

RAILWAY ACCIDENT (SUTTON TUNNEL).

RETURN to an Order of the Honourable The House of Commons,  
dated 29 May 1851 :—for,

COPY " of the REPORT of the OFFICER appointed by the Commissioners of Railways to inquire into the Circumstances attending a FATAL COLLISION which occurred in the SUTTON TUNNEL, on the Birkenhead, Lancashire, and Cheshire Junction Railway, on the 30th day of April 1851."

*Ordered, by The House of Commons, to be Printed, 29 May 1851.*

CAPTAIN LAFFAN'S REPORT ON THE FATAL COLLISION IN THE SUTTON TUNNEL of the BIRKENHEAD, LANCASHIRE AND CHESHIRE JUNCTION RAILWAY, on the 30th April 1851.

Sir, 22 May 1851.

I HAVE the honour to report to you, for the information of the Commissioners of Railways, the result of my inquiry into the circumstances attending a fatal collision which occurred in the Sutton tunnel on the Birkenhead, Lancashire and Cheshire Junction Railway, on the afternoon of the 30th ultimo.

The following is a brief outline of the occurrence :—The race for the Chester Cup, which annually attracts to Chester a great number of visitors, had taken place on the afternoon of the 30th ultimo ; and when the races were over, a number of special trains were started from Chester to proceed to Manchester along the Warrington line of the Birkenhead, Lancashire and Cheshire Junction Railway. Two of those trains became delayed in the Sutton tunnel, and a third coming up before any effectual steps had been taken to give notice of the obstruction, came into violent collision with them, and destroyed several of the carriages, causing the death of six of the passengers, and injuring a great number of others.

On receipt of the instructions conveyed to me in your letter of the 2d instant, I wrote to the secretary of the Birkenhead, Lancashire and Cheshire Junction Company, to apprise him of the purport of the orders I had received, and to inform him that I should proceed next day to Birkenhead for the purpose of holding an inquiry ; and, in pursuance of this intention, I proceeded on the morning of the 3d instant as far as Chester by the express train. I there learnt that the secretary, the chairman, and all the officials of the company, and all the witnesses who could give information upon the subject of my inquiry, were then in attendance upon the coroner for the honour and fee of Halton, in the county of Chester, who was holding an inquest at Preston Brook on five of the passengers who had been killed by the collision. On receiving this intelligence, it appeared to me that it would be useless to continue my journey to Birkenhead, and I accordingly went instead to Preston Brook, where I arrived at the moment when the coroner was about to adjourn the first day's proceedings.

I informed the coroner that I had been instructed by the Commissioners of Railways to inquire into the circumstances of the collision, the fatal consequences of which formed the subject of his own investigation ; and I stated that, as all the witnesses were engaged in attendance upon him, I proposed, with his permission, to attend the inquest in order to gain as much information as possible from the evidence to be given before him.

The coroner, in reply, expressed his willingness to afford me all the assistance in his power ; and the chairman of the company, who was in the room at the time, came forward and stated that the directors wished to have nothing concealed, and courted the fullest inquiry ; that they were most anxious to trace out the true causes of the late accident, and that every facility should be afforded to me in the course of the proceedings.

From that time I continued to attend the coroner's inquest till it was brought to a close on the evening of the 12th instant. During the proceedings, I derived much valuable information from the evidence of the several witnesses who were examined by the coroner, by the jury, and by the counsel who attended to watch over the interests of the company. I also examined many of the witnesses myself, sometimes with the permission, sometimes at the desire of the coroner, who expressed a wish that I should afford to himself and the jury the assistance of any professional knowledge I might possess. My questions were directed to those points which it appeared to me absolutely necessary to clear up in order to arrive at a correct opinion as to the causes which had led to the late collision, and the measures which it might be desirable to adopt to guard against the recurrence of a similar disaster.

During the proceedings I thought it desirable, in order to obtain accurate information, to determine two questions by actual trial. The first question concerned the weight of the Druid engine, which drew the first of the two trains that came to a stand in the Sutton tunnel. The locomotive superintendent and his assistant stated their belief that the Druid weighed from 20 to 21 tons, and that there were 8 tons upon the driving-wheels; they added, however, that they had never seen the engine weighed.

On being weighed at Crewe the Druid was found to weigh 15.1 tons, and the weight upon the driving wheels was 5.9 tons; the engine, while being weighed, was so full of water that the workmen declared it to be "altogether past working." The cylinders of the Druid are 13½ diameter, and the stroke 22", the driving wheels 5½ feet. It is evident that both the locomotive superintendent and his assistant were greatly mistaken in their estimate of this engine's power.

