

SOUTHERN RAILWAY

MINISTRY OF WAR TRANSPORT,
Berkeley Square House,
London, W.1.

28th April, 1945.

Sir,

I have the honour to report for the information of the Minister of War Transport, in accordance with the Order of 31st January, the result of my Inquiry into the accident which occurred at 8.23 p.m. on Sunday, 28th January, at Esher Station on the Western Section main line of the Southern Railway.

The 7.57 p.m. electric train, Waterloo - Portsmouth, travelling under clear signals at about 50 m.p.h. collided with the trailing end of the 7.48 p.m. steam train, Waterloo - Bournemouth, which was gathering speed after having been stopped at the home signal of Esher Station; the relative speed appears to have been about 30 m.p.h.

I regret to state that one passenger was killed, 19 were injured and taken to Hospital, and 8 passengers suffered from minor injuries; all of these were in the electric train. In addition, the driver and guard of the steam train and the guard of the electric train suffered minor injuries.

The steam train consisted of 12 bogie coaches weighing 388 tons; it was drawn by engine No. 785, type 4-6-0 with 8-wheeled tender, weighing 136 tons in working order. The overall length of engine and train was about 800 ft; Buckeye couplings with Pullman vestibules were in use between all coaches except at the leading and trailing ends of the 5th coach, which had ordinary screw couplings.

The electric train consisted of four 2-car units, each consisting of a motor coach and a driving trailer, having a total weight of 301 tons; the leading end of the train was a driving trailer. The motor bogie for each unit had two 275 h.p. motors and the train had a balancing speed of about 55 m.p.h. The coaches had timber framed steel panelled bodies on steel underframes, and the train was fitted with the Westinghouse Brake on all wheels, with a percentage of brake power of 64%.

The couplings between the 2-car units were of the ordinary screw type with side buffers, but the couplings between the two coaches of a unit consisted of a central buffer (with no side buffers) and a tight central 3-link coupling, the 2 cars not being intended to be uncoupled in ordinary traffic working.

As a result of the collision there was damage, of a comparatively minor nature, throughout the length of the steam train, including sole bars and head stocks slightly bent, bodies shifted on underframes, etc; the tail lamp was still alight after the collision.

In the electric train serious damage was concentrated at the trailing end of the first coach and the leading end of the second coach; the underframe of the trailing end of the leading coach had its headstock buckled and forced in for a distance of about 18 ft., the sole bars being crumpled up with it, and the bogie being forced forward about the same distance, the bogie centre pin remaining in its bearing socket on the frame. The central longitudinals throughout the length of the coach were forced forward, distorting all the cross members, including the leading headstock. The underframe of the second coach was undamaged, but the floor of the leading coach rode up on to the floor of the second coach, and the three trailing compartments on the leading coach and the three leading compartments on the second coach were crushed and completely wrecked by the impact, the bodies of the two coaches crushing into one another concertina-wise. In the remainder of the electric train the damage was trifling. The driver's compartment of the driving trailer at the leading end of the train was substantially undamaged and the glass in front was unbroken. No wheels were derailed on either train, nor was any damage caused to the Permanent Way.

After the collision prompt measures were taken to extricate and attend to the injured and to obtain medical assistance. In both trains and in the station there were available emergency tool and First Aid equipments, much of which were used.

Ambulances arrived at 8.50 p.m. and all casualties were cleared by 9.30 p.m. Much assistance was given by Civil Defence Rescue squads and the N.F.S. as well as by troops in the vicinity and members of the Forces travelling on the train.

The weather at the time was clear, with snow on the ground and very cold.

Description

The 4 track main line between Surbiton and Esher runs in a direction roughly East (Waterloo) and West (Woking), the local tracks being on the outside and the through tracks in the centre. It is on bank and there is slight right hand curvature at intervals including the immediate approach to Esher Station. At Hampton Court Junction the Hampton Court branch down line crosses to the North by a flyover bridge, and a short distance further the Cobham branch up line crosses from the South by a flyunder. A diagram indicating relevant signals, crossovers etc., is attached. Gradients are negligible.

