

DEPARTMENT OF THE ENVIRONMENT

RAILWAY ACCIDENT

Report on the Collision
that occurred on 11th June 1974
at Pollokshields East Junction

IN THE
SCOTTISH REGION
BRITISH RAILWAYS

LONDON: HER MAJESTY'S STATIONERY OFFICE
1975

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Sir,

I have the honour to report for the information of the Secretary of State, in accordance with the Order dated 12th June 1974, the result of my Inquiry into the collision between two passenger trains that occurred on 11th June 1974 at Pollokshields East Junction, Glasgow, in the Scottish Region of British Railways.

At approximately 14.21 on Tuesday 11th June the 14.04 electric multiple-unit passenger train from Newton to Glasgow Central moved off from Pollokshields East Station on the Inner Cathcart Circle line and almost immediately came into oblique side-on collision with the 14.16 diesel multiple-unit passenger train from Glasgow Central to East Kilbride which was negotiating Pollokshields East Junction from the Up Eglinton Street branch to the Up Kilmarnock line. The electric train was under acceleration and the diesel train was running at or near the line speed of 30 mile/h. A head-on collision was only narrowly averted and the impact demolished the right-hand side of the driving cabs in the leading coaches of both trains, forcing the leading coach of the diesel train sideways into derailment of all wheels. The trains came to rest with most of their lengths overlapping: both remained upright, no telescoping took place, and although flying debris made contact with the overhead line equipment the electric current was immediately and automatically de-energised and there was no fire.

Railway staff on the trains and from the nearby Muirhouse Workshops reacted quickly and within two minutes accurate reports were sent to the Glasgow Central Signal Box and the emergency services summoned. The civil police were very soon on the scene and made sure that ambulances and rescue appliances had free access to the site. There was no panic and all injured passengers were removed to hospital within 10 to 15 minutes.

I much regret to report that one passenger was killed in the accident and 35 others were injured, 4 seriously. At the time of writing all the injured have left hospital and I am glad to say are making a good recovery.

The collision blocked both Up and Down Eglinton Street branch lines across Pollokshields East Junction and these lines were not cleared until nearly midnight. The blockage caused considerable disruption to services and led to many cancellations and diversions, but normal traffic was restored soon after midnight.

At the time of the accident the sky was overcast but the day was dry and visibility was good.

DESCRIPTION

The Site

1. Pollokshields East Junction lies about $1\frac{1}{2}$ miles to the south of Glasgow Central Station. Approaching the junction from Glasgow Central the railway consists of the Up and Down lines of the Eglinton Street branch. At Pollokshields East Junction two tracks lead off to the left onto the Cathcart Circle route and the Main lines continue on to Muirhouse Junction, where a further connection is made with the Cathcart Circle.

2. The routes followed by the two trains on their approach to Pollokshields East Junction are sharply curved, as may be seen on the plan at the back of the Report. The plan also shows the gradients and the location of various overbridges, in particular Bridges OB.1 and OB.4, both of which limit the view across and beyond the junction available to the drivers of approaching trains. A permanent speed restriction of 30 mile/h applies over Pollokshields East Junction from the Up Eglinton Street branch towards Muirhouse Junction and from the Inner Cathcart Circle line to the Down Eglinton Street branch.

3. All the lines concerned are wired for electric traction. Prior to 1973 the line voltage was 6.25 kV throughout, but in September 1973 and in connection with the major electrification works on the West Coast Main Line, the voltage was raised to 25 kV on the section of line running from Eglinton Street through Pollokshields East Junction and on to Muirhouse Junction and the western half of the Cathcart Circle. The eastern part of the Circle was however kept at 6.25 kV because of difficulties in achieving the required electrical clearances and an isolating neutral section was installed between Pollokshields East Station and Pollokshields East Junction. The location of this neutral section is shown on the plan.

The Signalling

4. All the lines concerned have continuous track circuiting and are worked in accordance with the Track Circuit Block Regulations. The lines from Mount Florida Station on the Down Inner Cathcart Circle line to Glasgow Central, and from Glasgow Central to Pollokshields East Junction, are equipped with four-aspect colour light signals. Control of these signals (except those set to work automatically) and the

power operated junction points is exercised by the signalmen at Glasgow Central Signal Box via a local remotely-controlled relay room at Muirhouse. All signal circuits and equipment, including track circuits, are immunised against interference by the high voltage traction current. All running signals in the area concerned in the accident are provided with inductors for the standard BR Automatic Warning System (AWS). The position of the inductors is shown on the plan.

