RAILWAY ACCIDENT

Report on the Collision that occurred on 4th March 1989 at Purley

**IN THE
SOUTHERN REGION
OF BRITISH RAILWAYS**

HMSO

DEPARTMENT OF TRANSPORT

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LONDON: HMSO

RAILWAY INSPECTORATE
DEPARTMENT OF TRANSPORT
2 MARSHAM STREET
LONDON, SW1P 3EB

27 October 1989

SIR

I have the honour to report for the information of the Secretary of State in accordance with the Direction dated 14 March 1989 the result of my Inquiry into the collision between two passenger trains which occurred on Saturday 4 March 1989 at Purley in the Southern Region of British Railways. Mr W J May, an Assistant Inspecting Officer of Railways, was appointed to assist me.

At 13.39, the 12.50 train from Horsham to Victoria was struck in the rear by the 12.17 train from Littlehampton to Victoria. The train from Horsham had just departed from Purley Station and had crossed from the Up Slow line onto the Up Fast line. The train from Littlehampton had been travelling at speed along the Up Fast line. The leading 6 vehicles of the 8 coach train from Littlehampton were derailed and deflected to the left down an embankment. The seventh coach of the train from Littlehampton was also derailed as were the rear two coaches of the train from Horsham.

I regret to report that 5 passengers were killed and 88 persons, including 3 railway staff, required hospital treatment. Of the injured, 32 were detained in hospital, some with serious injuries but by the time I opened my Inquiry only 4 remained in hospital.

The accident caused considerable disruption to rail services. The Up and Down slow lines, which were blocked to traffic to facilitate the recovery work, were re-opened at 05.17 on 6 March. The Up and Down Fast lines were re-opened, subject to a 20 mile/h speed restriction and without the damaged crossover being replaced, at 15.43 on 6 March. The removal of the vehicles from the side and bottom of the embankment was a difficult task and the last one was taken away by road on 9 March. The re-instatement of the crossover was completed and normal operations were restored at 08.00 on 27 March.

DESCRIPTION

The Site of the Accident

1.1 Purley Station is located some 13¼ miles south of London on the line from London (Victoria) to Brighton and the South Coast. To the north of Purley Station the line is carried some 20m above the surrounding residential area on a tree covered embankment. There are four tracks, from west to east they are the Up Fast, Down Fast, Up Slow and Down Slow lines respectively. The Up direction of travel is towards London. Purley Station has six platforms with the additional Up and Down Loop lines lying to the east of the other four lines. Immediately to the north of the station there are double ladder crossovers from the loop lines to the Slow lines and then to the Fast lines. The accident occurred at the point where the crossover from the Down Fast line joined the Up Fast line.

1.2 Immediately to the south of the station the loop lines diverge into two double track branch lines to Caterham and Tattenham Corner. The line to Tattenham Corner passes beneath the Fast and Slow lines. The Fast and Slow lines continue to Stoats Nest Junction, approximately a mile south of Purley Station, before splitting to form the alternative Redhill and Quarry line routes. The layout of routes in the Purley area are shown in Diagram 1.

1.3 The maximum permitted line speed on the Fast lines in the vicinity of Purley is 90 mile/h. The maximum permitted speed through the crossovers to the north of Purley Station is 25 mile/h. The railway is electrified on the 750 V dc conductor (third) rail system. In the area of the accident the traction current is supplied from a substation at Purley which is remotely supervised from a control room at Selhurst. From this control room it is possible to remotely switch and monitor the electrical supply and distribution from several substations over a large area. The supervisory instructions are carried by means of trackside cables which also transmit the state of the circuit breakers in the substations to the control room. Alternative electrical supplies are available to this area from adjacent control rooms including one at Brighton.

The Signalling Arrangements.

1.4 Train movements in the Purley area are signalled in accordance with the British Railways Board

Track Circuit Block Regulations. All running signals controlling main line movements are of the four-aspect colour-light type and are equipped with the Automatic Warning System (AWS). These signals are capable of displaying four different aspects, namely, a red stop aspect, a single yellow or double yellow caution aspect, or a green clear aspect. The correct sequence of aspects displayed by the signals is illustrated in Diagram 2. Where lines diverge the four aspects are supplemented by junction indicators which take the form of a row of 5 white lights mounted above the main aspects and angled in the direction of the divergence from the main route.

1.5 The signalling, which was installed in 1984, employs conventional relay interlocking. The interlocking for the Purley area is housed in a purpose built relay room adjacent to Purley Station. The signalling is, however, controlled from the Three Bridges Signalling Centre some 16 miles south of Purley. Responsibility for the operation of Three Bridges Signal Centre is split between a number of signalmen each of whom control a specific section of railway. The overall supervision is undertaken by a Regulator and an Assistant Regulator.

1.6 The whole of the area controlled by the Signalling Centre is shown on a continuous diagrammatic panel which displays the signal routes set, the track circuits occupied by trains and other displays relating to the lie of points, alarms, etc, so that each signalman is able to observe what is happening in the area for which he is responsible and also in the areas adjacent to his own. The identity of each train is shown on the display by alpha-numeric codes. These train descriptions are moved along the panel from signal to signal automatically by the passage of trains. The stepping forward of these descriptions is triggered by the train physically passing a signal showing a proceed aspect. Should a train pass a signal at Danger its description will not step beyond the last authorised position but is retained there.

1.7 The signalman sets the routes for trains by pressing first an entrance button and then an exit button for the route required. When the route is physically set it is indicated by a line of white lights along the route on the panel. Signal indications for controlled signals are shown on the panel by either a red light for a red signal aspect or by a green light for any proceed aspect; yellow aspects are not indicated separately from green aspects. Some running signals are either fully or semi-automatic in that the control of the signal is affected by the passage of a train. Without any action on the part of the signalman, the signal reverts to Danger as a train passes it and then as the train travels away from it passing other signals it changes to display progressively less restrictive aspects.

1.8 The layout of the relevant signals in the Purley Station area is shown in Diagram 3. Signal T168 on the Up Fast line which protects the crossovers immediately to the north of Purley station is a semi-automatic signal. In its automatic mode the signal operates for a succession of trains travelling along the Up Fast line. With it operating in the automatic mode the signalling interlocking is designed to prevent the setting of the crossover route from the Up Slow to the Up Fast line. The signalman is able to change the signal from the automatic mode to controlled operation at any time and the signal will then, after the passage of the next train, remain at Danger. The signalman would then, subject to other controls allowing it, be able to set the crossover route.

1.9 The signalman may also replace Signal T168 to Danger at any time. If he does so when a train is already approaching along the Up Fast line and has occupied any track circuit from TC.DZ to TC.PE the Comprehensive Approach Locking is designed to prevent the conflicting crossover route from being set until a 2 minute timing control has operated. This ensures that the route remains 'locked' until sufficient time has relapsed for the approaching train either to have stopped at Signal T168 or to have passed it. If Signal T168 is replaced to danger before the train has occupied track circuit DZ, the approach locking does not operate because the driver of the approaching train will not see a signal revert to a more restrictive aspect. Similar approach locking controls are provided for trains routed from the Up Redhill line to the Up Fast line through Stoats Nest Junction.

1.10 The AWS provides both an audible and visual warning to the driver of the signal aspect. It is operated by magnets positioned between the rails approximately 187m before the signal to which they apply. With the signal displaying a green aspect a bell sounds and the indicator displays an all black disc. The driver is not required to acknowledge the AWS for a green aspect. With the signal displaying a red, yellow or double yellow aspect a warning horn will sound. The driver has to acknowledge the AWS by depressing a button which silences the warning horn and causes the indicator disc to display black and yellow segments as a reminder to the driver. If the driver does not acknowledge the warning within 3 seconds the brakes of the train will be automatically applied. The AWS system does not distinguish between red, single yellow or double yellow aspects.

The Trains

1.11 The 12.50 train from Horsham to Victoria was a 4-car electric multiple-unit (EMU) No. 3441 of Class 423. This class of EMU was introduced in 1967. The formation of the train was as follows:

Coach 76378 (leading). *Driving Trailer Coach* with 18 First Class seats in compartments and 38 Standard Class seats in an open saloon and 8 in a compartment.

Coach 62261 *Motor Coach* (Non-Driving) with Guards Brake Compartment. 58 Standard Class Seats in two open saloons.

Coach 70894 *Trailer Coach* with 98 Standard Class seats in an open saloon.

Coach 76377 *Driving Trailer Coach* with 18 First Class seats in compartments and 38 Standard Class seats in an open saloon and 8 in a compartment.

1.12 Each vehicle was 19.74m long. The driving trailers weighed 35 tonnes, the trailer 31.5 tonnes, and the motor coach 49 tonnes giving a total weight of the train of 150.5 tonnes. The train was timetabled to depart from Purley Station at 13.34 and to cross from the Up Slow line to travel along the Up Fast line.

1.13 The 12.17 train from Littlehampton to Victoria was formed on departure from Worthing of two 4-car EMU of the Class 421/2 which were introduced in 1970. The units were No. 1280 leading and No. 1295 trailing and the formation was as follows:

Unit 1280
Coach 76730 (leading) *Driving Trailer Coach* with 18 First Class seats (in compartments) and 36 Standard Class seats (in open saloon).

Coach 62368 *Motor Coach* (Non-Driving) with Guards Brake Compartment. 56 Standard Class seats (in open saloon).

Coach 71048 *Trailer Coach* with 72 Standard Class seats (in open saloon).

Coach 76801 *Driving Trailer Coach* with 24 First Class seats (in compartments) and 28 Standard Class seats (in open saloon).

Unit 1295
Coach 76816 *Driving Trailer Coach* with 24 First Class seats (in compartments) and 28 Standard Class seats (in open saloon).

Coach 71063 *Trailer Coach* with 72 Standard Class seats (in open saloon).

Coach 62383 *Motor Coach* (Non-Driving) with Guards Brake compartment. 56 Standard Class seats (in open saloon).

Coach 76745 *Driving Trailer Coach* with 18 First Class seats (in compartments) and 36 Standard Class seats (in open saloon).

1.14 Each vehicle was 19.74m long. The driving trailers weighed 35.5 tonnes, the trailers 31.5 tonnes, and the motor coach 49 tonnes giving a total weight of the train of 303 tonnes. The train was timetabled to pass Stoats Nest Junction travelling along the Up Fast line at 13.38½.

1.15 The damage caused to the vehicles of the trains in the collision and subsequent derailment was as follows:

12.50 Horsham to Victoria
Coach 76378 - No damage (leading vehicle)

Coach 62261 - No damage

Coach 70894 - Trailing end of vehicle, left hand side (in direction of travel) badly damaged internally and externally over the length of the bogie with a 1.5 metre length of bodyside totally disintegrated from floor and roof. The electrical control and heating jumper receptacle boxes

destroyed and wiring damaged in this area. Other minor damage sustained along left side of the coach.
Coach 76377 - Extensive damage to trailing end of the vehicle, left hand side (in direction of travel) having taken the full force of the impact. From the driving cab, with its handbrake column sheared, the bodyside was totally disintegrated for a 3 metre length, with severe damage sustained for a further 3 metre length including door pillars, windows and all wooden stepboards. The first two seating areas were severely damaged and various windows throughout the remainder of the coach were broken. The underframe equipment, including the truss-bars (strengthening members of the underframe) and brake reservoir tanks, was badly damaged. Both bogie frames were twisted and their suspension damaged, with the wheels of the leading bogie being torn away in the impact.

12.17 *Littlehampton-Victoria*

Class 421/2 Unit No. 1280
Coach 76730 - Coach at bottom of bank with both bogies detached. Severe body damage to right side of cab front, trailing end of vehicle torn away and flattened to floor level and centre roof section torn away. Extensive damage to under frame cross-members and longitudinal truss bars. Both bogies twisted and suspension damaged.