Hampton Court Junction box is situated on the South side of the line and contains 37 working levers. This box and its equipment were damaged by enemy action some months ago; all apparatus was overhauled and thoroughly tested after this and no case of failure or trouble has since been reported. The box has an illuminated diagram indicating all relevant track circuits.

There is colour light signalling with automatic control by continuous track circuiting from Waterloo to Hampton Court Junction, the last colour lights being the home signals of this box and the last track circuits ending a short distance beyond the starting signals.

A certain number of the colour light signals are automatics which, after being put to red by the passage of a train, return to yellow as soon as the train has cleared track circuits for the appropriate distance ahead, and to green as soon as the signal ahead has been cleared, but the majority, including the Hampton Court Junction home signals, are manually controlled from a box as well as by track circuits and go to red automatically after the passage of a train; these remain red, after a train has passed by whatever distance, until the signalman has replaced the signal lever and pulled it a second time. There is also rotation locking between the home and starting signals of Hampton Court Junction Box, so that the home signal cannot be pulled a second time until the starting signal has been pulled and replaced.

In this area trains are bell signalled and indicated by train describers.

The Hampton Court Junction down starting signal and signals beyond (as far as Woking) are semaphores and the Sykes Lock and Block system is in use. Beyond the Esher down advanced starting signals are intermediate section signals at Mole, and the Esher signalman can send trains forward as far as these signals without necessarily obtaining acceptance from Walton. Visibility and location of all signals is good.

Esher Station has up and down platforms on the local roads and a central island platform to serve the through roads; all platforms have Verandah roofing for a considerable proportion of their length. Esher East Box is only open for special movements. Esher West Box is on the North side of the line at the West end of the station and has 47 working levers; it is adequately lighted and blackout is provided by removable panels, in some of which apertures are provided for vision. It should be possible for a signalman to see an engine standing at the down home signal 660 yards away, but with difficulty, and he would not notice it unless he was looking for it particularly.

In the operation of the Sykes Lock and Block on this (Western) section of the line the normal position of the miniature semaphore in the Sykes instrument at the sending end is "up". The instructions prescribe that the sending signalman should ask for "Line Clear" by bell in the usual manner, and the receiving signalman, if he is free to do so, should acknowledge by bell and should then remove the switch hook from the plunger which will lower the miniature arm at the sending end. The receiving signalman should then plunge which will change his indicator tablet to "Train On", changing the tablet at the sending end to "Free", at the same time releasing the lock from the starting signal at the sending end.

When the sending signalman sends "Train Entering Section" on the bell the receiving signalman should turn over his switch hook on to the plunger, which will raise the miniature semaphore at the sending end to its "up" position.

Report.

The sequence of down movements past Hampton Court Junction Box immediately prior to the collision appears to have been as follows: (booking of movements is discontinued at this box at 8 p.m. on Sundays).

- (1) 7.30 p.m. Steam, Waterloo - Yeovil, which after stopping at Surbiton platform was crossed over again to the through line and continued thereon passing Walton about 8.13 p.m.
- (2) 7.33 p.m. Slow Electric, Waterloo - Alton, after stopping at Surbiton platform continued therefrom on the local line, stopping at Esher and subsequent stations and stopping at Walton at 8.13 p.m.
- (3) 7.45 p.m. Fast Electric, Waterloo - Portsmouth via Cobham, which passed through Surbiton station on the through line without stopping, and was diverted at Hampton Court Junction to the local line and thence to the Cobham branch. This train had started late from Waterloo and in Surbiton station it passed the 7.48 steam train standing at the platform.
- (4) 7.48 p.m. Steam, Waterloo - Bournemouth, after stopping at Surbiton platform started thence about 8.12 p.m. crossing over again to the through line, and came to a stand at Esher Home signals about 8.18 p.m.
- (5) 1st Light Engine left Surbiton down sidings for Feltham about 8.15 p.m. and proceeded along the local line, passing the Bournemouth train standing at Esher home signal on the through line, and passed Walton about 8.25 p.m.
- (6) 2nd Light Engine, Waterloo - Guildford. This engine had assisted the 7.48 train out of the platform at Waterloo; it came from Waterloo on the through line behind the 7.45 electric, and, after being checked at Surbiton home signal, followed the 7.48 down the through line as far as Hampton Court Junction where it was diverted to the local. It approached Esher just after the collision and was stopped clear by a hand signal from a porter.
- (7) 7.57 p.m. Semi Fast Electric, Waterloo - Portsmouth, stopped at Surbiton platform, and on leaving about 8.20 p.m. was diverted to the through road, next stop being Woking, and continued thereon until it collided with the rear of the 7.48 p.m. steam train in Esher Station.