5. On the route followed by the electric train the Down Inner Circle platform starting signal at Queens Park Station, G 613, is of automatic type, as is Signal G 611 which subdivides the section ahead towards Pollokshields East Station and which reads to the platform starting signal at Pollokshields East, G 607. This latter is a controlled signal and also acts as the junction protecting signal. At the time of the accident it was located immediately to the left of a low masonry wall on the left-hand side of the Inner Circle line and some 132 feet back from the top of the platform ramp. Prior to September 1973 it had been positioned beyond the end of the platform on the Glasgow side of Bridge OB.1, but the installation of the overhead line neutral section had necessitated its being moved back. This was because of the risk that a train starting from near the Glasgow end of the Pollokshields East platform would lose power in passing the neutral section and would have insufficient momentum to continue across the junction. The repositioning had the advantage from an operating point of view that trains could be brought forward to Signal G 607 whilst a conflicting route was set across the junction: hitherto such a conflicting route would have necessitated a train being held behind Signal G 611 on the approach to Pollokshields East Station.

6. On the route followed by the diesel train the signals from Eglinton Street reading towards Pollokshields East Junction, G 233 and G 602, are controlled signals located to the left of the line. The junction signal, G 604, is a similar signal but with a right-hand 45° lunar white junction indicator.

7. In the Glasgow Central Signal Box the relevant signals and points are controlled from Panel 3, which is a conventional entrance-exit route setting panel. When a route has been set by the signalman and cleared a line of white lights marks the appropriate route on the panel and the signal indications show a proceed aspect. These appear on the panel as green lights irrespective of the actual proceed aspect: signals at Danger appear as red lights. Once the route is set it cannot be cancelled by the signalman until after the lapse of 2 minutes, or until a train has passed. The passage of a train is shown by the display of red lights as track circuits are occupied. As the train proceeds the track circuits, when occupied, automatically replace the signals behind them and the signalman is then free to reset his controls, except that each set of points is held in its position by the appropriate track circuit until the train has moved clear: no conflicting move can be made whilst this applies.

8. The route relay interlocking ensures that before a proceed aspect can be obtained on Signal G 604 for a route across the junction towards Muirhouse Junction, i.e. the route required for the diesel train, the points on the route are set correctly and that any points on other lines which could permit a conflicting movement are set to trap such movements. In this case, referring to the plan, No. 672 points must be set for Muirhouse Junction and No. 673 points must be set for the route from Muirhouse and not from Pollokshields East before Signal G 604 can show a proceed aspect together with an illuminated junction indicator. The fact that 673 points must lie in this direction means that Signal G 607, the Pollokshields East Station starting signal, cannot show a proceed aspect as long as a route is set from Signal G 604 across the junction towards Muirhouse. Similarly a route set from Signal G 607 across the junction requires No. 672 points to be set for the Cathcart Circle line, and makes it impossible for Signal G 604 to be cleared for the route across the junction, i.e. with the junction indicator illuminated. With either route setting, occupation by a train of the track circuits immediately past either Signal G 604 or G 607 automatically places the other signal to Danger if it is not already at Danger.

9. The signalmen at Glasgow Central are provided with a train describer system whereby the identity of each train is displayed on the panel immediately on the approach side of each signal. These indications move from signal to signal as the track circuits are occupied, but they will only do this if a route has been set from the signal concerned. If a train passes a signal from which a route has not been set the red lights showing occupation of the track circuits ahead of the signal step forward with the train, but the train description remains behind the signal. Certain of the train description movements are recorded on a printing machine which records the time at which a train passes selected signals. A record is available of the train movements and timings past Signals G 604 and G 607 on the day of the accident.

The Trains

10. The 2K27 14.16 Glasgow Central to East Kilbride train was formed of a Derby built non-gangwayed high density multiple-unit, 3-car set No. 152, marshalled as follows in the direction of travel:

SC. 50874	Motor Open Second	36 tons
SC. 59329	Trailer Composite	28½ tons
SC. 50821	Motor Open Second (brake)	36 tons

Its length overall was 198 ft. It was fitted with standard BR AWS equipment and its available brake force was 74.38 tons.

11. The 2E20 14.04 Newton to Glasgow Central train was formed of 3-car electric multiple-unit No. 108 of Class 311, marshalled as follows in the direction of travel:

SC. 76419	Battery Driving Trailer	37 tons
SC. 62179	Motor Coach (brake)	57 tons
SC. 76438	Driving Trailer	34 tons

Its length overall was 198 ft 7½ in. It was fitted with standard BR AWS equipment and its available brake force was 112.74 tons (EP automatic brake). It had power-operated sliding doors.

The Course of the Collision and Damage Caused

12. The actual point of collision was some 156 yards past Signal G 607 at Pollokshields East Station and 126 yards past Signal G 604. The electric train was thus almost across the junction when the right-hand side of its leading cab struck the corresponding point on the front cab of the approaching diesel train. The two trains thereafter remained in sidelong contact until coming to rest with 2½ of their coach lengths overlapping. The movement forced the leading coach of the diesel train sideways into total derailment. Extensive damage was caused to the leading coaches of both trains: the right hand half of the cabs in both trains were virtually destroyed and within the passenger compartments windows were smashed, sides torn, and seats displaced. The second and third coaches in both trains were less severely damaged and only minor damage was caused to the permanent way and other equipment.