The second question which I thought it desirable to determine by actual trial was the probable cause to be assigned for the decided failure of the Druid engine after leaving the Frodsham station. It appeared to me that the shower of sleet to which the whole blame was attributed by the company's locomotive staff was in no way sufficient to account for so great a failure; inasmuch as it was stated in evidence that the same shower of sleet continued to fall when the next two trains left Frodsham; and yet the speed of those two trains did not appear to have been at all slackened, nor was their progress in any way delayed in consequence. The slow speed of the Druid between Frodsham and the tunnel might, it is true, be sufficiently accounted for by the light weight upon the driving wheels; but then the Druid not only failed to keep its train in motion in the tunnel, but actually came to a stand even when assisted by the more powerful engine, No. 16, which followed with a far lighter load. On weighing the whole of the evidence, it appeared to me that the failure of these two engines in the tunnel had been so complete as to suggest the possibility of its having been influenced by other causes than the slipperiness of the rails and the disproportion between the Druid's engine power and its load: and as the best means of arriving at a satisfactory explanation, I requested the locomotive superintendent to make a trial of the Druid engine, with a train composed, as far as could be ascertained, of the same carriages and the same weights that it had drawn on the afternoon of the 30th ult. The first trial gave no practical result, owing to a misunderstanding about the weights; the second, however, appeared to afford some explanation of the failure, for the open third class carriages which had formed part of the Druid's train, when loaded with a weight corresponding to the great number of passengers who had travelled in them on the afternoon of the 30th ult., were found to be too weak in the springs to bear so great a load; and the result of the trial made it appear probable that on the occasion in question the woodwork of the framing of some of these carriages had borne slightly upon the tires of the wheels, and thus acted, to a certain extent, as breaks to retard the progress of the train. When the trial was over the locomotive superintendent stated in evidence before the coroner, that in his opinion this had been one of the causes of the delay.

In addition to this cause, another suggested itself during the course of the experiment. The ballast in the tunnel was found to be of a different quality from that outside; it had become saturated with water impregnated with earthy matter, and when used to sand the rails, did not afford to the driving wheels the same hold as the cleaner ballast on the open parts of the line.

The coroner's inquest was brought to a close on the evening of the 12th inst. The coroner had been good enough to furnish me each day with a copy of the evidence taken before him; and at the close of the proceedings, that evidence, together

together with my own notes and personal observations, appeared to show clearly the causes to which the fatal collision was to be attributed. There remained some points of engineering detail, and some particulars respecting the arrangements of the central station at Chester, upon which I wished to obtain accurate information; and on the morning of the 13th inst. I proceeded to Chester for that purpose.

At Chester I examined the several lines and platforms of the central station, and the points of junction of the different railways which converge upon it. I was accompanied by the general manager, who explained the manner in which the ordinary business is conducted, and the arrangements which had been made to accommodate the greatly increased traffic of the Chester race week, and particularly that of the 30th ult., which was the cup day. The comparative amount of the extra traffic on that day being a point of some importance to the object of this inquiry, it may be useful here to state, on the authority of the general manager, who took considerable pains to arrive at a correct result, that the ordinary traffic at the central station amounts, on the average, to 1,000 arrivals and 1,000 departures each day; whereas, on the 30th ult., 18,000 passengers, as nearly as can be ascertained, departed by different lines, of which number 9,000 went by the Birkenhead, Lancashire and Cheshire Junction Railway, 5,000 going by the old line from Chester to Birkenhead, and 4,000 by the new line, which leads through the Sutton tunnel to Warrington. The arrivals were not quite so numerous, as many people had reached Chester the day before.

At Chester I examined also some of the locomotive stock of the Birkenhead, Lancashire and Cheshire Junction Company; namely, the engine No. 16, which drew the second train that came to a stand in the Sutton tunnel, and the "Victor," which was, I was informed, the companion engine to the "Albert," which drew the train that followed. Both these appeared to be much heavier engines than the "Druid," and on the afternoon of the Chester cup day they drew far lighter loads. I requested the locomotive superintendent, who was unable at the time to furnish the required information, to forward to me a return, showing the exact weights and principal proportions of these engines, as also of all the other engines which the Company possessed. This return, however, I have not yet received.

It may be desirable, before proceeding further, briefly to review the position of the Birkenhead, Lancashire and Cheshire Junction Railway Company, and the manner in which their ordinary traffic is conducted.

The Birkenhead, Lancashire and Cheshire Junction Company was incorporated in 1846, and empowered to make a railway connecting the Chester and Birkenhead Railway with the lines of the London and North Western Company. In 1847 the new Company was amalgamated with the old Chester and Birkenhead; and, under the new title, the united Companies continued to work the traffic between Chester and Birkenhead from 1847 to December 1850, the length of their line being 15 miles.

In December 1850 a portion of the new line was opened, extending from Chester to the junction with the London and North Western Railway, at Walton, a distance of 18 miles. It may be useful hereafter in this Report, to distinguish the new line as the "Cheshire Junction," and leave to the other its old title of "Chester and Birkenhead" Line. The opening of the new line brought with it a greater increase to the Company's business than is represented by its own length of 18 miles; for the trains on the "Cheshire Junction" line carry their traffic over the whole distance between Chester and Manchester,  $39\frac{1}{2}$  miles, running for  $21\frac{1}{2}$  miles each way over the lines of the London and North Western Company.

The affairs of the Company in all that relates to the actual working of the two lines, and to the provisions to be made for the safety and convenience of the public travelling upon them, are entrusted to an executive committee, consisting of six directors. The committee are responsible that proper officers are placed at the head of the several departments, and that the staff of the Company is maintained in an efficient state. The officers appointed by the executive committee, and responsible under them for the efficiency of the departments connected with the safe conduct of the traffic, appear to have been—

1st. A secretary, who was also nominally the coaching superintendent, but whose duties in the latter capacity appear to have been limited to collecting returns.

