MINISTRY OF TRANSPORT

RAILWAY ACCIDENT

Report on the Collision that occurred on 4th January 1969 between Paddock Wood and Marden

IN THE
SOUTHERN REGION
BRITISH RAILWAYS

LONDON: HER MAJESTY'S STATIONERY OFFICE
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SIX SHILLINGS NET

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MINISTRY OF TRANSPORT,
ST. CHRISTOPHER HOUSE,
SOUTHWARK STREET,
LONDON, S.E.1.
18*th July* 1969.

SIR,

I have the honour to report for the information of the Minister of Transport, in accordance with the Order dated 6th January 1969, the result of my Inquiry into the high speed following collision, at 20.42 on the 4th January 1969, between an express passenger train and a parcels train ahead of it on the Down Main line about a mile short of Marden, between Ashford and Tonbridge, in the Southern Region, British Railways. I was assisted by Lt-Col A. G. Townsend-Rose.

As the collision occured between two wayside stations, I have given map references (MR) where appropriate in this Report. The Ordnance Survey sheets concerned are 1 in. to 1 m. No. 171, London, S.E., and No. 172 Chatham.

At the time of the accident there was thick fog in the Paddock Wood (MR 6745)–Marden (MR 7444) area, the visibility being variously estimated at between 25 and 150 yds.

The express was the 20.00 8-coach electric multiple-unit train from Charing Cross to Ramsgate via Ashford. It was booked to pass Paddock Wood, the last station before Marden and some 4½ miles short of it at 20.42. Its driver would normally expect to have a clear run through Marden since the booked train ahead of it, which was the diesel-hauled 19.18 London Bridge to Dover Priory parcels train of 8 vans of mixed types, was due to pass Paddock Wood 20 mins ahead of it and to arrive at Ashford, some 21¼ miles further on, still 18 mins ahead of it.

On the evening of the accident, however, a track circuit in the Down Main line through Marden had failed shortly after 19.00, holding at Danger the automatic 3-aspect colour light signal that it controlled (No. A 370 at about MR 726448). Also, the train immediately ahead of the parcels train was a special rail train which had started from a siding at Paddock Wood for Ashford some two hours late and only 8 mins ahead of the parcels train and which was limited to a maximum speed of 25 m.p.h. Thus the parcels train, which had been running under clear signals well ahead of the express, incurred increasingly severe signal checks through Paddock Wood and was stopped at each of the last two 3-aspect signals short of Signal A 370, though each cleared from Danger to Caution automatically and as a result of the rail train clearing the section ahead, the first (A 322 at MR 685451) clearing just after the train stopped at it and the second (A 324 at MR 706450) while the secondman was speaking to the Ashford signalman over the signal post telephone. The signalman had told the secondman about the rail train ahead and the signalling failure, and that he was to telephone again from Signal A 370, so that although that signal was at Caution as he ran up to it, the driver stopped the train: when the secondman again spoke to the signalman he was told that the failure had been put right and that the train was to continue its journey in accordance with the aspects displayed by the signals ahead.

Meanwhile the express, which was running some 3½ mins ahead of time at Paddock Wood, was quickly catching up the parcels train. As the latter was drawing ahead past Signal A 370 and had reached a speed of 10–15 m.p.h. with its rear van a short way past that signal the express, which had run past Signals A 322 at Caution and A 324 at Danger but which was still running at some 75 to 80 m.p.h., collided violently with it.

So severe was the impact that the leading coach of the express plunged down the side of the 5 ft high embankment and came to rest, completely upside down, some 115–120 yds past the point of collision, with its bodywork entirely smashed. The second coach overrode the first and came to rest on its side and very badly damaged, to the right of and partly ahead of it. The third coach jack-knifed between the second and fourth, one end being dragged down the bank and the other remaining on the ballast. The rear five coaches, under the restraint of their buckeye couplings, remained upright and in line though they were derailed towards the Up line but not actually foul of it: damage to them was relatively light and the rear bogie of the last coach remained on the rails. I much regret to report that of over 100 passengers in the express three were killed, as was the driver of the train. Eleven other passengers were taken to hospital, nine of them being detained: of the latter eight were discharged before the end of January and the last on 1st April. A number of other passengers were slightly injured. The remaining passengers were conducted to Marden or to the nearest road, whence road transport conveyed them to Staplehurst (MR 7844) to continue their journey by rail.

The last three vans of the parcels train, although of all-steel construction, were almost completely destroyed. One of them came to rest across the Up line, which it blocked, and another had one end forced up 15 ft into the air and at right angles over it, and the one ahead was burst open at its trailing end and was buffer-locked with the vehicle ahead which was damaged. These vans absorbed the shock to the parcels train, the leading three being undamaged and remaining on the rails, though they were propelled forward. Fortunately, the guard was riding in the engine's rear cab and he and the driver and secondman were unhurt.

The collision short-circuited both conductor rails, tripping the circuit breakers, so that the traction current was cut off. The wreckage of the parcels train however, although completely blocking the Up line. did not short circuit the Up line track circuits.

There was some avoidable delay in calling for the emergency services and the first ambulance did not reach Marden Station until 21.06. In all 18 ambulances and 10 fire appliances attended. Rescue and relief arrangements were very severely hampered by the combination of darkness, mud, and thick fog, and the remoteness of the site from main roads. Access by vehicles was eventually established along narrow lanes and over two recently ploughed fields, and very good rescue work was carried out under very bad conditions by the Kent Constabulary, Fire, and Ambulance Services. I think it right also to make special mention of the Farm Manager and staff of Brook Farm (MR 728455) about a mile away by lane and fields, who helped in many ways and not least by providing tractors to transport supplies and personnel from the nearest lane across the fields to the railway, and of the local Women's Royal Voluntary Service who set up a field kitchen and provided food and hot drinks for those engaged in the rescue work. The last injured person was removed from the wreckage by 23.37, but it was not until 08.55 the following morning that the last body was recovered.

Railway breakdown equipment was promptly summoned and both lines were cleared and opened for traffic, under a temporary speed restriction, at 04.23 on Tuesday, 7th January. While the lines were closed trains between London and the coast via Ashford were diverted via Maidstone. Local trains terminated at and started from Paddock Wood and Staplehurst, between which points bus services operated, calling at Marden.

Description

Layout and Signals

1. Marden is a wayside station on the Southern Region Main line between London and the Kent Coast via Tonbridge and Ashford. The attached Plan shows the general layout of the line and signals, the gradients, the approximate point of impact, and the positions in which the vehicles of the two trains came to a stand.

2. Through Marden the line is two-track. At Paddock Wood there are Up and Down platform loops, sidings connected with them, and a single-ended Down Siding West, at the London end, which feeds into the Down Main line past ground position light Signal No. PE 65. Just beyond Paddock Wood the two-track Maidstone Branch line diverges to the left on the Down side.

3. Approaching Paddock Wood on the Down Main line the first signal is A 320 and the next is PE 130, 2188 yds beyond Signal A 320 and 922 yds short of Signal PE 129, which is level with the Marden end of the Down platform. Signals A 320 and PE 130 are 4-aspect colour lights because of the restricted braking distances ahead, but Signal PE 129, which is the last signal controlled from the Tonbridge signalbox, is a 3-aspect colour light signal as are the automatic signals beyond it which are well sited on the left of the line and at driver's eye level and are located as follows:

Signal A 322–1540 yds beyond Signal PE 129

Signal A 324–2187 yds beyond Signal A 322

Signal A 370–2191 yds beyond Signal A 324

Signal A 372–2190 yds beyond Signal A 370 (and at the far end of the Marden Down platform)

The only Up line signal to which reference is made in this Report is Signal A 321 just over 1000 yds on the Marden side of Signal A 370.

4. Paddock Wood is easily identifiable in bad weather and at night because of its two platform loops and because it is the first station after Tonbridge and has a pair of signals side by side at the country end and the facing junction to the Maidstone Branch just beyond them. Signal A 322 is sited some 10 yds on the Paddock Wood side of the first road or lane overbridge beyond the junction. There is then another lane overbridge (at MR 691451) and a track crossing, preceded by a whistle board, (at MR 700450) before the line crosses the River Teise (at MR 702450) and Signal A 324 is a little over 400 yds beyond the river. Between Signal A 324 and Signal A 370 there are two more road overbridges, the second one of which carries the B 2162 road from Collier Street to Horsmonden (MR 7040) over the railway at MR 706450: Singal A 370 is about 1000 yds beyond this second bridge. The line, although absolutely straight, is thus by no means featureless even when darkness and fog restrict a driver's view of the countryside through which it runs.

5. The line was completely resignalled in 1962.

Method of Operation

6. The line is operated in accordance with the "Regulations for Train Signalling on Double Lines by the Track Circuit Block System" with the running lines between successive signalboxes completely track circuited. These Regulations are referred to hereafter in this Report as Track Circuit Block Regulations. The system allows a train to leave the last signal controlled by the signalbox in rear as soon as the preceding

train has passed a sufficient distance (the overlap distance) beyond the next stop signal ahead, as indicated by the track circuits, without the permission of the signalman at the box ahead first being obtained, and it applies whether the next stop signal ahead of the controlled signal is an automatic or semi-automatic signal.

Signalling Controls

7. Each automatic signal in para. 3 is controlled to Danger by the occupation of the single long track circuit that starts at a point an overlap length beyond that signal and continues to a point an overlap length beyond the next signal. This continuation of an approach track circuit past a signal to form the "overlap track circuit" beyond it is in accordance with the British Railways Board's Standard Signalling Principles.

8. Signal A 322 is controlled to Danger by Track Circuit FG, Signal A 324 by Track Circuit FH, Signal A 370 by Track Circuit FJ, and Signal A 372 by Tract Circuit FL. The "overlap track circuit" length beyond Signal A 322 is 200 yds and overlap lengths beyond the other signals are each 440 yds. Aspect sequences are normal, Green (Proceed) meaning that the next signal ahead is at Green or Yellow, and Yellow (Caution) meaning that the next signal ahead is at Red (Danger). Track Circuits FG, FH, FJ, and FL are for technical reasons each in two sections but the two sections of FH (FH1 and FH2) are dependent on one another and are fed from the same source (see para. 11 below): occupation of either section holds Signal A 324 at Danger. The same is true of Track Circuit FJ and Signal A 370. Up line Signal A 321 is controlled to Danger by Up line Track Circuit EK.

