one pair of wheels being off the line, and so supported by the couple which never gave way, that they did not impinge heavily upon the sleepers and cause successive jerks. Hence it would appear that a guard's brake in this instance would have been of little or no use; and had a guard been placed upon the last carriage, a method by which to signal the driver would consequently have been required in order to stop the train. This has frequently been brought before the notice of the Commissioners, and numberless have been the inventions for achieving this end, but in most of them some practical difficulty has arisen to preclude their adoption by Railway Companies. There appears but one remedy therefore at present, which, as it is not of a mechanical nature, is objected to as defective; but in the present state of our information, I should recommend its adoption, leaving to Railway Companies to find a mechanical substitute, if possible, more effectual to achieve the desired object.

This remedy which has frequently been proposed, and acted upon to a certain extent in some railways, is to place a guard on the tender and also on the last carriage, building for each a box glazed, so that they may sit, the one facing to the rear and the other to the front, their seats being so placed that they shall face each other directly, and not obliquely, each being provided with signals. By this means, should anything go wrong with the train, it will be under the eye of each, and the guard on the leading carriage will have it in his power to stop the engine. His box should be placed in such a position that he may actually touch the driver with his signal staff without moving. This arrangement has been partially carried out on several railways, by invariably placing a guard in the first and last carriages; but I conceive that their system has failed from the want of efficient boxes for the guards; some of them are placed so that the guard sits fronting perpendicularly to the direction of the train, with glazed openings on each side, to enable him to look both ways, the consequence of which is that he generally looks towards neither, and can only look one way at a time, so that his attention being given in one direction, the accident may happen in the other, and thus not be remarked; the

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dust is frequently so great, and the pelting of the rain so hard, that the guard on the last carriage cannot look steadily to the front, unless protected by glass from the weather. His brake should be so placed, with reference to his box, that he may look out to the front even while applying it.

The necessity of a guard on the last carriage is enforced by this melancholy accident, by reflecting on the position in which the travellers in the last carriage would have been placed had the couple connecting them with the train broken whilst in the tunnel. They would have been then without lights, or a knowledge of what was to be done, even if they had them, and as it proved, a luggage train within a short distance coming upon them. Under these circumstances, the necessity of a guard upon the last carriage is so apparent, and of such vital importance, that I need not further urge it upon the consideration of the Commissioners.

With regard to the permanent way which I have above described, I have to report, that when relaid with the heavy rail, it will be in a most favourable condition for a very fast and heavy traffic; but in the mean while I consider that the condition of the half mile of old road which I examined most carefully and minutely, was not such as to warrant an express speed of 48 miles per hour, which, allowing four minutes' loss of time in stopping and starting again, dropping and picking up passengers, is the speed advertized in the time tables, more particularly with so heavy an engine as the one which drew the train in question, working with outside cylinders.

The road is of too light a description, and, moreover, is badly maintained, the inspector himself having informed me that he considered a looseness allowing a vertical play to the rail of a quarter of an inch as of no importance, an impression of a most dangerous nature for an inspector of permanent way to hold, as any defect in a road, however slight, is to be most strictly avoided, as creating an undue movement in passing engines and trains, causing jars and wear and tear upon their parts, which, although not immediately, may eventually lead to accidents, which cannot at the time be accounted for.

In explanation of the state of the road, the inspector of permanent way informed me that he had a working party of five men to each two miles to maintain it, and that they were hard worked; if so, judging from the present condition of the road, they are not sufficient, and it behoves the Company to provide such means that all chairs be secured as speedily as possible to the blocks, allowing no play; that the blocks be readjusted, and also that the chairs be re-bedded on the old sleepers, by which means the road may be rendered safe for ordinary passenger traffic, until relaid with the heavier rail.

I have, &amp;c.,

*The Secretary to the Commissioners of Railways.*

J. L. A. SIMMONS, Capt. R.E.

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## APPENDIX No. 29.

*Office of Commissioners of Railways, Whitehall,  
October 6, 1847.*

SIR,

THE Commissioners of Railways having, by your letter of the 24th ultimo, directed me to inspect the Manchester and Leeds Railway, I have to report that I placed myself in communication with the manager and engineer, from whom I received every assistance, and that I made my inspection on the 1st and 2nd instant, commencing near Normanton, at the junction with the Midland Railway. The length of the line thence to the Victoria Station at Manchester is about 50½ miles, the works having been completed, and the line opened throughout for public traffic in the year 1841, a part at the Manchester end having been opened in 1839.

I did not examine with a view to report upon the engineering works, which are of a heavy nature, consisting of stone and iron bridges, tunnels, and extensive earthworks, apparently of very solid and durable construction, but confined my inspection to the permanent way, and matters affecting the working of the line.

As stated in my report of the 22nd ultimo, the line was originally laid with rails weighing 58 lbs. per yard, having a single flange on top, 2½ inches wide by 1½ inch deep, and a centre rib ¼ inch thick, the whole depth of the rail being 5 inches, fixed by balls and keys into chairs, resting on supports at central intervals of 3 feet. These supports were partly stone, and partly wood, but the whole are being replaced by a permanent way of a very different and superior class, likewise described in the same report.

At present, about 17½ miles of the whole distance have been so renewed, 10 miles of the remainder being on stone blocks, and 23½ miles on wooden sleepers.

