LONDON ELECTRIC RAILWAY.

Ministry of Transport,
7, Whitehall Gardens, London, S.W. 1.
18th February, 1925.

SIR,

I have the honour to report, for the information of the Minister of Transport, in accordance with the Order of the 20th January, the result of my Inquiry into the circumstances of a collision, which occurred at about 8.40 a.m. on January 19th, near Charing Cross, on the London Electric Railway.

The collision took place on the loop line between Strand and Charing Cross Stations. The two trains involved were No. 2, a five-car set, which was standing at the first automatic signal beyond Strand Station, and No. 59, a seven-car set, which, shortly after leaving Strand Station on the south-bound road, collided with the rear of the standing train.

Train No. 2 consisted of two motor and three trailer cars with motor car No. 48 in rear. The total weight of this train was nearly 106 tons, and its overall length just over 250 feet. No. 59 train consisted of three motor and four trailer cars with motor car No. 535 in front. This train had a total weight of nearly 167 tons, and its overall length was just over 359 feet. Both trains were fitted throughout with the Westinghouse brake. They were fairly well loaded with passengers, although there was no crowding.

As a result of the accident the motorman of No. 59 train had his leg badly crushed and broken. The guard of the standing train was injured in the head and chest, and two gatemen were bruised. One passenger—in the standing train—was hurt in the back.

The damage to the stock was as follows :—

Train No. 2.—motor car No. 48.—End framing pushed in and broken away from the roof. Cab windows broken and piping displaced. Drawbars and couplings on all cars bent and end platforms of trailer cars Nos. 205, 146 and 171 set down slightly. No glass broken in passenger compartment of any car.

Train No. 59—motor car No. 535. End headstock and part of cab floor with end framing and panels pushed up against motor bogie. Brake and electric piping at end broken away, side and end cab doors broken and motor cab windows broken. Drawbars and couplings on all cars bent and strained. Cab end headstock of middle motor No. 553 pushed in slightly and brake train pipe broken. No glass broken in passenger compartments of any car.

There was no derailment or damage to the permanent way. It is of interest to note that the cab windows in train No. 59 were of Triplex glass. Both were extensively cracked and starred, but there was no splintering or displacement from the frame.

Description.

A plan of the railway shewing the site of the collision is attached to this Report. On this plan are shewn the various track circuited sections which exercise control over the signals in the usual manner. The occupied or unoccupied condition, as the case may be, of certain of these track circuited sections is indicated by means of an illuminated diagram in the signal cabin. All the signals shewn on the plan with numbers preceded by the letter C are of the controlled or semi-automatic type ; that is to say, with the levers pulled over in the frame the signals work automatically, but they can alternatively be restored to and maintained at the danger aspect by replacing the levers in the frame. The other signals are of the purely automatic type, controlled entirely by the condition of the track circuits ahead. The control exercised between these track circuits and the signals, whether of the semi- or purely automatic type, includes :—(*a*) The replacing of the signals to danger directly the track circuit joint immediately ahead of them—indicated by a black dot on the plan—is reached by the train ; and (*b*) The maintaining of the danger aspect of a signal until the joint at the far end of the overlap track ahead of the next signal is cleared ; for example, signal C.8 is returned to danger as soon as the track joint 26 feet ahead

(K2128) Wt25680/760/1717 875 4/25 H & Sp **Gp 77**

of it is reached by the train, and cannot again be cleared until the track joint 349 feet ahead of signal S.262 has been cleared and the whole of J and K track sections are unoccupied.

All stop signals are equipped with train stops so arranged that when the signal is at danger the train stop is in the operative position and actuates a trip cock on the trains; so that should the signal and train stop be passed in the danger position, the trip cock is opened and the continuous brakes applied upon the train. The working of these train stops and of the crossover road west of the station is by power on the electro-pneumatic system. The signals are all of the two-aspect, i.e., "danger" (or "warning") and "clear" lamp type.

Normally all the north- and south-bound controlled signal levers are kept pulled over so that the signals operate automatically. They are not controlled unless it is necessary either to check certain trains, in order to maintain regularity of running and of time intervals, or when it is desired to work a train over the crossover road, which is used on an average some four or five times a day.

