

MINISTRY OF TRANSPORT

# **RAILWAY ACCIDENTS**

REPORT ON THE COLLISION which occurred on the 24th October, 1947, near SOUTH CROYDON JUNCTION on the Southern Railway

LONDON : HIS MAJESTY'S STATIONERY OFFICE

1948

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# MINISTRY OF TRANSPORT, Berkeley Square House, Berkeley Square, W.1.

18th December, 1947.

Sir,

I have the honour to report for the information of the Minister of Transport, in accordance with the Order of 24th October, 1947, the result of my Inquiry, at which I was assisted by Brigadier C. A. Langley, into the collision which occurred in dense fog at about 8.37 a.m. on that date near South Croydon Junction on the Central Section of the Southern Railway.

The 8.4 a.m. electric passenger train, Tattenham Corner to London Bridge, running on the Up Main line, was improperly allowed to approach and pass through Purley Oaks under clear signals, and came into violent collision with the rear of the 7.33 a.m. electric passenger train, Haywards Heath to London Bridge, which was passing South Croydon Junction Home signal at slow speed after having been checked by the Distant at Caution.

The accident occurred at the height of the peak morning traffic, and both trains were overcrowded, with passengers standing in the compartments. It is estimated that the Haywards Heath train was carrying 800 and the Tattenham Corner train 1,000, seating accommodation being for 536 and 750 respectively. I regret to report that 31 passengers lost their lives, of whom one died after admission to hospital, whilst the motorman of the Tattenham Corner train was also killed; 183 passengers suffered injuries or complained of shock, of whom 58 were taken to hospital, 41 being detained. The majority of the casualties were sustained in the leading coacb of the second train.

As a result of short circuit, the breakers at Purley Sub-Station and South Croydon Track Paralleling Hut opened, and power was cut off immediately from the Up and Down Main and Down Local lines. It was shut off from the Up Local at 8.52 a.m. on the request of the South Croydon Stationmaster, who arrived on the scene a few minutes after the collision. There are no grounds for considering that any passengers suffered from electric shock as a result of the accident.

Relief work was carried out very efficiently, an immediate call having been sent to the police and fire brigade. The first ambulance arrived at about 8.40 a.m. followed by many others from Croydon, Wallington, Beckenham, Purley and the L.C.C. Casualty Service Section, and all the injured passengers were removed to hospital by 9.40 a.m. Police, firemen, doctors, nurses, the Company's staff trained in first aid, and the inhabitants of Sussex Road rendered most valuable assistance. Six sets of emergency first aid equipment were available on the two trains, and three were used.

Clearance of the lines was effected expeditiously; the Up Local was opened three hours after the accident, and the Down Local was cleared by 4.0 p.m., in time for the evening business traffic. The Up and Down Main lines were finally cleared and normal working was resumed at 10.30 a.m. on 25th October.

The Haywards Heath train consisted of two 2-car sets from Haywards Heath and one 4-car set attached at Redhill, totalling 8 coaches with 6 motor units. The length was 516 feet over buffers, and the total loaded weight about 350 tons. Westinghouse brakes operated on non-ferrous brake blocks throughout the train, and efficiency (unloaded) was 65.5 per cent. The coaches were of composite construction, timber framing and steel panelling on steel underframes, having been built in 1932.

The Tattenham Corner train consisted of two 3-car sets from Tattenham, and one 3-car set from Caterham which was attached at Purley, totalling 9 coaches with 6 motor units. The length was 580 feet 9 inches over buffers, and the total loaded weight about 400 tons. The Westinghouse brake operated on cast iron blocks throughout the train, the efficiency of which (unloaded) was 79 per cent. The coaches were of timber construction on steel underframes, with the motor cabs faced with steel panelling. They were originally built in 1921 and adapted for present service in 1930.

The impact was severe and the leading buffers of the Tattenham Corner train underrode the rear buffers of the Haywards Heath train. Both rails were buckled, probably by the action of the leading bogie of the overtaking train, which was derailed and tore up the track for 120 yards. The Down Main was also destroyed for 40 yards and debris was thrown across the local lines.

The rear coach of the Haywards Heath train was thrown off its bogies and turned on its side, causing the body to break away from the frame; the van and rear motorman's cab of the train were shattered. The rear of the next coach was also damaged but it was not derailed.

As regards the Tattenham Corner train, the body of the leading coach, except the last two compartments, was swept away. The underframe was badly buckled and twisted, and the motorman's control gear and cab equipment were torn away and thrown on the track about 50 yards from the point of collision. The second, third and fourth coaches were derailed owing to the track disturbance, but were not seriously damaged.

It was misty in the early morning but by the time of the accident visibility had deteriorated to about 50 yards, on account of fog.

#### DESCRIPTION

The site of the collision was 367 yards south of South Croydon Junction signal box on the Up Main from Brighton to Victoria. At this point the line runs from south to north with four tracks designated Down Main, Up Main, Down Local, Up Local in that order from east to west. The gradient is falling 1 in 263 from Coulsdon North to South Croydon. Curvature is easy on a radius of 95 chains left-handed, over a mile in length, through Purley Oaks Station, up to a point 270 yards in rear of the collision, where formation is on bank. The general layout is shown on the accompanying plan : the stations and signal boxes referred to hereafter are as follows in order from the south :—

Coulsdon North Box, where trains are described to Purley North and South Croydon Junction.

**Purley Station,** where there is an additional pair of tracks on the east side to accommodate trains from Tattenham Corner and Caterham which join the Main line here.

**Purley North Box,** which controls movements at the north end of Purley Station.

- **Purley Oaks Box** (a block post with no connections) where the signalman in charge erroneously accepted the Tattenham Corner train while the Haywards Heath train was standing in the station.
- Purley Oaks Station, where the Haywards Heath train stood for 6 to 7 minutes, awaiting the lowering of the starting signal.
- South Croydon Junction Box, where the branch line from Oxted, with connections from East Grinstead and Tunbridge Wells, joins the Main line on the east side.