Coach 62368 — Coach down bank with both bogies detached. Severe body damage with luggage area bodyside panels smashed in and roof section split. Extensive damage to underframe cross-members and longitudinal truss-bars. Both bogie frames twisted and suspension damaged.

Coach 71048 — Coach down bank on its left side with both bogies detached. Severe body damage at leading end and to left hand side of vehicle. Extensive damage to underframe cross-members and longitudinal truss-bars. Both bogie frames twisted.

Coach 76801 — Coach down bank on its right side with trailing bogie detached. Severe body damage to corners of vehicle. Moderate damage to underframe drawgear and one solebar bent. Bogie brakegear bent.

Class 421/2 Unit 1295
Coach 76816 - - Coach down bank on its left side held by the buckeye couplers. Moderate body damage to left side of vehicle. Underframe equipment damaged and bogie headstocks and brakegear bent.

Coach 71063 — Coach part way down bank on its left side held by the buckeye couplers. Superficial damage to body, underframe and bogies.

Coach 62383 — Derailed all wheels but still on trackbed. Superficial damage to body, underframe and bogies.

Coach 76745 - - No damage and not derailed.

EVIDENCE

Working of the Trains
2.1 *Driver E W Sellwood* drove the 12.06 train from Eastbourne to Victoria on the day of the accident. It passed through Purley travelling along the Up Fast line at about 13.06. Mr Sellwood said that Signal T182 displayed two yellows, Signal T178 a single yellow and Signal T168 a red aspect. He said Signal T168 "Came off as I was crawling along the platform" and he had seen a train going round the curve in the line ahead of him beyond Signal T162. As far as Mr Sellwood was concerned the signals were functioning as they should have done.

2.2 *Driver A J P Lawless* drove a Gatwick Express along the Up Fast line through Purley at about 13.33 on the day of the accident and he said all the signals were clear. He was a regular driver on the Gatwick Express and that journey was the fourth he had made that day. The only problems he had expe-

rienced with the signalling in the Purley area was having to stop the train for a red signal which was then cleared to green.

2.3 *Signalman D J Owen* had signed on duty at 13.10 and taken charge of that part of the Three Bridges Signalling Centre panel which controls the Purley area. He had been a signalman at Three Bridges since September 1983. When he commenced work on the day of the accident the panel was working correctly and no abnormal train movements were taking place and there was nothing to cause him any concern.

2.4 Signal T168 was in 'Auto' as the Gatwick Express was approaching Stoats Nest Junction and he took it out of 'Auto'. As the Gatwick Express went past Signal T168 the signal indication on the panel went to red and stayed at red. The indicator lights for the platform and overlap track circuits cleared as the Gatwick Express continued its journey towards Croydon. It was normal for the train from Horsham to be routed onto the Up Fast line behind the Gatwick Express and this he did once the Tattenham Corner train had left Platform No. 5.

2.5 He operated the entry button at Signal T170 and the exit button at Signal T162. He saw the panel indications for 1639 and 1641 points go to the reverse position and the route lights illuminated showing that the route was set. He was not sure of the position of the train from Horsham because the track circuit indication extends from Signal T180 to T170 and he knew only that the train was between the two signals. He watched the indications as the train from Horsham departed and as soon as it occupied the first track circuit beyond Signal T170 the signal went back to red.

2.6 All the track circuit indications on the panel went to red indicating a failure of some kind. He was told there had been a major accident by a driver using the signal post telephone at Signal T153. After about 30 to 40 seconds the indications began to return to the panel and then he could see what had happened. When the indications returned the 1H05 description for the train from Littlehampton was in the berth for Signal T168 but there were no track circuit indications illuminated for that train. The only track circuit showing occupied was PH where the train from Horsham was standing, which was just on the trailing end of 1639 points.

2.7 As soon as Mr Owen was told of the accident he immediately told Mr Timms, the Regulator, and asked him to call the emergency services while Mr Owen used the direct telephone link to the Selhurst Electrical Control. He told the electrical controller what had happened and asked for the traction current to be discharged in the whole area. The electrical controller told Mr Owen that there was a loss of indications at the Selhurst control and that he could not confirm the current was off.

2.8 Mr Owen said that he had always intended to allow the train from Horsham to follow the Gatwick Express and run ahead of the train from Littlehampton and that he had not changed his mind. That was the normal pattern of services which was repeated each half hour and it was also the normal method of operation to take Signal T168 out of 'Auto' as the Gatwick Express was approaching or going over Stoats Nest Junction. That day, as the Gatwick Express passed through Purley station, Mr Owen said his recollection was that the train from Littlehampton was on the country side of Stoats Nest Junction and between Signals T178 and T182.

2.9 He said it was not unusual for the trains from Horsham to be a minute or two late or for the trains from Littlehampton, which run non-stop from Gatwick, to be slightly early. He said, however, there was no point in allowing the train from Littlehampton to run before the train from Horsham because the train from Littlehampton would be held at Croydon waiting for the correct departure time and the train from Horsham would be delayed that much more. It was, therefore, not unusual for trains to be checked or stopped at Signal T168. Mr Owen said he would consider changing the sequence of trains if the train from Horsham was 5 minutes or more late.

2.10 *Driver V A R Brown* drove the 12.50 train from Horsham to Purley. Earlier in the day he had driven a train from Horsham to London and back. There was nothing unusual about the second journey as far as Purley. As he approached Purley station Signal T170 was displaying a red aspect which cleared to a single yellow aspect with junction indicator lights for the route to the Up Fast line. He could not remember whether the signal cleared as the train ran into the station, which he said it often did, or if it cleared immediately the train came to a stand.

2.11 He thought the stop at Purley was for the normal length of time. The signal was still showing the same aspects when he started the train. He looked back along the train as it departed and in doing so had looked toward platform No. 1 but had not noticed the aspect Signal T168 was showing. He drove the train over the crossovers at about 25 mile/h. The train was about three coach lengths onto the Up Fast

line when he felt a series of violent snatches from the rear of the train. He shut off power and applied the brake but the train was virtually at a stand anyway.

2.12 He realised something serious had happened to the rear of the train. He got out of the driving cab on the embankment side of the train. At first he thought only his train was involved and it was some time before he realised another train was involved. He saw the driver of a light locomotive standing on the Down Fast line jump down and use the telephone at Signal T153 and so he knew the signalman had been advised what had happened. By that time passengers were beginning to get out of the front of his train.

2.13 Mr Brown applied a short-circuiting bar on the Down Fast line. In the meantime Driver Luxford, who had been travelling as a passenger on the train, had used a telephone adjacent to the Down siding to speak to the signalman and he shouted across that the Selhurst Electrical Control could not confirm the current was off. Mr Brown obtained another short-circuiting bar and applied it towards the rear of his train on the Up Slow line. Passengers were now beginning to get out of his train on the offside and he was concerned that the current was not off. He then, with other members of staff, did his best to ensure that passengers made their way to the Down side and then to the station without stepping on any conductor rails.

2.14 *Guard D J Stanford* was in charge of the train from Horsham which arrived at Purley a minute late. As soon as the train stopped he stepped from the guards van, which was at the rear of the second coach of the train, onto the platform and he saw that Signal T170 was showing a single yellow aspect with the junction indicator illuminated. There were quite a few passengers waiting to board the train and that took about a minute. One of those waiting was Guard Barnes who entered the guards van. Mr Stanford checked the doors were closed, the signal aspect had not changed and gave the 'Ready to Start' bell signal to the driver.

2.15 The train started and proceeded over the crossover at what he estimated was between 15 and 20 mile/h. The train was nearly over the crossover and onto the Up Fast line when "there was a crash and a judder, an almighty crashing noise and a terrible juddering". He was being tossed around and could not recall what happened next. When the train had stopped he saw Mr Barnes putting down track circuit operating clips on the Down Fast line and he knew the train was being protected. He walked back through the train to see what damage had been done and tried to calm passengers and get them to stay on the train.

2.16 He noticed three passengers who were bleeding in the rear coach and one lady lying unconscious. There was another person with her and so Mr Stanford tried to calm the other passengers. He was concerned to keep them on the train because he did not know if the current was off. He got out on the embankment side of the train and walked forward to find his driver and found that passengers were getting out. He tried to make sure that they did not go near the conductor rails. Having spoken to Driver Luxford and learnt of the problems of confirming the current was off, he gathered passengers together and, aided by another member of staff who was a passenger on the train, he walked them back to Purley station along the Down Fast line on which a short-circuiting bar was in position.

2.17 *Guard B M Barnes* caught the train from Horsham at Purley to travel to Victoria where he was due to sign on duty at 14.00. He noticed, while he was waiting on platform No. 3 at the top of the staircase from the subway, that a Bedford service and then a Gatwick Express went past along the Up Fast line. As the train from Horsham approached platform No. 3 he saw Signal T170 clear to a single yellow aspect and the lunar lights 30 seconds before the train stopped. He boarded the train with Mr Stanford.

2.18 As the train went over the crossover road onto the Up Fast line there was a terrible juddering and he thought the train had been derailed. He looked to the lefthand side of the train and actually saw the other train going down the embankment. Leaving the train on its righthand side, while Mr Stanford went to the left, he placed track circuit operating clips on the Down Fast line.

2.19 He got back into the brake van and got the ladder out. In the compartment next to the brake van was a gentleman with two children and he was shouting he wanted to get out. Mr Barnes placed the ladder on the embankment side of the train and got him, his children and a lady out. He walked to the front of the train where there were people standing and he thought they were being taken away. He went round to the other side of the train and walked back on the Down Fast line side to the third coach where he put the ladder up and got people out making sure they did not touch the conductor rails. A gentleman got out and said he was the last one in the third coach and Mr Barnes made his way to the last coach. He was told by a policeman that there was a seriously injured lady and, placing his overcoat on the ladder to turn it into a stretcher, he helped him place her on it. She was taken away by an ambulance crew.

2.20 *Driver R G Morgan* was the driver of the train from Littlehampton. In order to enable him to assist my Inquiry he was given a limited immunity from prosecution by the Director of Public Prosecutions. At his request, on the advice of his legal representatives, he gave his evidence in camera.

2.21 Mr Morgan had been a driver for 22 years and during that time he had not been involved in any serious incidents nor had he passed a signal at Danger when not authorised to do so. He said he had had no domestic worries, had been in good health, had not been taking medication and had not consumed any alcohol. He had just returned from an annual holiday.

2.22 On the day of the accident he booked on duty at Littlehampton at 07.18 and his first trip was to drive an empty Stock train from Littlehampton to Lover's Walk at Brighton. The booked departure time was 07.57 and he departed from Littlehampton at about that time and arrived at Brighton at 08.40 or 08.50. He then travelled back to Littlehampton as a passenger on train at about 09.50. With the guard he went to a cafe and ate breakfast. He also bought two sausage rolls. He then made his way back to Littlehampton and spent the time until his next job in the driver's mess room. He had not slept or dozed. There were others there and he had joined in the conversation and had spoken to the supervisor.

2.23 Shortly before the 12.17 departure time of the train from Littlehampton he left the mess room and made his way to the train which was already in the station. He entered the cab and prepared for departure carrying out a brake test in conjunction with the guard using the internal train telephone. He took off his jacket and hung it up which is what he normally did. The heater in the cab was on and the windows closed. The departure was normal and he opened the sliding window to look back along the train as it pulled away.

2.24 The first station stop was at Angmering where he stopped the train at the four car mark. The platform was also on the lefthand side as it was at Littlehampton and again he looked back through the open window on departing. He repeated this at the next station. At West Worthing the signal at the end of the platform was at red and there was a wait until it changed to a proceed aspect. The signal at the end of Worthing platform was at red because a second train was to be coupled to the rear of his train. While waiting he ate the sausage rolls he had bought. The other train was coupled and another brake test was made. He thought the wait at Worthing was between 3 and 4 minutes. The signal cleared to a green aspect for the departure of the train. Because the platform was on the righthand side he did not look out of the window.