There is a speed restriction of 15 m.p.h. round the loop.

Report.

The history of this case begins just before the arrival of train No. 5 on the south-bound road at Strand Station. Richard Heley, the signalman then on duty, became aware that this train was late in arriving at Leicester Square, and it eventually ran into Strand Station two minutes after time. Heley then made out a non-stop form to authorise the train to pass Strand and Goodge Street Stations on its north-bound journey. Station master Williams took this non-stop order from Heley, saying: "I am going to Charing Cross and will give the message to the guard." He spoke to the guard accordingly, who then told him that there had been some trouble in getting the train away and that a fitter was wanted. The station master therefore did not board the train as he intended to do in the first instance, but went back towards the signal box, calling out to the signalman that this fitter was wanted. Heley telephoned this message through to the Traffic Controller, and received the information that a fitter would meet the train at Leicester Square north-bound platform. No. 5 train then left and the station master went to the signal-box to watch its progress on the track circuit diagram. No. 57 train next arrived at Strand south-bound and left for the loop line, followed by No. 2, which in the normal course of running would leave Strand Station, on the south-bound road, while No. 5, that is, the train next but one ahead, was standing at Charing Cross. This actually occurred, but No. 5 train stopped in the tunnel immediately after leaving Charing Cross on its north-bound journey, and therefore held up Nos. 57 and 2 trains in the loop line tunnel. The station master then said to signalman Heley: "You had better get ready to reverse," and added that he was going overground to Charing Cross to see what was the matter with No. 5. On his way out of the station he saw foreman collector Pugh, to whom he gave very much the same message. Signalman Heley therefore decided to reverse the next train, that is, No. 59, which by this time had arrived at the south-bound platform, by setting it back over the crossover at the west end of Strand Station. No. 59, being a seven-car train, was not clear of the track joint between G and H tracks as it stood at the platform, and, since the lever operating the crossover road is electrically locked in both positions by the occupation of track G, it was necessary for the train to draw forward past the starting signal at the east end of the platform before the crossover road could be set. Heley conveyed his intention of reversing this train to foreman Pugh, who was standing about half-way down the platform. The passengers were accordingly detrained and the driver drew his train forward in order to clear the track joint in rear. In doing so, he went past the starting signal at which the train was tripped, the train stop being in the operative position, and came to rest, according to the evidence of the train crew, about half a car length beyond the signal. The trip cock was then closed and the train prepared for the reverse movement. Heley then set the crossover road, but did not pull the lever controlling the north-bound starting signal at the west end of the south-bound platform. After setting the crossover he received a message from Charing Cross that No. 5 train was on the move again. He therefore decided to replace the crossover road and to allow No. 59 train to take its normal route round the loop, and called out: "No. 5 is clearing; all right, load up, right away to Charing Cross." Heley

had already pulled off the usual running signal levers, including, therefore, that of the south-bound starting signal, so as to restore the frame to its normal running condition. This signal, however, did not clear when the lever was pulled, and Heley was aware that it was being held at danger by train No. 2 standing at automatic signal No. 262. He knew this by seeing the occupied condition of the track in question, and also realised that No. 59 train had not reached the track joint ahead of the south-bound starting signal, so that it had not, therefore, arrived at the point where it would, by short circuiting J track, hold the starting signal to danger behind it. Heley then left the signal cabin and went to the north-bound platform to see whether No. 5 train was going away under its own power or was being propelled. When he returned he found that No. 59 train had left, and therefore assumed that the starting signal had cleared. As a fact it had not done so, and No. 59 train came into collision with No. 2, which was still standing at automatic signal No. 262.