2d. A resident engineer for the old line from Chester to Birkenhead. This officer was also locomotive superintendent, and as such had charge of the whole

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whole locomotive and rolling stock of the Company upon both lines; and he was, in addition to these duties, responsible for the safe conduct of the traffic upon the old line.

3d. A resident engineer for the new or "Cheshire Junction" line, who, in addition to his ordinary duties, was responsible for the safe conduct of the traffic between Chester and Warrington.

4th. A manager of goods traffic.

On the new line being opened in December last, the locomotive superintendent appears to have represented very strongly to the executive committee, that the great extension of their traffic required an increased number of engines; and with considerable difficulty, and not till upwards of two months after the opening, he prevailed upon them to add four new engines to the stock of 14, with which they had worked the old line. The addition was out of all proportion to the increased work; and the locomotive superintendent states in evidence, that the Company's present stock of 18 engines is not sufficient even for the ordinary traffic; but that officer appears to have shrunk from the unpleasant duty of continuing to press this deficiency upon the attention of the directors; stating as his reason, that he was convinced any further representations on the subject would be useless. The Company thus continued to work an extended traffic, with a locomotive stock insufficient for their ordinary business, and of course unequal to any emergency.

On the 1st of April last, the agreement which had hitherto subsisted between the Company and the resident engineer who had charge of the "Cheshire Junction" line, expired. A negotiation ensued between that officer and the executive committee as to the terms upon which the Company might secure the continuance of his services; and, at a meeting of the committee on the 19th ult., the chairman was authorized to re-engage the resident engineer upon such terms as he, the chairman, might think fit; the negotiation, however, had not yet been brought to a close when the fatal collision occurred in the Sutton tunnel on the 30th of April; and thus during a whole month, including the Chester race week, the busiest season of the year, the line between Chester and Warrington was left without any officer to direct the working of the traffic, or to take any precaution to protect the public from the danger to which the measures of the executive committee, anxious to attract a great traffic on to the line, were about to expose them.

On the 19th of April, the executive committee met to consider the arrangements to be made for the Chester race-week. They authorized, as before stated, the chairman to re-engage the proper officer, whose duty it would be to watch over the safety of the traffic upon the "Cheshire Junction" line; and then proceeded to approve and order to be issued an advertisement, stating that the "Cheshire Junction" line was the most direct route between Manchester and Chester, and that five special trains should start from Manchester on the morning of the cup-day, and accomplish the distance (39½ miles) to Chester in times varying from an hour and a quarter to an hour and a half. The advertisement further stated that these trains would return from Chester when the races were over, commencing to run at half past five, and continuing to do so as soon as filled; these were to be in addition to the ordinary trains on the line. To provide for the great increase of traffic which this advertisement was likely to create, the committee gave unlimited authority to the locomotive superintendent to borrow all the carriages that could be procured, directing him to apply for that purpose to the Shrewsbury and Chester, the Shrewsbury and Birmingham, the North Staffordshire, the Manchester, Sheffield and Lincolnshire, the Lancashire and Yorkshire, and the East Lancashire Railway Companies. The chairman of the Company stated in evidence before the coroner, that, both at the meeting on the 19th ultimo, and at a subsequent meeting on the 26th ultimo, the executive committee had considered the subject of locomotive power; that they considered they had sufficient for the occasion of the Chester races, and that they had not consulted the locomotive superintendent on the subject; they thus left that officer no discretion as to the number of engines he was to employ; and the locomotive superintendent stated in evidence, that he considered the Company's stock of engines insufficient even for the ordinary traffic.

In obedience to the directions of the executive committee, the locomotive superintendent appears to have been engaged, during the greater part of the ensuing week,

week, in travelling from place to place endeavouring to procure carriages. He returned to Birkenhead in time to attend the next meeting of the committee on the 26th ultimo, when he reported that he had succeeded in obtaining 12 first class and 38 other covered carriages, mostly third class, and 24 open third class carriages, in which the passengers travel standing. Some more carriages were subsequently lent to the Company at Manchester. Many of these carriages, and particularly the open carriages, which formed part of the "Druid's" train, only reached Chester the day before the cup day; and the locomotive superintendent states, that there was then no time to examine them, with a view to ascertain whether they were in a fit running condition. At the meeting on the 26th ultimo, the committee made their final arrangements for the traffic of the Chester race week. They, however, took no step to appoint any other officer in lieu of the late resident engineer, to watch over the safety of the traffic on the Cheshire Junction line, nor did they themselves direct that any peculiar precautions should be adopted by their servants. They gave orders that the contractor for the repair of the permanent way should cause an efficient watch to be kept along the old line from Chester to Birkenhead, and omitted to make a similar provision for the safety of the numerous trains that were about to run between Chester and Warrington. So unconscious, indeed, do all parties appear to have been of the danger to which they were about to expose the public, that two policemen, who had been stationed in the vicinity of the Sutton tunnel since the first construction of the line to protect the Company's property, were withdrawn, during the race week, by express orders from the secretary.