Driver Potter of the 7.48 p.m. Bournemouth train said that when he stopped at Surbiton platform his starting signal was Red; by the time platform work was completed the starter had changed to yellow, with the diversion light for the crossover to the through line, and he started at about 8.12 p.m. By the time he saw the auto signal and the Hampton Court Junction home signal they were green and he found the Hampton Court Junction starting signal (semaphore) off, with the Esher distant beneath it in the caution position. He drew to a stand at the Esher home signal which was on, and so far as he could recollect the corresponding home signal for the local line was also on.

Potter did not send his fireman to the box as Rule 55 is exempted at this signal, in view of the Lock and Block equipment, but after waiting about two minutes he blew his whistle; about a minute later the signal was lowered and he moved forward and estimated he was travelling about 20 m.p.h. when at about 8.23 p.m. he felt an impact in rear, which he imagined for a moment was due to an enemy rocket. As soon as he brought his train to a stand he sent his fireman back to see if the adjacent road was fouled and to put down detonators.

Motorman Martin of the 7.57 p.m. Portsmouth Electric train said that after stopping at the platform at Surbiton, the starting signal being red, they left, a few minutes late, at about 8.20 p.m. with the starter shewing a yellow aspect and the diversion light for the crossover to the through line; as he approached the auto signal at red it changed to yellow, and to green before he passed it. Thereafter he found the Hampton Court Junction home signal green, and the semaphore starter off, with the Esher distant below it also off.

He estimated that he was running at about 50 m.p.h. approaching Esher when he saw a tail lamp ahead but owing to the curvature thought it was on a train on the local line; approaching more closely he saw the shape of a coach and realised it was on his own line. He made a full brake application, let go of the deadman's handle, and dropped on the floor; he felt the brake take hold before the impact and said that it had been working quite satisfactorily earlier on the journey.

After the collision he informed Signalman King of what had happened and took immediate steps to warn passengers alighting about keeping clear of the live rail, thereafter arranging for current to be switched off; the circuit breakers feeding the down through line opened automatically three times and were therefore left open, but those feeding the down local were reclosed after tripping once and were opened on request from Esher at 8.40 p.m.

Driver Dodd of the first light engine saw the Bournemouth train pass him on the through line before he left the Surbiton down sidings by the local line; he passed his auto signal at yellow and saw his Hampton Court Junction home signal change from yellow to green as he approached it. The Hampton Court Junction local line starter and Esher distant beneath it were both off when he first saw them; he was under the impression that the corresponding signals for the through road were on at this time. He then passed the Bournemouth train standing at the Esher through home signal which was on, as was also the Esher starter on the through road; he noticed the Walton Down through home signal come off as he approached Walton.

Driver Hankin of the second light engine, coming down on the through line from Waterloo, found the Surbiton home signal red, but it changed to yellow just before he reached it, as did also the Surbiton down through starter; he found the auto signal at yellow and the Hampton Court Junction home signal was red when first seen, but it came off to yellow with the diversion sign for the local line just before he reached it. The Hampton Court Junction local starting signal came off before he reached it, and immediately afterwards the starter for the through line came off and then the Esher distant on the through line; his Esher Home signal was on when he first saw it and he was preparing to stop when this signal came off. The 7.57 electric passed him at 45 to 50 m.p.h. on the through road between Hampton Court Junction starter and Esher home, and he was stopped just as he entered the platform at Esher by a hand signal from one of the station staff.