2.25 He then ran on green signals to Lancing but received a yellow signal at Shoreham where he stopped the train at the eight car mark with the platform on the lefthand side. A normal departure was made with signals displaying green aspects. Again he opened the window and looked back as the train departed. The next station stop was Hove where the train was routed into the loop line with the platform on the righthand side of the train. When the train departed from Hove with a double yellow aspect signal, the next signal was a single yellow, but the one after that changed to green before the train reached it. There were then green signals to just before Gatwick where a double yellow changed to green before the train reached it.

2.26 At Gatwick Airport the platform was on the lefthand side and Mr Morgan supposed the station stop lasted about 2 minutes. The train departed under green signals and again he opened the window and looked back. The next thing he could recollect was a green signal in the 'covered way' but he had no recollection of the next two Signals T182 and T178. He said that as the train, travelling at 60 to 70 mile/h, approached the end of Purley station platform he noticed Signal T168 at red and he immediately made a full emergency brake application. He believed he did not cancel the AWS but that the power was shut off.

2.27 He realised that the train would not stop at the signal and he just hung on. He told me that "it ran through my mind it should not be that colour". He said everything happened so quickly, his train hit the other train a glancing blow, veered off to the left and went down the embankment. When the coach stopped he slid out from a gap in the cab and fell out onto the ground. He said he was mumbling as he tried to think how it happened. He still could not explain or understand it.

2.28 *Guard A H Squires* worked the empty stock train from Littlehampton to Brighton with Driver Morgan and ate breakfast with him. They had read newspapers and discussed the news generally and he believed Mr Morgan was his normal self. He had then later in the day been the guard on the 12.17 train from Littlehampton to Victoria. His evidence agreed with the evidence given by Mr Morgan on the working of the train from Littlehampton to Gatwick Airport.

2.29 He gave the signal for the train to start from Gatwick Airport station from the guards van in the second coach of the train. After the departure he went into the third coach and commenced checking

tickets. While doing so he met Mr Knights, a revenue protection inspector, and they agreed to share the duties between them and to meet again in the guard's van. Mr Squires was the first back to the guards van. When Mr Knights returned he stood in the corridor at the open door to the guards compartment while Mr Squires stood inside the compartment with his back against an electrical cupboard.

2.30 They were chatting when there was a sudden emergency brake application and Mr Squires' initial thoughts were that a signal had been replaced to Danger in front of the train. He saw the emergency application register on the brake gauge. He had returned to the guards van when the train was in the Coulsdon area and had there been an earlier brake application he would have been aware of it. There was a series of bumps and he said that "the next thing we were flying through the air" and the electrical cubicle doors and fuses were falling like "autumn leaves".

2.31 Mr Squires said he could not remember everything that happened after that but remembered struggling to open a door and getting out of the coach and being concerned about protecting the train and being told by others that it had been done. Later he found Mr Morgan lying on the ground covered with a blanket and mumbling. There was someone he did not know in the remains of the driving cab and Mr Squires asked what he was doing and received the reply that "the driver wants his key". He told the person not to touch it.

2.32 *Mr A C W Knights,* a Revenue Protection Inspector, joined the train from Littlehampton at Gatwick. He made his way through the train until he found Guard Squires checking tickets and they agreed to split the work between them and afterwards they met again in the guard's compartment. He stood by the door to the guard's van chatting with Mr Squires for about 2 or 3 minutes. Then there was a very hard brake application.

2.33 There was a bump followed by three large bumps and he thought the train was derailed. He was thrown violently against the door, which separates the corridor from the passenger compartment, tearing it from its hinges and carrying it with him. The door came to a rest against the first seat but he was propelled over the top of the seat and onto a man and women in the next bay of seats. He remembered another passenger asking him if he was all right and then asking him to move so they could reach the female passenger. He also remembered trying to find his glasses and trying to find out what had happened to the guard before being helped out of the coach through a window and down a ladder.

2.34 *Mr P Young,* a Traffic Controller in the Regional Operations Control at Waterloo, was travelling as a passenger in the centre of the sixth coach of the train from Littlehampton which he boarded at Shoreham by Sea. Until the approach to Purley the journey had been uneventful. He believed the brake application had been made when about half way between Signal T178 and Signal T168, approximately 500 yards from the station. As a regular traveller he knew that if a train was to be checked at Signal T168 there would be a brake application on the approach to Stoats Nest Junction but he could not recall one being made there. He estimated the speed of the train before the brake application as between 70 and 80 mile/h and the speed at the collision approximately 40 mile/h.

As to the Cause of the Accident

2.35 *Mrs M M Neve* joined the train from Horsham at Redhill and had travelled in the centre of the rear coach, sitting on the righthand side in the direction of travel. She was a regular, albeit occasional, traveller on the line and said that the journey between Redhill and Purley had been perfectly normal. Soon after leaving Purley, the train's brakes were applied, although Mrs Neve had the impression that the train was still being propelled continuously forward. The carriage in which she was travelling eventually derailed and, although there was a loud roaring noise, the train came gently to a stand with her carriage leaning over to the righthand side. One passenger had slipped from his seat and luggage had fallen from the racks, otherwise she considered it remarkable how undisturbed everything and everyone appeared. After a short period, a railwayman appeared who told them to remain where they were until it could be ascertained that the traction current had been switched off. Within a few minutes the railwayman returned, warned everyone not to touch or step on any rail and Mrs Neve, together with the other passengers, stepped down the half metre or so that the coach footboards were above the ballast and walked along the track to Purley Station.

2.36 *Mr A Wilcox* boarded the train at Littlehampton that departed at 12.17. He was sitting in the standard class compartment in the centre of the first coach. At Shoreham *Mr P F Brandon* joined the train and sat in the same compartment. The journey was uneventful and both passengers were reading. As the train approached Purley it was travelling fast, although both agreed not unduly so. Mr Wilcox was conscious of a bang like a detonator followed by two or three severe applications of the brake. Mr Brandon confirmed that there were two or three jerks as the brakes were applied followed by lateral buffeting before the coach tumbled down the side of the embankment. Both witnesses were disoriented by the subsequent events but

both had the impression that the coach somersaulted before coming to rest. They were both surprised and gratified by how quickly help and assistance was provided to them by the residents of the locality in which the accident occurred.

2.37 *Ms F Donnelly* was seated in the standard class open compartment that was at the trailing end of the first coach of the train from Littlehampton. The journey appeared perfectly normal and she was not aware of the application of the brakes at first until the coach started jumping up and down. She closed her eyes and attempted to hold onto a seat. She felt that she was being "beaten with baseball hats" and tumbled around. She believes she was thrown through a window because when the train came to rest she was lying in a tree with her feet through the remains of the window. She could see the compartment that she had been sitting in had been completely destroyed and it was unrecognisable as a railway coach.

Events immediately following the Accident

2.38 Two neighbours, *Mr R Taylor* and *Mr D A Lewis* were in the gardens of their homes which are at the end of Glenn Avenue, a small cul-de-sac situated at the foot of the railway embankment about 300 metres north of Purley Station. At about 13.40 Mr Lewis was in the garden shed when he heard the sound of the accident. The air was filled with flying debris and tree branches from the trees that had stood on the embankment. A bogie landed beside his shed and less than a metre from his house. Having ascertained that his dog had survived the accident, he went indoors and telephoned the emergency services and succeeded in reporting the accident. He returned to the badly damaged coach and saw the Driver of the train from Littlehampton staggering beside his train. He laid the Driver on the ground and covered him with one of the blankets that were by then being brought by other neighbours but he does not recall speaking to him. He then went to one of the overturned coaches and reassured the passengers who were still inside that the emergency services had been summoned and were on their way. Subsequent to the evacuation of the casualties, in order to provide access for the large cranes required to retrieve the carriages from the foot of the embankment, Mr Lewis very kindly agreed to the demolition of a garage and utility room that was under construction and was almost complete when the accident occurred.

2.39 Just before the accident occurred *Mr R Taylor,* a retired police sergeant, was tending plants in his greenhouse. He had returned to the conservatory attached to his house to collect water for his plants when he heard a loud crashing noise and saw four railway coaches crashing through the trees down the embankment. The leading coach and the fourth coach came to rest on top of the greenhouse in which Mr Taylor had been working. He immediately telephoned 999 but when he received the engaged tone he realised that others were already in contact with the emergency services. He then asked his wife to telephone their son who lived nearby. After again surveying the scene Mr Taylor collected his ladders from his garage and placed them against the overturned vehicles for the use of younger neighbours who were by then arriving. Mr Taylor fetched his saw and started cutting the tree branches that were covering the damaged end of the leading coach. Mr Taylor was conscious of the sound of the sirens of emergency vehicles in the vicinity but none appeared to arrive for what Mr Taylor considered to be about 15 to 20 minutes. Mr Taylor therefore ran through an alleyway to Whytecliffe Road, which is parallel to his own, where he found a Fire Brigade pump appliance vainly trying to find the location of the accident. After giving directions, access was further delayed to emergency vehicles by the number of private motor cars parked in the narrow cul-de-sac. Mr Taylor subsequently freely opened his house and offered his telephone for the use of casualties and the emergency services. Mr Taylor confirmed that prior to the accident the embankment had been covered with mature trees with heights ranging up to 20 metres.

2.40 As a result of the telephone call from his mother, *Mr A Taylor,* a police constable based at Mitcham Police Station, left his home, where he was off-duty, and arrived at the site of the accident at about 13.42. Pc Taylor was the first member of the emergency services to arrive on site. He described the scene and said that about a third of the length of the leading coach of the train from Littlehampton was completely demolished and he was able to enter, and examine and tend the casualties. He found at least three ladies, in various stages of consciousness, trapped in the wreckage. He was assisted by others who had arrived in attempting to free them. He then tended a lady who was in considerable pain until she was extracted and he accompanied her to hospital.

2.41 *Mr G S Hindess,* a British Rail Train Crew Supervisor based at Selhurst was at home in Whytecliffe Road when he heard the sound of the accident. He immediately went to the site of the accident. He found the Driver of the train from Littlehampton lying beside his train who was able to identify himself as Driver Morgan of Littlehampton. Driver Morgan was concerned about his train keys and also said "I've never done anything like this before". When the Fire Brigade arrived the Fire Officers requested the residents to provide ladders so that they could gain access to the coaches. Mr Hindess returned to his home to collect his own ladders and when he came back, Driver Morgan had been removed to hospital.

2.42 *Driver M Brown* was at the controls of a Class 47 locomotive travelling light that was brought to a stand at Signal T153 on the Down Fast line about 550 metres north of Purley Station. He saw a train depart from Platform 3 and move across his path from the Up Slow to the Up Fast and he then became aware of the approach of another train travelling along the Up Fast at a speed he considered too great to be able to come to a stand before it reached the convergent point. The last coach of the slow train had not completed its manoeuvre over the trailing points on the Up Fast when it was struck in the rear by the fast train. Before the wreckage came to a stand, Driver Brown had climbed down from his cab and he then went to the signal post telephone. He telephoned Three Bridges Signalling Centre and advised the signalman that a major train crash had occurred to the north of Purley Station and that it was an emergency. At about this time another passenger train came to a stand at an adjacent signal on the Down Slow line. Driver Brown placed detonators from his own locomotive on the track in order to provide protection. He could see that short-circuiting bars had been put down across the conductor rails but could not obtain confirmation that the traction current had been switched off. After warning passengers on the train from Horsham of the possible danger from the live rail, he assisted other railwaymen, who had by then appeared on site, in conducting the passengers along the track to Purley Station.