#### South Croydon Station.

Signalling.—The system of signalling in use is Sykes' Lock-and-Block of which a brief account is given in Appendix A. The mode of signalling on the Central Section is described in Appendix B. Signals and points are worked manually by the operation of levers mechanically interlocked in the normal manner.

Purley Oaks signal box is on the east side of the line, set back 50 feet from the Down Main and 170 yards in rear of the south end of Purley Oaks Up Main platform. The frame contains 56 levers, of which 13 only are working. The box is used as an intermediate block post between Purley North and South Croydon Junction, and is open daily from 6 a.m. to midnight. A diagram of the instrument shelf and a sketch showing the position of the signals and treadles is attached. The positions of the release keys (A) and (B) for use with the Up and Down instruments respectively are indicated, and copies of the Instructions regarding their use and a special warning issued in July, 1946, are attached as Appendices C and D.

Trains are described on Walker's type transmitters from Coulsdon North to Purley North and South Croydon Junction, but not to Purley Oaks. Passenger trains on the Up Main from Coulsdon and beyond are offered forward by giving the "Is-Line-Clear" bell signal 3 pause 1. The Tattenham Corner and Caterham trains, which join the Main line at Purley North, cannot be described on the Walker transmitters, and are therefore offered by giving the special "Is-Line-Clear" bell signal 3 pause 3 pause 1. Owing to the intensive working and the interlacing of the Tattenham Corner trains into the flow of traffic through Purley North, incorrect description of trains sometimes occurs, and the special hell signal 5 pause 3 is used to call attention to this prior to transmitting the correct signal.

At South Croydon, the Up Main signals are only 276 yards in rear of the converging junction ; consequently, when a train has been accepted from Oxted, Up Main line trains from Purley Oaks are allowed to approach in clear weather only, in accordance with Block Regulation No. 5, "Section Clear, but Station or Junction Blocked." When this arrangement is in force, Block Instrument No. 19 in Purley Oaks box remains locked, but Warning Instrument No. 20 is changed from "Locked" to "Free" by operation of the special plunger in South Croydon Junction box. Purley Oaks signalman is then able to reverse Warning Signal No. 20 which he should not do until the train has been brought nearly to a stand. During peak traffic in clear weather, many trains are sent forward under the authority of this regulation ; but in foggy weather, its use is prohibited, and under these conditions Main line trains may be delayed for several minutes at Purley Oaks when Up Oxted trains are accepted by South Croydon Junction.

## **REPORT AND EVIDENCE**

1. Owing to deterioration in the weather, the fogmen had been called out before dawn on 24th October, and by 8 a.m. all were in position at Purley Oaks, South Croydon Junction and South Croydon Station Up Main and Local Distant signals. Estimates of visibility varied in different places from 200 yards at Purley North to between 20 and 100 yards at South Croydon. At Purley Oaks the estimates of different witnesses varied from 20 to 170 yards.

2. Motorman A. Clack, of the Haywards Heath train, stated that on approaching Purley Oaks Station, the Distant signal was at Caution and he brought his train to a stand at Starting signal No. 19 which was at Danger. He thought he remained there for 7 or 8 minutes and then the signal was lowered and he proceeded forward. He had whistled on passing the Home signal near the box, but was exempt from carrying out Rule 55, having regard to the protection afforded by the Lock-and-Block system. The South Croydon Junction Distant signal was at Caution and a detonator was exploded there. The next signals, viz. the Junction Home, with South Croydon Station Distant under it (seen at a range

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of probably 60 to 100 yards) were both "Off", and he therefore released the brake and opened his controller. He judged that he had increased speed from about 12 to 20 m.p.h., when the collision occurred, his driving cab being about 3 coach lengths on the London side of these signals. Marks, however, on the track indicated that the cab could have been only one coach length past the signals and the speed of the train may have been less than Clack's estimate. He judged that visibility was about a train length (170 yards) at Purley Oaks. (The rear of the train was some 190 yards from the signal box).

Guard W. C. Waters, who was travelling in the brake van at the rear of this train, generally confirmed this evidence, but considered that visibility at Purley Oaks was much worse than Clack had estimated, namely, no more than 60 yards. The train, which left Coulsdon South moderately well loaded, became crowded with passengers when waiting at Purley Oaks platform. On leaving, speed was low, about 12 m.p.h., and the fog was so thick that Waters did not see the South Croydon Junction Distant signal ; nor did he hear the detonator explode. Shortly afterwards there was a very heavy impact from the rear, and he was thrown into the right-hand corner of his brake van, from which he was most fortunate to escape with only minor injuries—his compartment was completely shattered.

3. Acting Guard A. F. Sims, of the Tattenham Corner train, said that it arrived two minutes late at Purley Station, where the Caterham portion was attached in the rear. A large number of passengers got in and the train was crowded when it started at 8.35 a.m. Visibility was restricted to about 30 yards, but improved a little when they passed through Purley Oaks, at a speed of 20 to 25 m.p.h. He noticed a fogman at the side of the track, but he could not recognise the signal he was displaying, nor was he certain at which signal he was working. Almost immediately afterwards, he felt the shock of collision. There was a great deal of noise as if a weight was being pulled along the rails, followed by a thump which threw him forward. He thought that-the brakes must have been applied before the collision took place. They had been tested after coupling up the Caterham portion at Purley, when the train pipe pressure was between 60 and 75 lbs. per square inch.

Motorman H. Goldsmith, of the Tattenham Corner train, was unfortunately killed at his post, and the control gear and cab equipment were so damaged by the collision that it was not possible to tell whether he had had time to apply his brakes.