It is clear, therefore, that the collision resulted from the fact that No. 59 train left the Strand Station on an incorrect assumption that the section to the next signal ahead was clear. Foreman Pugh, who was in charge of the station in the station master's absence, merely repeated the signalman's message to the train staff in regard to the final decision to send No. 59 train round the loop instead of back over the crossover. He did not himself take steps to ascertain whether or not the section ahead of the starting signal was clear, but took the signalman's message as sufficient indication that this was the case. He realised that the starting signal was at danger when he gave the message to the train staff, but imagined that it was being so held by No. 59 train itself, and that its aspect was in no way due to the presence of a train ahead. Exactly the same assumption in regard to the aspect of this starting signal was made by George Ainge, the guard in charge of No. 59 train, who told the driver before starting that the train had to go to Charing Cross instead of reversing. He took it for granted from the foreman's message that the section ahead was clear, and it did not occur to him that there was any possibility of its occupation.

As soon as the train started, guard Ainge went into the motorman's cab to alter the destination boards, and very soon afterwards saw the repeater signal of No. 262 automatic, which was shewing the warning aspect, and just round the curve the tail lights of the standing train. Ainge can give no estimate of the speed at which the collision occurred, nor the distance at which he first saw the tail lights of the train ahead.

George Looker, the motorman of No. 59 train, is a man of 17 years' service with the Company, for five of which he has been a motorman, at first in a temporary capacity, and later in the permanent grade. He amplified the evidence given by previous witnesses in regard to the first forward movement of the train as a preliminary to setting back over the crossover, by saying that in the first instance he stopped short of the starting signal, but was told that the train was not yet clear of the track joint, and therefore proceeded about 4 yards past it. He then got down and re-set the trip, and about two minutes afterwards heard the signalman call out to the station foreman that the train was to go to Charing Cross. The guard then came to him and said : "We are all right for Charing Cross," or words to that effect, and on Looker asking him : "Are we all right to go ?" the guard said : "Yes."

Looker did not think that his train had reached the track joint ahead of the starting signal, as in fact it had not, and assumed that this signal was off, since the information given to him was not qualified by any remark as to the aspect of the signal. When, therefore, Looker received the usual bell he started his train and ran ahead in the normal manner. It is Looker's practice not to move his controller beyond the series position until he sights the repeater for automatic signal No. 262. This he sighted about two car lengths away, in the warning position, and at the same time saw the tail lights of the standing train. He immediately applied his brakes but was unable to stop short of the obstruction, though he thought that if he had had another six yards or so to run he might have pulled up his train in time. In view of the conditions of gradient at this point, it is probable that his speed was at least 15 miles an hour when he first sighted the obstruction.

The circumstances in which the guard of the standing train was injured were as follows :—

Walter Bishop, the motorman of train No. 2, after standing at Strand south-bound platform for about a minute, drew forward to automatic signal 262, which was at danger. In consequence of previous checks, Bishop was nearly certain that this danger aspect was not due to a signal failure but to the presence of a train ahead,

and did not therefore pass this signal under the emergency regulations after standing there for one minute. Meantime Ward, his guard, had come into the cab, and after some conversation with the motorman about the probable state of the road, went forward along the tunnel to see whether Bishop's supposition in regard to a train standing ahead was correct. Ward soon returned and confirmed the presumption that the section ahead was occupied, adding that if the signal did not clear within a few seconds they had better pass it; the idea both in his and the motorman's minds being that this train might be defective, and that it would therefore be advisable to get close up to it so as to be handy in case of assistance being required. Motorman Bishop's idea that there must be some trouble ahead was confirmed in his mind by the fact that the tunnel lights, whose use is confined to occasions of emergency, were switched on just after his guard had left. No. 2 train, as has already been mentioned, was still standing at signal 262 when it was run into in the rear, and the guard, who had not yet rejoined the train, was standing on the permanent way close to it. The train, on which the brakes were fully applied, was driven forward about three yards. Ward was, therefore, knocked down, and subsequently lay on the track with one foot caught in the brake rigging and his head partly under the magnet case of the motor. Bishop added in his evidence that the signal at which he was standing cleared almost exactly at the time when the collision occurred.

Conclusion.

The physical conditions and nature of the traffic on Tube Railways are such that the emergency arrangements designed to minimise the effect of any accident are only second in importance to the precautions taken against the possibility of an accident occurring. The evidence taken at the Inquiry had reference to both these aspects of the case, and it will be convenient to separate the conclusion in a similar manner; dealing in the first place with the circumstances and cause of the collision, and in the second with the operation of the emergency apparatus subsequent to the accident.