2.43 *Guard S C Parr* was in charge of the 13.40 Purley to Farringdon "Thameslink" service that was standing at Platform 6 awaiting its departure time when the accident occurred. Guard Parr, who was at the rear of his train, was told by his driver by means of the internal train telephone he could see that a serious train accident had occurred. Guard Parr immediately collected his emergency equipment and went towards the site of the accident. He saw that some track circuit clips had already been placed and he completed protecting those tracks that appeared not to have been dealt with. He also saw one traction short-circuiting bar in position and although he could not obtain an assurance that the isolation of the traction current had been confirmed he was advised that all the necessary protection had been carried out. He then went and assisted passengers to evacuate initially from an overturned carriage of the train from Littlehampton that was half way down the embankment and then the other train until the emergency services arrived and took over.

2.44 The most senior person present at Three Bridges Signal Centre was *Regulator M T Timms* who was being assisted by *Assistant Regulator J C Underhill.* The first indication they received that an accident had occurred was the indicated failure of the remote control signalling transmission system known as Time Division Multiplex (TDM) when an alarm bell rang and all the lights on the signal panel diagram showed red. After about a half minute the signal lights reverted to normal and a few seconds later telephone messages were received by the Signalman Owen from Driver M Brown at a signal post telephone and by Assistant Regulator Underhill from staff at Purley Station. It was agreed that Mr Underhill would contact the British Rail telephone exchange in order to summon the emergency services. Using the appropriate emergency telephone number on the BR private line, he made contact with *Miss J Hooker,* a telephone operator at Waterloo. Because of initial confusion over the location of the incident, the caller was connected with the East Sussex Constabulary instead of the Metropolitan Police. It was over 5 minutes before Mr Underhill was connected with the Metropolitan Police. He then advised them that the incident was just to the north of Purley Station and could not identify the location nearer.

2.45 Meanwhile Mr Timms was telephoning *Electrical Control Operator T L Foster,* who was on duty in the Electrical Control Room at Selhurst, to request an isolation of the traction supply in the area of the accident. Mr Foster was aware that there was something amiss when the Control Room lighting had dimmed and indications were received that two oil circuit breakers had automatically opened at the Croydon Sub-station that takes its supply from the National Grid. However, Mr Foster could obtain no indication of the state of the traction supply in the Purley area in spite of opening the circuit breakers controlling the immediate area. He therefore extended the area of isolation to the north by opening circuit breakers at the Selhurst Sub-station and requesting the Brighton Control Room operators to open the circuit breakers supplying the area from the south.

2.46 He explained that by 13.45, whilst he was confident that all the necessary circuit breakers had been opened, because he had no supervisory circuits available, he could not be absolutely certain that there was no train or other short circuit bridging the electrical section gaps and providing a stray supply to the area of the incident. He was therefore unable to give an undertaking to Regulator Timms that the conductor rails were not energised in the area of the incident and recommended that they be checked on site with test equipment.

2.47 *Station Manager P Stark* had been in charge of thirteen stations for five weeks when, on the day of the incident, he arrived at Purley Station at 13.45 to start a late turn duty to cover arranged leave by the station chargemen. He was immediately advised by a station chargeman that there had been an incident. He then put on a high visibility vest and walked along the track arriving at the site of the incident about

6 or 7 minutes later. At this time, he was the senior British Rail manager on site and remained so until 14.25 when the first of the Regional Managers arrived. Although there were members of the fire brigade and police at the top of the embankment he did not consider it necessary to make contact with the incident officer of either force. He considered his primary duty was the evacuation of the uninjured passengers along the track and this he proceeded to organise with the railway personnel who were by this time on site. Station Manager Stark was able to arrange for the tracks south of Purley to be cleared to enable the traction current to be restored to enable a passenger train trapped at Stoats Nest Junction to be moved.

Actions of the Emergency Services
The Fire Brigade

2.48 Evidence on behalf of the London Fire Brigade was given by *Deputy Assistant Chief Officer B J Ash* who stated that according to the Brigade's records the incident occurred at 13.44, that is, 5 minutes later than that reported by British Rail and the first report was received by the Brigade direct from Scotland Yard at 13.45. The predetermined response to a train accident was two pump ladders, one pump, one emergency rescue tender, one forward control unit and one area control unit and these units were duly dispatched. The first unit to arrive was under the control of T/Sub Officer Goodchild of Purley Fire Station. Having initially attended Purley Station and been redirected to Whytecliffe Road, the unit was finally directed to Glenn Avenue. After Sub Officer Goodchild initiated an advisory message to Croydon Control at 13.53 regarding the site of the accident, he directed initial search and rescue operations. Sub Officer Powell of Sanderstead assumed control upon arrival and after further assessing the situation, Sub Officer Powell made a message at 13.58 requesting further assistance to which two pump ladders, two pumps and an emergency rescue tender responded. Because no assurances could be obtained regarding the state of the traction current, the Brigade posted lookout men with warning horns, in accordance with their standing instructions for incidents upon the railway, while the search, rescue and removal of casualties continued.

2.49 At 14.02 Divisional Officer Mitchell arrived and took command of the incident. At 14.07 he initiated a message implementing a "Major Incident Procedure". Although this message was received at Croydon Control, it was not passed to the London Ambulance Service and this matter was the subject of a formal internal Brigade inquiry. The London Ambulance Service invoked a "Major Incident Procedure" at 14.20. Contact was made on the site in Glenn Avenue with the senior officers from the other emergency services and British Rail to determine a common policy for dealing with the incident.

2.50 Coincidentally Mr Ash, although off duty, was at the Brigade's South West Area Headquarters at Croydon. When he became aware of the extent of the incident, he placed himself formally on duty and went to site, booking in with the Brigade's incident control unit at 14.23 and, at 14.29, took control of the Fire Brigade's inner cordon and the search and rescue operations. Meanwhile senior Brigade officers had been instructed to attend New Scotland Yard and BR Waterloo to assist with liaison duties. Liaison meetings were held on site with the Senior Officers of the London Ambulance Service, Metropolitan Police and British Transport Police. These three services subsequently set up their own control units.

2.51 The last casualty was removed at about 15.15. Due to the topography of the site and the overturning of some carriages, it was necessary for the Fire Brigade and both police forces to carry out a concentrated search of the site and carriages to ensure there were no more casualties and to retrieve personal property. At 17.00 it was determined that no further casualties remained undetected on site. A Stop message was sent from the incident site at 17.45. Mr Ash left the site at 18.46 after handing over command to Divisional Officer Fisher. The Brigade remained in attendance on the site until 22.56 on Thursday 9th March when the last vehicle was removed from the site and a final search could be made.

2.52 Mr Ash commented upon the excellent liaison that had been quickly established between the emergency services, British Rail and both police forces. However, he stated that the primacy of the London Fire Brigade in the rescue operations only became formally and clearly established when he had taken command. He said Rescue operations are most effective when duties and responsibilities are clearly understood by the emergency services and all other agencies from the outset and, in order to improve the effectiveness, efficiency and safety of those involved, and in his opinion command and control responsibilities of the Fire Brigade should be statutorily recognised.

The Metropolitan and British Transport Police Forces

2.53 *Assistant Chief Constable (Operations) I W McGregor* of the British Transport Police (BTP) provided evidence on behalf of his own Force and the Metropolitan Police. The first reports of a rail accident at Purley were received by the Metropolitan Police at Scotland Yard by way of the 999 system from members of the public at 13.40. A major incident procedure was immediately put into effect which included

advising all the emergency services and other relevant agencies of the incident and directing police officers to the scene. Metropolitan Police officers were quickly on site and within 10 minutes several cars were in attendance. Initial police action was directed by the duty officer Inspector Edwards whose priority was to provide an accurate assessment of the situation and to arrange access for the emergency vehicles. A control vehicle was established as a rendezvous point in Whytecliffe Road in order to co-ordinate liaison between the emergency services.

2.54 The Information Room of BTP received a telephone call from the British Rail Waterloo Regional Operations Control at 13.42 advising of the accident. BTP notified the Fire Brigade and Ambulance Service and dispatched their own officers to the scene. A similar message was received from Scotland Yard at 13.44. The first BTP officers arrived on site at 14.17 and set up a forward control and started the liaison with the emergency services Incident Officers which was continued by Chief Inspector Davison when he arrived and became the BTP Incident Officer. The BTP Incident Control Vehicle was established and fully operational by 15.15 and by 16.00 a total of 90 police officers were deployed. In addition to the establishment of a Major Incident Room at BTP Headquarters at 14.00, a Casualty Bureau at Scotland Yard was implemented at 14.00 and was fully operational, with BTP officers assisting, at 15.35.

2.55 Mr McGregor arrived on site at 15.08 and undertook the duty of official appraisal. He was satisfied that the Fire Brigade was controlling the search and evacuation and that good liaison had been established between all emergency services and British Rail. Incident Control Vehicles of the various services had been parked adjacent to each other, traffic arrangements invoked and cordons established. A management team was established to control the incident and the first of several meetings involving the heads of the emergency services was held at 15.20 in the house of Mr Taylor in Glenn Avenue.

2.56 In total BTP had 120 officers and MP 60 officers present at various stages. The Metropolitan Police officers carried out a phased withdrawal after the casualties had been removed whilst the BTP officers remained in attendance engaged in security, searching duties and assuming responsibility for recovered personal property. The BTP presence was not withdrawn until 14 March when the site was totally cleared.

2.57 It is an important function of the police to protect the site of an accident and to preserve the evidence, both on and off site, which would assist in the determination of its cause. As a result of lessons learned at the accidents at King's Cross and Clapham Junction, instructions were given for police officers to be present as independent witnesses when rolling stock and signalling equipment were tested and examined. This was not only to protect the evidence but the integrity of all parties concerned including British Rail. Nevertheless the increased participation of the police was unfamiliar and Mr McGregor therefore recommended that guidelines to be followed in the event of a rail accident, especially fatal and major injury accidents, be issued to all parties to enable the situation to be better understood. It is not the intention of the police that British Rail investigators are excluded from the scene but that they are admitted after they have identified themselves to the police and fire brigade incident officers and that they are accompanied on site by an independent witness.

The London Ambulance Service

2.58 The London Ambulance Service was represented by *Mr H Chambers*, Assistant Chief Ambulance Officer, South West Division who stated that telephone call advising of a train accident had been received at 13.42 and a further 20 calls were received up until 14.20. Although the accident occurred at a traditionally busy time on a Saturday and with the service operating with just the Accident and Emergency fleet manned, the London Ambulance Service and the Surrey Ambulance Service were each able to provide five ambulances within 30 minutes of the accident occurring. Two Forward Control Units were dispatched to the scene, the first from Surrey arriving at 14.03 and the other, from LAS Headquarters Waterloo, at 14.32. A total of 27 ambulances from Surrey and London were committed to the incident, plus two coaches from London. Mr Chambers arrived at 14.20 and assumed the role of Ambulance Incident Officer.

2.59 Three hospitals were advised of the incident and placed on "yellow alert", starting at 13.50, and received casualties. The designated hospital was Mayday Hospital, Croydon with St Helier Hospital, Carshalton and the East Surrey Hospital, Redhill in support. A Major Incident was declared at 14.20 as a result of reports from the first crews to arrive on site and advised to the hospitals. Two medical teams attended, the first to arrive from the St Helier at 14.35 and the other from the East Surrey at 14.51. In addition six general practitioners, members of the British Association for Immediate Care (BASICS) offered their assistance, which was accepted, and teams were requested to attend.

2.60 It was not possible to determine the exact number of casualties treated. Some of the injured made

their own way independently to various hospitals not designated to receive casualties from the train accident and these hospitals may not have advised the Casualty Bureau at Scotland Yard of the numbers treated. The number of casualties treated at the designated hospitals, as recorded by the Ambulance Service,

Hospital	*Conveyed by Ambulance*	*Conveyed by Police*	*Made their own way*
Mayday	21	24	•
East Surrey	20	–	11
St Helier	12	–	•
Totals	53	24	11

• Casualty numbers treated have not been determined.