4. Lengthman J. Langridge took up his position at South Croydon Junction Up Main and Local Distants fogging post, at about 7.45 a.m. The fog was thick at the time of the accident and he estimated that visibility was 20 to 30 yards. When the Haywards Heath train passed the Distant was at Caution, and Langridge exhibited a yellow hand-signal and heard the train explode a detonator. Some  $1\frac{1}{2}$  to 2 minutes later, the Distant was lowered and the Tattenham Corner train passed about half a minute afterwards at a speed considerably higher than that of the Haywards Heath train, he thought at about 40 m.p.h.

Lengthman L. Tipper was on fogging duty at South Croydon Station Distants, which are carried under the South Croydon Junction Home signals. He thought that visibility was only 20 yards immediately before the accident. The Distant was "Off" for the Haywards Heath train which approached at a speed of about 15 m.p.h. Immediately the front of the train passed, he heard the noise of the collision.

5. Signalman B. Neary, of Purley North box, stated that at 8.23 a.m. he offered the Haywards Heath train to Porter Signalman H. D. Hillier of Purley Oaks box, who accepted it at once. Neary transmitted the "Entering-Section" signal at 8.27 a.m. and expected to receive "Out-of-Section" from Hillier one or two minutes later. In the meantime, the Tattenham Corner train had arrived at Purley North and the Caterham section had been attached in rear, whilst at 8.33 a.m. a passenger train from Ore was described from Coulsdon South. Neary had to decide which of these two should be given precedence on the Up Main after the Haywards Heath train, and, not having received "Out-of-Section" from Hillier, he spoke to him and asked "*How he was looking on the Up Main.*" The only reply he received was "*Gor Blimey*," and then the telephone receiver was replaced. Neary could not make anything of this, but a few seconds later he received from Hillier the "Out-of-Section" signal and thereupon decided to give precedence to the Tattenham Corner train which he offered on the special code 3—3—1. Hillier immediately accepted it correctly, whereupon Neary changed the road and lowered his signals for this train which left the station at 8.34 a.m.

Neary was a good witness, aged 53, with 38 years' service, of which 33 had been spent in his present capacity, the last 6 at Purley North. He explained that he spoke to Hillier in a friendly manner; he knew he was a porter-signalman who had recently returned from the Army. He wanted to avoid making him feel "uncomfortable by saying anything about delaying the 'Out-of-Section' signal, as this would have been inclined to put the man off his balance." He knew Hillier well, and had "never worked with a better porter-signalman." As regards Hillier's experience, he suggested that he should have graduated through a lower class box "because it did seem in a way unfair to put a porter-signalman with a few weeks' experience out on the Main line."

6. Porter-Signalman Hillier's tour of duty at Purley Oaks was from 6 a.m. to 3 p.m. When he opened the box at 5.58 a.m. the weather was foggy, but he could see the near end of the platform awning about 200 yards away. Fogmen had been called out and arrived at his Up Distant signals at 7.20 a.m. Weather conditions deteriorated, and by 8.30 a.m., the fog had become so dense that he could no longer see the station or platforms.

A train register book is not kept at this box, and Hillier could not recollect the train from Littlehampton which preceded that from Haywards Heath. He remembered, however, accepting the latter, but, as he did not receive "Line-Clear" from South Croydon Junction and was unable to lower Starting signal No. 19, he brought the train nearly to a stand at Home signal No. 18 before allowing it into the station up to the Starter. Owing to the fog, he could not see the train after it had passed him, and whilst it was standing at the piatform. In consequence, he forgot it, and, when a few minutes later Neary spoke to him, he glanced at his Home signal instrument No. 18, and, seeing the upper tablet was showing "Locked" and the lower "Blank," he jumped to the conclusion that it had failed.

Hillier referred to previous failures (see para. 10) and, without waiting to think, he used the release key to reset the instrument. "I just turned round (from the telephone) and looked at the instruments and thought I had stopped something, and immediately freed the instrument .... at this time No. 19 Starting signal was section locked." He then transmitted the "Out-of-Section" signal to Purley North and accepted the Tattenham Corner train on the 3—3—1 bell code immediately it was offered to him by Neary a few moments later. Shortly afterwards, at about 8.35 a.m., South Croydon Junction accepted the Haywards Heath train on the bell code 3—1 and plunged, thus freeing Starting signal No. 19. Hillier did not appreciate that this acceptance related to the Haywards Heath train and lowered his Up Main Home, Starting and Distant signals for the Tattenham Corner train, which he had never offered forward to South Croydon Junction.

As a result, the Haywards Heath train, which had then been standing in Purley Oaks station for 6 to 7 minutes, moved forward and operated Treadle F, which changed instrument 19 from "Locked" to "Free." Hillier noticed this and thought at first that platelayers had struck the treadle, thus freeing the instrument, but realising it was too foggy for them to be working, he assumed that the rod had simply fallen through, so he lifted it and replaced the tablet to "Locked" without returning the signal to danger. In the meantime, the Tattenham Corner train was approaching and ran through Purley Oaks under clear signals. Hillier saw the headcode as the train passed and realising that it was from Tattenham Corner, while South Croydon Junction had accepted the train on bell code 3—1, he rang up Signalman Walder and told him that a branch train was coming, to which Walder replied "All right."

