

STOCKTON AND DARLINGTON RAILWAY.

*Railway Department, Board of Trade,
26th September 1861.*

SIR.

I AM directed by the Lords of the Committee of Privy Council for Trade to transmit to you, to be laid before the Directors of the Stockton and Darlington Railway Company, the enclosed copy of a report which their Lordships have received from Captain Tyler, R.E., the officer appointed by them to enquire into the circumstances which attended the accident that occurred to an excursion train on the 29th ultimo, near the Bowes Station of the South Durham and Lancashire Union section of the Stockton and Darlington Railway.

*The Secretary,
Stockton and Darlington
Railway Company.*

I am, &c.
J. E. TENNENT.

*Barnard Castle,
14th September 1861.*

SIR,

IN compliance with the instructions contained in your minute of the 2nd instant, I have the honor to report, for the information of the Lords of the Committee of Privy Council for Trade, the result of my inquiry into the circumstances which attended the accident, that occurred on the 29th ultimo, near the Bowes Station of the South Durham and Lancashire section of the Stockton and Darlington Railway.

A special excursion train was appointed to run on that day from Darlington to Windermere and back, leaving Darlington at 6.30, a.m., and Windermere, on the return journey, at 5.30, p.m. After starting from Darlington at 6.35 in the morning, it reached Windermere in due course; and it left that station punctually at 5.30 in the evening, for Tebay, Kirby Stephen, Barnard Castle, and Darlington, on its return, with about 180 passengers.

It left Tebay at 6.25, and arrived at Kirby Stephen at 7 o'clock, running twelve miles in thirty-five minutes; and it left Kirby Stephen at 7.7, consisting of an engine and tender, six carriages, and two break-vans. It proceeded all right for thirteen and a half miles from that place, and was within three and a half miles of Bowes, when, at 7.45, the engine suddenly left the rails to the right hand, and ran down the slope of the embankment, about eight feet high, which occurs on that part of the line.

The engine fell over on its right side at the bottom of the embankment, at eighty-two yards only from the point at which it first left the rails. The tender lay behind it, partly turned over. The leading van lay on its right side, at right angles to the line, rather in advance of the tender; and parallel to this van, there was a third-class carriage, also on its right side, but in a reverse position, so that the wheels of these two vehicles pointed towards, and were locked in each other. A third-class carriage third in the train was inclined at an angle of about 72° to the line, and was partly heeled over. A first-class carriage next to it was on its wheels, leaning partly against it, and partly against a second-class carriage behind, which, with another second-class carriage, was on its right side. A third second-class carriage stood, leaning over to the right, on the slope of the embankment; and the last van was behind it, with its front wheels on the slope, and its trailing wheels on the top of the bank. This van was only about twenty-five yards from the spot where the engine first left the rails.

The driver and fireman were found under a heap of coke, which had fallen on them from the tender, with their legs jammed in between the quadrant of the reversing lever and a cover provided on the engine to shelter them from the weather. They could not be extricated from their position for eight hours, and were so much injured and burnt, that the driver has since died, and the fireman is not expected to recover. A third person, also a fireman in the service of the Company, was thrown off to the right on the grass, and stunned; but he escaped without serious injury.

Nearly 300 passengers were riding in the carriages, but only six of them are reported to have been injured; a result which is very surprising, considering the speed (stated by different witnesses at from 25 to 35 miles an hour) at which the train appears to have been travelling, the sudden way in which it was brought to a stand, and the manner in which the carriages were thrown about.

This result is due partly to the length and strength of the carriages, which reflect credit upon the Company, but principally to the fact that the hind van and three carriages in front of it were connected together with continuous breaks of Mr. Newall's pattern. The superintendent of police, Mr. Brown, who rode in that van, had applied these breaks, after passing the summit, for the purpose of checking the velocity of the train down the steep gradients which they were descending; he had given them an extra turn or two shortly before the accident, when he found the speed increasing; and he held the break-handle in his hand when it occurred. These breaks, acting upon the wheels of four vehicles, and producing a powerful resistance at the tail of the train, prevented the carriages from running forward upon the engine and each other with the violence that they would otherwise have done, when the engine was brought so suddenly to a stand; and the destruction of the carriages from collision with one another, which so frequently happens, and which is so liable to be attended with fatal results to the passengers, was thus avoided. In fact, the damage done to the carriages was principally confined to that which they received by coming into contact with the ground, and did not arise from collision with one another, except in the case of one which had its end partly knocked in against the tender, a second, which was indented by the corner of one behind it, and two or three cases in which the buffers came in contact with the pannelling. I may add, that these carriages, besides being about 35 feet long, were strengthened by means of vertical timbers on their ends, according to a method which has always been adopted by this Company.