I.—*Circumstances of the Collision.*

The immediate cause of the accident was the incorrect assumption on the part of the station and train staff at Strand Station that the section of line ahead of the starting signal was clear when the train left the station. The circumstances in which this signal was originally passed in the danger position have already been explained in the foregoing summary of evidence, from which it will be clear, in conjunction with the description, that when once this signal had been passed, the normal safeguard against following collisions, provided by the train stop at this location, was rendered inoperative should the train subsequently, as this one did, proceed ahead into an occupied section. There is no instruction in the Company's Regulations which literally applies to the exact circumstances of this case, but it is clearly covered by the spirit of their Regulations regarding the passing at danger of a controlled automatic signal which is presumed to have failed, and therefore to be incorrectly exhibiting a danger aspect. These regulations read as follows:—

73B.—DEFECTIVE SEMI-AUTOMATIC SIGNALS.

(*a*) Drivers must not proceed past a Semi-Automatic Signal at "Danger" except when authorised to do so by the Station Master, as set out below:—

(*b*) Station Masters are empowered to authorise a Driver to pass Semi-Automatic Signals at "Danger" only under the following conditions:—

(i) The Station Master must previously satisfy himself that the next Section ahead is clear and that the Signal has failed.

(ii) He must in each case have a proper understanding with the Signalman controlling the Signal in question.

. . . . . .

(iv) The Driver must then be informed that there is reason to believe that the Signal has failed, but he must proceed cautiously throughout the whole of the Section governed by the Signal, prepared to stop short of any obstruction.

. . . . . .

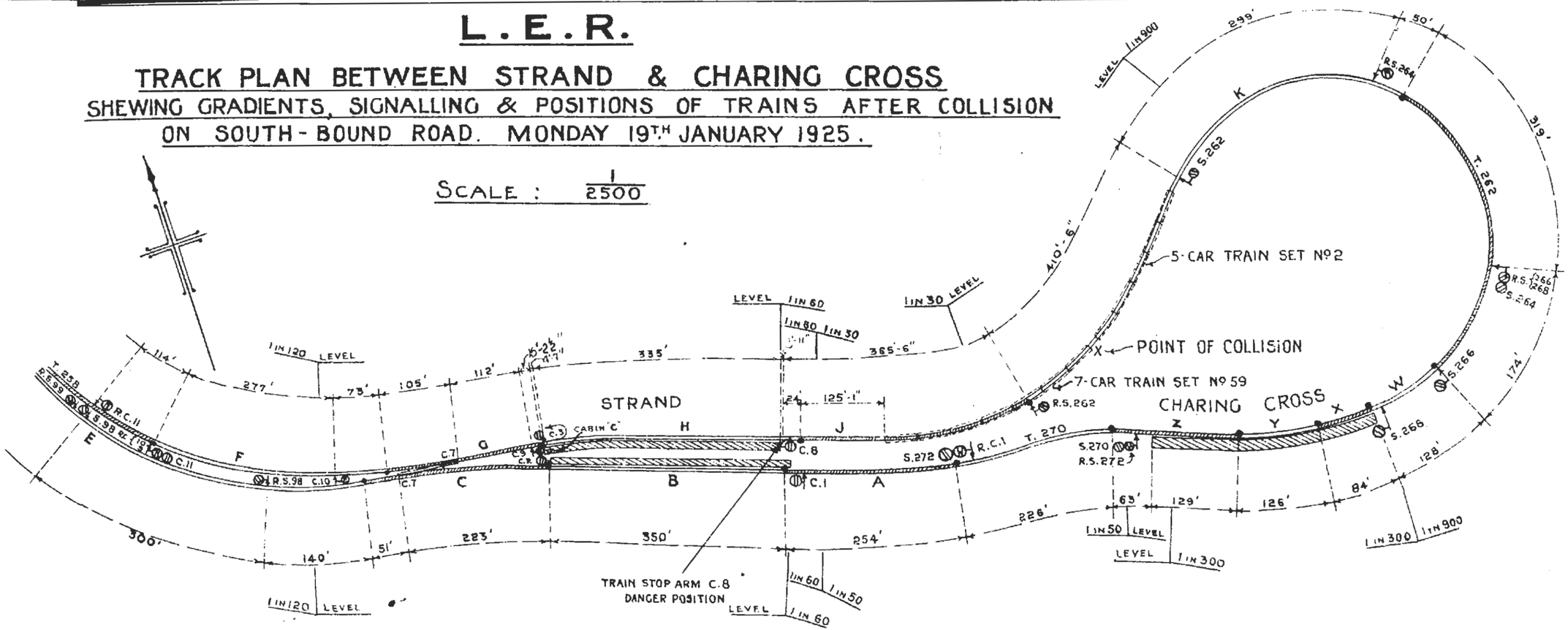
It is, therefore, the duty of the man in charge of the station concerned to make sure, either by walking along the section, or by examination, in consultation with the