EVIDENCE

As to the Signalling of the Trains

13. Shortly before 14.17 on the day of the accident *Signalman W. Burgess* was on duty at Panel 4 in the Glasgow Central Signal Box when he was asked by his colleague, *Signalman McGowan*, to look after Panel 3 for a few minutes. Burgess had worked in the signal box for some five years and was familiar with the operation of all the panels. At 14.17 he signalled the 14.16 Glasgow Central to East Kilbride train from the Up Eglinton Street branch across Pollokshields East Junction onto the Up Kilmarnock line. He did this by operating the appropriate push buttons on Panel 3 and obtaining the correct white route lights all the way from Signal G 604 through Signals G 612 and G 644 to the start of the sequence of automatic signals beyond G 644. He was sure that Signals G 604, G 612, and G 644 all showed the correct proceed aspect on the panel once the route was set. Just before setting the route for the East Kilbride train he had noticed from the panel indications that the electric train from Newton was approaching Pollokshields East Station. According to the train sequence chart the East Kilbride train had precedence across the junction and Burgess told me that it was normally signalled over the junction before the incoming electric train.

14. A minute or two later *Signalman McGowan* returned and Burgess told him that he had set the route for the East Kilbride train. At this time the electric train was either at or closely approaching Pollokshields East Station: Burgess said that as far as he could recollect the indicator for Signal G 607 was showing red. Shortly afterwards the lights in the room suddenly dipped and he and McGowan saw that track circuits in advance of Signal G 607 were showing occupied as well as those showing the presence on the junction of the East Kilbride train. They had thought at first that a track circuit had failed but then a telephone message gave notice of the accident. They placed the appropriate signals to Danger to prevent other trains approaching the junction and then examined the panel. Apart from the track circuit indications on the junction the white route lights were still showing from Signal G 604 right through to beyond G 644. The train description, 2K27, for the East Kilbride train had stepped forward from Signal G 604 and was showing alongside Signal G 612. That for the electric train, however 2E20, had not stepped forward and was still behind Signal G 607.

15. I asked *Signalman Burgess* whether he had at any time cleared the route for the electric train, or had attempted to do so, and he assured me that he had not. When he accepted Panel 3 from McGowan there were no routes set on it. He was equally certain that McGowan had not attempted to cancel the route once it was set for the diesel train.

16. *Signalman J. McGowan* confirmed the evidence given by *Signalman Burgess*. He had left the panel to visit the toilet and on his return Burgess had told him that he had set the route for the East Kilbride train and that the electric train was in Pollokshields East Station waiting to cross the junction once the diesel train had cleared it. He had seen the white lights showing correctly for the route from Signal G 604, and this signal showing a proceed indication on the panel. He had not interfered with the route setting in any way. At approximately 14.21 he noticed that track circuits ahead of Signal G 607 had become occupied and that track circuit 751 T, in rear of the signal, was showing clear. Seconds later he received a message via the telephone at Signal G 604 advising him of the accident. Together with *Signalman Burgess* he noted the indications shown on the panel: these were as reported by Burgess.

17. In charge of operations in the signal box at the time of the accident was *Senior Supervisor P. Burton*. At about 14.21 he noticed a dip in the lights and his attention was drawn to Panel 3. At almost the same moment *Signalman McGowan* received a telephone call reporting the accident: Mr Burton spoke to the caller

and immediately alerted the Emergency Services. He then went to look at Panel 3 and found that track circuits were showing occupied ahead of both Signals G 604 and G 607, that both these signals were indicating Danger, and that a route had been set and was still holding from Signal G 604 to the Up Kilmarnock line. The train description for the East Kilbride train had stepped forward from Signal G 604 but that for the incoming electric train had remained behind Signal G 607.

18. Mr. Burton confirmed that it would be normal practice, and in accordance with the train sequence chart, for the East Kilbride train to be given priority across the junction. He had been aware that Signaller Burgess had temporarily taken charge of Panel 3 just before the accident, and had been able to observe what Burgess was doing during the absence of McGowan. He was quite certain that neither McGowan nor Burgess had attempted to give priority to the electric train by setting a route from Signal G 607 and then changed his mind: had either of them done so he was certain that he would have known because of the 2 minute delay that would have been involved in cancelling the route.