The Sutton tunnel is situated  $11\frac{1}{2}$  miles from Chester, and is one mile and 180 yards in length. It is perfectly straight throughout, and in ordinary weather, and when the tunnel is free from steam, a driver entering at one end can see the whole way through to the other opening. For some time, however, after a train has passed, the tunnel remains partially filled with steam; and the time within which that steam will clear away is very uncertain, depending upon the weather, the direction of the wind, and other variable causes. An engine driver entering the tunnel when filled with steam may suddenly find himself in perfect darkness; even a signal lamp can sometimes be seen but a very short way through such a clouded atmosphere. It is probable that this circumstance had never been brought to the notice of the executive committee, for, till the occasion of the Chester races, there had never been any unusual traffic upon the Cheshire Junction line, and the ordinary trains only follow one another through the tunnel at intervals of from two to three hours. These trains had never experienced any difficulty in getting through; and the necessity of watching the tunnel had, therefore, never hitherto been felt. On the present occasion there was no officer whose duty it was to represent to the committee that a different state of things would arise when a number of trains would have to follow one another at very short intervals; and the committee omitted to consult any one practically conversant with the management of railway traffic as to the sufficiency of their arrangements.

There was yet another circumstance connected with the Sutton tunnel, which had considerable influence in bringing about the late disaster. The resident engineer of the Cheshire Junction line, in reporting to the Directors upon the system of signals to be used, had omitted to mention any peculiar provision for the working of this tunnel; but it was stated by the chairman of the Company, in his evidence before the coroner, that at that time it was intended that a station should be placed at a short distance from either end of the tunnel, and that those stations were required to be placed there, either by Act of Parliament or by private agreement with landowners, but that they had not yet been constructed, as the Company were crippled for means. The executive committee do not appear to have been aware of the effect which deferring the construction of these stations necessarily had upon the safety of the traffic through the Sutton tunnel; for had those stations been in existence, or, in their absence, had an efficient watch been kept at the tunnel mouth, it is probable that the late collision might have been averted. The chairman stated that the Company were about to construct these two stations at once.

I now proceed to describe the occurrences of the 30th ultimo, the Chester cup day. On the morning of that day the special trains from Manchester to Chester all started late. The number of passengers was very great, and considerable confusion prevailed in consequence. The first train started an hour late: it consisted

of 38 carriages, drawn by two engines; and at Frodsham, 10 miles from Chester, it was joined by a third engine, which had brought four empty carriages from the latter place to take up the Frodsham traffic. The third engine proved a seasonable addition to the motive power, and enabled the train to reach Chester at half-past 11 A. M., two hours and a half behind its time, having started one hour late from Manchester. The second train started at 20 minutes to 10; and, according to the speed contemplated in the Company's arrangements, should have reached Chester at six minutes past 11. It consisted of 50 carriages, drawn by two engines; and there is no evidence of the time it reached Chester. The assistant locomotive superintendent, who accompanied it states, that he was so glad to get to Chester with such a heavy load, that he entirely forgot to observe the time. At one part of the journey, it was stated in evidence that a considerable number of passengers got out, and walked. Throughout the present inquiry great difficulty was experienced, in consequence of its being found impossible to obtain from the Company's servants any accurate evidence as to time. The Company do not require that their servants should carry watches; and the clocks at the stations are placed inside the buildings, and cannot be seen by the parties who have charge of the trains. The times assigned to the several occurrences mentioned in this Report have all been taken from the evidence of passengers.

From Chester the trains, returning after the races, were started by the staff of the central station. There are six lines of railway which converge upon the central station at Chester; namely, the Chester and Birkenhead, and the Cheshire Junction lines, both of which belong to the Birkenhead, Lancashire, and Cheshire Junction Company; the Chester and Holyhead, the Mold, the Shrewsbury and Chester, and the London and North-Western. The management of the central station is vested in a committee of representatives of the companies interested in it. The working staff consists of a general manager, who exercises a general superintendence over the whole business of the station; of a station-master, with a superintendent under him, who attend to the arrival and departure of trains; and of a number of policemen, pointmen, gatekeepers and porters, sufficient to provide for the safe working of the ordinary traffic. On the occasion of the Chester races this staff was reinforced by the addition of as many efficient hands as could be procured.

The rules published for the guidance of the staff of the central station have for their object to provide for the safety of the traffic and the convenience of passengers, and generally for the prevention of confusion or accident while the trains remain within the station, and they extend to providing with proper signal lamps and other lights those trains which do not appear likely to reach another depot of those articles before dark. There is a rule also which forbids trains leaving the station to proceed along the same line at shorter intervals than seven minutes in fine, and ten minutes in foggy weather; but beyond these rules, intended to promote the general convenience of the public and of the different companies, all arrangements as to the arrivals and departures along any particular line, and all provisions as to the intervals between trains (provided those intervals are not less than seven or ten minutes), and all precautions to be taken to provide for the safety of those trains when once clear of the central station, rest with the individual company to whom the line belongs. It is evident, therefore, that the blame of having allowed trains which would necessarily have to pass in rapid succession through a long tunnel where no watch was kept, to start without tail-lights, without lights in any of the carriages, and without even the guards being provided with a hand-lamp, is not to be attributed to the authorities of the central station, but that the responsibility of having omitted those provisions for the safety and comfort of their passengers rests with the executive committee of the Birkenhead, Lancashire and Cheshire Junction Railway Company.