9. Down line track circuits to inclusive FF are indicated on the panel in Tonbridge signalbox, as are all the Up line track circuits from well on the Ashford side of Marden. Down line track circuits from inclusive FF are indicated in the Ashford signalbox. The aspects shown by automatic signals are not indicated in either signalbox: this is in accordance with general British Railway's practice.

Signalling Power Supplies

10. Traction power is supplied at high voltage and in duplicate to the electrical sub-stations, where it is transformed to medium voltage for signalling purposes, this reduced voltage then being transmitted by signalling cables in each direction for several miles. A failure of the high voltage supplies to a sub-station would thus cause a complete failure of the signalling. As these supplies are however duplicated and controlled by the Chief Mechanical and Electrical Engineer for traction purposes they are regarded as reliable for signalling supplies, and standby equipment for the latter is not provided. Failure of the traction supply would in any case bring all electric trains to a stand.

11. In the Down direction Signals A 324, A 370, and A 372, and Track Circuits FG (one only of its two sections), FH, FJ, and the first of the two sections of FL, are fed from the signalling supply provided by Marden sub-station. Failure of the supply from Marden would thus extinguish the lights in the three signals and, by the de-energisation of part of Track Circuit FG would cause Signal A 322 to be held at Danger. The extinction of Signals A 324, A 370, and A 372 and the reversion of A 322 would not be indicated in the Ashford signalbox (see last sentence of para. 9). Track Circuits FG, FH, FJ and FL would however show "occupied" on the Ashford panel, the "Call Technician" indicator in that signalbox would flash, and a buzzer would sound.

Telephones

12. All the automatic signals are provided with signal post telephones. Those at Signals A 322, A 324, and A 370 are connected to Ashford signalbox, each on a separate circuit and with the number of the signal concerned being clearly displayed on a panel under the signalman's eye during a conversation. Up line Signal A 321 is similarly connected but to the Tonbridge signalbox. (No other signalbox was open between Tonbridge and Ashford on this occasion). At Marden electrical sub-station, located some 715 yds on the Marden side of Signal A 370, there is a telephone on the outside wall connected to Paddock Wood electrical control room.

Automatic Warning System

13. This main line is not equipped with inductors for the Automatic Warning System (AWS) of train control.

The Track

14. The Down track from Tonbridge to Marden is mostly laid in standard jointed lengths on wooden sleepers, but there are some stretches of continuous welded rail and one of these extended, at the time of the accident, from about Signal A 324 to some 45 yds short of Signal A 370, where it changed to jointed track. About midway between Signal A 370 and Marden Station there are spring catchpoints in the Down line which consist of insulated switches in the rail: they were installed in August 1964 and, because they lie within

the length of Track Circuit FJ, they have an insulated sole plate and two insulated stretcher bars between the switch blades. On some six occasions in the three years before the accident a stretcher bar has broken causing a failure of Tract Circuit FJ.

Gradients

15. The line from Paddock Wood to the point of collision although straight is undulating as shown on the Gradient Diagram on the Plan. It is steadily rising at 1/500–1/580 between Signals A 322 and A 324.

Speed Limits

16. The line speed limit is 90 m.p.h. but there is a permanent speed restriction of 50 m.p.h. for a short distance at the London end of Tonbridge Station.

The Parcels Train

17. The parcels train, at the time of the accident, comprised eight mixed vans hauled by Class 33 1550 h.p. Diesel Electric Engine No. 6558. The vans were, in order from the engine:

a 4-wheeled continental refrigerator van (Interfrigo),

a 4-wheeled parcels mail van (PMV), built in 1943 and with a steel underframe, and wooden sides, end panels, and roof,

a second PMV of similar construction,

a bogie luggage brake van (Pigeon) with a steel underframe and a wooden framed body and panels,

a non-gangwayed bogie general utility van (GUV),
a bogie corridor brake van (BG),
a second GUV, and
a 4-wheeled covered carriage truck (CCT)
} of all-steel construction

18. The overall length of engine and train was 151 yds and the train was screw coupled with side buffers throughout and fully vacuum braked, the total available brake power being 66 per cent of the total weight.

The Express Passenger Train

19. The express consisted of two 1957 design express passenger electrical multiple-units, each of 4 coaches (4 CEP). The leading unit was No. 7181 and comprised, in order of travel at the time of the collision

a motor brake second saloon coach,

a trailer second corridor coach,

a trailer composite corridor coach, and

a motor brake second saloon coach.

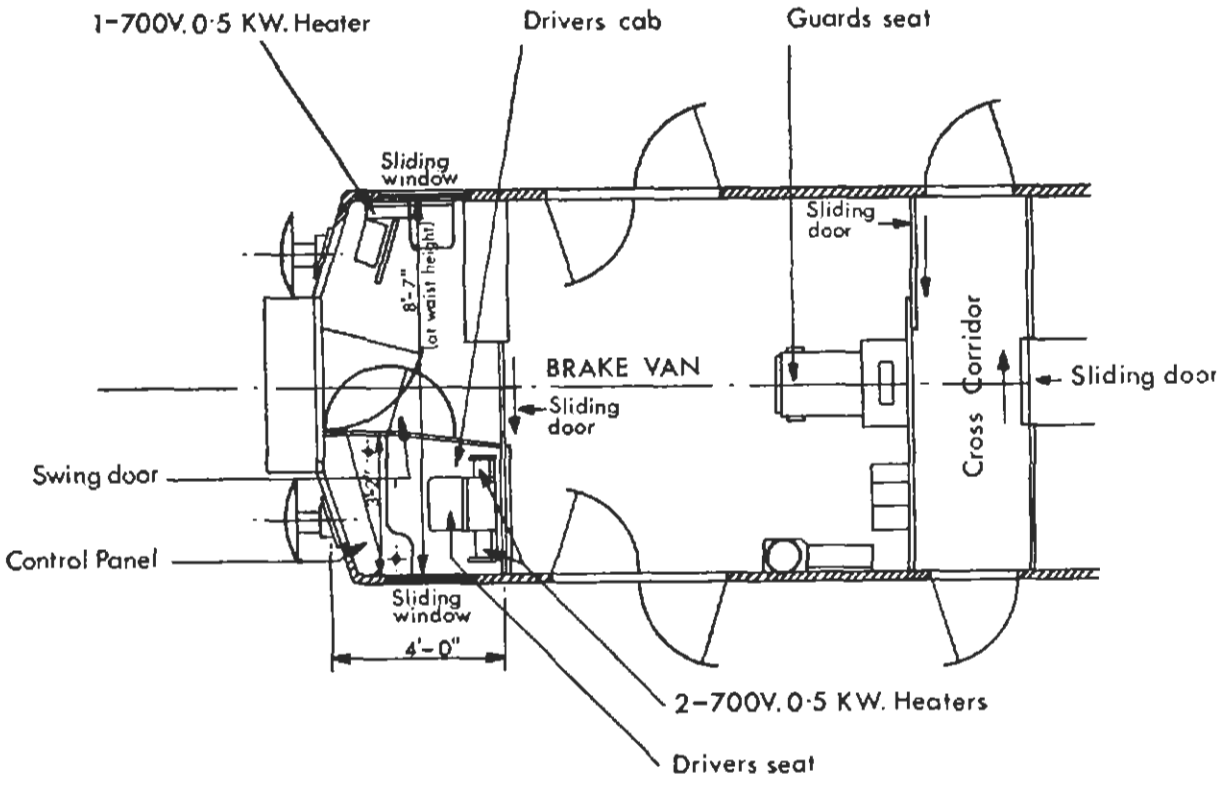
This unit was built in 1960. It last had a general overhaul in October 1967, since when it had run 110,000 miles: its electrical equipment had last been inspected on 13th November 1968, and its brake blocks had been renewed on 30th December.

20. The trailing unit was No. 7117 and was of make-up similar to No. 7181: the coaches were in the reverse order in the direction of travel and the unit was built in 1958. It last had a general overhaul in August 1968, since when it had run 32,000 miles: its electrical equipment had last been inspected on 27th December 1968, and its brake blocks had been renewed on 15th December.

21. The two units were specially built for the Kent Coast electrification. They were of all-steel construction and their combined weight was 296 tons and their overall length was 177 yds. AWS train equipment had been installed on all the motor coaches, in connection with AWS tests on the electrified lines of Southern Region.

22. The train was fitted with buckeye couplings throughout, the four coaches in each unit being connected by those of the solid shank, solid head type, and the two units by the drop head type, this latter type being fitted also at both ends of the train. The brakes throughout the train were of the electro-pneumatic (EP) type with Westinghouse additional. The total available brake power (EP) was 76 per cent of the total weight of the train.

23. The leading motor coach (the leading coach in the train) was divided by vertical cross panels and partitions (bulkheads) into six differently sized compartments, the leading three of which are shown in the sketch opposite:



HEIGHT OF LEADING COMPARTMENT 7'-8"
AT HIGHEST POINT.

The brake van gave access ahead to the leading compartment through a sliding door (with a lifting catch) in its forward bulkhead, and thence through a swing door (usually kept locked open when the driver is in his cab) in the fore-and-aft partition that separated the driver's cab from the rest of the leading compartment. A sliding door in the offside end of the brake van's rear bulkhead gave access to the cross corridor which had ordinary outwards opening coach swing doors at each end for passenger entry, and a sliding door giving access to the leading passenger compartment. The brake van had double swing doors in each side for luggage loading.

24. The driver's cab had a wide forward window, with a windscreen wiper, which gave a driver a good view of signals ahead: he also had a good view to the near side through a sliding window on his left. There were two electric heaters, each of ½ kw capacity, under the driver's seat and a third, of the same capacity, at the other end of the leading compartment: the level of heating (½, 1, or 1½ kw) was under the driver's control. There were two roof ventilators, the one above the driver being controlled by a Bowden cable arrangement, and a small controllable ventilator above each sliding side window.

25. Immediately in front of the driver's seat was his horizontally mounted control panel with the Brake Handle on his left as he faced forward and with the Master Controller on his right. Mounted vertically along the forward edge of the panel and immediately under the forward window was a dash board on which were mounted the gauges showing air pressures, train speed, and amperage, and various switches etc.