In effect, Hillier's explanation for falsely assuming the failure of his instrument was that he had overlooked the Haywards Heath train (obscured by fog) having regard to the heavy pressure of traffic. In one hour, 13 trains are booked on the Up Main, 12 on the Up Local, with 13 on the Down lines, a total of 38 trains, for which that number of plunges are required and 90 to 100 bells, besides the pulling and replacing of the signal levers for each. As to his competence, he said "*in the normal way, I was at home in that box*": but on this occasion "*I could not see further than the other side of the tracks, looking directly out.*" He added that while he usually made use of the Switch Hook, "*I do not know whether I actually did this time*" when acknowledging the "Entering-Section" signal for the Haywards Heath train ; "*It is quite possible that in offering the train to South Croydon, I may have been at the other end of the frame and ringing on bells far away from the instrument … I am afraid I must have overlooked it (the switch hook)."* Hillier said that he had not heen worried previously and had nothing on his mind; his health had been good and he finished duty at 3.0 p.m. on the previous day.

7. Signalman E. Walder, like Signalman Neary, is a man of long experience and has been at South Croydon Junction for 11 years, with a total service in this capacity of 35 years. He said he had been offered a train from Tunbridge Wells by Selsdon (on the Oxted Branch) at 8.21 a.m., but he did not accept it at first because he was not expecting it to arrive for several minutes and he wished to keep his Junction working clear for as long as possible, especially as he could not accept Main Line trains under the Warning Arrangement on account of the fog. He had had the Littlehampton train described on the Up Main at 8.17 a.m., and he therefore accepted it when offered by Hillier at 8.23 a.m.; it passed the station box at  $8.27\frac{1}{2}$  a.m.

In the meantime, the Haywards Heath train had been described at 8.24 a.m. and Hillier offered it on the 3--1 code at  $8.26\frac{1}{2}$  a.m. Walder, however, did not accept this train, as he decided to work to the booked order and accepted the Tunbridge Wells train instead at 8.29 a.m., after he had received "Line-Clear" for it from South Croydon Station. The latter passed his box at about 8.32 a.m. and when South Croydon Station cleared the block at 8.35 a.m., Walder accepted the Haywards Heath train, which, as previously noted, Hillier had offered  $8\frac{1}{2}$  minutes earlier. Walder did not, however, consider that there had been undue delay because the working of trains through the Junction was always interfered with during fog. Walder lowered his Up Main Home, but he thought it was two or three minutes before he was able to lower his Distant which is controlled by South Croydon Station Box. At 8.36 a.m. he received the "Entering-Section" bell signal, and a few moments later Hillier told him that the Tattenham Corner train was approaching on the Main Line. Walder did not comment on this because it was not unusual for the order of running to be altered. About a minute afterwards, however, he heard the noise of the collision and took immediate steps to block all lines and put all his signals to Danger. He inquired from Hillier whether the Tattenham Corner train had passed signals at Danger and Hillier replied "*No, it was all my fault.*"

8. Signalman Hillier is 29 years old and has been in the Company's service for 11 years, of which he spent over five in the Army, including three as a prisoner of war after capture at Tobruk. He rejoined the Company in May, 1946, and having first been employed as a leading shunter and then as an acting ticket collector, he applied in March, 1947, for the appointment of Porter-Signalman at Purley Oaks and was accepted. He commenced training at once, and after four weeks he was tested

and passed by Inspector E. G. Akehurst on 12th May. After another week as second man, he took over full charge, working a shift from 6 a.m. to 3 p.m. and 3 p.m. to midnight on alternate weeks for four weeks whilst the two regular signalmen went on a fortnight's holiday in turn. He then reverted to his normal duty of Porter at Purley from 8 a.m. to 2 p.m. and Signalman at Purley Oaks from 2 p.m. to 4 p.m. Five weeks before the accident he again resumed full-time duty as signalman, in place of Signalman Beadle, who was ill. He had thus had nine weeks' previous experience of heavy traffic, including the morning and evening peaks, and 14 weeks of normal duty, involving two hours per day in the signal box during the slack period. He had also performed Sunday duty as a signalman on nine occasions. Prior to the morning of the accident, he had not had any experience of working a signal box in fog.

9. Inspector Akeliurst, an ex-signalman who has 32 years' service, for the last nine in his present capacity, had recommended Hillier for training as a signalman after being asked by his Divisional Superintendent whether he could do so. Akehurst considered him to be "*perfectly suitable*" and a man above the average. He was quite confident that Hillier was competent to take full charge after he had tested him on 12th May. During the test, he watched him working the frame and instruments for an hour or so, and then gave him the usual examination in Rules and Regulations. Akehurst said that failures of apparatus were discussed and how to deal with them. He made a particular point of impressing on Hillier the care to be exercised in using the release key. For instance, he told him "to treat it as a red hot poker and handle it as such."

Akchurst did not agree that the appointment was a mistake, and he had been impressed with Hillier's "steady manner." He was "quite prepared to accept him as a signalman to work any turn in the box at any time," and he considered that Hillier fully understood his duties. He pointed out that "it is left to the man to decide when he is ready to take over" as a signalman, and that no man is examined and passed unless he has expressed his willingness. The previous failures of equipment should not have influenced Hillier; nor would a train register necessarily have acted as a reminder. He did not feel that the fog or telephone messages should have put Hillier "off his balance"; but that "he was prompted by the signalman at Purley that he was delaying traffic, which caused him to take the action he did on the spur of the moment."

On three occasions during the week of the accident, apparatus at Purley Oaks had failed 10. while Hillier was on duty. On Monday, 20th October, Down Main Treadle D only reacted intermittently to the passage of trains and did not free instrument No. 36, so that Hillier had to use the key to release the backlock on this starting signal lever. Assistant Lineman Daniels attended to the treadle and set it somewhat finer. On Thursday morning, 23rd October, the same treadle failed again, due to being set too fine. It operated, in fact, as the result of vibration, probably caused by trains passing on adjoining tracks, and thus released the backlock incorrectly, allowing the instrument to change 10 "Free" when it should have remained at "Locked"-a danger-side failure. This was attended to, but on the morning of the accident, Down Local Treadle B failed to release instrument No. 40 after the passage of a train. Hillier took correct action in this case, and did not clear the block to South Croydon Junction until he received the "Out-of-Section" signal from Purley North. In connection with the reporting of these incidents, he stated that failure forms exist but are not used for treadle failures (which are entered in a book provided for the purpose). He had used one form since he had been in the box for a failure of rotation locking between Home and Starter; but he could not remember the circumstances or date.