The subject of providing station accommodation for the great traffic of the race week, and especially for that of the cup day, had been discussed between the general manager and the station-master for some time previous to that event. On the morning of the cup day especially, having received correct lists of all the intended arrivals and departures, they arranged where every train was to be brought in, and, as far as possible, the place from which each train was to be dispatched. Those arrangements were, generally speaking, strictly adhered to; but still some slight modification was made towards the close of the day, at a time when 400 empty carriages standing in and about the station, and

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5,000 passengers crowding together on the platform, rendered it difficult to adhere strictly to the order laid down.

The general manager had received no instructions from the Birkenhead, Lancashire and Cheshire Junction Company as to the manner or the order in which the return trains on the Cheshire Junction line were to be dispatched. The only notice sent him by the directors was a copy of the printed advertisement, which stated that the trains were to be started as soon as filled. Beyond, therefore, seeing that the prescribed interval of seven minutes was in all cases allowed, the staff of the central station had no authority to delay the departure of those trains. The locomotive superintendent to the Birkenhead, Lancashire and Cheshire Junction Company, with two assistants, was present to superintend the marshalling of the Cheshire Junction trains, to see that the carriages left the station in proper running condition, and that the engine power was sufficient for the load.

The two first trains started from the platform, the first about a quarter to six, the second about half-past six; the number of passengers was, as nearly as can be ascertained, 430 by the first, and 470 by the second.

As the second train was about to start, a vast crowd of people, most of whom were provided with return tickets, came up to the station, to leave by the different lines. The races were just over, and the general manager and the station master both calculate that there were at that time fully 5,000 people together on the platforms. A number of persons, finding that every inside place in the carriages of the second train was already filled, proceeded to get upon the roofs; but they were ordered down by the general manager before the train was allowed to start.

In the meantime, however, a train of empty carriages, provided by the Birkenhead, Lancashire and Cheshire Junction Company, and labelled in large letters, "Manchester, *via* Warrington," had been standing upon a side line, and had become partially filled with passengers, who had crossed the intervening lines of rail to secure places in time. On the departure of the second train, as above described, the crowd, attracted by the labels on these carriages, crossed over to the side line, and soon every available seat or standing room was filled. The station master then considered that it would be useless to draw these carriages to the platform, and accordingly the third train started from the side line about 10 minutes to seven. As this was the first of the return trains which came to a stand in the Sutton tunnel, it is important to ascertain in what manner it was composed.

The train which thus started at 10 minutes to seven, was drawn by the "Druid" engine, and consisted of two first-class and six second-class covered carriages, and of 10 open third-class carriages, in which the passengers travelled standing. The whole of the carriages were very much crowded. It was stated in evidence, that the passengers in the third-class open carriages had barely room to stand. From the best information I have been able to obtain, the following appears to have been the composition of the train:—

	WEIGHTS.		PASSENGERS.
	Tons.	Cuts.	
The "Druid" engine	15	0	—
Tender	9	0	—
2 first-class carriages	9	0	36
4 large second-class carriages	17	8	128
2 small ditto ditto	6	14	48
5 open third-class carriages, six wheels each	26	10	350
5 ditto ditto ditto four wheels each	23	0	350
<b>TOTAL</b>	<b>106</b>	<b>12</b>	<b>912</b>

And, assuming that the passengers would, on the average, weigh 15 to the ton, which I believe is the proportion usually adopted in estimating railway traffic, the total weight of the train drawn by the "Druid" engine appears to have been about 167 tons. The weight upon the driving wheels of the "Druid" was 5.9 tons.

In allowing the number (70) of passengers to each of the open carriages, I have been guided by the evidence as to the very crowded state in which they left Chester. These carriages afford an available standing room of  $136\frac{1}{2}$  square feet; and it appears to me that 70 passengers is not too high an estimate, under the circumstances. The Company's locomotive superintendent stated in evidence that these carriages would hold from 50 to 70 passengers; and the manager of the North Staffordshire Railway, by whom they were lent to the Birkenhead, Lancashire and Cheshire Junction Company, informs me that, on special occasions, they will hold from 70 to 80.

The next train, which was the fourth of the special trains returning from Chester, started from the centre line of the station, without coming to the platform; it got away at a quarter-past seven, and consisted of two first-class and nine second and third-class covered carriages, of a cattle waggon filled with passengers, and of a private carriage upon a truck. The number of passengers who travelled by this train was, as nearly as can be ascertained, 430; it was a far lighter train than the preceding, and it was drawn by an engine, No. 16, heavier and more powerful in every way than the "Druid."

The fifth train started from the centre line of the station at half-past seven, 15-minutes after the preceding train; it consisted of two first class and twelve second and third-class covered carriages. The number of passengers was, as nearly as can be ascertained, 470. This was also a much lighter train than the third, and the engine, the "Albert," weighed about three tons more than the "Druid."

A sixth train started from Chester a little before eight; it consisted of two first class and eleven second and third-class covered carriages; the number of passengers about 430.

There were yet a seventh and an eighth train, but as they were in no way concerned in the collision, it would be useless to trace their progress.