26. The Brake Handle would have to be moved anti-clockwise, i.e. forward away from the driver, to the full extent of its travel to a position pointing some 20° short of fully forward in making a full emergency brake application, and to a position short of this in making a service application. The Master Controller, when viewed in the direction of travel, had two knobbed handles protruding from it horizontally to right and left and a slot for the driver's master key. When the key was inserted and turned it would unlock the right hand handle which had two positions only—"On" and "Off": when this handle was moved to the "On" position it would switch on the compressors etc. and unlock the left hand handle. This latter handle, the Reverser Handle, had three positions i.e. the central or "Off" position (hereinafter referred to as the "Neutral" position to distinguish it from the "Off" position of the right hand handle and of the Control Handle), the "Forward" position, and the "Reverse" position. When the Reverser Handle was moved to either "Forward" or "Reverse" it would unlock the centrally mounted Control Handle, the knob at the outer end of which would then have to be held down continuously against a spring to keep the brakes from being automatically applied: unlocking the handle would also allow the driver to move it anti-clockwise towards him to one of the four power positions ("shunt", "series", "parallel" and "weak field").

27. The driver's safety device (DSD) was thus incorporated in the Control Handle: it was of a usually effective type, the knob of the Control Handle having to be held down against a pressure of 5–5¼ lbs to prevent the brakes being automatically applied.

28. The DSD became effective as soon as the Reverser Handle was moved to either the "Forward" or the "Reverse" position and when the Control Handle, in which the DSD was incorporated, was in any power position it locked the Reverser Handle. Two points that may be of importance in this case are that if the Control Handle were to be in the "Off" position, i.e. fully forward away from the driver, the Reverser Handle would be unlocked and could be moved from "Forward" to "Neutral" or "Reverse", and that if the Reverser Handle were thus to be moved to "Neutral" the DSD could be released and let spring upwards without the brakes being applied.

The Damage to the Trains

29. What happened to the trains after the initial impact has been described generally in the introduction to this Report (7th and 8th paragraphs).

30. When the leading coach of the express plunged to the left down the side of the embankment it must have rolled over and ploughed forward when already upside down, since its vertical cross panels and partitions had been folded back in the complete demolition of its bodywork. It finished up upside down at the bottom of the embankment and roughly parallel with the track, with its badly damaged underframe acting as a roof to the wreckage beneath it and with its bogies torn off: what had been its leading (motor) bogie was found alongside the third coach, and its offside cab corner was found on the bank beyond the Up line near the sixth coach of the train, and was almost the first item in the trail of wreckage. The fixed buckeye coupling between the first and second coaches parted and the second coach was free to take its own path and it finished up ahead of the first coach, lying on its near side and partly along the side of the embankment, with its near side torn out, extensive other damage to its body particularly at its leading end, and its underframe badly damaged. The third coach, which jack-knifed between the second and fourth coaches with its couplings holding, was badly damaged at its leading end only, one corner being torn out and the other pushed in with its corner pillar pushed out: both solebars were bent and one side of the underframe, and some of the underframe equipment, was damaged. Its near side leading end and the trailing end of the second coach finished up on the edge of the upturned underframe of the leading coach. That the damage to this coach, apart from its leading end, was relatively light compared with that to the two coaches ahead of it is best brought out by the fact that, in the Chief Mechanical and Electrical Engineer's Departmental Report on the damage to the train, it could be itemised in detail in a fairly short list, whereas the best that could be said of the leading coach was that it was "completely demolished" and of the second coach that it was very severely damaged. Damage to the other five coaches was slight, although, as was to be expected in view of the rapid deceleration involved, a number of seats were carried away or displaced.

31. Of the parcels train, the CCT in rear and the GUV next ahead of it, both had their underframes very badly damaged and their all-steel bodies were completely destroyed. The remains of the CCT finished up well ahead of the GUV, lying across both tracks and level with and roughly parallel to the express train's third coach: the remains of the GUV that had been ahead of it were down the bank and almost as far back as the other train's sixth coach. The BG next ahead had part of its all-steel body destroyed and the rest very badly damaged. The demolished end of its underframe had been driven into the ground and it lay at right angles to and across the Up line with its other end, with part of its body still attached, uplifted to 15 ft above it: part of its body panelling was found under the express train's first coach. The GUV fourth from the rear had one bogie pushed 3 ft towards the van's centre: its underframe was badly distorted, 15 ft of its roof, one end, and one side of its all-steel body were torn off, and the other side was buckled. The Pigeon next ahead of this GUV, and with which it was bufferlocked, sustained fairly severe damage, and both vehicles were not fit to run, but they were not derailed. The two PMVs and the Interfrigo were undamaged and also remained on the rails, as did the engine.

Damage to Track, etc.

32. In the Down line some 8 lengths of rail had to be replaced, together with the crippled conductor rail and 110 yds of concrete post and rail fencing. A considerable depth of ballast had also to be made good. In the Up line the damage was relatively superficial, though a length of conductor rail was crippled and the track was distorted in places. Some feeder and signalling cables and cable troughing were damaged over a short length.

Relevant Rules and Regulations

British Railways' Rule Book

33. *Extracts from Rule 77(e), first para.*

> (*e*) When a signal controlling the entrance to the section ahead is locked at Danger by the disconnection of a track circuit or other apparatus performing a similar function, the Handsignalman must be stationed at the signal and he must instruct Drivers of all trains to proceed cautiously through the section.....
>
> [Note. The second para. of Rule 77(*e*), in which reference is made to a defective signal, starts with the words "When a track circuit (except as described above)...is disconnected" and is not relevant in this case.]

34. *Signalling during Fog*

NOTE under above main heading on page 98: "Fogsignalmen are not employed at Colour Light signals unless otherwise specially advised."

35. *Extracts from Rule* 127

"The Driver MUST—

(iv) observe and obey all signals.....and when owing to fog.....the fixed signals are not visible at the usual distance, use every precaution and reduce speed if necessary.....to enable the train to be stopped should it be at Danger.

(xiii) regulate the running of his engine to ensure, as far as practicable, punctual working.....

(xxii) .....when the fog is so dense that the fixed signals cannot be seen by the Driver on approaching them.....where a stop signal is concerned he must assume that the signal is at Danger and stop his train immediately."

Tract Circuit Block Regulations

36. *Regulation 4* lays down that "should the signalbox diagram indicate the occupation of a track circuit and no train description or emergency bell signal has been received, the Signalman must immediately endeavour to ascertain the cause, communicating with the Signalman at the box in rear if necessary."

37. *Extracts from Regulation 25. "Failure of.....Track Circuits."*

"In the event of a failure of signalling apparatus so that trains cannot be signalled and dealt with in the usual way, arrangements must immediately be made to have the apparatus put in working order and the following instructions observed in the meantime for the line or lines affected:

.....

(*d*) Track Circuits

If a track circuit fails to clear after the passage of a train, or otherwise shows occupied, and the Signalman is satisfied.....that there is no train occupying that portion of line, the following instructions will apply:

(i) The first train requiring to pass over the affected line must be stopped at the signal held at Danger and when an assurance has been obtained from the Driver that the line is clear as far as can be seen, he must be told to pass the signal at Danger, and to proceed cautiously towards the next signal, prepared to stop short of any obstruction. He must also be told to stop at the latter signal, even if it is showing a proceed aspect and to report the state of the line to the Signalman at the box ahead, from the telephone there.

(ii) If the Driver reports that the line is clear, then until the failure has been rectified the most suitable* of the following arrangements must be brought into operation:

(*a*) A Handsignalman/men must be appointed in accordance with Rule 77(*e*).

(*b*) Each train requiring to pass over the affected track must be stopped, the Driver authorised to pass the signal at Danger and to proceed cautiously over the affected portion of the line.

(*c*) Block working in accordance with Regulation 1B, Drivers being instructed to pass the signal at Danger."

*(*d*)(ii) thus supersedes Rule 81(*b*) which would otherwise make the adoption of Rule 77(*e*) mandatory in the case of a track circuit failure.

38. *Regulation 1B* covers the "Mode of Signalling When Block Working by Bell or Telephone is in Force" and lays down that this mode must be instituted in connection with single line working and may be used during the failure of track circuits. The use of this mode of signalling in the case of a failed track circuit between Paddock Wood and Marden would have involved the introduction of absolute block working with bell code train signals ("Description of Train", "Train Entering Section", and "Train Out of Section") between the last signal controlled from Tonbridge and short of the automatic signal held at Danger by the track circuit's failure and the first controlled signal at Ashford that was so located that a train's tail lamp could be observed from the Ashford box after the train had cleared its overlap. Alternatively, the section could have been shortened by sending a handsignalman out to observe and report on the train's tail lamp from some controllable signal between the Ashford end of the section of line affected and Ashford.

EVIDENCE

39. *Mr. J. S. Cartlidge*, Mechanical and Electrical Engineer (Rolling Stock Maintenance), Southern Region, was of the opinion that, on the assumption that the parcels train was moving forward at the moment of impact, the damage sustained by the rolling stock and track indicated a speed of collision, i.e. the speed of the express minus the speed of the parcels train at the moment of impact, of some 65–70 m.p.h.

40. *Mr. A. J. Barter*, Divisional Traction Engineer, South Eastern Division, said that he reached the site at about 23.00 approaching it for the last few hundred yards along the track from the Paddock Wood direction, through thick fog. He could not estimate at what range he could first see Signal A 370's aspect except that he could not see it from about 300 yds. The rear end of the express was some 5 yds beyond the signal, and he agreed that since the combined length of the two trains was 328 yds or 122 yds less than the length of the overlap beyond Signal A 370, the head of the parcels train must still have been well short of the start of Track Circuit FJ at the moment of impact. *Mr. A. W. Damon*, Chief Signal and Telecommunications Engineer, Southern Region, confirmed that this meant that as the express ran up to Signal A 370 the latter would have been displaying the same aspect as, or possibly one less restrictive than, it was showing when the parcels train's engine passed it. Mr. Barter also confirmed that, although the engine and first three vehicles of the parcels train had been propelled forward by the collision, the engine was still short of the start of Track Circuit FJ.

41. Mr. Barter went on to say that the driver's control panel was not found in the wreckage of the leading end of the first coach until the fourth day after the accident and that then he could not see the controls but was able to reach them with the tips of his fingers. Full access to the controls was achieved, through an inspection trap in the floor of the guard's van and by cutting through what had been the bulkhead behind the driver's seat and which was now folded flat back against what had been the floor of the guard's van and other debris and obstacles, two days later (part of the delay was caused by the fire risk and consequent need to minimise flame cutting).