The number of persons identified as receiving hospital treatment as a result of the accident was 88.

2.61 The last casualty was released at about 15.30 and conveyed to Mayday Hospital and, shortly thereafter, the hospitals and the Surrey Ambulance Service were stood down and the London Ambulance Service attendance was reduced to six ambulances. Both medical teams returned to their respective hospitals and medical attendance was provided by the BASICS team. At 15.52, Mr Chambers declared the incident closed and the number of ambulances were progressively reduced until, at 21.08, one remained in attendance for the duration of the recovery of the coaches.

2.62 Mr Chambers concluded by paying tribute to the cooperation between the emergency services and to the expeditious manner in which all the casualties were released and conveyed to hospital within a time of less than two hours. The professional manner in which all ranks of the ambulance service carried out their duties was, in his opinion, a credit to the Service.

The British Association for Immediate Care

2.63 A written statement of the activities of the British Association for Immediate Care (BASICS) on the day of the incident was submitted to the Inquiry by *Dr K Hines* of the Hertford & Essex Immediate Care Scheme. The British Association for Immediate Care is a national charitable association whose 2000 medical members provide skilled medical assistance at the site of an incident and during transport of the casualties to hospital. These doctors are skilled in a wide range of resuscitation and rescue techniques and work alongside the statutory emergency services at incidents as well as in planning and rehearsing disaster procedures.

2.64 At 13.53 the police alerted Dr Hines that a BASICS team was required to attend a rail accident at Purley. Dr Hines and Dr R Winch were conveyed by police car and Dr R Herbert travelled by police helicopter. They arrived at 15.05, 15.15 and 15.30 respectively. Meanwhile, the Surrey Ambulance Service had notified the Hampshire, Berkshire and Surrey Immediate Care Scheme and as a result Dr C Carney, Dr B Robertson and Dr K Wiscombe were mobilised in their own vehicles, arriving on site between 14.50 and 15.10. All the BASICS doctors reported on arrival to the London Ambulance Control Vehicle and a Forward Medical Equipment Point was established at the end of Glenn Avenue.

2.65 Doctors Carney and Robertson assisted in the treatment of the last remaining trapped casualty who had sustained a serious leg injury. His condition was stabilised on scene with an intravenous infusion, analgesia and traction splintage. This patient was subsequently transferred to hospital accompanied by Dr Carney. Following departure of the hospital medical teams, Dr Robertson assumed the role of Medical Incident Officer and maintained close liaison with the emergency services. The remaining BASIC doctors assisted the fire service to carry out a thorough search of the site and provided medical attention to local residents and others who had been shaken by the incident. At 17.40 Dr Hines relieved Dr Robertson of the role of Medical Incident Officer and Dr Robertson and the remaining BASICS Doctors were stood down. Dr Hines maintained a presence on site while the coaches were being secured to prevent their movement until 22.30.

2.66 Dr Hines included in his statement a comparison between the accident at Clapham Junction on 12 December 1988 and that at Purley. Firstly, access to the Purley site was much more restricted with major problems in manoeuvring vehicles close to the incident. Secondly, the mechanism of the accident was different in that the injuries were mainly caused by the tumbling and roll-over of the vehicles as opposed to crushing and trapping injuries that occurred at Clapham. Thirdly, initial medical control was not established by either of the two hospital medical teams which worked independently of each other. In Dr Hines' opinion one of the doctors should have assumed a managerial role but given the geography of the site such

an omission was understandable. Fourthly, casualties were removed rapidly from site without the use of triage labels. Nevertheless Dr Hines concluded that this incident again illustrated the value of using a small number of highly trained doctors, experienced in dealing with large scale multiple casualty situations supporting locally based mobile medical teams who are unlikely to have had previous experience of such incidents.

Signalling

2.67 *Mr C Porter*, the Regional Signal Engineer, explained how four-aspect colour-light signalling operated and in particular the comprehensive approach locking controls on Signal T168. He also explained the operation of the AWS and demonstrated the visual and audible indications given to a train driver. The explanation of the signalling and AWS appears in paragraphs 1.4 to 1.10 of the description section of this report.

2.68 Mr Porter also defined various classifications of signalling equipment faults as follows:

Rightside Failure

All signalling equipment was designed to failsafe principles, which meant that with any failure of the equipment the system was designed so that, as far as practicable, the equipment fails to a safe condition and displays a more restrictive state to the driver or signalman than it would have done if it had not failed. These failures were referred to as *Rightside Failures*.

Wrongside Failures

A wrongside failure was a failure where something happens that should not happen and where the signalling system does not fail to a safe mode. There were some wrongside failures which were protected by other parts of the signalling system and are known as *Protected Wrongside Failures*. For example, the failure of both filaments of a signal lamp was a wrongside failure but it would be 'protected' by the previous signal remaining at Danger when the controls on the previous signal failed to detect an electrical current flowing through the lamp of the other signal. An *Unprotected Wrongside Failure* was one which was potentially very serious and, for example, could be caused by a defective piece of equipment.

2.69 *Mr N D Remfrey*, a Technician Officer in the Signals and Telecommunications Engineers Department arrived at the Three Bridges Area Signalling Centre at about 13.55 to relieve another technician officer who informed him he had just had a telephone call from Brighton and had been told that the train describer had 'frozen'. They telephoned the Signalling Centre Regulator and were informed of the accident. They made their way to the operating floor where they arrived at 13.58.

2.70 Mr Remfrey observed the indications on the signalman's panel. He said Signals T168, T170, T172, T174, T167, T153 and T154 were all showing a red indication as were shunt signals 1093, 1091 and 1096. He observed that the track circuit PK was showing occupied with the description 2C07 (the train from Horsham) displayed within the track circuit. Track circuit PH was showing occupied for the route through 1639 points reversed. Track circuit XD was showing occupied through 1639 and 1641 points reversed. Track circuit WR was showing white route lights for the route through 1641 points reversed. WQ track circuit was showing white route lights from Signal T170 indicating the route had been set but was no longer occupied.

2.71 He observed the description for the train from Littlehampton, 1H05, was showing in the PE track circuit but the track circuit was showing clear. This indicated to him that Signal T168 did not have a route set from it and, therefore, the train description had not stepped from PE track circuit towards PK track circuit.

2.72 On the signalman's control desk the independent point switch for 1638 points was in the central position and an 'out-of-correspondence' indication was showing. The switch for 1639 points was in the central position with an 'out-of-correspondence' indication showing. The switch for 1640 points was in the central position with a 'normal' indication showing. The switch for 1641 points was in the 'reverse' position with a 'reverse' indication showing and he said the signalman told him he had moved the switch to the reverse position. The switches for 1642, 1644 and 1645 were all in the central position and with 'normal' indications showing. The switch for 1646 points was in the central position with a 'reverse' indication showing. The switches for 1649 and 1650 points were in the central position with a 'normal' indication showing.

2.73 Mr Remfrey spoke on the telephone to Mr McLellan, a Technician Officer at East Croydon and was informed that Mr McLellan had 'signed out' all signals between South Croydon and Stoats Nest Junction. Mr McLellan had arranged this with the signal box Regulator and Mr Remfrey arranged with the signalman to itemise the signals concerned and he also included two signals south of Stoats Nest Junction.

2.74 *Mr V G McLellan, a* Technician Officer in the Signal and Telecommunications Engineers Department was on duty at the East Croydon relay room when he was informed of the accident by another technician officer at the Victoria Signalling Centre. Having spoken to Mr Timms the Regulator at Three Bridges Signalling Centre, he signed the signals out of use from the Up Quarry line and the Redhill line at Stoats Nest Junction, and also the Down Slow and Down Fast lines from South Croydon. He then proceeded to the site at Purley.

2.75 Before departing from East Croydon Mr McLellan had not been able to find the drawing of the Purley Area because it was not in its usual place. The other drawings were there but not the one for the Purley Area and he had some difficulty arriving at an accurate picture in his mind when he telephoned the signalman and it was for that reason he decided to sign out a larger area of signalling.

2.76 On arriving at Purley he said he examined the positions of the points and signal aspects in the area. He saw Signals T153, T155, T168, T170, T172, T174 and T176 were all showing red aspects. Both A and B ends of 1641 points were in the reverse position. The B end of 1639 points in the Up Fast line were destroyed. He then, in conjunction with other technical officers, started to carry out disconnections of the signalling equipment. The fuse for track circuit PE was removed, which had the effect of making the track circuit appear to be occupied, and also other circuits for the Down Fast, Up Fast and Down Slow lines were disconnected.

2.77 Mr McLellan also disconnected the 'links' to the green, single yellow and double yellow aspects on Signals T163, T155, T168, T170, T172, T174 and T176 which allowed only a red aspect to be displayed. An error was made on Signal T168 and the link to the red aspect was also disconnected and as a result the signal displayed no aspect for a period of time. He thought that this had occurred at about 15.15 and had lasted for about 5 to 10 minutes before being corrected. Before the disconnections were commenced he did not establish the aspects which Signals T178 and T182 were showing.

2.78 *Mr J J Devlin,* a Signal Maintenance Supervisor based at East Croydon was at home when he was informed of the accident by his son, who heard about it on the radio, just after 16.00. Although off-duty Mr Devlin was 'on-call'. His home telephone was out of order and he had spoken to the Waterloo Control that morning and told them that he could not be contacted by telephone but he could be contacted by his 'pager' and checked that they had the correct number. He had, however, not been contacted. With his son, also a railway employee but in the Telecommunications Department, he immediately made his way to the relay room at Purley.

2.79 From the relay room he telephoned the Three Bridges Signalling Centre and spoke to Mr Page, the Area Signal Engineer (Maintenance), who gave him a brief description of what had happened and asked him to remain where he was until Mr Page and other staff arrived. Shortly afterwards Mr McLellan returned to the relay room and Mr Devlin checked with him what signals had been disconnected. He told me that what Mr McLellan had done at the time "seemed to be quite right and correct". He considered Mr McLellan had done nothing that would have disturbed anything on Signal T168 other than maintaining that signal at Danger (at red).

2.80 Mr Devlin was involved in the subsequent testing of the signalling and was personally responsible for the testing of Signal T182. In this work, which was finished about 09.00 the following morning, he was assisted by signal technicians and they were observed by British Transport Police Officers. He said he was satisfied with the functioning of the signal following his examination.

2.81 *Mr J F Wilson,* the Area Signal and Telecommunications Engineer, learnt of the accident from a member of his staff who arrived at his home. He discovered that his telephone had been inadvertently "left off the hook". He left home at about 16.00 and arrived at Three Bridges Signalling Centre at about 16.20. He confirmed that the site was protected but was not told of the disconnections that had been made. The signalling panel was showing more track circuits occupied than he expected but when he discussed it with the signalmen and other staff he was told that numerous track circuit operating clips had been applied.

2.82 He then proceeded to Purley where he arrived at about 16.50 and reported to the railway incident control room which had been established at Purley Station. On the journey from Three Bridges to Purley he had formulated a plan as to what testing would be required and this was discussed with Mr C P Thompson the Regional Signal and Telecommunications Engineer who was at Purley. The testing was organised into two teams led by two senior members of staff, Mr Page and Mr Coulson, with Mr Wilson co-ordinating the work.

2.83 Although the indications on the signalling panel suggested that Signal T168 had not been cleared, the full testing was undertaken and all the circuits relevant to Signal T168 and the preceding signals were

tested thoroughly. The overall testing immediately after the accident took some 26 hours and involved over 400 man-hours of work. At that time the crossover between the Down and Up Fast lines (1639 points) had not been replaced and further testing was done after the replacement of the crossover.

2.84 Signals T168, T178 and T182 and the associated AWS equipment was visually checked and then functionally checked to confirm the equipment was operating correctly. An examination was made for extraneous wires or foreign materials. Electrical voltages were measured and recorded and the cables were tested to check there were no 'short-circuits' between individual wires or to earth. The circuits were wire counted to ensure there were no spurious wires and that the circuits agreed with the diagrams. The track circuits, not damaged in the mishap, from the one ahead of Signal T168 back to Signal T182 were tested and found to be in order.