The two first trains referred to in the preceding list appear to have got through their journeys and reached Manchester without anything happening to call for particular remark. The third train, drawn by the "Druid," was not so fortunate. It began raining shortly after the train left Chester, and continued to do so, and occasional showers of hail and sleet fell throughout the afternoon. A brief description of the line between Chester and the Sutton tunnel may serve to render what followed more readily understood.

On leaving Chester, the Cheshire Junction line ascends for a mile and 15-chains to a point called Hoole, rising in that distance  $56\frac{1}{2}$  feet. From Hoole, the line descends again for 2 miles and 14 chains, falling in that distance  $86\frac{1}{2}$  feet; after that, there are five miles of alternate slight elevations and depressions, the line upon the whole rising three feet in the five miles, and then commences the ascent of the Frodsham gradients, which rise 39 feet in one mile and 74 chains; at first, at an inclination of 1 in 440, then increasing the steepness to 1 in 260, and finally, leading through the Frodsham station and up to the Sutton viaduct, at an inclination of 1 in 240. At the Sutton viaduct, there is a length of 53 chains of level line, and then begins a long ascent of 1 in 264, which leads into the Sutton tunnel. These peculiarities would not have been of material importance had the engine power been proportioned to the load; but considered with reference to the power of the "Druid" engine and the weight of the train it drew, they form important elements in the present inquiry.

Each of the special trains on leaving Chester was assisted by a pilot engine up the ascent to Hoole, and it is evident from the preceding description, that the line from Hoole to Frodsham was as favourable as could be wished. On leaving the Frodsham station, however, the "Druid" had to start its heavy train upon a gradient ascending 1 in 240; and then, after a short run upon a level line, to encounter a long ascent of 1 in 264, the latter part of which lay through a tunnel in which the rails are generally in a very slippery state.

The "Druid" had stopped at one intermediate station, and had reached Frodsham about half-past seven, having taken 40 minutes to come from Chester; whereas the time allowed the ordinary trains of the Company is 26 minutes. Beyond the slow speed, however, the driver states that he perceived nothing in the working of the engine to lead him to conclude that the load was too great. The man knew very little of the "Druid," his usual work being to drive goods-trains with engines having coupled driving wheels. At Frodsham, and at the intermediate stations, it appears that, altogether, about 100 passengers left the train. The total weight at starting from Frodsham was probably 160 tons.

but



Hitherto, though it had been raining greater part of the way, the driving-wheels of the engine had not slipped.

The tractive power required to set this train in motion at Frodsham on an ascending gradient of 1 in 240 may be taken to be—

$$\begin{array}{l} \text{First, to overcome friction } 160 \times 6 = 960 \text{ lbs.} \\ \text{Second, to balance the} \\ \text{effect of the ascending} \\ \text{gradient - - -} \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} \frac{160 \times 2,240}{240} = 1,493 \frac{1}{3} \text{ lbs.} \quad \left\{ \begin{array}{l} \text{From Mr. Scott Russell's} \\ \text{formula for the resist-} \\ \text{ance of trains.} \end{array} \right.$$

$$\text{TOTAL - - - } \underline{\underline{2,453 \frac{1}{3} \text{ lbs.}}}$$

This amount of tractive power would simply suffice to set the train in motion, but could not enable it to move with any speed. The weight on the driving-wheels of the "Druid" being 5.9 tons, or 13,216 lbs., it is evident that to obtain a tractive power of 2,453  $\frac{1}{3}$  lbs., it was required that the adhesion should be  $\frac{2,453 \frac{1}{3}}{13,216}$

or between  $\frac{1}{5}$  and  $\frac{1}{6}$  of the insistent weight. On wet rails, so high a proportion could scarcely be expected. The "Druid" was evidently unequal to its train.

The "Druid" started from the Frodsham station at 33 minutes past 7. As soon as the steam was put on, the driving-wheels began to slip; and, after some ineffectual attempts to get away, the fireman got off and walked beside the engine, throwing sand upon the rails, while a plate-layer, who happened to be near at the time, did the same at the other side. With this help the train proceeded slowly to surmount the ascent to the Sutton viaduct, on reaching which, and finding himself once more on a level line, the driver endeavoured to get up sufficient speed to enable him to carry the train through the tunnel; in this attempt, however, he was not successful. The "Druid" appears on the level line to have attained a speed of from six to eight miles an hour; but that speed rapidly decreased when it reached the ascending gradient leading to the tunnel, and as the train entered the tunnel mouth the carriages were scarcely moving a mile an hour. The fourth train from Chester was then within 70 yards, and the guard of the "Druid's" train signalled to the driver of the other engine to come up and help.

The fourth train from Chester, drawn by No. 16 engine, had started at 7' 15", and, maintaining on the journey the usual speed, had reached Frodsham in the ordinary time, at 7' 41". The station-master at Frodsham delayed this train for two minutes, as the preceding one was still in sight; but when 10 minutes had elapsed from the time of the "Druid's" departure, the station-master, fearing to cause a detention to the great traffic that was to follow, signalled to the driver of No. 16 engine to move on; and the driver at once endeavoured to overtake the "Druid's" train, which was still in sight, and distant about a mile and a quarter, before it should have entered the tunnel. The rain and sleet were still falling, and the rails were wet; but the engine was far more powerful than the "Druid," and it drew a lighter train. On coming near the tunnel mouth the driver found himself within 70 yards of the last carriage of the train before him; but some time being then necessarily consumed in regulating the speed, so as to avoid a concussion when the trains met, the two trains entered the tunnel still 30 yards apart. The time was five minutes to eight. The "Druid" had taken 22 minutes to move somewhat less than two miles; its speed at the tunnel-mouth may be estimated from the statement of the driver of the other engine, that when he overtook it inside the tunnel his own engine was certainly not moving faster than two miles an hour. Both drivers, however, appear to have hoped that the assistance of the second engine would still enable both trains to get through.