42. As regards the driver's Brake Handle, Mr. Barter said that he found it right forward in the full emergency brake application position, with its outer end thrust through a hole in the dashboard and stuck fast in the mud below. When full access to the Master Controller was gained, he found the Control Handle in the fully forward position ("Off") with its knob up. The lack of score marks on the desk top and the fact that the knob made such marks when moved convinced him that the handle had been in that position at the moment of collision. He found the Reverser Handle to be in the "Neutral" position: debris prevented its being moved to the "Forward" position but it could be moved freely by hand to the "Reverse" position. He was able to move the Control Handle through all its positions and satisfied himself that the interlockng between it and the Reverser Handle was correct. Between his discovery of the Controller and my Inquiry Mr. Barter had carried out experiments with a number of Controllers and found that when he struck the Reverser Handle sharply with a 2-lb hammer, it nearly always moved into "Neutral". With only one Controller out of three, and with that one only once in three attempts could he apply a blow that could move the handle right through "Neutral": similar tests with the train's Controller, after more debris had been removed, gave similar results, the handle stopping in "Neutral" in all except one of several attempts to drive it through.

43. Mr. Barter was strongly of the opinion that the Reverser Handle had been in the "Forward" position at the moment of collision, and that a full brake application had been made and the DSD released with the Control handle in the fully forward ("Off") position. He said that the brakes when applied in this way would start to "bite" at the leading end of the train in some 2 secs and in some 3 secs at the rear. He was later able to tell me that when the brake Controller had been recovered and put on test in a Repair Shop, no defects were found in it. He also estimated, from the damage sustained by both trains, that the speed of collision was some 65–70 m.p.h. The damage was such that he could not say what had been the state of the heaters and ventilators.

44. Mr. Barter said that after the accident the brake blocks were found to be generally a quarter worn and the slack adjusters to have half to three quarters of their movement remaining. There was nothing to suggest that the brakes were of reduced efficiency before the collision, and examination of the three surviving motor coaches showed their controls to be in the correct position for forward movement.

45. *A large number of passengers* in the train very kindly responded to an appeal I had made through TV, Radio, and the Press, either by writing to me direct or by making statements to the Police. Their recollections of whether or not the brakes were applied before the collision varied greatly and analysis of the views expressed suggested that the brakes may have been applied some 3–4 secs before the collision. Two of the passengers in the last coach, *Mrs. H. Kennedy* of Ashford and *Mrs. J. Wood-Brignall* of Boughton Aluph, wrote and told me that after the accident they looked out of a near side window of the last coach, in which they were travelling together, and got the impression that Signal A 370 was then, at about 20.45, showing a Green aspect.

46. *Mr. G. McConnachie*, Motive Power Officer, South Eastern Division, said that the express train driver's body was found some 12 ft back from the driving cab, lying fore and aft and face down with the head forward, on what had been the offside of the ceiling of the first passenger compartment. He said that the driver (Driver Harvey) had booked on duty for this trip at 15.30 and had had plenty of time for any personal needs before he took over the train.

47. *Mr. J. F. Rogers*, Divisional Movements Manager, South Eastern Division, said that he reached Up line Signal A 321 on foot from Marden Station at about 22.30. Walking along the Up line through thick fog he first observed the aspect displayed by that signal at a range that he estimated at 75–100 yds and he agreed that it might have been visible from driver's eye level (to which colour light signals are focussed) at a slightly longer range. In general ordinary objects could be seen at only 50–60 yds: he had made this estimate

at the time and by comparison with the known length of the 60 ft rails in the track. Mr. Rogers lives in the Ashford area and so travels frequently in express trains of this type, as a passenger as well as officially in the driver's cab. He said that a train not stopping at Tonbridge and running under Green signals and in clear weather would normally reach a speed of 80 m.p.h. or so through Paddock Wood, after observing the speed restriction of 50 m.p.h. approaching Tonbridge, and that he would expect the speed to drop slightly over the undulating but generally rising stretch to beyond Marden whence it would rise again over the falling stretch to Staplehurst: he would expect the speed under these conditions to be between 75 and 80 m.p.h. past Signal A 370. In reply to a question Mr. Rogers added the qualification that such a speed under Green signals would be quite correct "in clear weather and with everything else being normal."

48. *Mr. G. F. Huskisson*, Divisional Manager, South Eastern Division, told me that he reached the site across the fields from the nearest lane at about 22.15. His estimate of the visibility in the fog at the site was some 40–50 yds and he emphasised that the fog was patchy and that the visibility at times was considerably more and at other times somewhat less.

49. *Railman G. H. Young*, who was on platform duties at Paddock Wood said that he could see the aspect of the Down Starting signal very faintly from the point where the Down platform widens, i.e. from about 100 yds away. He did not see the parcels train go through and so could not report on its tail lamp's visibility, but he did see the express and said that it whistled quite normally when it ran through the station and that its speed was about the same as that of similar fast trains through Paddock Wood.

50. *Leading Railman J. Packham* was on platform duties at Marden. He said that he was in the office when the train ahead of the parcels train went through and so did not observe its tail lamp. Shortly before the accident he could not see the relay room from the station footbridge, i.e. at a range of about 50 yds.

51. *Signalman J. S. J. Shipp*, on duty as the country end signalman in Tonbridge signalbox, said that at about 18.00 he was advised by Control that the driver of a special rail train that was due to leave Paddock Wood for Ashford at 18.10 had declined to take it forward because the fitted head specified for it in the Special Traffic Notice under which it was to run had not been provided and that the driver was to bring his engine and brake van back to Tonbridge to collect wagons for a fitted head and to return to Paddock Wood for a later departure. This was done and the engine and fitted head returned to their train in the Down Siding West at Paddock Wood. Sometime between 19.00 and 19.15 Shipp was told by the Ashford signalman that Track Circuit FJ at Marden had failed and he at once arranged for the Tonbridge technician to get into touch with the Ashford signalman.

52. Later, in accordance with arrangements Signalman Shipp had made with Control, the rail train left Paddock Wood on the Down line in the wake of a passenger train at 20.12, two hours later than had been shown on the Special Traffic Notice. The next train on the Down line was the parcels train and it left Tonbridge at 20.12, 3 mins early: Shipp said that he saw it pass his box but did not then observe its tail lamp, though he had seen the latter, at a range of about 50 yds through the fog, when the train first arrived. He then saw, from the track circuits on his panel, that it passed Paddock Wood at 20.20. The next Down train through Tonbridge was the express and he said that it was described to him from Sevenoaks at 20.26 and that he could see its lights through the fog as it passed at its usual speed at 20.34, some 3 mins ahead of time, and that it passed through Paddock Wood at 20.39.

53. Signalman Shipp went on to say that at 20.42 he saw that all the Up line track circuit indications on his panel, from their start on the Tonbridge side of Ashford to Paddock Wood, were showing Occupied, which they continued to do for between 2 and 3 mins, and that the signal repeater indications for Headcorn (a station some 10½ miles on the Marden side of Ashford) were flashing. He at once telephoned the Ashford signalman who told him that all the Down line track circuits on his panel were similarly showing Occupied and that there had been a collision. He had already concluded from the behaviour of his own indications that something was amiss and he had received and acknowledged the "Obstruction Danger" bell code from Ashford. Having control of two signals at Headcorn he ran an approaching Up passenger train into the Up Loop there where he held it, agreed with the Ashford signalman that no more Up trains would be despatched, and arranged for a Down goods train that was approaching Paddock Wood to be shunted to the sidings there.

54. *Signalman, Power "A", L. F. Lindfield*, on duty as the country end signalman in Ashford signalbox, said that, as was customary there on the 14.00 to 22.00 shift, each of the two signalmen in turn took over temporary control of the whole panel to enable his colleague to take a tea break. His turn for sole charge was from about 18.00 until about 18.30 and at about 18.20 he saw that the indication for Track Circuit FJ at Marden was showng Occupied after a Down train had passed well clear of it and was approaching Headcorn. He did not report this apparent failure but since there was a Down train between Paddock Wood and Marden at the time he decided to wait until its driver stopped at Signal A 370 and telephoned him from there. This the driver did shortly afterwards, correctly identifying himself and reporting that the signal was at Danger, and Lindfield told him to pass the signal thus and to proceed cautiously to the next signal and to telephone again from there. In due course the driver reported from Signal A 372 that the line was clear, and Lindfield told him to proceed normally obeying all signals in the usual way. As the train cleared Track Circuit FJ the latter ceased to show Occupied and Lindfield concluded that the failure had rectified itself. At 18.30 he handed the country end of the panel back to his colleague, telling him of the temporary failure and that it had rectified itself.

55. *Special Rest Day Relief Signalman R. E. Prescott*, Signalman Lindfield's colleague in the Ashford signalbox, confirmed that when he resumed control of the London end of the panel at 18.30 Lindfield told him about the temporary failure of Track Circuit FJ and that the failure had rectified itself. He said that at 19.14 this track circuit again showed Occupied when he knew that there was no train on it and that he reported this failure to the S. & T. technician at Tonbridge through the Tonbridge signalman and the technician said that he would deal with it as soon as he could and would report back. Prescott was firm that the technician subsequently telephoned him, not later than 20.40, that the failure had been rectified and he agreed that this repair must have been completed a few minutes earlier because after it the technician would have had to walk to the telephone before he could report the repair. Seven trains passed over the line ahead of the parcels train and while the track circuit was in a state of failure, and each was identified correctly by the trainman. Prescott said that he used the first of these to prove the line and then allowed the remainder to pass Signal A 370 at Danger as soon as the line was clear to the overlap point beyond Signal A 372. The driver of the rail train telephoned from Signal A 370 and was given these instructions at 20.27 or 20.28.

56. Signalman Prescott said that the parcels train was running fairly close behind the rail train. It was described to him by Tonbridge at 20.20 and it was stopped at Signal A 324 at Danger because the rail train was then still occupying the controlling track circuit. He could not remember at what time this occurred, but he told the trainman who telephoned him, correctly identifying his train when he did so, that he was to wait at the signal until its aspect changed and then to run on to Signal A 370 and to telephone him again from there. At about 20.39 the same trainman telephoned him from Signal A 370 and said that that signal had changed its aspect, and he agreed that this must have been after the failed track-circuit had in fact been repaired and that the repair must have been effected between 20.30 and 20.40. He told the trainman to proceed normally.