As to the Running of the Diesel Train

19. The guard of the 14.16 Glasgow Central to East Kilbride train was *Guard W. Lang*. He had worked over the line concerned for some 3½ years and knew it and the signalling well. On the day of the accident his train had left Glasgow Central about 2 minutes late having been delayed by other train movements. He was travelling in the guard's compartment in the rear vehicle of the 3-car unit. Approaching Pollokshields East Junction at the normal speed of just under 30 mile/h he looked out of the right-hand side window and saw the junction signal, G 604. It was showing a green aspect and the junction indicator was illuminated. His view of the signal had been across the front of his train, just before the train reached the signal. Seconds later, and without there having been any prior brake application, he felt the brakes go on in an emergency application followed by the shock of the collision. When the train had stopped he went to confer with his driver and then protected the train.

20. The driver of the diesel train, *Driver J. Mullan*, also knew the line well having driven trains over it for many years. He had signed on at 12.05 and after taking a train from Corkerhill to Glasgow Central he had taken over Unit 152 and worked it as the 13.00 to Busby and then as the return working to Glasgow. The train had handled properly and the AWS was working correctly. After leaving the Central Station as the 14.16 to East Kilbride he had received mainly single or double yellow signals on the journey out to the former Eglinton Street Station. The signal here, G 602, which reads forward to the junction signal, G 604, had been at green when it first came into his view, but Mullan thought that it had probably only just cleared since the previous signal, G 233, had been at yellow. The junction signal, G 604, was at green with the junction indicator illuminated when it first came into view and it remained thus until he had passed it. He had received the correct bell indication as the train passed over the AWS magnet on the approach to the signal and his cab indicator had remained at black. Mullan thought that if Signal G 604 had suddenly changed to Danger he would have noticed it, provided the front of the train was then not more than about 20 yards from the signal: if it had been any closer he felt that his attention would by then have been concentrated on the junction ahead and not on the signal. He emphasised that the junction was a place where men were often at work on the track or crossing the lines and he always concentrated his attention on it for this reason.

21. Almost immediately after passing the signal, with the train coasting at about 30 mile/h, Mullan saw the electric train coming under the bridge from the direction of Pollokshields East Station. He realised at once that it was on a collision course and made a full emergency brake application. At the same moment he looked down at the points ahead (672) and saw that they were set for his path across the junction and not for the Circle line. He told me that he knew about the interlocking between these points and the junction signal, and for a moment had almost hoped that he had made a mistake and passed Signal G 604 at Danger so that his train would be routed round to the Circle line: he knew however from the lie of the points that he had made no mistake. After the collision he extricated himself from his wrecked cab and made sure that protection had been arranged for the train and that the traction current had been disconnected. He later looked at the AWS indicator in his cab and it was still showing all-black.

22. *Controller A. Aird*, who is employed in the BR Regional Headquarters in Glasgow, was travelling as a passenger in the East Kilbride train. He was a regular traveller on the line and on this occasion was seated next to the window on the left-hand side in the direction of travel in the rear seat of the front compartment of the leading coach. He did not observe any of the signal aspects during the journey, nor did he consciously hear the AWS warnings, until the train approached Pollokshields East Junction when he happened to glance out of the side window, just as the train passed the junction signal, G 604, and saw this signal at Danger. He estimated that at the moment he first saw the signal it was not more than a yard or two away: the next second it had gone. He looked ahead along the length of the coach and saw the electric train coming across the junction. He had just time to shout a warning to the other passengers before the collision occurred. He was not conscious of any brake application being made before the collision. After the train had stopped he made his way to the telephone at Signal G 604 and reported the accident to the signal box. Regarding the speed of the train during the journey Mr. Aird said this had been quite normal and he estimated the speed approaching the junction as being below 30 mile/h.

As to the Running of the Electric Train

23. The guard of the 14.04 Newton to Glasgow Central electric train was *Guard L. Thomson*. After signing on duty at 08.35 he had acted as guard on a number of services, including the 13.12 Glasgow Central

to Newton. This train, with the same driver, then formed the 14.04 train from Newton. They had left on time, by his watch, and the journey to Pollokshields East had been a perfectly normal one: the train had stopped at the proper stopping marks at the intermediate stations and none of the station stops had been exceptionally long. Thomson had not observed any of the signals during the journey. He was travelling in the guard's compartment at the leading end of the centre coach in the 3-car unit. There were about 30 or 40 passengers in the train.

24. On arrival at Pollokshields East the train stopped at, or close to, its normal mark and Thomson opened the train doors. A few passengers left the train and others entered and, about 20 or 30 seconds after opening the doors, he reclosed them and gave the 2-bell signal on the train intercommunication system to the driver to indicate 'train ready to start' which the driver acknowledged by repeating the 2 bells. The train started almost at once and Thomson was not aware that anything was wrong until the collision occurred. During the stop in Pollokshields East he had remained inside his compartment, merely looking out along the platform. He had not at any time seen the aspect of the starting signal, G 607. After the collision he checked that the driver had lowered the pantograph, made sure that the injured passengers were receiving attention, and protected his train.