L.E.R.

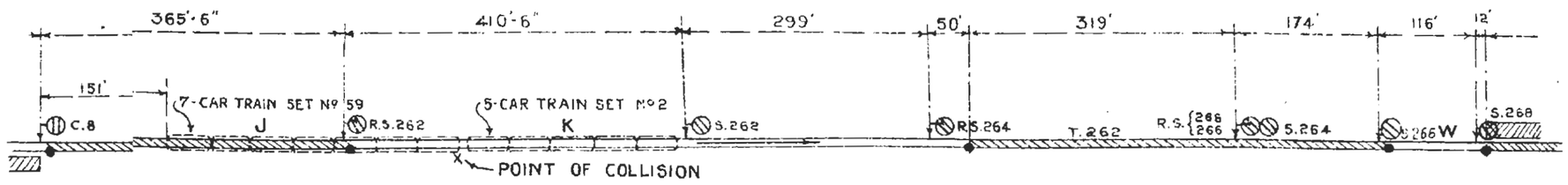
TRACK PLAN BETWEEN STRAND & CHARING CROSS

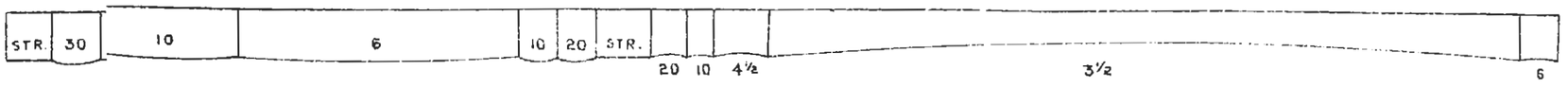
SHEWING GRADIENTS, SIGNALLING & POSITIONS OF TRAINS AFTER COLLISION ON SOUTH-BOUND ROAD. MONDAY 19TH JANUARY 1925.

SCALE : 1/2500



TRACK CIRCUITS INDICATED IN STRAND CABIN } T.257, T.258, F.G.H.J.K. (SOUTH-BOUND Rº)
Z. T.270. A.B.C.E. (NORTH-BOUND Rº)





DIAGRAMMATIC PLAN OF LINE & RADII OF CURVES IN CHAINS

SIGNAL	CONTROLLED BY TRACKS
C.9	H.J.
C.8	J.K.
R.S. 262	S.262 & K.
S. 262	T.262. W.
R.S. 264	S.264 & T.262
S. 264	X. W.
R.S. {266 268	S.266 & S 268
S. 266	W. X. Y.
S. 268	X. Y. Z.