57. Signalman Prescott went on to say that the express passed Paddock Wood at 20.39, with the parcels train still on Track Circuit FH, and that he then saw it occupy Track Circuits FF and FG in turn. When he saw that it had cleared FG with FH still occupied by the parcels train he realised that it would collide with the rear of the latter and he sent the "Obstruction Danger" bell code to Tonbridge: the time was then 20.42 and about 1½ mins later his Down line track circuits showed Occupied but for a short time only.

58. *S. & T. Technician P. E. Young*, stationed at Tonbridge signalbox, said that at 19.20 he was told by the signalman there that there had been a track circuit failure at Marden, and that he then telephoned the Ashford signalman and learnt that Track Circuit FJ had failed after a short failure earlier in the afternoon. He had had previous trouble with track circuits within the length of which catchpoints were located, and on arrival at Marden and with this experience in mind he went straightaway back to the catchpoints between Marden and Signal A 370, where he found, as he expected, that the first stretcher bar had broken causing a short circuit which would cause the track circuit to show Occupied. He removed the broken stretcher bar and this rectified the failure at about 20.30, and then walked to Marden and reported this to the Ashford signalman at about 20.40. He said also that at about 20.44, shortly after he had left the Marden booking office after reporting the repair, he observed Signal A 372, at a range of about 45 yds, showing a Caution aspect. Young was emphatic that nothing that he had done during the repairs to the catchpoints and thus to Track Circuit FJ could possibly have affected Track Circuit FH and thus the controls of Signal A 324.

59. *S. & T. Inspector A. J. Hawkett*, the Signal Department District Supervisor at Ashford and with 8 years' experience in his rank, said that he reached the site at 22.30 and that Signal A 370 was then at Green. He sent one of his staff back to Signal A 324 to report on its aspect: the answer was that it was at Danger which he said was to be expected with the debris of the two trains occupying Track Circuit FH. He confirmed that Track Circuit FJ, controlling Signal A 370, was unoccupied and he arranged for it to be shunted so that Signal A 370 was put back to Danger for full protection purposes: he put Up line Signal A 321 back to Danger in the same way.

60. Mr. Hawkett went on to say that he then tested the relays controlling Signals A 322, A 324, A 370, and A 372, the signals themselves, and Track Circuits FH and FJ, and found all to be in order: a false feed had to be used in the initial test of the Ashford end of FH (FH2) because it was occupied by the remains of the two trains, but a later full test of FH2 confirmed the earlier false feed results. A full aspect sequence test was made on the second day after the accident, when the track was clear, and the sequences were found to be in order. Comprehensive cable tests had already been made as soon as possible after the accident and the insulation had been satisfactorily proved. In response to a question by *Mr. Damon* (see para. 40 above), Mr. Hawkett said that during his tests of the relays controlling Signal A 324 he was accompanied by Mr. D. W. Perry, the Divisional Signal Engineer, who was also present during some of the other tests, and that during his tests on the day after the accident he was accompanied by *Mr. H. L. F. Tuff*, Mr. Damon's Senior Assistant, and that the latter had suggested various additional tests which he had carried out. In addition to bringing out this point that the field tests of the signalling had been closely supervised by senior signalling staff officers, *Mr. Damon* said that he had himself examined their results and found them to be satisfactory. Later, when sending me the details of the tests (which are at paras. 75–76) he confirmed his entire satisfaction with their results: he considered it proven that with Track Circuit FH1 or FH2 occupied Signal A 324 would be at Danger, with Signal A 322 at Caution, and Signal PE 129 at Paddock Wood showing a Green aspect.

61. *Senior Secondman J. S. B Davison* was the driver of the rail train that was running under a Special Traffic Notice and which left Paddock Wood two hours late, and thus immediately ahead of the parcels train,

because he had had to take his engine and brake van back to Tonbridge to collect the fitted head that the Notice specified for this train. (The train comprised 5 salmon wagons loaded with 300 ft lengths of continuous welded rail, two brake vans, and a 7-wagon fitted head, and was hauled by a Class 33 diesel-electric engine and its maximum speed on the open line was restricted to 25 m.p.h.). He said that when his train ran through Paddock Wood on the Down Main—it had left from the Down Siding West—the visibility was about "the length of an engine, about 50 ft" and that it was at this range, or perhaps half an engine length longer, that he first saw Signals PE 129, A 322, and A 324 in turn and each displaying a Caution aspect. The fog seemed to thicken as he ran towards Marden but was patchy and he saw Signal A 370 at Danger also at "about an engine length." He was running at between 15 and 20 m.p.h. as he approached the signal but he had no difficulty in stopping at it, when he at once alighted and telephoned the signalmen who told him of the failure and that he was to pass Signal A 370 at Danger and to proceed cautiously, obeying all subsequent signals. He estimated the length of his stop at Signal A 370 at between one and two minutes.

62. *Guard F. G. Tyler,* the guard of the rail train, said that when that train left the Down Siding West he first saw ground position light Signal PE 65 (the exit signal) at a range that he estimated at "roughly four bogie lengths" (this would be about 90 yds). He first saw Signal PE 129 at Caution at the same range as the train ran through Paddock Wood at 20.12. Because this signal was at Caution he kept a good look out and he first saw Signals A 322 and A 324, both at Caution, at about the same range: he was out on his brake van's verandah throughout. He said that he first saw Signal A 370 at Danger before his train's engine stopped at it (this would be at a range of at least 150 yds) and he was then just able to see someone alight from the engine and go to the signal. He estimated that "a few minutes" elapsed between the train's stopping and its starting again past the signal at Danger.

63. *Driver R. Pocknell,* the driver of the parcels train, said that as he ran into Tonbridge, with only 7 vans behind his engine at this stage, the conditions were no worse than misty and that he saw the platform Starting signal at about 300 yds. Another van was added to the train at Tonbridge and he left with a load of 8. Although the Starting signal there had been at Green he experienced signal checks as he ran towards Paddock Wood through thickening fog and he first saw Signals PE 130 and PE 129 there at Danger, though they cleared to one Yellow as he approached. His speed as he ran past Signal PE 129 was only about 5 m.p.h. and he accelerated to some 10 m.p.h. only as he ran on towards Signal A 322 which was at Danger when he saw it and stopped. His secondman was in the act of alighting to telephone the signalman when it cleared to Caution—half a minute perhaps after he had stopped at it—and he continued forward at a speed not much more than 10 m.p.h. towards Signal A 324. This also was at Danger and he stopped at it. Both he and his secondman alighted and the latter telephoned the signalman, who told him of the failure and that there was a ballast train ahead: as he was speaking the signal cleared to Caution and when told of this the signalman said that they were to proceed and to telephone him again from the next signal.

64. Driver Pocknell said that his train's speed as it ran between Signals A 344 and A 370 hardly exceeded 10 m.p.h., and that the latter signal was at Caution when he first saw it. He stopped and his secondman spoke to the signalman, who told him that the fault had cleared and that the train could proceed: he set the train in motion accordingly and had accelerated it to not more than 15 m.p.h. when "he heard a tremendous bang" at the back of his train and his engine was then shunted forward about two engine lengths. The guard went back at once to protect the train and he sent his secondman forward to protect the Up line. A little later, after he had seen what had happened, he ran towards Marden, overtaking the secondman, and put down detonators on the Up line at Signal A 321, which was showing a Green aspect, and then telephoned the Tonbridge signalman, and told him what had happened. Later, when he had returned to Signal A 321 from Marden Station, Mr. Rogers arrived and told him to put a handlamp in the 4-foot showing a Red aspect towards Marden. Driver Pocknell was definite that he observed his speedometer when checking his speed between signals and that at no time did it exceed 15 m.p.h. His estimate of the range at which he saw the signals approaching and after Paddock Wood was 50–60 yds.

65. *Secondman A. C. Hodges,* on the footplate with Driver Pocknell, confirmed the latter's evidence, except that his estimate of the train's speed between signals—he did not observe the speedometer—was slightly higher (about 15 m.p.h.).

66. *Guard A. G. Keene,* in charge of the parcels train and riding in its engine's rear cab, said that when the CCT was added to the rear of the train at Tonbridge the tail lamp was changed to it by the shunter. Keene had however checked the lamp at London Bridge, where it was showing a good light, and he looked at it again after the shunter had moved it to the back of the CCT and saw that its glass was clear. He said that they first ran into fog at Paddock Wood and, although he had his head out of the window and was looking out for them, he first observed Signals PE 130 and 129, both at Caution, at a range of some 50–60 yds, and that it was at about the same range that he first saw Signals A 322, A 324 and A 370. He confirmed that the train passed through Paddock Wood at 20.20.

67. Keene's estimate of the train's speed between Signals PE 129 and A 322 was about 25 m.p.h. and he first observed the latter signal at Danger: the driver had to brake quite sharply to stop at it. The aspect quickly changed to Caution and the train proceeded, but now at a speed of 10–15 m.p.h. only, until it was stopped at Signal A 324 also at Danger. He alighted from his cab and heard the secondman say, after speaking on the telephone, that there was a ballast train (i.e. the rail train) ahead and a track circuit failure but that the parcels train was to proceed as soon as the signal's aspect changed and that they were to telephone from the next signal. The aspect changed to Caution almost at once and the train ran on towards Signal A 370 at some

10–15 m.p.h. He was again looking out and first saw Signal A 370 at Danger but its aspect changed to Caution as the train approached. He did not himself alight at this signal but he saw the secondman do so, speak on the telephone, and then return to his cab. The engine again started forward and had accelerated to some 10 m.p.h. when he felt a violent crash from the rear and was thrown from his seat: when questioned Keene thought that the speed might have been as high as 15 m.p.h.

68. Guard Keene went on to say that, after picking himself up and collecting his lamp, he alighted on the near side and ran towards the rear of the train, followed by his driver and secondman. When they had seen what had happened his mates set off towards Marden to protect the Up line while he went back towards the point of collision and quickly met the guard of the express (Guard Mummery): he could not recall at what range he first saw him. The two guards quickly agreed that Mummery should protect the rear of his train, and Keene then made his way to the Marden electrical sub-station where he used the outside telephone to ask the Electrical Controller to summon the emergency services and to check that the traction current had been cut off. (This call was recorded as having been made at 20.58). He then returned to the scene of the accident and helped the passengers: Signal A 370 was then showing a Green aspect.