25. One of the passengers in the electric train was *Junior Technical Officer J. France* who was employed in the Chief Signal & Telecommunications Engineer's Department at Partickhill. He had joined the train at Mount Florida, and was sitting near the middle of the leading coach on the left-hand side in the direction of travel, facing the rear. He was not a regular traveller on that part of the line and he did not observe any of the signals, nor did he hear any of the AWS audible signals although he agreed that he was not consciously listening for them. On arrival at Pollokshields East some passengers left the train and others entered and after a stop that he estimated was not longer than about 40 seconds the train restarted. A few moments later the collision occurred and he went to the assistance of the injured passengers. Shortly afterwards he left the train and went to the lineside where he spoke to the driver of the train and asked him what had happened. The driver said that he had no idea what had happened but that his AWS indicator was showing all-black: he had seen the other train, assumed that it was routed onto the Circle line, and was about to wave to the other driver when the trains collided. The driver also said something to the effect that it should have been impossible for the signalman to set up opposing routes. At no time did he say anything about the signal aspects, and France did not question him on this point.

26. Another passenger travelling in the leading coach of the electric train was *Mr. Roberto Mori*, of Glasgow. Mr. Mori, who is not connected with British Railways, was seriously injured in the accident, suffering a broken left leg. He was interviewed in hospital on 13th June 1974 by *Senior Operating Inspector A. Mackie* and made a statement which, at my request, Mr. Mackie read out at the public hearing. Mr. Mori had agreed to his statement being used in connection with inquiries into the accident during the course of a visit to the hospital made, on 14th June, by Mr. Rowbury, Movements Manager, Scottish Region. Immediately after the public hearing, which was held in Glasgow on 27th June 1974, I also visited Mr. Mori, accompanied by a Trades Union representative, and Mr. Mori confirmed that the information he had given to Mr. Mackie was correct.

27. In his statement Mr. Mori said that he was not a regular traveller on the Cathcart Circle lines, although he travelled regularly on the Airdrie line. Whenever he travelled in multiple-unit trains he liked to sit near the front so that he could watch where he was going. On the day of the accident he joined the 14.04 train from Newton at Queens Park and sat in the seat immediately behind the driving cab on the right-hand side in the direction of travel. He thus had an excellent view forward. As the train left Queens Park he saw the signal showing yellow: it could have been either a single or double yellow but he could not be sure which. Halfway between Queens Park and Pollokshields East he observed another signal which was showing a single yellow and before the train passed this signal he heard a horn sound in the cab and saw the driver press a button. Before the train entered Pollokshields East Station Mr. Mori heard the horn sound again and saw the signal across from the station platform at red (during his interview with Mr. Mackie, Mr. Mori gave an accurate description of Signal G 607). The train drew right up to this signal so that his seat was almost opposite the signal post, but from this position he could not see the signal aspect. The train stood in the station for what seemed to Mr. Mori a normal time, about half a minute, and then after the guard had given the bell signal and the driver had acknowledged it, the train set off. Just after emerging from under the bridge Mr. Mori saw the diesel train approaching very closely and realised that there was going to be a collision. He dived across into a seat on the left-hand side but was almost immediately struck by a displaced seat and flying glass. In recalling the journey between Queens Park and Pollokshields East Mr. Mori said "I am positive that I saw no green lights and I heard no bells ringing at any time after joining the train. The only bell I heard was the guard's signal to start the train at Pollokshields East Station which was answered by the driver".

28. The driver of the electric train was *Driver A. McMahon*. He had been a driver since 1953 and before that had been a passed fireman. He had had many years experience of driving on the Cathcart Circle lines. He remembered the signalling alterations being made at Pollokshields East during 1973 and told me that after the repositioning of Signal G 607 he regarded this signal as being one that demanded special attention by a driver, both because of its location and because trains approaching the junction were now permitted to run up to it with the junction occupied whereas before they would be held behind Signal G 611. He had quite often been held at Signal G 607 because other trains were passing over the junction: this however had always

been with trains other than the 14.04 Newton to Glasgow since, to the best of his knowledge, he had never worked this particular train until the day of the accident.

29. On the day of the accident McMahon had booked on duty at Motherwell at 11.25. His previous turn of duty had finished at 01.00 on the previous day and he had spent all of Monday at home, mostly in the garden. He had slept well on Monday night and felt properly rested when he reported for work on the Tuesday. Having booked on he worked the 11.52 electric service from Motherwell to Glasgow Central via the Hamilton Circle and then the 12.37 Cathcart Circle service from the Central round the Circle and back before taking the 13.12 from Glasgow Central to Newton, this train then forming the 14.04 from Newton. All these runs had been made with the same 3-car unit, No. 108, and the train had handled quite normally throughout. During the first of his runs, the 11.52 from Motherwell to Glasgow, McMahon had been accompanied in the cab by a Traction Supervisor who was carrying out a routine assessment of his driving.