2.85 Within the relay room a wire count was undertaken of all the appropriate equipment racks to check there were no additional or extraneous wires. Relay contacts were examined for signs of silver migration and short-circuits. The approach locking controls of Signal T168 were fully tested. New wiring to relays and busbars and some new relays installed for the 'Right-Away' indicators required for the proposed Driver Only Operation of train services, whether or not relevant to platform No. 1 at Purley or to Signal T168, were all fully wire counted and checked.

2.86 Mr Wilson confirmed that none of the initial testing or any of the subsequent testing, which again included the testing of the approach locking of Signal T168, following the reinstatement of 1639 points, had found anything at all that was behaving abnormally or any fault in the signalling equipment which could have accounted for the accident. Since the accident monitoring equipment had been temporarily installed on the aspect of Signals T168, T178 and T182 and on the approach locking of Signal T168 and no spurious operation had been seen. (On 25 August 1989 a driver reported that Signal T168 changed from a green to a red and then back to a green aspect. This was recorded by the monitoring equipment. The approach locking was maintained and this rightside failure was attributed to a momentary loss of detection on 1639 points.)

2.87 *Mr R F Cawley*, the Resources and Services Engineer for the Director of Signal and Telecommunications, together with a Signalling Inspector and a Traction Inspector checked the sighting of the signals after the accident. This was done using a periscope which simulates the view from the driver's position. The minimum distance to give the required seven second sighting of a signal at a maximum line speed of 90 mile/h was 283.5 m (310 yards).

2.88 Commencing with Signal T168 and working away from it they established a sighting distance of 321 yds. Beyond that distance the signal was obscured by the banner repeater signal for the Down Fast line Signal T159 and then by the island platform buildings. At 321 yds all four aspects of the signal were clearly visible. Signal T178 could be seen from over 1,122 yds, that is, from the preceding Signal T182. Signal T182 could be seen from a distance of 500 yds and sighting checks were not continued beyond this point. In making their sighting checks of the signals Mr Cawley had looked for signals which may have been confused with the intended signals and had found none.

Examination of Rolling Stock

2.89 The first competent person on site able to inspect the train controls was *Area Traction Inspector J A Nivison* who was based at East Croydon. He arrived about 14.18 having walked along the track from Purley Oaks Station to the site of the accident. He did not report to any of the control centres but at 14.25 he entered the driving cab of the train from Horsham in order to ascertain the position of the driver's controls and check whether any air pressures in the brake cylinder or the main reservoir were registered on the cab gauge. Mr Nivison noted that the AWS had not been isolated, the seal being intact, and that the AWS dial was showing a yellow and black aspect indicating that the train had passed a signal with a restrictive aspect and the audible warning had been cancelled. Both the hand brake and the power brake were applied and the brake cylinder pressure was indicated as 30 lb/sq ins. The driver's key was in position with the forward/reverse switch in neutral and the driver's controller was closed. He considered that everything was the way he would have expected.

2.90 He inspected the four-coach train from Horsham and found that the leading two vehicles were intact and not derailed. The trailing bogie of the third coach was derailed. The leading bogie of the fourth coach had been dislodged and was under the centre of the coach and the trailing bogie was very considerably damaged. Mr Nivison did not inspect the nearside of the train and was therefore not able to comment on the damage to the body shell.

2.91 Being advised against climbing down the embankment, Mr Nivison walked along the track to Purley Station and returned by way of the road to Glenn Avenue at about 15.30. After identifying himself to both the Police and Fire Brigade Incident Officers, he explained the purpose of his reason to examine the driver's cab of the train from Littlehampton but he was refused permission to enter the cab. No reason was given but he was told that when anyone was allowed in, he would be the first to do so.

2.92 After the Police had carried out a thorough search of the leading coach and removed all personal property, he was eventually allowed into the cab at 16.15. He noted that the gauges recording the air pressures in the brake pipe and brake cylinder were showing zero, the power brake handle was in emergency and the master switch was in the forward position. The Driver's Safety Device (DSD) isolating switch was in the correct position and sealed. However the power controller handle was in Notch 4 ie full power, but he explained that when the control handle, which has to be held down, was released the DSD would have operated, the brakes would be applied and the power supply to the traction motors automatically removed. Mr Nivison explained that in view of the damage to the brake pipes and air reservoirs on the underframe of the leading coach it was not surprising that all the air pressure had been lost. The AWS indicator was showing an all black aspect but Mr Nivison said that in view of the accident this had no real significance.

2.93 *Rolling Stock Inspector B J Lowden,* who was based at East Croydon, arrived about 14.40 and walked along the track to the site of the accident. He did not report to any of the control centres but went with the intention of examining the driving cabs. Mr Lowden noted that the brake piston rods on the trailing vehicles of the train from Littlehampton were fully extended indicating that the brakes had been applied but he was unable to determine whether this had been as a result of a brake application made by the driver, the discontinuity of the brake pipe or the operation of the Driver's Safety Device or the Automatic Warning System. He felt the wheels and found them to be warm but not hot. He could make no estimate as to the severity of the application of the brakes.

2.94 When he attempted to check the driver's cab he was denied access to the cab by an officer of the Metropolitan Police and instructed to leave the site. When he was able to return to site after about 2 to 3 hours he was told that the cabs had already been examined.

2.95 The on-call engineer was *Mr C S Moss* Depot Engineer at the Brighton Rolling Stock Depot. He received initial notification of the incident and was subsequently advised at 14.40 of its seriousness. He met his superior *Mr D A Woolvett* then Area Maintenance Engineer on his way to site. They arrived at 15.50 and checked in at the railway incident control centre on Purley Station. They explained who they were to the Police and that they were concerned that the position of the controls had been recorded and that all the necessary electrical isolation had been carried out. They too were denied access to the driver's cabs of both trains and became involved in several acrimonious exchanges with the Police.

2.96 At about 16.00, after being refused entry to the cabs, Mr Woolvett walked along the line as far as the country end of Purley Station platform in order to examine the state of the rail head on the approach to the accident site. He found that the rail heads were wet but not greasy. There was no indication of wheel slide or slip on the head of the rails and, in his opinion, there appeared to be nothing in the state of the rail that could have attributed to the cause of the accident.

2.97 On return to the site of the accident, they ignored the instructions of the police and examined the exterior of the vehicles. The wheels on the last two vehicles of the train from Littlehampton were found to be warm with the brake blocks in the applied position. The remaining available bogies were examined and the brake blocks were found to be in good condition and fully bedded in. Mr Woolvet concluded that the brakes on both trains had been functioning normally up until the time of the accident.

2.98 Mr Woolvett also surveyed the wreckage of the train from Littlehampton and concluded that no attempt should be made to retrieve the vehicles on the embankment until they had been stabilised and propped and that it should not be started until the following day. Mr Woolvett gave instructions that when the vehicles were removed, any parts and components that were removed were to be identified with the vehicle from which they were taken.

2.99 Arrangements to carry out testing of the vehicles and their components after their recovery was arranged by the Traction Mechanical Engineer for Network SouthEast, *Mr I Ross.* Because of damage, it was not possible for the brakes of all the vehicles of the train from Littlehampton to be tested in situ. Therefore, in the presence of a police officer, the driver's brake valve and the remainder of the electro-pneumatic brake equipment with the exception of the brake cylinders were removed from the first five vehicles and mounted on a test rig at the Chart Leacon Rolling Stock Overhaul Depot. No faults were found in the exhaustive testing which was carried out. After minor repairs to the pipe runs, the last three vehicles were tested with the brake equipment in situ and again no faults were found.

2.100 Sample brake blocks were removed from each of the leading five vehicles and subjected to metallurgical examination at the British Rail Central Research Laboratory at Derby. The results showed that the metallurgical composition was within specification and that there were indications that they had been hotter than normal in service due to a hard application but that it was not possible to determine how long before the accident the application had been made.

2.101 Mr Ross arranged for the AWS modules to be removed from the driver's cab of the train from Littlehampton, identified them and witnessed the tests that were carried out at the Signalling Technical Investigation Centre at Crewe under the direction of the Assistant Engineer *Ms B Perkin*. The modules tested were the receiver which detects the polarity of the track magnets, the relay unit containing the electric circuitry and the voltage converter, the Baldwin air valve, the visual indicator and the audible warning modules, the horn and the bell units. All the component parts of the AWS were received with the exception of the connecting cable to the receiver which was damaged in the course of the accident. The seals on all modules were intact when they were received. Each module was tested against the parameters specified for new equipment and, with the exception of slightly extended times before the bell started ringing and the application of the emergency brake, all were functioning within their specification. Ms Perkin was of the opinion that the equipment would have functioned as designed.

2.102 The braking performance of the British Rail Southern Region Class 421 4-CIG stock was discussed by the Network SouthEast Traction Performance Engineer, *Mr P J Russenberger*. He said that the braking performance of the stock from an initial speed of 80 mile/h (128 km/h) on level track had been determined experimentally and a correction factor for gradient assuming a constant retardation rate, was used to calculate the remaining parameters. Mr Russenberger was requested to attend the site of the accident in order to assist in determining the possible speed of the train from Littlehampton at the instant the two trains collided. The following parameters were either assumed or determined as shown below:—

(i) A full brake application was made at the sighting point of Signal T168;
(ii) No allowance was given for thinking time.
(iii) The sighting distance of Signal T168 was 961 feet (293m).
(iv) The initial speeds were taken to be constant at 75 mile/h, (120 km/h), 80 mile/h (128 km/h) and 85 mile/h (136 km/h).
(v) The gradient was 1 in 263 falling.
(vi) The speed of the train from Horsham was taken to be 25 mile/h (40 km/h) that is, the permanent speed restriction on the crossing.

2.103 The theoretical speed at the point of impact was determined as follows:-

Initial speed	*Sighting time of Signal T168*		*Speed at point of impact*		*Speed difference between trains*	
Mile/h	km/h	seconds	Mile/h	km/h	Mile/h	km/h
75	120	8.74	46	74	21	34
80	128	8.19	55	88	30	48
85	136	7.71	64	102	39	62

Mr Russenberger produced a graph of distance travelled on the falling gradient against speed which showed that it would require a distance of 3248 feet (990 m) for a train initially travelling at a speed of 80 mile/h (128 km/h) to have come to a stand. Mr Russenberger confirmed that it would not have been possible for the train travelling at line speed to have come to a stand before the fouling point of Points 1639 if braking had not been initiated until Signal T.168 had come into the sight of the driver.

Driving Technique

2.104 *Mr G R Taylor*, the Regional Chief Traction Inspector, was responsible for the maintenance of the standards of performance of footplate staff throughout the Southern Region. Assisting him were a team of 22 traction inspectors. Mr Taylor had been the Chief Inspector for 3 years, having been the Assistant Chief Inspector for 2 years, and a Traction Inspector for the previous 17½ years. Prior to that he was a driver for 13 years.

2.105 He described to me the typical technique of drivers of trains similar to the train from Littlehampton on the journey from Gatwick Airport to Purley. Different driver's technique varied slightly and different techniques would be employed for different types of trains such as locomotive hauled trains or freight trains. From Earlswood to Quarry Tunnel, which is one mile and 353 yds long, there is a rising gradient. With power being applied normally on departing from Gatwick Airport station under clear signals

the train would be travelling at 70 mile/h. At this point the train is a little under 4 miles from Purley and the gradient falls towards London. If the driver shuts off power at that point the train would be travelling at about 75 mile/h at Purley. Most drivers would not shut off power at that point.