FEET 100 50 0 100 200 300 400 500 FEET

K2429. H&Sp. G227. 25660A. 760/1717. 875. 3'25.

signalman, of the track circuit diagram in his cabin that the section ahead is in fact clear, even though the signal is at danger. In this case the necessary steps were not so taken by foreman Pugh, who, in the temporary absence of the station master, was in charge of the station. There was in fact no failure of any of the apparatus, and the signalman was well aware of the exact state of the road ahead. In giving the message which he did, his intention was merely to intimate a change of route; that is, to inform the staff concerned that the train was to proceed round the loop instead of being reversed at the crossover. He knew that it was unsafe for the train to leave until the starting signal cleared, and had no intention of conveying the opposite impression which foreman Pugh appears to have formed. It is to be regretted that Heley did not make it clear in giving his message that the train was not "right away" until the starting signal cleared, and he is not, I think, free from some blame for the sequel in failing to do so. At the same time, the staff concerned should have assumed this conditional factor in default of a definite assurance that the section ahead was clear. For this omission foreman Pugh is mainly responsible. There were, indeed, mitigating circumstances which in fairness to him must be taken into account. In the first instance his station master, who would normally have assumed this responsibility, was temporarily away; secondly, the circumstances were admittedly quite exceptional, in that the signal had already been passed under authority, and the assumption that it was being held at danger by train No. 59 itself was in consequence a natural one, though actually it was incorrect. In spite of these considerations, however, foreman Pugh cannot be freed from blame for making the assumption which he did and in consequence risking the safety of the traffic.

So far as guard Ainge is concerned, it is to be regretted that he did not tell the motorman that the starting signal was still at danger before he gave him the authority to start. If Looker had known this it would have been his duty, which I have no doubt he would have carried out, to proceed ahead with caution under the provisions of Regulation 73 B (iv). The fact that guard Ainge did not do so was no doubt due to his natural but erroneous impression that No. 59 train was itself responsible for the danger aspect of this signal. However, the responsibility for ascertaining or confirming the state of the road ahead was not his, and his conclusion that this had been done by the station staff was, I think, justifiable. I do not, therefore, attribute any direct responsibility for the accident to guard Ainge, though he committed, I think, at least an error of judgment in not telling his motorman that the starting signal was still at danger.

Motorman Looker is not in any way to be blamed for the collision. He was not in a position to see the starting signal when he received authority to start, and was justified in assuming that it was clear in default of any caution to the contrary. He appears to have been alert and to have taken prompt action to stop his train when he sighted the obstruction, the view of which was certainly insufficient to enable him to stop short.

The immediate cause of the collision has been dealt with in detail in the foregoing paragraphs. The final factor, however, was, as it frequently proves to be, particularly in the case of a railway so carefully safeguarded as is the London Electric, the outcome of a series of quite exceptional occurrences and of mistaken impressions, all of which contributed to the result. The initial factor was the partial failure of train No. 5, which led not only to the temporary absence of station master Williams at the critical time of the departure of No. 59 train from Strand, but also both to the delay to No. 2 train at the automatic signal, where it was standing when the collision occurred, and to the decision, subsequently cancelled, to reverse No. 59 train, which was actually the principal feature of the case. Had this decision to reverse the train not resulted in the starting signal being passed, there is little doubt that the collision would not have occurred. The exact distance between the G–H track joint and the train stop at signal C.8 is 341 feet 6 inches, and the overall wheel base of the train is 347 feet 5½ inches. There is, therefore, not room for a train of this length to stand between this track joint and the train stop in question. There are in fact only very few seven-car trains run on this line, and in normal working trains of this length are never required to set back over the crossover.

II.—*Operation of the Emergency Arrangements after the Collision.*

Complete and carefully thought-out precautions have been taken on this section as well as elsewhere on the Company's systems to minimise the danger and

inconvenience which would otherwise arise in the event of an accident on Tube Railways. The principal features of these emergency arrangements are as follows :—

(1) Removal of Electrical Pressure from the Section of Line concerned.—This is accomplished by connecting together the two "telephone" wires which run along the whole of the tunnel sections of these railways, and this action can be taken by any of the train staff without leaving the train. In this case, immediately the collision occurred, a short circuit across the conductor rails was set up sufficiently complete to open the circuit breaker at Charing Cross sub-station, the only one from which this section of line is fed. The sub-station attendant at once, in accordance with his instructions, closed this circuit breaker, which then remained in, no doubt in consequence of the original short circuit having been only momentary. Four and a half minutes afterwards the alarm was given by the signal apparatus in the sub-station, brought into action by the short circuiting of the tunnel telephone wires, and the attendant there immediately opened the circuit and left the line dead. This interval of four and a half minutes is accounted for in the evidence of motorman Bishop, of No. 2 train. Immediately the collision occurred, Bishop, seeing that his guard had been knocked down, got on to the track, and after he had discovered the situation in which the guard was placed he got back into the cab and put his telephone clips across the tunnel wires, so giving the signal to the sub-station.