30. The run from Newton to Pollokshields East had been unremarkable. He had received a double yellow signal on leaving Queens Park, and a single yellow at G 611, the intermediate signal between Queens Park and Pollokshields East. Then, approaching Pollokshields East, McMahon said that the AWS bell sounded, his AWS indicator went to black, and he looked forward and saw Signal G 607 at green. He drew into the station and stopped with the front of the train slightly ahead of the signal so that the signal post was behind his left shoulder. From this position he could not see the signal's aspect. When I questioned him on this point McMahon told me that, ever since the starting signal had been brought back, and with it the position of the 6/3 car stop mark on the platform, he had had the feeling that the back of his train might not be properly in the platform and he had developed the habit of drawing slightly ahead of the signal as a matter of course. He said that he knew about the interlocking and the time delay imposed on a signalman before he could change a route and, provided the signal was at green when he entered the station, he was confident that it would not change its aspect unless his stop at the station was prolonged for some reason. In answer to further questions McMahon told me that he was not surprised to find Signal G 607 at green after receiving caution signals on the approach to it, since he imagined that another train must have cleared the junction during the time that he was travelling between Signals G 611 and G 607.

31. After getting the guard's 'train ready to start' signal McMahon started the train. He was looking down towards the neutral section magnets and as the train passed over them he looked at his control panel, watching for the line current to be restored. At the same moment he became aware, out of the corner of his eye, of another train on the right but he took no particular notice of it until the trains collided. He did not recall making a conscious brake application. As the train came to a stop he heard the AWS bell ringing: he had not been aware that it had rung before the collision. The AWS indicator was showing all-black. McMahon's first action was to lower the pantograph and he then left the train and found that the lines were being protected. He was feeling shaken and, after being interviewed by the civil police, he was sent home.

32. I put it to Driver McMahon that all the technical evidence, supported by the evidence of Mr. Mori, pointed to the fact that Signal G 607 must have been at Danger both as his train approached it and later as it passed it. Whilst agreeing that the facts did not seem to add up, he insisted that he had seen the signal at green and received the correct AWS bell on its approach.

33. The assessment of Driver McMahon's driving, made only two hours before the accident, had been carried out by *Traction Supervisor A. Rafferty* who told me that all drivers were assessed about once a year as a matter of routine, and that it was purely fortuitous that McMahon should have been assessed that morning. During the journey from Motherwell to Glasgow Mr. Rafferty found no fault whatsoever with McMahon's driving technique: he drove at the correct speeds and in accordance with the signals, handled the brakes correctly, and stopped at the correct stopping marks at stations. He was alert and seemed perfectly normal. Nor was there any discernible fault with the train on which everything, including the AWS, was working properly.

As to Tests carried out after the accident

34. Tests of the signalling were carried out immediately after the accident under the direction of *Mr. J. Simpson, a Works Assistant in the Chief Signal & Telecommunications Engineer's Department*. On his arrival at the site he arranged for the panel indications in the signal box to be checked, and these were found to be as already described in the evidence given by the signalmen. He then arranged for insulation tests to be carried out on all the cables connected with the Pollokshields East Junction signals and for voltage tests to be made on the red aspects of Signals G 604 and G 607. The results of all these tests were satisfactory, except that the red lamp voltage on Signal G 607 was, at 10 volts, slightly below the normal standard of 11.5 volts. Mr. Simpson did not consider that this marginal difference would have had any discernible effect on the brightness of the red aspect. During the course of these tests Mr. Simpson examined the location box containing the relays controlling Signal G 607: the box was secure and there were no faults in the relays. He also examined the junction points and found these to be set correctly for the passage of the East Kilbride diesel train. The electric train had come to a stand only a few feet from the toe of No. 673 points: had it not stopped it would have run through and damaged these points.

35. Later that evening, after the trains had been removed, Mr. Simpson carried out a full programme of functional tests on the signalled routes within the area and also within the signal box. These included tests

of the interlocking, approach locking, AWS, signal aspect sequence, track circuits, earth fault detection, and of the equipment in the controlling relay room. In the signal box tests were made to check that a train description would only step forward if the appropriate route was cleared. The results of all these tests were satisfactory and no fault could be found with any of the signalling equipment.

36. Evidence on the testing of the diesel multiple-unit and of the AWS equipment on both trains was given by *Mr. W. Pate, Senior Technical Officer in the Chief Mechanical & Electrical Engineer's Department*, and evidence on the testing of the electric train was given by *Mr. K. Sharp, Maintenance Assistant at Shields Electric Traction Depot*. Thorough tests on both trains had failed to reveal anything that could have had a bearing on the accident. The AWS equipment on both trains, although damaged, was working correctly, the braking systems were in order, the cab windscreens were clean, and the speedometers were accurately calibrated.