2.106 After passing Signal T192, the next signal the driver would see would be the repeater signal for T190 provided because the minimum 7 second sighting time for that signal was not available, and then Signal T190 itself. The line then crosses over the Redhill line and it was on this section of line most drivers shut off power and the train would approach Purley travelling at 80 mile/h. The next signal is T188 and then comes the 'covered way', which used to be a tunnel, and if the controller had been kept open the train would be travelling at approximately 86 mile/h. After the covered way there is the main Brighton Road and then the old sidings. Looking towards the centre span of a bridge which crosses both the Quarry and Redhill lines Signal T182 first becomes visible. On the approach to Signal T182 the next Signal T178 also becomes visible.

2.107 If on sighting Signal T182 it were displaying a double yellow aspect the driver would not immediately apply the brakes, he would reset the AWS but about 200 yds beyond the signal with the single yellow aspect of Signal T178 continuously in view he would start the brake application which he would continue, making allowances for the weather and rail conditions, so that the speed of the train would be reduced and it would roll into the station, and the driver would be able to stop the train at Signal T168 which was sited at the end of the platform.

Previous Incidents and Signalling Faults

2.108 *Driver B Mathews* was involved in an incident at Signal T168 in 1984. While driving a Gatwick Express he saw a series of double yellow signals and received the AWS warning which he cancelled before realising that Signal T168 was displaying a red aspect and that the previous Signal T178 must have been displaying a single yellow aspect. He was able to stop the train which was travelling at between 40 and 50 mile/h about a coach length past Signal T168. He immediately used the telephone to tell the signalman he had gone past the signal at Danger. In due course he made out a report to the Train Crew Manager and was subsequently disciplined.

2.109 Mr Mathews accepted the responsibility for passing the signal at Danger at the time and still did at the time of my Inquiry. He felt that with momentary inattention he did not register that Signal T178 was displaying a single yellow aspect instead of a double yellow aspect. He expressed reservations about the AWS system because it did not distinguish between single and double yellow aspects and that the repetitive resetting of the AWS when travelling under a series of double yellow aspects became an almost automatic reaction.

2.110 *Driver D Creasey* accepted the responsibility for passing T168 at Danger on 4 April 1986. He said he was running on a series of single yellow signals which turned to a double yellow as he approached them. He reset the AWS and kept the train running. Signal T178 was displaying a single yellow aspect which did not change to a double yellow. He reset the AWS and left the train to run before suddenly realising what he had done and although he made a full brake application the train passed the signal by 2 or 3 coach lengths. Mr Creasey was disciplined for passing the signal at Danger.

2.111 *Driver D J Wright* was the driver of a Gatwick Express which ran by Signal T168 by about a coach length on 16 November 1986. On the approach to a double yellow signal at Stoats Nest Junction he made a brake application but there was very little response. He sounded the warning horn continuously and believed he had attracted the attention of the driver of a train on the slow line. When the train had stopped he telephoned the signalman and told him what had happened. Although initially charged under the disciplinary procedure with passing a signal at Danger the charge was withdrawn after it was established that there was a fault with the brakes of the train.

2.112 *Mr V C H Lambert* who was now retired was a driver of some 40 years experience when on 2 January 1987 he was driving a train which was routed from the Redhill line to the Up Fast line at Stoats Nest Junction. He claimed Signal T178 was showing a double yellow aspect, a Gatwick Express passed travelling in the opposite direction on the Down Fast line as he approached Purley Station and then he saw Signal T168 at red. He made a full brake application but knew the train would not stop before the signal when to his amazement he saw a train crossing from the Up Slow line to the Up Fast line ahead of him. He estimated his train stopped two coach lengths clear of the other train.

2.113 After the train had stopped he asked the guard to telephone the signalman from Signal T168 because the guard was nearer to the telephone. The guard relayed an instruction from the signalman to

continue to East Croydon. Mr Lambert spoke to the signalman by telephone from East Croydon. He said the signalman asked him "What have you to tell me driver?" and he replied "I haven't got to tell you anything other than what you already know — that I have over-shot a red light at Purley platform". He continued to Victoria Station where he was seen by a supervisor and later spoke to a Traction Inspector by telephone.

2.114 When charged under the disciplinary procedure with passing the signal at Danger his initial response was "I was not expecting 168 to be red but as I am the only person to see and know that — and after 38 years' driving — and well aware of the system I know it will be almost impossible for me to prove, as all signals applicable will have been tested and nothing found wrong". Mr Lambert accepted that the first occasion he had claimed that Signal T178 was showing a double yellow aspect followed by Signal T168 at red was at the formal disciplinary hearing. He had not mentioned this to the signalman, the supervisors or managers to whom he had spoken.

2.115 Mr Lambert said he was proud of his driving record of 40 years without making a mistake. In his evidence to me he was adamant that Signal T178 was showing a double not a single yellow aspect and he claimed that the signalling system allowed the conflicting movement to be made after Signal T168 had been put back to Danger after just a few seconds.

2.116 *Mr A Galley,* the Southern Region's Operations Manager, explained how allegations of signals being passed at Danger were dealt with. He said the incident would be regarded as a serious one. Normally the signalman, as well as the driver, would be the first to realise what had happened and a conversation would take place between them. Immediately following that the driver would be seen by an operating supervisor who would be in the vicinity to ascertain that the driver was fit and able to continue his driving duty and to make arrangements for the driver to be seen by a traction inspector for a much more detailed examination and record of the incident to be made. At the same time arrangements would be made by the signalman for Signal and Telecommunications staff to carry out full testing of the signalling equipment and as soon as possible the train would be taken out of service to have its brakes tested.

2.117 Following the incident if there were any dispute between the driver and signalman about the aspects of the signals he had seen the driver would be subjected to a medical examination which would concentrate on eyesight testing. Should there be an admission, or a conclusion, that the driver was in the wrong he would be dealt with through the disciplinary procedure. The same would apply if the error was by the signalman. The disciplinary procedure did not start with an assumption the driver was always wrong. A full check of the facts would be made first and if there were any form of dispute an inquiry would be held to establish the facts and conclusions drawn before any blame or discipline was started.

2.118 *On occasions the driver will sincerely believe in his own view of the incident, despite evidence* to the contrary. If the driver believes he has been wrongly blamed there was an appeal procedure at which the driver could be represented by an officer of his trade union or another advocate of his own choice. That appeal would be heard by an officer senior to the one who held the original disciplinary hearing. Mr Galley confirmed that Mr Lambert should have been seen in a 'face to face' interview and not interviewed over the telephone. Appropriate action had been taken against the Traction Inspector concerned.

2.119 *Mr L H Page,* the Area Signal Engineer (Maintenance) for the South Central Area, first learnt of the accident while at home shortly after 14.00. From home he made the necessary arrangements by telephone for dealing with the accident before going to site and taking charge of one of the testing teams.

2.120 In his normal duty of maintaining the signalling system he was assisted by two Signal Maintenance Engineers, one based at Clapham Junction and the other at Brighton. Located at East Croydon was a Supervisor and 18 staff to undertake the maintenance of signalling equipment in the Croydon and Purley areas. The maintenance work was based on a 6 weekly cycle. A technician would check the signal structure, clean the signal lenses, and oil the hinges and lock of the access door. Moving parts of point machines would be lubricated and track circuits checked for loose wires or connections. During the six-weekly cycle there was no specific test of the functioning of the equipment, though during the work on busy sections of line, the technicians would see the signals display the full range of aspects. Full functional testing of the signalling equipment was carried out to a laid down testing procedure quarterly.

2.121 Mr Page said that his staff would recognise any abnormal behaviour of the signal but that such failures were so rare that the chances of a technician seeing one was fairly remote. Normally reports are received from a signalman because of what he has observed or had reported to him by a driver. When the problem has been identified and rectified the information is entered into a computer record system which stores the information in a simplified form. From these records Mr Page produced information on failures

of Signals T186, T182, T178 and T168 at Purley. The records covered both actual faults and incidents when there was no fault in the signalling equipment.

2.122 The following incidents or failures had been recorded:

Signal T186
24 January 1985 - a 'rightside' failure occurred when the signal failed to clear when the signalman set the route. The failure rectified itself and no fault was found.

21 December 1987 — there was a report that the signal was displaying a red aspect instead of a green aspect. No fault was found which would have caused this 'rightside' failure and it was possible that the signalman had replaced the signal to Danger.

Signal T182
18 June 1985 — a 'rightside' failure when the signal aspect went from green to red. This was not reported to the signal technician and was, therefore, not investigated.

28 June 1985 — the green aspect lamp failed. This was a 'wrongside-protected' failure which would have caused the previous Signal T186 to display a red aspect.

10 September 1985 - a 'rightside' failure when the signal went from green to red. No cause was found.

30 March 1987 — a 'rightside' failure when the signal went from green to red. No cause was found but there had been problems with the detection on 1662 points which lay in the line ahead of the signal and a momentary loss of detection would have caused the signal to go to red.

7 July 1987 - a 'rightside' failure when the signal aspect went from green to red. No cause was found.

10 October 1987 — a 'rightside' failure when the signal aspect went from green to red. No cause was found.

18 October 1987 — the signal was passed at danger. No fault was found with the signalling and the driver was held to blame.

15 November 1988 - a 'rightside' failure when the signal aspect went from green to red. No cause was found.

26 March 1988 — it was alleged that the signal was showing a double instead of a single yellow aspect with the junction indicator lights illuminated for the route from the Up Fast line to Up Slow line through Stoats Nest Junction. All the signalling in the area was thoroughly tested and it was found that it was not possible when the junction route was set for Signal T182 to display more than a single yellow aspect. The driver involved reported that he only thought he saw the signal displaying a double yellow aspect but he could not actually be sure.

Signal T178
24 October 1984 - a 'rightside' failure when the signal aspect went from green to red. This was not reported until June 1985 and, therefore, had not been investigated.

18 April 1985 — a 'rightside' failure when the signal aspect went from green to red. No cause was found.

4 October 1985 - a 'wrongside-protected' failure when the green aspect lamp failed causing the previous Signal T182 to display a red aspect.

21 November 1985 — a 'wrongside - unprotected' failure when the signal was showing a green instead of a red aspect. The cause was found to be a basic error which resulted in the equipment for two track circuits of the same frequency being housed in the same apparatus case, and it was possible to get cross-talk from one track circuit to the other via electromagnetic radiation. Track circuit frequencies were checked throughout the Southern Region; no other similar situations were found. The track circuits at Purley were modified. (This incident became known as the 'Fitzjohn' incident.)

4 February 1986 — a 'rightside' failure when the signal aspect went from green to red. No cause was found.

Signal T168
16 October 1984 — the signal was passed at Danger. No fault was found with the signalling system and the driver (Mr Mathews) was held to be responsible.

5 May 1985 — A signalman realised that in certain conditions it was possible for the approach locking circuit on Signal T168 to be prematurely released; there was no incident which led to this discovery. When the design was checked it was found that one of the track circuits had been omitted from the approach locking controls. This was rectified and thoroughly tested to ensure that the approach locking was "absolutely perfect".

22 May 1985 — a 'rightside' failure when the signal aspect went from green to red. The cause was established as the momentary loss of detection of 1639 points as a train passed on the adjacent line.

10 June 1985 — a 'rightside' failure when the signal aspect went from green to red. The cause was again established as a loss of detection of 1639 points.

15 July 1985 — a 'wrongside-protected' failure of a signal aspect lamp. The computer record did not identify which aspect was involved.

3 December 1985 — a 'rightside' failure when the signal aspect went from green to red. This was not reported to the signal technician at the time and was, therefore, not investigated.

26 December 1985 — a 'wrongside-protected' failure of the red signal aspect lamp causing the previous Signal T178 to be held at red.

4 April 1986 — the signal was passed at Danger. The signalling was thoroughly tested and found to be working correctly. The driver (Mr Creasey) was held to be responsible.