I have had occasion to draw their Lordships' attention, in the case of previous accidents, to the want that has existed of a powerful break at the tail of a train, to the good effects that would have resulted from the employment of continuous breaks in such a position, and to the loss of life that might thus have been prevented. The present instance is a strong corroboration of the soundness of those views, if corroboration be required; and I trust that it may tend to induce those engineers and managers, who, on certain railways, either deny the advantage of such a precaution, or steadily refrain from adopting it, to amend this practice, if they do not alter their opinions, and to apply, not only a break-van, but also a series of continuous breaks at the tail of their trains.

I enclose a sketch of the engine (No. 1491), which was attached to the train in question. It was a six-wheel coupled mineral engine, with a six-wheeled tender. It had cylinders 17 inches in diameter, with a 26-inch stroke. The wheels were 5 feet in diameter, and there was a distance of 6 feet 2 inches between the leading and middle, and 5 feet 3 inches between the middle and trailing axles, measured from centre to centre. The weights on the wheels before and after the accident were as follows:—

	Before the accident, loaded with cold water.			After the accident, as returned, without water, and without chimney- gearing, &c.			
	Tons	cwts.	qrs.	Tons	cwts.	qrs.	
On the leading wheels	-	10	6	0	8	5	0
On the middle wheels	-	8	15	0	8	12	2
On the trailing wheels	-	11	3	1	9	11	2
Total	-	30	5	1	26	9	0

It was new in April 1860, and has only run altogether 7,109 miles since that time, having remained idle from June 1860 to July 1861. Its springs were uninjured, even by the accident; it was at work

again two days after it occurred; and it has been running ever since, without alteration of its wheels and axles; except that the trailing axle of the tender, which was slightly bent in the course of the accident, was straightened. At the same time, it must be added, that, as will be observed from the weights above given, its centre of gravity was behind its middle wheels; that its wheel base, 11' 5", was too short for great steadiness; that there was a considerable overhanging weight behind its trailing wheels; and that, therefore, if not absolutely unfit for running with a passenger train, it was at least not a desirable engine for that description of duty.

The gradient at the site of the accident was a descending one towards Bowes and Barnard Castle of 1 in 94, and the train had recently left a gradient of 1 in 67.5, descending in the same direction. The line curved to the left, or northward, on a radius of 79 chains. The engine had just passed over a bridge, or cattle-creep, of 6 feet span, constructed with cast iron girders on masonry abutments, before it left the rails.

The permanent way was laid with double-headed rails, weighing 75 lbs. to the lineal yard, in lengths of 18 and 21 feet. The joints of the rails were not, unfortunately, fished, but rested on cast-iron chairs, weighing 32 lbs. each; and the intermediate chairs weighed 18 lbs. each. The sleepers, of French larch, were half round, laid with the flat side downwards; were 9 feet long by 9" by $4\frac{1}{2}$ "; and were placed 3 feet apart on the average. The line was only opened for passenger traffic last month, and for mineral traffic in the previous April.

The first disturbance observable in the permanent way was at 9 yards on the east of the bridge above referred to, where a key on the outside of the outer rail of the curve was crushed and split into several pieces in its chair, apparently by the flange of a wheel which had got outside the rail. The chair behind the above chair was afterwards found to be fractured under the rail; and the chair in front of it, which was a joint-chair, had lost its inner jaw, and had had its outer jaw chipped and flattened. The east end of the rail in front of the above joint-chair had been thrown about four feet out of its place to the southward, and the line was torn up for about 50 yards forwards on the same side of the line,—the right, or south side, on the outside of the curve. The corresponding rails on the inside of the curve were undisturbed for 20 yards forward from the first point of disturbance, after which some of them were bent, evidently as the result of the accident. No mark was observed on the south rail east of the bridge, to indicate the precise spot at which the flange of the engine-wheel passed over it.

The gauge of the rails on this curve was, in places, from an eighth to a quarter of an inch below the ordinary gauge, $4' 8\frac{1}{2}"$, of the line; whereas it is desirable that it should be on the curves, if anything, rather wider than on the straight portions of the line. The super-elevation of the outer rail varied considerably on different parts of the curve, from less than half an inch, up to an inch and five-eighths, when I measured it this morning. It is stated to have been rather more than an inch upon the bridge referred to, when tried on the day after the accident.