Signalman Merritt of Hampton Court Junction Box said that he asked for Line Clear from Esher for the 7.48 p.m. Bournemouth and for the (first) Light Engine, Surbiton - Feltham, on through and local lines respectively, at practically the same moment; he got "Line Clear" for both at the same time and pulled off his signals accordingly. Train and Light Engine passed his box at practically the same time, about 8.16 p.m.

Immediately after this Merritt saw on his train describer the 7.57 p.m. Electric on the local line and the (second) Light Engine, Waterloo - Guildford, on the through line; he spoke to Signalman Sherlock at Surbiton, reminding him that the 7.57 was booked fast along the through line on Sundays, and said that he (Merritt) intended to cross the (second) Light Engine (which was at this time running slowly on the through line between Surbiton and Hampton Court Junction) to the local line at his own crossover. Sherlock agreed, cancelled the Electric off the local line describer, and redescribed on the through line, setting his crossover, platform line to through, accordingly. Merritt said there was no question of a last minute change of route for any movement beyond his box, and the reports from the various drivers of the signal aspects seen by them conform to what would be expected in the normal working of the movements concerned.

While Merritt was either on the telephone or replacing his crossover behind the second Light Engine, he heard "Out of Section" bell signals from Esher, for both through and local lines, and almost immediately after this he asked Esher for "Line Clear" on both through and local lines for the 7.57 p.m. Electric and the (second) Light Engine respectively. Esher gave "Line Clear" and Merritt lowered his signals accordingly.

Signalman King of Esher West Box said that after the 7.30 p.m. train to Yeovil had passed on the down through line and he had given "Out of Section" for it to Hampton Court Junction about 8.10 p.m., the next signal on that line was at 8.20 p.m. when he was asked "Is line clear" for (as he assumed) the 7.48 to Bournemouth.

In the meantime on the local line after the 7.33 p.m. Electric had passed about 8.8 p.m., he had been asked for "Line Clear" for the first Light Engine at 8.14 p.m., this passing and "Out of section" being given to Hampton Court Junction at 8.20 p.m; immediately thereafter he was asked for "Line Clear" on the local for the second Light Engine, at practically the same moment as he was asked for "Line Clear" on the through line for the Bournemouth train.

King said that he accepted both train and Light Engine, plunged for them, and received "Entering Section" for both of them almost immediately, the Light Engine on the local being a moment earlier than the train; he obtained "Line Clear" from Walton for the train about 8.22 and lowered his signals accordingly, giving "Entering Section" to Walton at 8.23. He could not ask for "Line Clear" from Walton for the second light engine as he had not at that time had "Out of Section" for the first light engine.

King was emphatic that he did not use the emergency release key on his Sykes instrument and was quite satisfied that all the working was regular and in order; he was also emphatic that he had not been asked for Line Clear or plunged for the through line at the same time as for the first light Engine on the local line, in fact there had been no signals on the through line after the Yeovil train until about 8.20 p.m.

Conclusion

It is clear that Signalman King was in ignorance of the fact that the Bournemouth train had arrived and was standing at his home signal, and that when he lowered this signal (and the Bournemouth train started again) he was under the impression that he was lowering it for a train which had just been accepted from Hampton Court Junction; this train he assumed to be the Bournemouth but was actually the 7.57 Electric. In other words, by some means these two trains had got into the one block section. With the normal working of the Lock and Block system, and obedience to signals on the part of drivers, such conjunction of two trains in section is impossible except through (a) failure of apparatus or (b) use of release key. There is no suggestion of failure of apparatus in this case and it was found to be fully in order immediately afterwards. The circuits for down through and down local lines are taken along overhead wires on opposite sides of the track and their insulation resistance was tested and found satisfactory. I think therefore, that despite his denials King must have used the release key, though it may well be that he had no definite recollection of having done so.