Hillier's usual procedure was to telephone (eight rings) to the Lineman on duty (one of three); most of the failures in his experience were on the safety side, preventing the release of backlocks. Inspector Akehurst thought that one such failure actually occurred on 12th May when he was examining Hillier in the box; but from what he had heard generally from the 200 signalmen under him, he was of opinion that the incidence of these failures was not worse than pre-war, and that the three cases mentioned above were coincidence. Mr. Boucher, the Assistant Engineer for Signals and Telegraphs, also thought that they were exceptional in such a short period, and said that the whole equipment had been overhauled between 15th April and 18th May this year. It appeared, however, that he was not being invariably informed of such incidents, though Inspector A. F. Kadwell reported that, since the overhaul, the Lineman's attention had been called to two failures of apparatus on the Local lines, but to none on the Main lines.

## CONCLUSION

11. There is no doubt that the Tattenham Corner train was running under clear signals, and the late Motorman H. Goldsmith was in no way responsible for the accident. In the first place, the train was improperly allowed to leave Purley, and secondly, to enter the Purley Oaks—South Croydon Junction section. Judging by the severity of the collision, its speed must have been 40 to 45 m.p.h. when it overtook the Haywards Heath train, travelling at 15 to 20 m.p.h. while passing South Croydon Junction Home signal after check by the Distant at Caution.

12. The primary cause appears to have been that Porter-Signalman H. D. Hillier of Purley Oaks entirely forgot the Haywards Heath train while it was in the station for six or seven minutes obscured from his view by fog. It is difficult to account for what transpired, but responsibility must rest upon him for his most irregular use of the key to release his Sykes instrument No. 18 thus destroying the protection afforded by the Lock-and-Block system to this train which was standing at Starting signal No. 19.

This followed Signalman Neary's telephone inquiry as to the position on the Up Main, upon which Hillier jumped to the erroneous conclusion that his instrument had failed, a very serious error on his part, particularly in fog. His confusion of mind must have deluded him into thinking that he alone was right and his instrument wrong; thus his series of blunders were set in motion, the first being his transmission of the "Out-of-Section" signal for the Haywards Heath train, and then the release of the block to Purley North.

Nor were subsequent warnings of any avail in the absence of visual reminder of the train. Having used his key to cancel the front lock on Signal No. 18 and to free that instrument, which correctly registered "Locked," he was able incorrectly to accept, and lower signals Nos. 18, 19 and 17 for the Tattenham Corner train. Although he could not see or hear the Haywards Heath train start from the station, he observed instrument No. 19 change from "Locked" to "Free" when the actuation of Treadle F released the backlock on the starting signal lever, but this did not warn him that something was wrong. He again falsely assumed that this second instrument had also failed, and re-set it to "Locked" without returning the signal to Danger.

He did not appreciate the significance of Signalman Walder's 3--1 bell signal acceptance, and assumed that this applied to the Tattenham Corner train, although that train had been offered to him by Neary only a few moments before on the 3-3-1 bell signal, and he had not offered it to Walder. Even when Hillier saw the headcode and informed Walder that the Tattenham Corner train was approaching, he was not reminded of the position, and it was not until Walder spoke to him after the collision that he realised his mistake. He frankly and immediately admitted it, and expressed deep regret.

13. Hillier's breakdown in instrument manipulation in this emergency must, I think, have been due to some failing to appreciate the danger of irresponsible use of the key, and it occurred in the face of the most stringent Instructions, reinforced by the Superintendent of Operation in July, 1946. I know of no other Instruction which gives warning that improper use of apparatus may incur dismissal, and the Company at once took the view that he should be employed on other work.

The relevant Instructions provide for the switch-hook being placed over the Sykes instrument plunger when the "Train-Entering-Section" signal is acknowledged, but Hillier presumably failed to do this when he acknowledged this signal for the Haywards Heath train. When he used the key his block indicator was in the raised position, as it had been so placed when the switch-hook was turned over the plunger by Signalman Walder at South Croydon Junction at the time he refused to accept the Haywards Heath train. Although Hillier therefore operated his signals for the Tattenham Corner train, the Haywards Heath train, which he had overlooked, started from Purley Oaks platform, and, as already mentioned, he thereupon failed to appreciate the significance of the freeing of instrument No. 19.

The recent failures of treadles referred to in Hillier's evidence, and in particular that on the previous day when instrument No. 36 incorrectly changed from "Locked" to "Free," a danger-side failure, may have influenced him. It was also the first time he had worked in fog during his brief experience of five months as a signalman. There were men of long service in the boxes on either side of him, and Signalman Neary's telephone reminder obviously surprised him and appears to have led him to think that he was delaying traffic. In the circumstances, all that could have been expected of him was to do nothing until he had consulted the box on either side ; but there is, of course, the natural desire of a signalman to rely on his own initiative rather than on his colleagues. Presumably, however, he would have been told to ring up the man on duty on the platform to ask if a train was standing there awaiting the lowering of Starting signal No. 19.