But it was observed, that while the north rail on that bridge stood firm under the passage of an engine, the right rail deflected an inch or more at the west end of the bridge, in consequence of the longitudinal timber on which the chairs rested not having been supported on the bottom flange of the trough girder below it, while the rail and timber were held up together, when they were not weighted, by the strength of the rail, to the extent, or nearly, to which the sleepers at either end of the bridge were packed up.

These girders were not well bedded on the west abutments of the bridge. They were simply laid on the abutments, without being in any way secured to

them. They rested on the middle of stones of considerable size at the east end of the bridge, and were steady at that end; but they were both laid upon joints in the stones at the west end; and the stones were not in good line, owing, apparently, to the abutments having settled since the bridge was built; so that the girders rested on uneven beds at that end. The longitudinal beams, which were placed in the girders to carry the chairs and rails, were laid upon the bottom of the girders, without being fastened to them; and they did not fit them accurately. The east end of the beams were secured in their places by certain tie-rods, which passed transversely through the girders, and through holes in the beams at that end. The corresponding holes in the west end of the beams had been cut through to the bottom of them; and the tie-rods did not, therefore, prevent them from rising; so that when the platelayers packed up the sleepers at the west ends of the bridge, to afford what they considered a proper amount of super-elevation to the outer rail of the curve, they lifted the west end of the beam in the south girder, and left it hanging to the rails and chairs as above described.

The effect of this condition of affairs upon an engine passing at speed over the bridge would have been as follows:—

The right leading wheel of the engine would suddenly drop an inch as it travelled on the south girder, and the leading end of the engine, thus suddenly losing the advantage of the super-elevation in the outer rail which counteracted the effect of centrifugal action as it passed round the curve, would be thrown towards the right. The middle wheels dropping in like manner would increase that tendency. The trailing wheels falling immediately afterwards, the leading end of the engine would be lifted up, and the more readily in the case of the engine in question, because, as I have already explained, the trailing end over hung the trailing wheels, and the centre of gravity was behind the middle wheels. The right leading wheel, thus lifted and turned to the right, would readily pass over to the outside of the outer rail of the curve, and would drop off on the wrong side of it, without leaving any mark upon it; and the crushing of the intermediate key, and fracture of the joint chair, would naturally follow, as it ran forward upon them.

As the engine proceeded onwards, with its right leading wheel on one side of the rail, and its middle trailing wheels upon the rails, the other chairs on the right side would naturally be broken, the rail resting in them would be displaced, and the engine, followed by the train, would meet with no obstacle to prevent it from running down the slope of the embankment on the outside of the curve, in the manner which I have above described.

This is evidently the way in which the accident occurred, and the principal cause of it may be stated to have been, the want of proper permanent super-elevation to the rail on the south girder of the bridge, by the insertion of a longitudinal timber in the girder on the south side, an inch and a quarter, or an inch and a half deeper than the beam in the girder on the north side of it. The packing up of the sleepers on either end of the bridge by the platelayers, in itself a judicious precaution, without proper support being at the same time afforded under the longitudinal beam on the south side, directly tended to produce it; and the employment of an engine with overhanging weight behind its trailing wheels, and with its centre of gravity behind its middle wheels, to take a train at a comparatively high speed over it, had a material effect in leading to it, under the particular circumstances of the defect in the permanent way which it encountered, though the engine would no doubt have travelled safely over the bridge if this defect had not existed.

The south girder of the bridge, on which the rail ought to have been higher, was nearly an eighth of

an inch lower than the north girder ; and the longitudinal beam in the south girder was only an eighth of an inch deeper at the west end, and three quarters of an inch deeper at the east end, than that in the north girder, the measurements having been taken through a spike hole near each end of these beams ; so that, at the west end of the bridge, there was no super-elevation for the outer rail of the curve, and at the east end, only $\frac{3}{8}$ " super-elevation, instead of an inch and a quarter, or an inch and a half, which may be considered a suitable amount of super-elevation for a curve of this description.

The deceased driver is said to have attributed the accident, before his death, to the sinking of the hind wheels of the engine as it passed over the bridge ; and it appears that the condition of this bridge, and of some other bridges, had been brought to the notice of the inspector of that part of the permanent way before the accident. In fact, the day before it occurred, he had taken the foreman platelayer to it, and

had directed him to set it to-rights, as he had also himself perceived that the engine passed unsteadily over it, as he rode over that part of the line. He supposed, however, that this effect was produced in consequence of the sleepers having somewhat sunk at the ends of the bridge, which is a common occurrence in newly-made lines, and did not discover the real cause of unsteadiness ; and the foreman platelayer made the same, not unnatural mistake. To correct the supposed defect, he and his men lifted a joint which appeared to be a little low at the west of the bridge, between the bridge and the joint at which the first joint-chair was afterwards fractured ; and they thus increased the risk of, and led to the accident which they endeavoured to prevent.