But apart from the security which should have been afforded by the Lock and Block equipment, a further measure of protection should have been given by the bell signals, in that Signalman Merritt is not permitted to ask for "Line Clear" for a second train until he has had "Out of Section" for the preceding one. It is reasonably certain that King never sent "Out of Section" for the Bournemouth train, and I think it is probable that when Merritt got "Out of Section" for the 1st Light Engine on the local line, he mistakenly thought he had had it on both local and through lines. Equally King must have missed the "Entering section" bell signal for the Bournemouth train, and this is to some extent supported by Merritt's statement that his miniature semaphore did not go "up" immediately he gave entering section for this train, though he says he saw it up shortly afterwards. (The Regulations prescribe that on receiving "Entering section" King should turn over the Switch Hook of his Sykes instrument, which would raise the miniature semaphore in Merritt's instrument).

I have considered the possibility that the use of the release key by King might have taken place earlier, and legitimately, as the result of a last minute change of route of a previous movement, when King might thus have restored his instrument to normal, but Merritt might have failed to re-engage the lock of his instrument, (as is prescribed in case of such emergency use of the release key by the signalman ahead), with the result that he was in a position to lower his

starting signal without the necessity of its being released by a second plunge from King. In some ways this would be a more plausible explanation but there is no evidence to support it; moreover, this theory also implies omission or misreading of bell signals as does the former explanation.

In accordance with the regular week-end change of shifts King had been on duty from 10 p.m. Saturday to 6 a.m. Sunday, and came on duty again at 2 p.m. Sunday to work till 10 p.m; between 6 a.m. and 2 p.m. he cycled to his home near Feltham, the journey taking him almost an hour each way. The weather was exceptionally cold and there was snow on the ground, so it seems probable that these two journeys were more than usually tiring. King stated that at the time of the accident he was feeling quite fit, he had had some tea earlier, and his box was warm; I cannot but think however, that the above abnormal conditions might well have made him much more tired than he realised, and possibly also the box was unduly warm.

I think he was working mechanically and without much thought, and that he did plunge for the Bournemouth train, but failed to notice, or did not receive, "Entering Section" for it; that subsequently, when offered the 7.57 he saw his Sykes instrument for the through line at "Train On", but the switch hook not over, and, knowing that a light engine had just passed on the local line, thought he must have accepted on both lines in error. I think he then used his key hastily to release his instrument without any proper investigation of the conditions of the block section. It is surprising also that he failed to hear the whistle which Driver Potter of the Bournemouth train sounded after a couple of minutes waiting at the signal. There was only one train in the up direction around the time in question which passed Esher about 8.23.

Although primary responsibility must rest with King, I do not think that Merritt can be absolved of all blame, in that I feel sure that he could not have had "Out of Section" for the Bournemouth train and therefore was not entitled to ask for "Line Clear" for the following train; as noted above this may have been due to misreading of the bell signal on one road as being two signals for both roads. I think it is reasonably certain that confusion between simultaneous movements on the two down lines had some considerable bearing on the accident.

Signalman King is 43 years old with 29 years Railway service, 14 years as signalman, and at Esher since 1938; he has a clear record.

Signalman Merritt is 53 years old with 33 years Railway service, 22 years as signalman, and 1 year at Hampton Court Junction; he has a good record, with a commendation for remaining at his post to ensure the safety of traffic when suffering from shock as the result of an enemy missile falling in the immediate vicinity and causing serious damage to the track and to his signal cabin.

I do not think any blame should be attributed to Motorman Martin of the Electric train, who was running under clear signals, and was hindered from earlier realisation of the presence of the train ahead by curvature of the line and the station buildings.

Recommendations and Remarks.

Attention has been drawn in previous reports to the fact that the provision of a release key is unavoidable with the Sykes Lock and Block system and it is needless to enlarge on this again.