14. Although Hillier was considered to be fully competent to take charge of Purley Oaks box, the circumstances of this accident led me to think that both he and Inspector Akehurst, who tested and passed him, over-estimated his ability to work alone in a Main Line box under the stress of heavy traffic in adverse conditions, such as fog. I realise that Inspector Akehurst has many years' signalling experience, and that signalmen even of long service have in the past misused the release key. But it seems to me that Hillier was allowed too rapidly to assume duties with too much responsibility, and the Company's Officers have assured me that the extent of training and the methods of examination and instruction will be reviewed; as also the placing of men of short experience in Main Line boxes, even if used only as block posts, where peak traffic is as heavy as at Purley Oaks.

15. Having regard also to the sequence of three treadle failures during the week of the accident, to which should be added a fourth, namely that of Treadle E, which actually occurred during my inspection at Purley Oaks on 27th October, the question of insistence upon reporting such incidents by signalmen to the Traffic Department, as well as direct to the lineman, appears to require further emphasis; by this means all in authority should be kept aware of the extent of such failures, and of the efficiency of maintenance. It should be added, however, that the Company's statistics showed that, on this section of line, there had been no deterioration in the general standard of reliability, in spite of difficulties in obtaining staff and material.

#### REMARKS

16. Lock-and-Block signalling apparatus is designed to afford complete protection, but it is necessary to provide some means for interrupting the normal sequence of operations. For example, a train which has been accepted may have to be cancelled; in certain circumstances shunting operations affect other movements: and provision has to be made for correcting failures of treadles to release backlocks. It is for such reasons, and others varying according to the locality, that a key is provided so that instruments may be legitimately re-set. The problem resolves itself into limiting the use of the key for essential purposes and preventing the signalman resorting to it at the wrong time. The Company accordingly has issued the strictest possible warnings against the misuse of this releasing device, and safety of operation naturally depends on the maintenance of a high standard of discipline.

17. The accident would not have occurred had colour light signalling and track circuiting been installed between Battersea Park and Coulsdon, as was the Company's intention. It was proposed to commence this work in 1940, but, like many other schemes, it had to be postponed on account of the war. Approval, however, has recently been given for this modernisation to proceed, and I understand that the Company's plans are well in hand. The present signalling in this area has been in use for over 50 years, and it is probably true to say that no other mechanical system could have coped so efficiently with such heavy main line and suburban electric services. It is essential, however, that more modern equipment should be provided to deal with increased traffic and to afford even greater safeguards against human error. It will also have the advantage of easing the man power position.

18. The overcrowding of the two trains, and especially the leading coach of the second, undoubtedly increased the number of casualties. When traffic is running out of course due to fog, some overcrowding is inevitable. On this occasion, for example, the Haywards Heath train, which was moderately well loaded on leaving Coulsdon, was filled with local passengers when it was stopped by signal at Purley Oaks. The main causes of overcrowding are shortage of rolling stock, high concentration of traffic at peak periods, and insufficient line capacity. The last-named will be assisted by the new signalling, and relief in respect of the others must depend on improved allocation of resources.

#### RECOMMENDATIONS

(a) Although Signalman H. D. Hillier acted in this instance without due sense of responsibility, his failure in the prevailing circumstances seems to have resulted from insufficient experience of the Sykes signalling system. In addition to reviewing their methods of training and examination, the Company should consider the propriety of placing men with short experience in charge of Main Line boxes.

(b) Stringent as the Instructions already are about using the release key, further consideration also appears desirable with the object of ensuring that the signalmen in the boxes on either side should be asked to advise and co-operate in any case of doubt. Alternatively, where applicable, the signalman concerned should be obliged to consult the platform staff before a Home signal, and/or Plunger, lock is freed.

(c) Greater emphasis appears to be necessary as regards signalmen reporting all failures of equipment to the Traffic Department, apart from the lineman being advised. This should facilitate the *full* recording of every failure, and ensure that all in authority may gauge the efficiency of maintenance.

I have the honour to be,

Sir,

Your obedient Servant,

A. H. L. MQUNT, Lieut.-Colonel.

The Secretary,

Ministry of Transport.

#### APPENDIX A

## DESCRIPTION OF THE SYSTEM OF SIGNALLING

The system of signalling between Purley and South Croydon is that known as Sykes' Lock-and-Block. The principle of operation is as follows :—

Each signal lever is connected by means of rodding to a Sykes' instrument, which shows two indications, either "locked" or "free." When the signalman is offered a train from the box in the rear, if he is in a position to accept, he pushes in a plunger which is part of his home signal instrument. This action frees the starting signal of the box in the rear and changes the lower tablet of his own home signal instrument from blank to "Train-on." The plunger becomes locked. The upper tablet of this same instrument indicates "free" as the line is clear to the starting signal. When the home signal lever is reversed, the upper tablet changes from "free" to "locked" and remains in this position until the starting signal lever has been pulled and replaced following the operation of the treadle in advance of that signal. When the train has passed the home signal, the replacement of the home signal lever changes the lower tablet from "Train-on" to blank, but the plunger remains locked until the upper tablet changes to "free" on the replacement of the starting signal lever as described below.

The instrument associated with the starting signal normally shows "locked." and in this position the instrument rod is raised and the signal lever locked. The rod is held in this position by means of a permanent magnet and detent in the instrument. When it is required to send a train into the block section, the appropriate bell signal is sent to the box in advance. If the signalman at that box is in a position to accept the train he pushes in a plunger. This action completes an electric circuit, which, by means of a coil winding in the instrument of the starting signal of the signal box in rear, neutralises the effect of the permanent magnet, and so allows the lock rod to drop. This frees the starting signal lever and gives the "free" indication in the instrument. The starting signal lever is then pulled. This action changes the indication in the instrument from "free" to "locked" and the starting signal becomes backlocked. Replacement of the lever cannot be effected until a treadle ahead of the signal has been actuated by a train. This treadle, when depressed, closes a contact which completes the circuit to release the backlock on the lever of the starting signal lever is replaced, the instrument becomes relocked and cannot be freed until a second release is given by the signalman at the box in advance.