DISCUSSION

37. In a case such as this, where there is a clear conflict of evidence as to the signal aspects, the first factor to be examined is the signalling. At Pollokshields East the signalling installation is of modern design and dates from 1962. Control of the relevant points and signals was transferred in September 1973 to a new relay room at Muirhouse Junction, operated by means of a standard remote control system from Glasgow Central Signal Box. The route-relay interlocking at the junction is designed to make it impossible for trains to be signalled on conflicting routes, whilst other controls ensure that once a route has been set up by the signalman and the signals cleared that route cannot be altered until after a train has passed or until the expiry of a predetermined time delay. From an examination of the reported signal failures and irregularities in the area controlled via the Muirhouse Junction relay room since its commissioning it is clear that the signalling had functioned properly, and without danger-side failure, until the day of the accident: the thorough tests carried out soon after the accident under the direction of Mr. Simpson failed to disclose any significant fault in the signalling at that time: and I am informed that the signalling has continued to function properly ever since the accident. There is thus no reason whatsoever to suppose that the signalling was not functioning as designed at the time of the accident.

38. The evidence on the route setting immediately before and after the accident is clear and consistent. The indications on the panel in the signal box agreed with the position of the points and signals on the ground, and there can be no doubt that, at the time of the accident, a route was set across the junction for the East Kilbride train. From this it follows that at none of the relevant times could Signal G 607, the starting signal at Pollokshields East Station, have been displaying a proceed aspect.

39. The inference that the electric train must therefore have passed Signal G 607 at Danger is supported by the fact that its train description remained behind Signal G 607 on the panel instead of stepping forward, as it would have done had a route been set from this signal.

40. The driver of the electric train, Driver McMahan, was not in a position to say what the aspect of Signal G 607 was as he started his train past it: on his own admission he stopped with his cab ahead of the signal. He maintained however that this signal was at green as he entered the station and that on the immediate approach to the station he received a bell on passing over the AWS magnet. His evidence in this respect is contradicted by that of Mr. Mori, who says that he saw the signal at red as the train approached and that as they passed over the AWS magnet he heard a horn.

41. Regarding the aspects shown by Signal G 604, the signal controlling the movement of the diesel train across the junction, Guard Lang and Driver Mullan both claim that it was showing a green aspect with a route indicator as their train approached it and Mullan says that he received a bell as he passed over the AWS magnet 200 yards in rear of the signal. Controller Aird, on the other hand, says it was at Danger as he passed it. He was sitting approximately 28 ft 6 in to the rear of the leading wheels of the train and the track circuit controlling the normal replacement of the signal to Danger commences at a block joint 69 ft past the signal: the signal would not therefore have been replaced by the passage of the train by the time Mr. Aird reached it.

42. As part of the investigation the Railway Officers provided me with graphs showing the probable performance curves of the two trains under braking and acceleration. Using these, and following the pattern of driving described by the drivers and passengers, it was possible to estimate the relative positions of the two trains during the 30 seconds leading up to the collision. These would be subject to some variation since the exact speeds of the trains were not known, nor the exact point at which Driver Mullan made his brake application, but even making generous allowance for these uncertainties it is clear that, on the assumption that Signal G 607 was at Danger when the electric train passed it, Signal G 604 must have been replaced to Danger some 6 to 10 seconds before the diesel train reached it. This, at a constant speed of just below 30 mile/h, represents between 80 and 135 yards on the ground.

43. The evidence provided by the AWS dials in the drivers' cabs also needs a mention. Both were seen to be all-black after the accident, which would appear to indicate that the last magnet passed had been set for a green signal, although an all-black indication will also be given if a signal is passed at Danger or Caution

and no cancellation is made by the driver. In addition, the AWS bell was alleged to have been sounding in the cab of the electric train as it came to rest after the collision. The last magnet passed by the diesel train was one 200 yards to the rear of Signal G 604 and it is reasonable to suppose that this corresponded to Signal G 604 at green: the route had been cleared and, at the time that the front of the train passed the magnet, the signal would not yet have been replaced to Danger by the passage of the electric train past Signal G 607. The last magnet passed by the electric train, however, was not that for Signal G 607, but was one of two magnets applying to Signal G 237 on the Down Eglinton Street branch. The position of this magnet is shown, just to the rear of the electric train, on the plan. The two magnets applying to Signal G 237 are energised in accordance with the detection on No. 673 points and the occupation of track circuits on the particular approach line and there was thus no question of the magnet in the line from Pollokshields East Station being energised at the time the electric train passed over it, even if Signal G 237 had been at green. This would appear to be inconsistent with the sounding of the AWS bell in the cab of the electric train but previous experience* has shown that damage to the AWS receiver, or to the indicator dial, or to the electric wiring, can under certain conditions cause a change in the indicator, from all-black to black-and-yellow or vice versa. For this reason the AWS cab indications can never be relied upon to give information on the aspect of the last signal passed, or the drivers' actions, if the train concerned has been subjected to a violent shock, or the AWS apparatus and its wiring has been damaged.