Any arrangement for a weekly change of hours among three men working 8 hour shifts must involve two turns of duty in close succession; the arrangement in force in this case is a common one and gives each signalman two weekends of long hours of duty and then a 48 hour spell off duty in the third weekend. I understand that signalmen usually prefer this arrangement for change of shifts, and I do not think hours of duty would have had any bearing on this case, but for the unlucky combination of two attendant circumstances viz:- the distance King had to cycle to and from his home, and the exceptionally severe weather conditions prevalent on that day.

The colour light signalling, with continuous track circuiting, installed between Waterloo and Hampton Court Junction covers the portion of this main line carrying the heaviest traffic, as, by the time Hampton Court Junction is passed, the heavy suburban services of the Epsom, Kingston, Cobham and Hampton Court branches have all been eliminated. Nevertheless pressure of traffic continuing on the 4-track line as far as Woking remains considerable, especially at weekday peak hours. Colour light signalling has been installed at Woking, and I understand that, but for the war, it is probable that such signalling and continuous track circuiting would have been in hand, to cover the gap between Hampton Court Junction and Woking, before this date. I think this work is one which deserves a high place among the signalling schemes to be put in hand after the war. The advantage lies not only in security of operation, in respect of which the Sykes Lock and Block, if properly operated, is in no way open to criticism, but in reduced pressure on signalmen, and above all a very substantial improvement of conditions for drivers, particularly in fog.

I understand that, in the meantime, the Company are providing track circuits in rear of the Esher down home signals, on both through and local tracks, occupation of which will lock the block.

The collapse of the trailing end of the underframe of the leading coach of the electric train was an unusual feature which invited consideration of the design and strength of the underframe in relation to the stresses imposed by such collision. The fact that impact is taken at the leading end on side buffers, while at the trailing end it has to be transferred to a centre buffer, involves a triangulated framework at the trailing end, consisting of two raking struts between centre buffer and sole bars, with a tie bar, actually 2 steel flats of 3 ins. by $\frac{1}{2}$ in. across the base of the triangle; owing to the proximity of the wheels, the two struts have necessarily to be set at a rather flatter angle than would be chosen if a designer had a free hand, with the result that the tensile stress in the tie bars must be high in the case of any severe impact, and the holes drilled for countersunk rivets reduce the net area available by almost one half.

In my opinion the primary failure is likely to have occurred in these tie bars, with the inevitable result that the struts forced the sole bars outwards, thus immediately weakening the whole of the trailing end of the underframe structure in a manner which led to the general collapse which occurred.

The matter was discussed with the Chief Mechanical Engineer, with particular reference to the Company's experience in certain previous cases of collision with this type of underframe, of which they have had a considerable number in service for almost 20 years, and it appears that in no case of collision has similar weakness been indicated; the leading end of the second coach, on which the effect of the impact must have been equal, has a flat bearing plate in place of the buffer, but is otherwise of similar triangulated construction, and this suffered no damage or even distortion.

The desirability of an increase in cross section of the tie bars of the end triangulation was discussed; there are too many uncertain factors to be able to make any useful calculation of the tensile stress developed in the tie bars as the result of such an impact, but I think that the distortion caused to all the cross members the whole length of the underframe, is evidence that the stresses of impact were distributed over the whole structure of the underframe. Indeed, the structural conditions generally are not dissimilar to those of coaches fitted with the Buckeye coupling, the behaviour of which in collision or derailment is as a rule distinctly satisfactory.

Notwithstanding these facts, I have a feeling that a greater margin of strength in the tie bars would have reduced the extent of the collapse of the leading coach underframe, and although the results of this one collision may not justify a definite recommendation to increase the cross section of these tie bars on existing stock, I think the Company should look into the matter further with a view to some improvement of design in this respect.

I have the honour to be
Sir,
Your obedient Servant,

A. C. TRENCH
Colonel.

The Director General,
Ministry of War Transport.

SOUTHERN RAILWAY

COLLISION AT ESHER 28TH JANUARY, 1945.

Not to Scale