69. *Guard G. W. Mummery*, in charge of the express passenger train and with 47 years' railway service, of which 17 had been as a guard, said that he booked on at Ramsgate at 16.30 and worked the 17.35 train thence to Charing Cross. Initially the train comprised unit 7117 only but unit 7181 was attached in rear at Ashford. The journey was quite normal and he travelled in the rear brake van of the train and between Waterloo Junction and Charing Cross he locked the sliding door in the bulkhead between the brake van and the cross corridor. On arrival at 19.20 he had a cup of tea in the canteen and returned to the train at 19.40 and walked along the platform to its front end to have a word with the driver. He found him changing the train's headcode and that he was Driver Harvey, whom he had known for many years. The two men spent some time chatting through the cab's open window and for the most part on social topics, and Harvey was quite his usual self except that he had got, or was recovering from, a heavy cold. At about 19.55 Mummery went back to the rear of the train to make a brake test: both EP and Westinghouse brake tests were satisfactory and he went to the rear brake van of unit 7181 (i.e. to the rear end of the fourth coach in the train) in which he intended to travel and told Harvey over the loudaphone that all was well. The train left on time.

70. Guard Mummery went on to say that after stopping at Waterloo (East) and running through London Bridge on time the train gained on its booked timings, increasing its lead to a maximum of 4 mins through Sevenoaks. Driver Harvey observed the speed limits approaching Tonbridge, braking quite normally for them, and the train ran through Paddock Wood at 20.38½, 3½ mins ahead of time. Mummery had been observing the signals through his periscope and all were Green as far as Tonbridge but he could not remember observing any thereafter: he thought that this might have been because of the fog or because he had knocked his periscope out of adjustment. Approaching Paddock Wood he saw through the fog the station lights, and he was sure that the train was running quite normally and at its usual speed towards Marden. After Paddock Wood he was sitting in the brake van and did not feel any unusual deceleration or application of the brakes until just before the collision, when he felt what he thought was a full emergency application or a release of the DSD. He got down as soon as he could and walked forward, and after a quick discussion with Guard Keene he went back to Signal A 370 and told the Ashford signalman, over the signal post telephone, what had happened. The signal's aspect was then Green and his estimate of its visibility through the fog was 25 yds. He then walked back and put down three detonators at Signal A 324: this signal was at Danger.

Discussion

The Signalling

71. The signalling system installed on this line was criticised after the accident both in the press and in letters from the public. Also in letters from the North East Kent Railway Travellers' Association (with whom the Broadstairs and St. Peter's Urban District Council wished to be associated) and by the Jury at the Inquest on those killed in the accident. The latter were specific in that in a Rider they "considered the method of signalling to be unsatisfactory, having regard to the speed of trains and weather conditions" and that they "felt there should be audible warnings—something in the driver's cab."

72. Where these criticisms were of the type of signals installed, i.e. 3-aspect as compared with 4-aspect colour light signals, many of which were fully automatic and controlled only by the state of the track circuits ahead, they were quite unjustified. 4-aspect colour light signalling can only be justified where, for headway or other reasons, the distance between successive signals has to be less than the maximum braking distance for the fastest train using the line and this was not so approaching and through Marden. 3-aspect signalling was appropriate for this part of the line. Automatic signals are quite safe: they and the track circuits that control them are designed so that a signal is put to Danger should it or its track circuit fail. The continued showing of a "proceed" aspect by the automatic signal until the leading wheels of a train that has passed it have run onto its controlling track circuit, i.e. have passed the signal by the length of the "overlap track circuit", is also quite safe since the signal in rear would meanwhile be held at Danger and even in good weather it is not possible for a driver to "read through" Signal A 324 at Danger to Signal A 370 showing a "proceed" aspect. In fog there is the positive advantage that the guard has a chance of observing the signal showing the same aspect as it was showing when the driver passed it.

73. Where however the criticism was of the lack of the AWS aid to drivers on this line, e.g. in the second part of the Jury's Rider, it had some substance and I report on this aspect at some length in paras 98–104 below.

74. As regards the signalling's integrity—and this was questioned—the evidence of the signalman and of the train crews, and calculations of time and space based on it, do not in any way suggest that the signals were not working quite normally. In particular Signal A 324 clearly showed Danger and Caution aspects correctly at the appropriate times for the parcels train.

75. The signalling was also tested soon after the collision and later, and I am satisfied that the tests were suitably supervised and that they were comprehensive and thorough. From only one point of view was the installation in any way below the standard expected on initial acceptance: the insulation resistance of certain of the cables was below the figure of one megohm laid down by Southern Region for the insulation of a cable core from other cores or from earth. At Signal A 322 the insulation tests of the cables to Signal A 324 disclosed two sub-standard resistances (0·8 and 0·7 megohms): at Signal A 324 there were three sub-standard resistances between the apparatus case and the signal of 0·8 megohms and two between Signal A 324 and the relay room of 0·6 and 0·8 megohms: and at Signal A 370 there were four sub-standard resistances (three of 0·8 and one of 0·6 megohms). Of these eleven cases where the measured insulation values were below the accepted minimum, three were in "group" tests where two or more lines were bunched together and so tested to earth, and a lower resistance would be expected in such tests since the leakages of all the wires involved would be combined. In the other eight cases the insulation losses were, in the Chief Signal and Telecommunications Engineer's (C.S. & T.E's) view, the result of surface leaks at the terminals in the very cold and wet conditions obtaining at the time of the tests: when the wires were disconnected from the terminals the insulation values were well above standard. Some of the resistances were, on test, below the standard set but the standard is a high one and I accept that there can have been no possibility of an insulation resistance causing a "wrong side" signalling failure.

76. The wires in the signal heads were carefully examined and the freedom of movement of all relays was checked. All were satisfactory as were the detailed aspect sequence tests and the drop-away value tests of the various track circuits. The Divisional Signal Engineer confirmed that the doors of the Marden relay room and the apparatus cases at Signals A 322 and A 324 were locked when he visited them after the accident.

77. I consider that the C. S. & T. E. was right to be satisfied with the results of the signalling tests and I accept that it was proved that, with Track Circuit FH1 or FH2 occupied, Signal A 324 would be at Danger with Signal A 322 at Caution.

Method of Emergency Signalling Adopted by the Signalman

78. At my Inquiry it was argued that, because Signal A 370 was an automatic signal, the Ashford signalman should, under the terms of Rule 81(*n*), have sent a handsignalman to that signal in accordance with Rule 77(*i*) and should have told the Tonbridge signalman to stop all Down trains and advise their drivers of Signal A 370's failure. This argument was however mistaken. Rule 81(*n*) would only have applied if Signal A 370 had been defective, but the defect was in fact in the controlling track circuit and not in the signal: even if it had applied the warning of drivers by the Tonbridge signalman would have been required only if Signal A 370 had failed at an aspect other than Danger: and Rule 77(*i*) would have applied only if Signal A 370 had been "inoperative during repair or other work" whereas in fact it was operative and held at Danger only by its controlling track circuit.

79. Track Circuit Block Regulations were in force and Signalman Prescott, when he became aware that Track Circuit FJ had failed and would be holding Signal A 370 at Danger, had three courses open to him under Regulation 25(*d*) (ii) (see para. 37 above). If he had sent out a handsignalman to Signal A 370 (Course (a)), as was also argued at my Inquiry, he would have wasted time (a suitable man would have had to be found on a Saturday evening, briefed, and transported to the signal possibly from a distance and certainly through thick fog) and the handsignalman, when appointed and at his post, would merely have been an extra link in the chain of communication between a train crew and the signalman, with the possibility of misunderstanding that any extra link in such a chain is bound to produce.

80. It is quite clear that Signalman Prescott acted sensibly and correctly in adopting Course (b), i.e. in using the first train to check that the line was clear and then authorising each driver in turn, when stopped at Signal A 370 at Danger, to pass it and to proceed cautiously over the affected portion of the line. The method of emergency signalling adopted was quite correct.

Medical

81. Driver Harvey was aged 38. The Chief Superintendent, Kent County Constabulary, kindly gave me copies of the post-mortem and blood analysis reports made after his death. His heart was of normal size and there was no evidence of valvular disease or any defect in the coronary circulation. There was no alcohol in his blood. Harvey was clearly fit and sober at the time of the accident. Medical reports showed his eyesight to be very good.

Position of Driver Harvey's Body

82. One remote possibility which, because Driver Harvey's body was found so far back in the wreckage, I could not dismiss out of hand was that, after passing through Paddock Wood under Green signals and assuming that all was clear ahead, he quitted his cab and walked back into the train for some personal reason. Presupposing that the Brake Handle was pushed into the fully applied position during the consequences of the collision and not by the driver and in emergency just before it, this would have been physically possible because he could have put the Control Handle in the "Off" position in which it was found and have moved the Controller Handle to "Neutral" thus making the DSD ineffective. The train could then have been left to coast on the undulating line through Marden to Staplehurst. Such behaviour has been known to occur in the past, e.g. in 1967 the driver of an electric multiple-unit train in another Region isolated his DSD in this way and walked back and was killed when he leant backwards from one of the windows of the transverse corridor behind his cab and was struck by a lineside signal.

83. A test was therefore made to see how the train would have behaved if it had been handled in this way. The test train was driven normally to Paddock Wood, where its speed was 79 m.p.h., but immediately after the junction power was shut off and the train allowed to coast. Its actual speeds approaching Signal A 322 and passing A 324 were 75 m.p.h. and 65 m.p.h. respectively and its estimated speed (a stop watch speed was impossible because the 38¼ MP had been destroyed) past Signal A 370 was a little less than 60 m.p.h. The speed thus fell by some 20 m.p.h. in a little over 3 miles. I was on the train during this test and I do not believe that Guard Mummery could have failed to notice such a loss of speed, apart from the shutting off of power that would have accompanied it. Also, the evidence of the passengers was that the run was quite normal until just before the collision and that there was no such loss of speed during the two or three mins that preceded it. In any case such a reduction in speed would have meant a collision speed of a little less than 45 m.p.h. and this would, in my view, be inconsistent with the damage. What I have been told of Driver Harvey's good character and conscientiousness also discount the possibility of his having behaved in this way and I am quite satisfied that he did not do so. In my view his body was carried back to where it was found in the course of the collision.