For some distance within the Sutton tunnel the trains moved slowly; the driving wheels of No. 16 engine began slipping the moment the trains met, and both the firemen were engaged in sanding the rails, using for that purpose the ballast which, as has already been described, was inferior for that purpose to the cleaner ballast on the line outside. After getting somewhat more than half way through, both trains came absolutely to a stand; the tunnel was full of steam, and perfectly dark; there were no lights in any of the carriages, and the guard of the "Druid's" train was not even provided with a hand-lamp; the guard of the fourth

train, however, had one in his possession, and there was also a tail-light attached to that train.

On finding that he was unable to proceed, the driver of the *Druid* detached the small gauge lamp from his engine, and sent the fireman back with it, to tell the guards to protect the trains, as they could not get on. The fireman went back, but his progress appears to have been slow; the usual way through the middle of the tunnel was blocked up at the time, the other line of rails being under repair, and the sleepers laid bare, and the ballast heaped up irregularly in the interval between the two lines; the fireman made his way along the narrow space which intervened between his carriages and the nearest wall, and as the engines were still striving to move the trains, the man had to take care that he was not caught by the footboards, or other projecting parts of the carriages. About the middle of the fourth train the fireman met the guard who had charge of it, making his way cautiously, with a hand-lamp, along the same narrow passage, to tell the driver that he intended to leave the train to take back a signal; the fireman engaged to deliver the message, and the guard turned back at once; he got past his own carriages, and then, not being so much cramped for room, began to run; ten minutes, however, had then elapsed since the trains entered the tunnel, and the guard had only got back a very short distance, when he heard the noise of another engine approaching; the man's nerves had been very much shaken by the unusual circumstances under which he was called upon to act, and upon hearing the engine apparently quite close to him, while the darkness prevented his seeing anything beyond the influence of his own small lamp, he completely lost his presence of mind, and fell over the ballast in the centre of the tunnel, and lay there while the fifth train passed him, as he himself describes, in such a state of excitement and fear that he was scarcely conscious of anything that occurred.

The fifth train from Chester, drawn by the "*Albert*," had started at half-past seven, and running at the usual speed to Frodsham, had reached that station five minutes before eight; at the same moment the third and fourth trains were entering the Sutton tunnel. The "*Albert*" remained two minutes at Frodsham, and was then started by the station-master, who gave the driver no caution whatever as to the two trains in front. The printed rules of the Company allow trains to pass the stations at intervals of five minutes, and as the "*Druid*" had then been gone twenty-four minutes, and the next train fourteen minutes, the station-master considered that in starting the fifth train no caution was required. No special directions had ever been issued as to the intervals to be allowed between trains passing Frodsham in the direction of the tunnel, and no instructions had been given as to any peculiar precaution to be taken during the race week; there was no officer charged with the safety of the line, to instruct the working staff.

The "*Albert*" entered the tunnel at a high speed. The driver found it unusually full of steam, but attributed that circumstance to the number of trains that had preceded him. There was no one at the tunnel mouth to tell him how long the preceding train had passed; and having received no caution at Frodsham, and fearing that if he delayed he might be overtaken by the train which followed, he thought it incumbent upon him to push on. This driver appears to have been impressed with a strong sense of the risk attendant upon so many trains following one another at such short intervals upon an unguarded line, but he was unwilling to take upon himself the responsibility of stopping the traffic, or of causing a delay which might lead to his own or some other trains being run into from behind.

The "*Albert*," at a high speed, came into violent collision with the last carriages of the fourth train, when it was standing still. Several of the carriages were destroyed, and others, together with the "*Albert*" engine, thrown off the rails. Both lines were completely blocked up; and some parties who wished to reach the tunnel mouth could only get past by climbing over the engine. The extent to which the tunnel was filled up with the debris of the collision may be estimated from the fact, that one of the passengers who was killed, was found suspended *near the roof of the tunnel*, crushed between the fragments of a carriage. A scene of fearful confusion ensued; 1,600 passengers found themselves crowded together in perfect darkness, while some were endeavouring to procure a light from the engines; the noise of another train was heard approaching, and led all parties to dread a second collision.

The sixth train from Chester approached the mouth of the tunnel during the confusion which prevailed within; but, fortunately, an engineer who happened to be travelling in one of the trains, had gone back to the tunnel mouth, and sent on a man, who succeeded in stopping it.

The exact time of the collision was noted by a superintendent of the Manchester police. It was too dark to see anything, but the witness states that he felt by his watch that it was three minutes past eight. The time thus stated agrees as nearly as could be expected with the rest of the evidence.