From Normanton to Todmorden, 31 miles, the road is maintained by an inspector of permanent way, with an assistant and 16 gangs of platelayers, each consisting of a foreman and four others, being nearly in the proportion of one gang for two miles. The old road over this portion is not in good order, the rails being bent outwards between the supports, assuming a wavy appearance, the blocks generally much worn, and the chairs embedded in them from ½ an inch to 2 inches, the bolts not being driven home, allowing considerable play of the chairs upon their beds.

The joints of the rails are not square, but cut, as shown in the margin, being consequently weak, and the rails themselves are in many cases very much worn; some of them are still sound, and appear as if they would stand for some time longer, but a large proportion show symptoms of decay, the iron being disintegrated, and stripping off the upper web, the sides of which are in many cases deficient.

The rails moreover have been allowed to work or slide over their beds, and the joints

are consequently wide, in many instances, as much as 2 inches. Much of the ballast also requires renewing. Appendix No. 29.

The other 19½ miles from Todmorden to Manchester are in charge of an inspector, with an assistant and 13 gangs of 5 men each, being in the proportion of 3½ men to every mile. The road is much better maintained, and well ballasted up; but the rails show signs of such wear as must materially lessen their strength.

The gauge on a large portion of the line was laid originally at 4 feet 9 inches, which, with the play allowed in wheels of vehicles constructed for a gauge of 4 feet 8½ inches, leaves space for a side motion of 1½ inch, in addition to any further play, which may be derived from the lateral bending of the rail, or any defect in the gauge, caused by neglect on the part of the platelayers.

It has been the custom to remedy the lateral deflection of the rails, by applying screws, and straightening the rail; but when a permanent set has taken place, it is a sign that the elasticity of the metal has been injured, and therefore the rail may be expected soon to return to its former state. The only sure remedy, therefore, is to remove such rails as may assume this form.

The Company are relaying the line by degrees, having two gangs of 20 men each employed upon it, who take up and replace the old road with new rails, at the rate of about one mile per month in fair weather, and would require therefore 33 months of fine weather, or probably 3½ years at least to complete the whole.

As the sufficiency of the road depends upon the weight and construction of engines employed to work it, I subjoin a short description of those now being made for this railway, and which are used upon it to a great extent. They are of a heavy class, weighing 22 tons, upon six wheels, 11 tons of which are upon the driving wheels, which are placed in the centre, being 5 feet 10 inches in diameter, on axles 7 inches thick, the fore and trailing-wheels being 3½ feet in diameter, on 5-inch axles, with outside cylinders, the diameters of which are 15 inches, and stroke, 20 inches, placed at central distances of 6 feet 1½ inch, the rear of the smoke-box and cylinders overhanging 19 inches in front of the leading axle. The trailing-wheels are placed behind the firebox, the distance from centre of leading to centre of driving axle being 5 feet 10 inches; and from centre of driving to centre of trailing-axle being 13 feet 2 inches. The total extreme length of the engine is 21 feet 6 inches, the firebox being 4 feet 2 inches long; boiler, 10 feet 1½ inch; and smoke-boxes, 2 feet 6¾ inches.

I consider the last end of the road from Todmorden in such a state that it is not fit to sustain the passage of any engines at high velocities without some risk, and the whole of the old rail dispersed throughout the length of the railway, from Manchester to the Midland Railway Junction, is not sufficiently strong to withstand the blows to which it must be subject, from the lateral movement of heavy outside cylinder-engines at high velocities which, with the gauge of 4 feet 9 inches, being that of a large portion of the old road, have 1½ inch of play, causing the rails to deflect laterally, and where weak to assume a permanent set, in many cases to the extent of a ¼ of an inch,—sometimes ½ an inch in a length of 3 feet.

In passing over this railway, except at junctions where unavoidable, notwithstanding the very heavy goods and passenger-traffic, I remarked that there were no facing points, with the exception of two, which had been lately put in and are about to be removed, as is also the facing switch at the Halifax junction.

This is a peculiar feature in this line, and shows the extent to which goods' traffic can be carried on, without the use of these dangerous but convenient contrivances.

The signals also are well worthy of remark, each station being provided with permanent signals 600 yards distant on each side, worked from the station by means of levers, and thereby affording a great security against accident.

I have, &c.,

Captain Harness, R.E.,  
&c. &c.

(Signed)

J. L. A. SIMMONS, Capt. R.E.,  
Inspector of Railways.

#### APPENDIX No. 30.

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#### GREAT WESTERN RAILWAY.—(Gloucester to Cheltenham.)

Great Western  
Railway.  
(Gloucester to  
Cheltenham.)

Office of Commissioners of Railways, Whitehall,  
October 15, 1847.

SIR,

I HAVE to report to you, for the information of the Commissioners of Railways, that, on Monday last, the 11th instant, I inspected the double gauge line of railway from Gloucester to Cheltenham, as also the broad gauge extension into the latter town, and a short piece called the "avoiding" line at Gloucester. The Commissioners will be aware that the railway from Gloucester to Cheltenham was originally laid with the narrow gauge of 4 feet 8½ inches, and has been worked in this manner for several years; the line from Bristol to Gloucester being on the broad gauge of 7 feet.

The two lines of railway on the different gauges cross each other immediately before arriving at the Gloucester station, into which they both lead, landing their passengers on different platforms; the station not being in the direct line of the traffic, but at the end of a *cul-de-sac*.

Additional rails have now been laid from Cheltenham to Gloucester, uniting the gauges