Signal Aspects Displayed to the Express Train

84. At 20.39 the parcels train was standing at Signal A 370 at Caution having stopped at it at about 20.38. The fact that the signal was at Caution shows that Technician Young had completed his repairs to Track Circuit FJ before that time, and that the signalling between Paddock Wood and Marden had been fully restored to order while the express train was still approaching Paddock Wood.

85. As the parcels train was still occupying Track Circuit FH at the time of the collision, the express must have passed Signals A 322 at Caution and A 324 at Danger, after passing Signal PE 129 (the Paddock Wood Starter) at Green.

86. There is however no such certainty about the aspect being displayed by Signal A 370 as the express was closely approaching and passing it, since the parcels train was well short of its controlling track circuit (FJ) when the collision occurred. Signal A 370 which had been held at Danger by the failure of Track Circuit FJ until the latter was repaired, was thereafter controlled only by the occupation and clearance of the track circuits ahead, i.e. by the progress of the rail train.

87. Accepting Guard Keene's evidence that Signal A 370 cleared to Caution as the parcels train ran up to it this would be because the rail train had just cleared the overlap track circuit beyond Signal A 372 at about 20.38, having passed Signal A 370 at about 20.30 (Signalman Prescott said that he told the driver, at about 20.27–20.28, to pass the signal and Driver Davison said that he was stopped at the signal for 1–2 mins). Allowing for the rail train's having a clear run past Signal A 372 it would probably have cleared the overlap track circuit beyond the next signal at about 20.43, when Signal A 370 would have cleared to Green. (Technician Young saw Signal A 372 at Caution at about 20.44 and Mrs. Kennedy saw Signal A 370 at Green at about 20.45). I think it fairly certain that Signal A 370 was at Caution as the express approached it.

88. The aspects displayed by the signals as the express was closely approaching them were thus in turn:

PE 129.....at Green
A 322.....at Caution
A 324.....at Danger
A 370.....at Caution

Additionally, as the express was closely approaching Signal A 370, the red tail lamp of the parcels train was a short way past that signal.

The Express Train's Speed

89. Driver Harvey would not have known that there was a rail train close ahead of the parcels train and which might be delaying it. He may have seen the Special Traffic Notice under which the rail train was running, but he cannot have known of the circumstances that had led to its running two hours late. Similarly, he cannot have known of the delays imposed by the track circuit's failure short of Marden. As far as Driver Harvey knew he had a clear run through Marden with plenty of space ahead of his train.

90. The extent of the damage to both trains (accepting that the parcels train was moving at 10–15 m.p.h. when struck in rear), the fact that the express was ahead of time through Paddock Wood and Guard Mummery's evidence that it continued to run as usual thereafter until there was an emergency brake application just before the collision, and Mr. Rogers' description of how such a train usually runs between Tonbridge and Staplehurst, all suggest that the express train's speed at the moment of impact was 75–80 m.p.h. I am satisfied that the speed was in fact of this order, and I accept also that a full emergency brake application was made a few seconds before the collision.

The Visibility

91. The fog was patchy and visibility varied. Those whose estimates of the visibility were made against known distances all put it however at upwards of 100 yds, whereas the lower estimates were made by those who did not use any positive yardstick. The positive evidence suggests that the range at which Signal A 370 could first be observed by a driver was at least 150 yds. The fog was increasing from Paddock Wood towards Marden and I think it likely that Signals A 322 and A 324 came into a driver's view at no less a range than this, i.e. the driver of a train running at 75–80 m.p.h. would have had one of these signals within his view for not more than 4 to 5 secs before passing it.

Driving in Fog

92. Rules 127 (iv) and (xiii) strike, in my view, the right balance between the need for caution in fog and the desirability of running to time. No special tuition on this point is given nor are any special instructions issued. It would be impossible to be precise on such a subject and responsibility for his speed in fog is left to the judgement of the driver. Provided he is satisfied that he can observe the signals, and subject to such speed restrictions as may obtain, a driver is entitled to drive through fog at any speed, within the line speed limit, that he thinks safe.

Conclusion

93. I am quite certain that the signalling was correct at the time of the accident, and I can only conclude that Driver Harvey for some reason missed Signals A 322 and A 324 in the thickening fog and continued past them at speed.

94. I do not think that Driver Harvey "got lost" in the fog after passing Paddock Wood and missed seeing the signals because he did not know where he was. He was by all accounts a most competent and experienced driver who knew the route well and this line, even in fog, was not featureless—Signal A 322 was sited against the first road overbridge after Paddock Wood, itself an easily recognisable junction, and the River Teise was 400 yds short of Signal A 324. Had Harvey in fact "got lost" I am sure that he would have braked his train at once and would have run forward cautiously, prepared to stop short of any obstacle and of the next signal should it be at Danger. He would in fact have acted in accordance with the spirit of Rule 127 (xxii).

95. I think that after passing through Paddock Wood under clear signals, and thinking it certain that the line would be clear ahead, Driver Harvey allowed himself to relax his vigilance and become abstracted, so that he failed, in the thickening fog, to observe Signals A 322 at Caution and A 324 at Danger and drove on at speed past them. His cab was too damaged for its heating and ventilation at the time of the accident to be established but the conditions in the cab of a train of this type are generally satisfactory and the heating and ventilation are under the driver's control, and I would expect Harvey to be too experienced a driver to allow his cab to get so warm and airless as to induce drowsiness. That he was not asleep is shown by his keeping his DSD depressed.

96. Accepting that Driver Harvey was abstracted while he drove past Signals A 322 and A 324 the sequence of subsequent events however suggests that he was fully alert just before the collision. It is idle to speculate on what brought him back to his senses, but I believe that he saw Signal A 370 at Caution at about 150 yds range and immediately shut off power and applied the brakes, and that he then saw the tail lamp of the parcels train ahead, pushed the brake handle to its fully applied position and let the DSD fly, and, having thus done what he could to stop the train, tried to make his own escape.

97. In all the circumstances I must conclude that Driver Harvey alone was responsible for this accident.

Remarks

Automatic Warning System

98. The Automatic Warning System (AWS) of train control provides a signalling aid to a driver by which, when he is closely approaching a signal at Caution (Double Yellow or Yellow), he is warned of that fact by the sounding of a horn in his cab: he can then acknowledge (cancel) the warning by pressing a button and if he does not do so the brakes are automatically applied. If the signal is at Green a bell sounds and does not need acknowledgement, but if the signal is at Danger the horn sounds as it would at a signal at Caution and the warning can be cancelled.

99. If AWS had been installed on this line, it should have prevented this accident. Provided the AWS equipment in his cab was working, Driver Harvey would have received positive audible warnings, which should each have aroused him to full alertness, first when he was 200 yds short of Signal A 322 at Caution and again when he was 200 yds short of Signal A 324 at Danger, and if, in either case, he had failed to respond, by the positive act of cancellation, to the warning given, the consequent automatic application of the brakes would have brought the train to a stand well clear of the signal ahead, i.e. in the case of the warning at Signal A 324 well clear of the parcels train. (I satisfied myself on this point by means of a practical test in which an AWS inductor laid 194 yds short of Signal A 324 brought a train similar to the express, and travelling at the same speed, to a stand over 1000 yds short of Signal A 370).

100. It must be remembered, however, that AWS when installed must be regarded only as an aid to a driver, which in no way relieves him of his responsibility for observing and obeying signals.

101. The fact remains that Driver Harvey did not have the aid of AWS and the lack of it on such an important line needs to be explained.

102. Any description of the development of AWS in Southern Region (SR) must take into account three main factors:

(*a*) *Doubts about the technical feasibility of AWS on SR electrified lines*

The first SR 5-year AWS plan, under the British Transport Commission (BTC) overall plan of 1957, was authorised by the BTC in June 1958, and was completed in August 1963. It covered steam operated main lines only and the submission of their second 5-year plan was delayed until June 1965 because of technical doubts within the BTC (subsequently the British Railways Board (BRB)) and among the Ministry's Inspecting Officers (IOs), as well as within the SR management, about its effectiveness on lines electrified on the 3rd rail system. Ground equipment for trials of this had been completed and the fitting of AWS train equipment to air-brake stock had been approved by the IOs in June and October 1961 respectively and trials had started over a test section at Swanley in June 1962 and had been continued, at the IOs' request, throughout the summer of 1963 and first few months of 1964 and their results had led to the Minister's approval in May 1964 of the application of AWS under 3rd rail D.C. traction conditions. The second 5-year plan was then submitted but under it the line through Marden would not have been equipped with AWS until 1971.

(*b*) *Doubts about the suitability of AWS under SR Operating Conditions*

Meanwhile, however, in early 1964, after experience with the AWS that had been in use on the Waterloo to Exeter and Bournemouth line, and in particular on those sections in the inner London zone where 4-aspect colour light signalling had been installed, SR had drawn the attention of the BRB to the unsuitability of a succession of warnings at Double Yellow signals which could occur in the peak traffic periods. The dangers that might arise from this had been recognised by the IOs following a collision at Norton Bridge in 1963, in which a driver after cancelling at a sequence of Double Yellows unthinkingly cancelled at a Single Yellow and then at the Red beyond it, and the problem of repetitive cancellation had been discussed by them with the BRB, but the latter in June 1964 expressed the view that it did not seem possible to modify the standard AWS to meet the successive Double Yellow problem. The possibility that cab signalling or some other similar system of train control might take the place of AWS in their Region was suggested by SR in December 1965 and, after considerable discussion between the IOs and the BRB, the then Chief Inspecting Officer of Railways, in April 1966, said that he would be prepared to recommend to the Minister that further conventional AWS should not be installed on SR lines provided the first (cab signalling) stage of some form of track to train communication could be made available in substitution for it in about the next four years, i.e. by 1970/71. I fully supported this view.

(*c*) *The SR view that the First Priority should be accorded to the Replacement of Semaphore by Colour Light Signalling*

Southern Region have over the years concerned used all their available technical capacity fully on the installation of modern signalling. Their view has been, and I cannot dissent from it, that the replacement of out-moded and out-worn semaphore signalling by multiple aspect colour light signalling should, for safety reasons, have a very high priority. Over the past 10 years SR have spent some £13·5 m on such replacements and even so 60 per cent of their route miles are still equipped with old-fashioned semaphore signalling. Work has already begun on other signalling schemes that will cost a further £4½ m. These programmes would have been severely curtailed if the Region had given priority to the installation of AWS after the doubts about its technical feasibility had been resolved.