The effect, therefore, of this rotation locking is that each train should pass through the block section, and beyond the starting signal, before a second train can be accepted.

In addition to the locking between the plunger and the signals, block indicators are provided to show whether the block section ahead is clear or occupied. These indications take the form of miniature semaphore arms, and are normally clear, i.e., the miniature arm is normally lowered. When the plunger at the box in advance is operated, this miniature arm is raised to the horizontal position, and remains in this position until the section has been cleared. Associated with the plunger is a switch hook, which, when turned over, prevents the plunger from being pushed in and also raises the block indicator arm at the transmitting end to the horizontal position if this has not already been done by the depression of the plunger. This switch hook, therefore, serves as a physical reminder that the plunger is not free to be pushed. In order to provide for the cancellation of a train, which, after acceptance, does not, in fact, proceed through the section, a key is provided to enable the signalman to re-set the mechanism and to operate his plunger a second time. This key can also be used to release the backlocks on starting signal levers in the event of treadle failures.

#### APPENDIX B

#### SYKES' THREE-WIRE, TWO-POSITION, LOCK AND BLOCK INSTRUMENT

#### Mode of Signalling—Central Section

"A," "B," and "C" represent three consecutive Block Signal Boxes and the process of signalling a Train is as follows :---

(a) Prior to the despatch of a Train from "A" the Signalman there, provided he has received the **Train Out of Section** Signal for the previous Train and the Block Indicator is in its normal position, must call the attention of "B" and having obtained it must give the proper Is Line Clear Signal. If the Line be clear at "B" the Signalman there must acknowledge the Signal and press in the Plunger firmly which will cause his own lower Tablet to change from Blank to Train On, unlock the leading signal at "A," change the upper Tablet there from locked to free and raise the Block Indicator at "A." The Signalman at "A" may then, if the Line be clear, lower his Signals for the Train to leave "A."

(b) On the Train leaving "A" the Signalman there must send the **Train Entering Section** Signal to "B" and the Signalman at "B" must thereupon place his Switch Hook over the Plunger and acknowledge the Signal.

(c) "B" must then, provided he has received the **Train Out of Section** Signal for the previous **Train and the Block Indicator is in its normal position, call the attention of** "C" and having obtained it must give the proper **Is Line Clear** Signal. On receiving permission from "C" for the Train to approach "B" may lower his Signals which will change his upper **Tablet** from **free** to **locked**.

(d) When the Train passes over the Treadle (where provided) fixed beyond the Home, Starting or Advanced Starting Signal at "B," it will change the upper Tablet there to free and enable the Signalman to replace the relevant Signal. The action of replacing the Signal Lever will restore the upper Tablet to locked and the lower Tablet to blank; "B" must then remove the Switch Hook from the Plunger (which will lower the Block Indicator at "A") and give the Train Out of Section Signal to "A" which "A" must acknowledge.

(e) If the Line is not clear, or if from any cause the Signalman is not in a position to give permission for a Train to approach when the Signalman in the rear forwards the Is Line Clear Signal, that Signal must not be acknowledged but the Switch Hook must be turned over the Plunger which will lock the Plunger and raise the Block Indicator at the Box in the rear. When the Line is again clear and the Signalman is in a position to give permission for a Train to approach the Switch Hook must be removed from the Plunger which will lower the Block Indicator at the Box in rear.

#### APPENDIX C

#### LOCK AND BLOCK SYSTEM OF TRAIN SIGNALLING

#### Extracts from Southern Railway Standard Regulations for train signalling

1. Electric Lock and Block System.—The object of this system of Train Signalling is to prevent more than one Train being in the Section between two Block Signal Boxes on the same Line at the same time. This is accomplished by a Signalman not being able to lower the Signal controlling the entrance to the Block Section ahead until that Signal has been electrically released by the Signalman at the Signal Box in advance, who cannot so release the Signal until the preceding Train has passed his own Signal controlling the entrance to the Section ahead or other Signal at such Box and that Signal has been replaced at Danger, nor where a Treadle is provided, until the Train has reached it. As this system of working is attained by the interior portions of the Block Instrument being connected with the Signal Levers. Signalmen must work these Levers with great care.

\* \* \* \* \*

4. Failures and Defects.—(a) In order to provide against the contingency of a failure of part of the Apparatus, the Bell Code is arranged to secure the working of the Block System in addition to, and independently of, the Lock and Block Instruments.

(b) If, when the Is Line Clear Signal is given, the Tablet of the Block Instrument for the Section in advance should drop to Free, without an acknowledgment being received on the Bell, the Bell Signal must be repeated until properly answered, unless it is found that the Bell has failed, and in the meantime the Signal controlling the entrance of Trains into the Section ahead must be maintained at Danger.

(c) In the event of "B" failing to free "A" through an imperfect Plunge or a failure of the Apparatus, "A" should call the attention of "B" on the speaking instrument and inform him of the fact. It must then be clearly ascertained that no Train is in the Section between the two Signal Boxes, after which "B" must change the Tablet of the Block Instrument from the Train Accepted (or Train On) position to the normal position by one complete turn of the Release Key in the direction of the Arrow. After withdrawing the Release Key he must again Plunge.

(d) If, however, it is clearly ascertained that the "Plunge" altogether fails to release the Signal in the rear, the Train must be hand Signalled by Flag or Lamp, after the Driver has been stopped, advised of the circumstances and instructed to proceed cautiously, provided that the Is Line Clear Signal has been sent and properly acknowledged.

(e) All cases of failure, from whatever cause, must be immediately reported to the Telegraph Lineman of the district, so that the failure may be rectified in the shortest possible time, and a full report of the matter, stating the nature of the failure, must be promptly sent by the Station Master to the Divisional Superintendent.