*The Secretary
Railway Department,
Board of Trade.*

I have, &c.,
H. W. TYLER,
Capt. R.E.

WEST MIDLAND RAILWAY.

Railway Department, Board of Trade,

SIR,

18th October 1861.

I AM directed by the Lords of the Committee of Privy Council for Trade to transmit to you, to be laid before the Directors of the West Midland Railway Company, the enclosed copy of the report made by Colonel Yolland, R.E., the officer appointed by my Lords to inquire into the circumstances which attended the collision that occurred on the 25th ultimo, between a passenger train and a goods train belonging to the Midland Railway Company, at the Droitwich station, on the loop line of the West Midland Railway.

I am, &c.

JAMES BOOTH.

*The Secretary of the
West Midland
Railway Company.*

[*Similar letter sent to the Midland Railway Company.*]

Northam near Bideford,

SIR,

11th October 1861.

I HAVE the honour to report for the information of the Lords of the Committee of Privy Council for Trade, in obedience to your minute of the 28th ultimo, the result of my inquiry into the circumstances which attended the collision that occurred on the 25th ultimo, between a passenger and a goods train belonging to the Midland Railway Company, on the loop line of the West Midland Railway at Droitwich station, when thirteen passengers and the guard of the passenger train were bruised, cut, or contused, but it is hoped that none of the injuries received are of a serious kind.

A West Midland mineral train arrived at the junction at Droitwich along their main line from Netherton at 4h. 5m. P.M., and the signalman allowed it to pass the junction, and it ran down to the station yard to do the shunting required, leaving the guard's break and one or two waggons standing on the crossing, foul of the down loop line. About 10 minutes after it arrived, the bottom of one of the waggons loaded with slack fell out, and the slack dropped out on to the line and prevented a pair of points from being opened, to allow of the waggons being shunted into one of the sidings.

A Midland goods train, consisting of engine and tender, 40 waggons, and a break van, arrived at the junction along the loop line from Stoke and Birmingham, at 4h. 7m. P.M., and as the junction and distant signals were on against it, the driver brought his train to a stand still with the engine about 15 or 20 yards short of the crossing of the main down line, on which the van of the West Midland goods train

was then standing ; and the guard of this goods train then went forward to the signalman's box at the junction, and asked the signalman how long it would be before he could let them into the Droitwich yard, where they had to leave 13 salt waggons ; and as the signalman could not tell him how soon the slack would be cleared away, the guard ran back along the loop line to protect the tail of his train, about 4h. 16m. or 4h. 17m., according to the statement of the signalman.

The guards break at the tail of the Midland goods train stood 173 yards inside of the down distant signal which is placed 480 from the signal box at the junction from whence it is worked, and the guard went back with a red flag to stop the next passenger train, a distance of 625 yards from the tail of his own train according to his own statement, or to 557 yards according to the statements of the driver and fireman of the 3.20 P.M. passenger train from Birmingham. The driver of the passenger train, which consisted of engine and tender, 6 carriages, and 2 break vans, with one guard riding in the last van, admits having seen the red flag of the goods guard, at the same time that he saw the down distant signal standing against him, when he was 813 yards back from the break van of the goods train, the line being perfectly level ; and he states, that at that time he was running with the steam shut off, at from 30 to 35 miles an hour, and when the flag was first seen by the fireman, the fireman sounded the whistle for the guard's break, and the fireman says the tender break was on before the whistle was sounded, in order to reduce the speed before coming to the junction. The guard of the train estimated the speed at 25 miles an hour, and he asserts that the whistle for the break was sounded when they were still further back on the line, and that he immediately put on his break ; the driver further states that he reversed his engine, and put the steam on the reverse way, just as he was passing the goods guard, and yet notwithstanding all these precautions, the passenger train ran into the goods train, at a rate of speed variously estimated at from 8 to 12 miles an hour, when the top of the break van was smashed and knocked off, and fell down the embankment, while the leading and driving wheels of the engine mounted upon the frame of the break van. All the breaks are stated to have been in good order, but the rails are said to have been very greasy and slippery, so that the breaks did not appear to take effect. The driver had only been three trips on this branch, before the day on which the accident occurred. This passenger train stopped at all stations, and the driver stated that in order to keep time they are obliged to