103. As regards the possible substitution of track to train communication for conventional AWS mentioned in para. 102(*b*) above, I am glad to report that good progress towards this end has already been achieved by the Electrical Research Division of the BRB under the direction of the BRB's Train Control Steering Group with which I am associated. A system has been developed whereby the proven features of the existing AWS system are used together with a cab signal display derived from lengths of track conductor laid between the usual location of the permanent AWS magnet, which is retained, and the signal. Under this

system when the driver's cab of a train passes over the permanent magnet the train AWS receiver is set in the usual way and a delayed brake application initiated, and when it passes over the track conductor the aspect shown by the signal is displayed on a panel in the cab and a bell or horn sounds. If the aspect is Green the brake application is cancelled automatically but if the aspect is Double Yellow, Yellow, or Red a manual re-set is necessary, the appropriate one of three separate re-set plungers having to be fully depressed and restored. As only the plunger appropriate to the aspect displayed is effective in cancellation there is the prime advantage that the driver is made to think which aspect he is cancelling and unthinking cancellation is thus much less likely. Other advantages are that:

(*a*) if the signal's aspect changes while the cab is between the permanent magnet and the signal itself, the change is immediately repeated in the cab; such a change of aspect could be accompanied by a short audible alarm so that the driver's attention would be drawn to it while he was closely approaching or standing at the signal;

(*b*) the aspect shown by the signal at the moment the driver passes it continues to be shown on the cab display panel until the permanent magnet for the next signal is reached when it is cancelled, ready for the display of the latter signal's aspect;

(*c*) the automatic re-set that occurs with a Green aspect could be made to occur with a Double Yellow aspect also, to obviate the need for successive cancellation in peak traffic hours, the automatic cancellation of Double Yellow being limited to specific geographical areas such as the inner London zone of the SR where the successive Double Yellow problem is at its worst;

(*d*) it would be possible to extend the system in due course to provide continuous cab signalling and speed supervision.

104. The present position is that the design stage of what has come to be called SR AWS has been completed, preliminary work is now in hand with measurements of electrical interference levels on SR electric stock (the elimination of all interferences on SR AWS is hoped for and measurements so far taken are encouraging) and the start of user trials of the equipment in the Bournemouth–Southampton area is planned for August 1969, initially with a few equipments only but with a build-up for test purposes to 20 track and 12 cab units for the Spring of 1970.

The Delay in Summoning the Emergency Services

105. A list of all the automatic signals in the South-Eastern Division, with their map references and the appropriate Ordnance Survey sheets, is kept in Divisional Control at Beckenham for the quick identification of signals in just such an emergency as this. Investigation into the over long interval (some 24 mins) between this accident and the arrival of ambulances at Marden Station disclosed that the chief cause of the delay was that the list had not been kept up-to-date and that Signal A 370 was not shown on it as such but as Signal RE 23, which had been its number when it was a semi-automatic signal before Marden signalbox was closed some two years before.

106. When therefore Control were told by the Ashford signalman, shortly after Guard Mummery had reported it over the signal post telephone at about 20.45, that the express had collided with the rear of the parcels train at Signal A 370 the site could not be identified and some 10 minutes were wasted in an attempt at identification. Also, though this does not seem to have contributed to the delay, the signalman did not say that ambulances would be needed until 20.50.

107. In my view the Ashford signalman should have asked for ambulances as soon as he knew of the accident. It is, I am sure, always better to ask for such help at once rather than to wait until the need for it is seen to be certain. Similarly, the senior Officer in Control should have rung the Police as soon as he knew that an accident had happened and without in the circumstances wasting time to find out its exact site.

108. Action was at once taken to check and re-issue all the lists of automatic signals and their map references throughout Southern Region and instructions were issued to require Inspectors and Officers to ensure that they are kept up-to-date. I am glad to report also that the General Managers of other Regions were quickly made aware of the details of this failure and reminded of the need to ensure that details of signal locations are brought up-to-date and so maintained.

Protection of the Opposite Line after Accident

109. An unusual feature of this accident was that, although the fully track-circuited Up line was for all practical purposes blocked by the wreckage of a van from the parcels train that was lying across it, Track Circuit EK which controls the Up line Signal A 321 was not operated. As that signal is fully automatic and there was no means of putting it to Danger from the Tonbridge signalbox, it continued to show a Green aspect until its controlling track circuit was shunted by Inspector Hawkett at about 22.30. The wreckage of the parcels train tripped the traction current circuit breakers for that section of the Up line, and other circuit breakers were opened to create a neutral section at 20.44, but if, at the time of the accident, there had been a diesel-hauled train on the Up line and on the Tonbridge side of the two signals at Headcorn that were under the Tonbridge signalman's control, i.e. within some 5 miles of the scene of the accident, it would have run under clear signals into one van up-ended at an angle over the Up line and another van across it: there would hardly have been time for the driver and secondman of the parcels train to run back and put down detonators at Signal A 321 before such a train would have passed it.

110. In recent years British Railways have developed a device called a "track circuit operating clip", which can be used by trainmen on a track circuited line to operate a track circuit quickly in emergency and so to get the signal protection of an obstruction before they carry out the procedure for conventional protection with detonators. The device consists of two metal clips, which can be forced over the heads of the two running rails, and a wire connecting them. In order to ensure good electrical contact between clip and rail the former is so made that it is a very tight fit over the rail head and in practice it has to be stamped down onto it. This is a potentially hazardous procedure for the man applying the clip if there is a live conductor rail close to the running rail, and, in discussions on the use of the clip before it was put into full production, the Chief Officers of the Board advised the Inspecting Officers that, after tests had been carried out and the views of all concerned obtained, it had been decided that the clips should not be used in areas of third/fourth rail electrification. In view of the possible hazard to the man operating a clip in such an area, the Inspecting Officers accepted this decision. When therefore the clip was generally introduced and its use under Rules 178, 179, 180 and 217 (Rule 180 covers the protection of adjoining lines that are obstructed by an accident) was made compulsory by an amendment to those Rules in October 1966, lines electrified on the conductor rail system were excepted.

111. The protection advantages that can be gained by the use of the track circuit operating clip, particularly on lines with automatically controlled colour light signals, were clearly demonstrated by this accident. I therefore asked the Chief Officers of the Board to re-examine the possibility of using the clip on lines electrified on the third or fourth rail system. The matter has been considered by the Board's Operating Committee and I am glad to report that, in the light of experience gained generally in the use of the clip, a further series of tests is to be carried out on such lines to establish more positively the degree of risk to the man applying a clip in close proximity to a conductor rail. If the tests establish that the degree of risk is unacceptable, alternatives to the track circuit operating clip for use on third or fourth rail electrified lines are to be sought. I attended the first test on 24th June 1969, when possible SR modifications to the standard clip were agreed for further testing as soon as possible.

I have the honour to be,

Sir,

Your obedient Servant,

J. R. H. ROBERTSON,
Colonel.

The Secretary,
Ministry of Transport.

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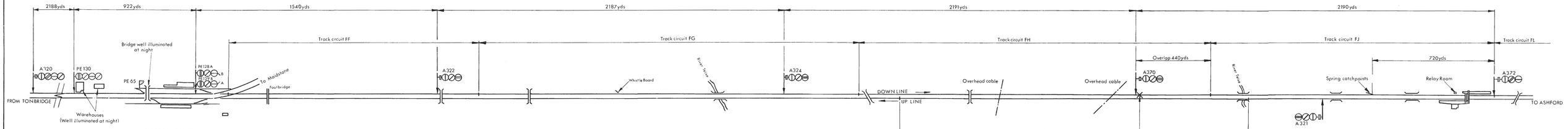
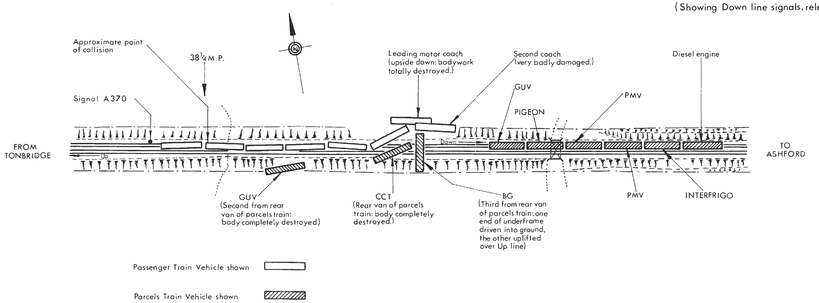
COLLISION NEAR MARDEN–4th. JANUARY 1969



GENERAL LAYOUT (Not to Scale)

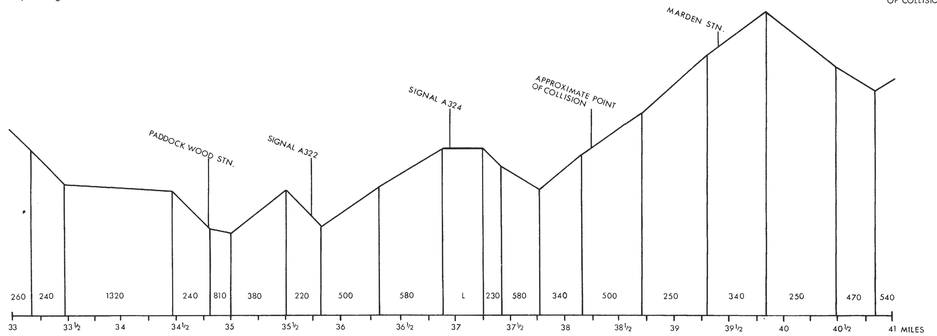
(Showing Down line signals, relevant track circuits, and Up line signal A321-TCEK)



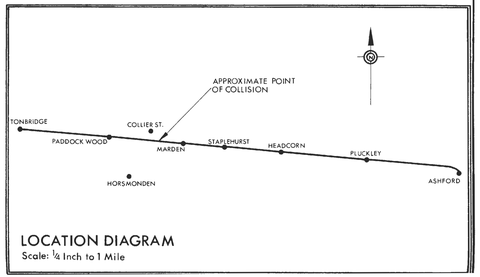
DETAILS AT SITE OF COLLISION

(Showing position in which vehicles of the two trains came to a stand.)

Scale 100 50 0 100 200 feet



GRADIENT DIAGRAM



LOCATION DIAGRAM

Scale: ¼ Inch to 1 Mile