After the collision, the "Druid" engine, which had come to a stand, with its train, even when assisted by the more powerful engine No. 16, was able to move away unaided, and took all its carriages on to the Moore station. A number of passengers, however, had left the train during the confusion which followed the collision, and made their way out of the tunnel on foot, and the train was thus considerably lightened. The fourth train also moved on with such of the carriages as had not been damaged; the carriages of the fifth train were taken back to Frodsham; most of the sufferers by the collision were sent on to Manchester the same night.

On reviewing all the circumstances of this collision, it appears to me that all the servants of the Company, in any way concerned, acted with a singular absence of all ordinary prudence and discretion:—

The Secretary, instead of directing increased precautions during the race-week, withdrew the two policemen who had been stationed near the Sutton tunnel; and whose presence, though they had no special orders as to that tunnel, might possibly have prevented the collision, by giving information to the driver of the "Albert" of the proximity of the other trains.

The Locomotive Superintendent was endeavouring, according to his own evidence, to work the extraordinary traffic of the Chester race-week with a stock of engines insufficient even for the ordinary business of the line. This officer, too, as well as his assistants, knew so little of the locomotive stock under their charge, that they classed an engine of 15 tons weight as one of 21 tons; and thus started the "Druid" with a train disproportioned to its power. They allowed, also, the open carriages to be loaded with a weight disproportioned to the power of the springs.

The drivers of the "Druid," and of No. 16 engine, acted with extreme imprudence in attempting to get through the Sutton tunnel with the whole of their loads, when it was seen that the "Druid" was so completely overtaken, and they showed themselves regardless of public safety in making the attempt without having previously stationed some one at the tunnel mouth to prevent their being overtaken in the event of their not being able to get on.

The guards of these two trains neglected their duty in not taking steps to protect their trains when they entered a long dark tunnel at so slow a pace, and when it was known that other trains would follow; and the guard of the fourth train, when at length he moved back to give a signal, showed a want of self-possession and firmness which should prevent his ever being employed in a similar capacity again.

The driver of the "Albert," on entering a tunnel which he knew to be unprotected by policemen or signals, and finding it so completely filled with steam, should have checked his speed, and not continued to rush headlong through an atmosphere in which a tail-lamp could only be seen for a few yards.

Finally, the station master at Frodsham acted with great want of judgment in allowing the "Albert" to start without any caution to the driver, although he had seen the great difficulty with which the "Druid" moved its train, and might therefore have foreseen the probability of a delay or stoppage in the tunnel.

But though these servants were thus greatly to blame for the want of prudence and discretion which characterized their proceedings, it appears to me that the chief

responsibility in the present instance rests with the executive committee. They had for some time previous been working their lines with a stock of engines insufficient for the ordinary traffic, and they resolved, without consulting the locomotive superintendent, to attempt to conduct the extraordinary traffic of the Chester race week without making any addition to that stock; they issued advertisements calculated to attract to the Cheshire Junction Line an unusual number of passengers, and they gave unlimited authority to the locomotive superintendent to provide carriages, but left him no discretion as to the number of engines he was to employ. Finally, they allowed the Cheshire Junction Line to remain for a whole month without anyone to direct the conduct of the traffic, or to see that due provision was made for the public safety, and even during the Chester race week, when trains were to follow one another as fast as they became filled, allowed that line to remain unguarded, though they thought it necessary to give orders that the other line from Chester to Birkenhead should be properly watched.

As a contrast to the neglect displayed in the conduct of this Company's business, I would wish to instance here the precautions taken on the Chester Cup day on the London and North-Western Line, from Chester to Crewe: on that day the whole of the platelayers were employed as policemen, and stationed within sight of one another along the whole line from Chester to Crewe, ready to signal any delay or obstruction, and to give every necessary information to the parties who had charge of the trains.

The recommendations which I would wish to make, with a view to prevent the recurrence of a disaster similar to the present, will naturally have suggested themselves from the circumstances mentioned in this Report. I would recommend,—

1st. That the two stations which the Company are already bound, either by agreement or by Act of Parliament to construct, one at either end of the Sutton tunnel, should be at once completed, and that a couple of wires be added to the electric telegraph between them. These wires will enable the staff at either station, to know at all times and in all weathers when any train has passed the other station; and no train should be allowed to enter the tunnel from one station, till it has been ascertained that the preceding train has left the station at the other end.

2dly. That there should be two guards to each passenger train, instead of allowing trains to start, as in the present instance, in charge of a single guard.

3dly. That the locomotive stock, as also the number of passenger carriages, be increased.

4thly. That the Company engage an efficient working staff both of officers and men. The present collision clearly demonstrates that it is a mistake to suppose there is certain economy in endeavouring to conduct a large undertaking with inefficient means.

5thly. That all passenger carriages passing through the Sutton tunnel, either by day or night, be provided with lights inside. These lights might be placed in the carriages at one of the new stations, and might be removed at the other station after the train has got through.

6thly. That the interval of five minutes at which trains are allowed to pass intermediate stations, should be increased considerably, and that intimation should be given to the driver of every train of the time when the preceding train has passed. The interval of five minutes is too small to provide for the safety of trains running at the ordinary speed of 30 to 40 miles an hour; and there is not in the present instance even the excuse of a very great traffic to plead for the existence of such a rule.

I have, &c.

Captain Simmons, R. E.,  
&c. &c. &c.

(signed) R. M. Laffan, R. E.