There was on this occasion no need for the line pressure to be immediately removed, since no permanent short circuit had been set up, nor was there any indication of fire or arcing throughout either of the trains. If this had been the case immediate action would no doubt have been taken, if not by motorman Bishop, at any rate by one or other of the men forming the staff of the trains, all of whom are trained in the necessary procedure. It is satisfactory to note that the alarm apparatus acted correctly, and that there was no delay at the sub-station in obeying the signal.

(2) Emergency Tunnel Lighting.—The tunnel lights had already been switched on by station master Williams just before the accident occurred, and were therefore available when the emergency arose. The Company's latest practice is to arrange for these lights to be switched on automatically when the traction supply fails. Sections of line such as this, where automatic devices have not yet been fitted, will be so equipped before long.

(3) Emergency Train Lighting.—Two lamps, supplied from batteries, are fitted in each car, and these are brought into action automatically in the event of failure of the traction supply. This emergency lighting came into action satisfactorily, and the evidence shews that sufficient light was available for the detraining of passengers.

(4) Detraining of Passengers.—Upwards of half an hour appears to have elapsed before the detraining of the passengers from No. 59 set was carried out. The explanation of this apparent delay is given in the evidence of station master Williams, who at the time of the accident was at Charing Cross Station. On his return to Strand his first intention was to get them out from No. 59 train through No. 2 train, because south-bound trains were still arriving at Strand Station and being reversed over the crossover. He found, however, that it was impossible to do this owing to the damage done to the leading end of No. 59 train and the trailing end of No. 2 train, and therefore returned to the cabin and explained the position to the Controller. Some little time elapsed before the necessary arrangements could be made for the protection of the detraining passengers in the face of traffic, which was still running into Strand on the south-bound road. The operation was finally carried out under the direction of Inspector Payne, who is to be congratulated on his handling of a difficult situation, since, had he not been able to keep traffic running up to the Strand Station, the whole of the line would have been shut down south of Mornington Crescent, and very serious inconvenience to the public at a peak hour of traffic would in consequence have resulted. It is due also to the passengers themselves to say that their quiet behaviour and the absence of any impatience or uneasiness largely contributed to their safe removal from the trains.

Recommendations.

I have the following points to bring to the notice of the Company :—

(1) Position of south-bound Strand starting signal. There is always the possibility of the reverse movement over the crossover road at this station being required, with a train of any length, in an emergency such as arose in this case, and moreover, the use of seven-car trains is likely, I understand, to increase. It would therefore

be advisable to move this starting signal out a sufficient distance to allow a margin for the longest train used on the line to stand between it and the track circuit joint in rear, and I understand that it is the Company's intention to make this alteration.

(2) Removal of Line Pressure.—I think that in the event of an unmistakable collision in a Tube section—an extremely rare occurrence—the signal to remove the line pressure should at once be given whether any symptoms of fire or arcing are immediately apparent or not. The result is, of course, a considerable reduction in the train lighting, but this should, in the event of accident, rather reassure than alarm the public if they recognise that, so far from being a symptom of danger, it is an indication that any risk of fire or further collision is thereby obviated.

(3) Emergency Train Lighting.—In the last two coaches of the leading train the light from the emergency lamps does not appear to have been particularly good, owing to a somewhat low charge in the battery concerned. The Company is, I understand, now fitting batteries of a greater capacity than those installed in these trains, and will no doubt take such steps as may be necessary to ensure that their periodical charging is invariably carried out.

I have the honour to be, Sir,

Your obedient Servant,

G. L. HALL,

Major.

The Secretary,

Ministry of Transport.