44. Finally, as regards the trains, there was no evidence that they were other than in proper working order and it is clear that nothing in their condition contributed to the accident.

CONCLUSION

45. The evidence in this case builds up a picture of the events leading to the collision as seen from the signal box and from the two trains concerned. In almost every respect the evidence fits together in a consistent and convincing pattern and is fully supported by subsequent tests and investigations. The one discordant note is the account given by Driver McMahon of the aspect of Signal G 607 at Pollokshields East Station, and the indication given to him by the associated AWS, as his train approached the station.

46. I am fully satisfied that Signal G 607 was at Danger at the moment that the electric train was started past it and that the passing of this signal at Danger was the direct cause of the accident. Having taken into account the consistency of the technical evidence and given due weight to the probable reliability of the eye-witness accounts concerned I must also conclude that Signal G 607 was showing a proper red aspect as the train approached it and that a proper warning was given by the associated AWS. Responsibility for the accident must therefore rest with Driver McMahon.

47. The movement of the electric train past Signal G 607 at Danger automatically replaced Signal G 604 to Danger and I am satisfied that this occurred whilst the approaching diesel train was still at least 80 yards away from Signal G 604. Driver Mullan, at the controls of the diesel train, had seen this signal at green and received the associated bell code from the AWS, but for some reason he did not notice the change in the signal's aspect. It may be that, as he claimed, his attention was focussed on the junction ahead: had he seen the signal go to Danger in his face he would no doubt have braked and the collision would have occurred at lower speed, with possibly less serious results, but a collision was nevertheless inevitable and Driver Mullan should not feel himself in any way to blame for what occurred.

REMARKS

48. In blaming Driver McMahon for the accident I am not necessarily implying that he was deliberately giving false evidence as to the aspect of Signal G 607. My own view is that he was not paying proper attention to the signal as he arrived at Pollokshields East and that, having stopped his train in a position from which he could not see the signal, he had no real idea of what the aspect had been. Perhaps subconsciously, he assumed that the signal was clear and therefore started the train immediately on receiving the guard's 'train ready to start' signal. Immediately after the accident he looked at the AWS indicator in the cab, not realising at that time that his train had just passed over a further magnet or that the indicator might have been altered as a result of the collision, saw it was showing all-black and persuaded himself that Signal G 607 must have been at green. This view is perhaps supported by his answers to questioning by Junior Technical Officer France immediately after the accident: the main thing in his mind appeared to be the state of the AWS indicator, not the aspect of the signal he had just passed.

49. There is no suggestion that Driver McMahon was other than properly fit for his duties at the time of the accident. He had been seen and his driving assessed by a senior supervisor only two hours before the accident. There is of course the possibility that his lapse might have stemmed in part from a degree of relaxation following the successful conclusion of this assessment. This however can only be conjectural and in any case cannot stand as mitigating the seriousness of his lapse.

* See Report on the Collision near Albion Sidings, Oldbury (LM Region) on 27th May 1970 (HMSO 1971).

50. There remains the question of whether the repositioning of Signal G 607 at Pollokshields East had produced a potentially dangerous situation. I do not think it had. The signal overlap, although slightly shorter than usual, was quite adequate for the line speeds concerned, and from my own observations from the cabs of trains I do not believe that the positioning of the signal presented any problem to a normally alert driver. The one possibly unfortunate effect was that trains were required to stop some distance down the platform, opposite a repositioned marker board, and whilst this gave adequate platform length for normal trains it seems that some drivers, Driver McMahon included, had been tempted to stop forward of the marker board and thus slightly in advance of the signal. I discussed with the Railway Officers whether anything could be done to overcome this difficulty. It was not possible to move Signal G 607 any closer to the junction since its position was dictated by the need for trains to have gained a certain minimum speed before reaching the neutral section. We discussed the possibility of providing a repeater signal forward of the signal but this would create an undesirable precedent and would, in my view, be a wrong application of a repeater. The solution finally adopted was to reduce the length of the platform face at Pollokshields East so that it would terminate in line with Signal G 607, there being thus no incentive for a driver to draw his train forward of the signal. I am glad to report that this work has received official approval and will be carried out in the near future.

I have the honour to be,

Sir,

Your obedient Servant,

C. F. ROSE,

Major.

The Permanent Secretary,
Department of the Environment.