5. Treadles.—(a) At many places Treadles are provided beyond the Home, Starting or Advanced Starting Signal to prevent the Signalman fully replacing a Signal Lever or releasing the Section in the rear until the Train has passed over the Treadle. If, from any cause, a Train in passing over a Treadle does not release the back-lock on the Signal Lever, the Signalman must wait until the Train Out of Section Signal has been received from the Signal Box in advance before releasing the back-lock by means of the Release Key, unless he can be sure by actual observation that the whole of the Train has passed.

(b) Each time the Release Key is used, owing to failure of a passing Train to release the backlocked Signal, an entry of the fact must be made in the Train Register or other book provided for the purpose.

(c) Signalmen are specially cautioned not to put the Lever partially back before the Train reactes the Treadle, except in case of emergency, as this will in many cases prevent the Treadle releasing the back-lock. The Tablet of the Block Instrument should also be watched before attempting to move the Lever.

6. Switch Hooks.—The Switch Hooks must always be placed (or maintained) over the Plunger to protect the Line, when at any time the Line is obstructed, or when special protection is needed. The turning of the Switch Hook, besides locking the Plunger, puts up the Block Indicator at the Signal Box in the rear, except at those Boxes where Double Arm Block Instruments are in use. When a Signal Box is being closed, the Switch Hooks must be placed (or maintained) over the Plunger by the Signalman before going off duty; they must be unhooked again on the Signalman reopening the Signal Box except where the normal position of the Block Indicator is at danger in which case the Switch Hook should be maintained over the Plunger.

Where, however, Sykes' Double-Arm Block Indicator Instruments are in use the Switch Hook must be removed from the Plunger by the Signalman when reopening the Signal Box.

- 7. Release Key.—(a) A Release Key is provided in every Signal Box for use as shown below :---
  - (1) To change the Tablet of the Block Instrument from the Train Accepted (or Train On) position to the normal (blank) position when the Cancelling Signal is given, or when the Plunger fails to release.
    - To release Back Lock on Signal Lever in case Treadle fails to release or is not actuated (2)for any reason.
    - (3) To release **Front Lock** on Home (where Starting Signals are provided) or on Starting Signals (where Advanced Starting Signals are provided) after shunting operations.
    - (4) To release Emergency Point Locks after Plunging, provided Train has been brought to a stand at the Home Signal.

Signalmen are specially cautioned not to use the Release Key or other means of Release unless they have clearly ascertained that no Train is in the Section, and that such Release is absolutely necessary and can with safety be given.

Release Keys either for the Treadle or other Electric Locking Apparatus must not, under any circumstances, be aflowed to remain in the Instruments, or other release Key-holes, and Signalmen disregarding this Order will be severely dealt with.

(b) Any Signalman who improperly interferes with the Lock and Block Instruments, or any part of the apparatus, or who makes any improper use of the Release Key or other means of release, will be liable to dismissal.

#### 8. Modifications in Block Telegraph Regulations :---

#### Regulation 5.--Section Clear but Station or Junction Blocked (Warning Arrangement) :--

At those Boxes where special Warning Signal Instruments are provided, when a train is accepted under the Section Clear but Station or Junction Blocked Regulation, the Signalman at the Box in advance must plunge on the Special Block Signalling Instrument working in conjunction with the Warning Signal . . . .

#### APPENDIX D

## SPECIAL WARNING TO SIGNALMEN AND PORTER SIGNALMEN AS TO USE OF SYKES' KEYS OR OTHER MEANS OF RELEASE.

The special attention of Signalmen, and other members of the signalling grade, is drawn to a case of irregular use of the Sykes' release key whereby two passenger trains were admitted to a block section and a collision occurred resulting in loss of life and serious injuries to passengers.

The opportunity is taken of reminding Signalmen of the relevant instructions in Regulation 7 of the Lock and Block System of Train Signalling Regulations which reads as follows :-

Signalmen are specially cautioned not to use the Release Key or other means of release unless they have clearly ascertained that no train is in the section and that such release is absolutely necessary . and can with safety be given. 1:

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Whenever a Signalman is offered a train and finds that his Sykes' Plunger is locked he must first assure himself, beyond all measure of doubt, by consultation with the Signalman at the box in the rear (even if this means delay to traffic) whether his inability to use the Plunger in the normal manner is due,

- (i) to a train having been accepted or being already in the section ; or
- (ii) to a shunt movement having been made from a siding to the main line within the area under his control; or
- (iii) to some failure of the apparatus.

At the same time he must have a clear understanding with the Signalman at the box in the rear as to the description and whereabouts of the last train signalled to him, before he uses the release key or other means of release to free the Plunger.

When in such circumstances the use of the Sykes' key or other means of release for accepting a train becomes necessary the Signalman concerned must maintain his distant signal at caution for the next approaching train.

Should a Signalman find that a signal (other than the signal controlling the entrance to the section ahead) is "locked" when it should be "free" he must, before effecting release, satisfy himself that no train is in the section between the signal concerned and the next stop signal ahead.

A note of the circumstances must be made in the train register book or other book provided for the purpose at each box.

When the use of the release key or other means of release becomes necessary in connection with the "Cancelling" signal (vide Regulation 18 of the Standard Regulations for Train Signalling) the Signalman at the advance box must, after aoknowledging the "Cancelling" signal and before using the key or other means of release, confirm with the Signalman at the rear box the particular train that will not proceed and for which the "Cancelling" signal has been sent. This procedure must be followed not only at those boxes where Sykes' instruments are provided but also at boxes where Standard Three-Position Closed Block Apparatus is installed and Push Button Releases are provided in connection with the "Cancelling" arrangement.

S. W. SMART,

Superintendent of Operation.

Waterloo Station,

4th July, 1946.