16 November 1986 — the signal was passed at Danger. The signalling was thoroughly tested and found to be working correctly. The records (incorrectly) indicated that the driver (Mr Wright) was to blame.

2 December 1986 - a 'rightside' failure when the signal aspect went from green to red. This was not reported to the signal technician at the time and was, therefore, not investigated.

2 January 1987 — the signal was passed at Danger. The signalling was thoroughly tested and found working correctly and the driver (Mr Lambert) was held to be responsible.

21 September 1988 — a 'rightside' failure when the signal aspect went from green to red. No cause was found.

2.123 During the course of the Inquiry reference was made to other signalling failures elsewhere on the Three Bridges area and Mr Page also gave evidence about these failures. These failures are not strictly relevant to the accident at Purley.

British Railways Board's Actions
2.124 Evidence on proposed developments and future policy of the British Railways Board concerning a number of topics relating to signalling and safety matters in general, although not specific to the accident under investigation, was presented to the Inquiry by *Mr I W Warburton*, Director of Operations of the British Railways Board.

Automatic Warning Systems (AWS) and Automatic Train Protection (ATP)
2.125 The form of AWS currently in use was developed and first introduced on BR during the 1950's and uses the comparatively simple technology of that era. Almost 80% of the lines which meet the criteria for the installation of AWS were fitted with it. AWS was considered an aid to the driver and provided an audible and visual warning about the aspect of the signal being approached. The fundamental philosophy of railway operation on BR was that a signal at Danger must not be passed and the responsibility for observing the signals and taking the appropriate action has always been and remained with the driver.

2.126 The electro-mechanical train stop system in general use on London Underground was unsuitable because it is intended for comparatively low speed operation. The advances in micro-electronics since the beginning of the 1980's and the development of various ATP systems on overseas railways resulted in the Board undertaking a full review of the available technology in order to make a judgement on whether to enhance the existing AWS or to develop an ATP system that would take over control of the train if the driver failed to respond to the signal aspect received. It was established that existing systems in use on overseas railways do not meet the criteria of British Railways without major modification because of their differing signalling philosophies or traffic patterns. Nevertheless, the result of the study was a recommendation to the Board that it should adopt an automatic train protection system and this was accepted as BR policy on 16th November 1988.

2.127 A development plan had been produced which would take full account of current proven technology and would ensure full compatibility with the existing AWS system in terms of safety, line capacity and support for the driver. The Director of Network SouthEast was acting as the lead sponsor in the development of ATP and authority to commence development work was given on 6th March 1989. It is anticipated that a technical specification would be distributed to potential suppliers in order that installation of prototypes for operational testing and evaluation could take place in the course of 1990/91. Providing the prototypes functioned in accordance with the specification and that there was provision of the necessary investment funds, widespread introduction of an ATP system could start in 1992.

2.128 The selected system must be compatible with the existing AWS and must be able to cater for the wide mix of passenger and freight traffic carried by a large variety of rolling stock on British Railways on differing categories of line and take account of foreseeable future developments. In operation, the system would be required to respond to signal aspects, the maximum permitted speeds of the line and permanent, temporary and emergency speed restrictions. It should also safeguard against trains starting against signals at danger. The most important criteria were that it must be fail safe, reliable and provide for safe operation in the event of a failure. It was anticipated that an intermittent system, where the information regarding the situation ahead transmitted to the ATP equipment was updated at fixed locations, would be the option favoured. This could be installed selectively (only at certain signals and speed restrictions) or comprehensively (covering all signals and speed restrictions). In an intermittent system line capacity considerations may require the installation of additional equipment between signals. The considerably more expensive continuous ATP system, where the information was continually updated, would probably not be adopted but if it were used at specific locations where increased line capacity required it, it must be compatible with the chosen intermittent system.

2.129 At the present time there was no intention on the part of the Board of adopting a cab signalling system whereby the driving cabs of all rolling stock would be fitted with in-cab signal displays and all lineside signalling removed.

Automatic Data Recorders

2.130 The purpose of an on-train data recorder was to provide a full record of the operation of the train over a designated period. It was seen to have two functions. Firstly, to provide a discipline to drivers and their driving technique and to provide a record of any malfunction, irregularity or incident. Secondly, to provide valuable evidence to assist any subsequent inquiry to establish the cause of potential or actual hazardous incidents.

2.131 In July 1988, the Director of Network SouthEast decided that multi-function data recorders would be fitted to all new builds of rolling stock for the Network with retrospective fitting of the equipment to the more modern stock. A full specification was prepared in October 1988 listing all the essential as well as desirable functions required to be recorded. It would be of the overwriting type with a capacity of 8 hours or 1600 km recording. Against a distance and time base the following parameters were to be recorded:

i speed of train
ii power controller position
iii brake pipe pressure
iv energisation of brake control wires
v operation of emergency brake
vi operation of AWS horn or bell
vii cancellation of AWS warning
viii isolation of AWS
ix isolation of driver's safety device
x isolation of any vigilance equipment

xi operation of wheel slide protection
xii isolation of wheel slide protection
xiii operation of emergency brake switch
xiv isolation of the traction interlock switch
xv operation of warning horn

In addition the following items were required to be maintained on record for 14 days before being over-written:

xvi application of brakes by other than the driver
xvii application of brakes by the driver's safety device

It was considered desirable but not essential that the following factors were recorded:

xviii operation of fire alarm
xix operation of speed selection device (where fitted)
xx operation of dynamic braking (where fitted)
xxi isolation of dynamic braking (where fitted)
xxii operation of wheel slide protection
xxiii release of sliding doors

2.132 The lorry type of tachograph has been found to be totally unsuitable for railway application. Recording equipment, suitable for downloading into a computer, was tested between 1983 and 1985 and it was believed that a sufficiently robust equipment was available. It was a significant development from the earlier paper recorders used on other railways.

Signals Passed at Danger (SPAD)

2.133 The overrunning of any signal, be it a running signal or a shunt signal in a siding, by even a few metres was regarded for record purposes as a SPAD incident. There was a fall in the number of SPAD from a figure of about 700 in 1970 down to fewer than 500 in 1979. Since then, however, the number had risen to a figure of more than 800 in 1988, although the number of serious reportable accidents remained in the order of 30 per year. The passing of signals at Danger has been acknowledged as a problem for many years and has been regularly on the agenda of the Railway Industry Advisory Committee. Full reports on the incidence of SPAD have been submitted from time to time to the Committee by BR, the latest being on *26th September 1988.*

2.134 Although general records of SPAD have been kept for many years, since 1985 detailed records of the classes of signals passed have been maintained. At the beginning of 1986, the Royal Holloway College was engaged, initially for a six month study and, subsequently, for a three year study, to work in conjunction with BR's own research organisation to identify the underlying causes and trends of signals passed at Danger. It was anticipated that the project would be complete in the Autumn of 1989 and would initially provide a management information system capable of capturing and analysing reliable data on a uniform basis to monitor future developments; secondly, a comprehensive analysis of the human factor influences on incidents of SPAD and, thirdly, a report on identified specific influences. In connection with the third aspect of the study, a report on train braking systems had already been completed and, with the co-operation and assistance of the trade unions, an investigation had been undertaken into relationship with the methods of driver training and effectiveness together with the influence of various methods of signalling.

2. 135 As the project had progressed and again on its completion, the interim and final findings had been and would be referred to the Railway Industry Advisory Committee. The latest report to the Committee, after two years work, anticipated that the likely conclusion would be that the most effective means of reducing the numbers of SPAD would be the provision of an automatic train protection system.

Discussion

3.1 Queries as to whether it was a safe arrangement to cross trains from the Slow line to the Fast line at Purley while 'Fast' trains were travelling towards the junction were raised during the course of the Inquiry and also by many of those who wrote following the accident. On any other than the simplest and lightly used railways the transfer of trains from one line to another must take place. If it did not take place at Purley it would still have to take place elsewhere. The arrangement at Purley should create no greater risk than it does elsewhere. The risk is recognised and appropriate safety provisions are made.

3.2 The standard provisions for such junctions are specified in the British Railway Board's signalling principles and they have been included in the arrangements at Purley. The provision of a full overlap of 187m (200 yds) beyond the protecting Signal T168 and the approach locking controls with the 2 minute delay are among the measures to avoid errors of judgement on the part of drivers or signalmen causing an accident. The overlap was adequate to prevent an accident on the previous four occasions when the signal was passed at Danger. I do not believe that increasing the overlap distance to the full braking distance is a practicable solution.

3.3 It is clear from the number of failures, that the Three Bridges signalling system, did not operate to the very highest level of reliability that should have been expected from a new and modern installation. While the general situation was still a matter for some concern, from the evidence given by Mr Page the situation was improving.

3.4 Of the failures of Signals T186, T182, T178 and T186, 16 were 'rightside' failures when the signal aspect reverted from green to red. This is part of the fail safe design concept that should a failure occur the signal will revert from a proceed to a stop aspect. This can be caused by many things such as a momentary loss of detection on points or an interruption in the electrical circuit of an unoccupied track circuit; because of the momentary nature of these events they frequently cannot be either reproduced or identified afterwards.

3.5 The reverting of a signal to Danger is in itself not dangerous. It may, however, result in a driver having to make an emergency brake application and could result in the signal being passed after it had reverted to Danger. The driver would not be blamed. Although regarded as potentially more serious the 4 'wrongside - protected' failures are in a similar category to the 'rightside' failures. The two 'wrongside-unprotected' failures were a very much more serious matter. Both stemmed from flaws in the design and installation procedures employed on the Three Bridges scheme. They should, in my opinion, both have been found during the design-checking of the system. They were, however, found and rectified prior to the accident on 4 March 1989.

3.6 After the flaw in the approach locking on Signal T168 was found and remedied in May 1985 the system was tested and, in Mr Page's words, found to be "absolutely perfect". After the incident in January 1987 it was re-tested and was also tested again as part of the exhaustive testing following the accident. Mr Lambert remained convinced that Signal T178 was displaying a double yellow aspect and Signal T168 a red aspect despite the comprehensive technical evidence to the contrary. His claims as to how the approach locking of Signal T168 operated were based on a completely mistaken understanding of the system. The timing relays used in such controls are specially designed and manufactured to 'fail safe'. Once the timer setting is accurately adjusted, for 2 minutes in this case, it is sealed. If these timing relays fail, they do so by failing to run at all and the locking would not be released and the conflicting route could not be set.

3.7 If Signal T178 was displaying a double yellow aspect or if Mr Morgan thought it was — he has made no suggestion it was — he would have had to make a brake application about 200 yds after passing Signal T178 and some considerable distance before the brakes actually were applied in order to be able to stop the train normally at Signal T162.

3.8 If Signal T178 had been displaying a green aspect he would not, of course, have made a brake application. It would have required a major 'wrongside' failure of the signalling system for Signal T178 to have been displaying a green aspect or a double yellow aspect with Signal T168 at red. It is known from the evidence of Mr Sellwood, who had seen Signal T168 at Danger, that half-an-hour before the accident the correct sequence of aspects was being displayed. I find it inconceivable that a major fault in the signalling system could have suddenly occurred and then not be found afterwards.

3.9 Since the accident Mr Morgan has consistently said that Signal T168 was showing a red aspect and there is no evidence to show that this was not so. Following the previous incidents when Signal T168 was passed at Danger, the signalling was tested and no faults found. After the accident the signalling system was subjected to the most exhaustive testing and again no faults found. I consider therefore, that the sequence of aspects being displayed was correct with Signal T182 displaying a double yellow aspect and Signal T178 a single yellow.

3.10 The only alternative I believe remains is that Mr Morgan failed to make any brake application on seeing the correct caution aspects being displayed by Signals T182 and T178. He must also have reset the AWS without heeding its warning. It was not unusual for trains to have to come to a stand at Signal T168 and Mr Morgan as an experienced driver over that route must have been well aware of that. It is unlikely, therefore, that he failed to reduce the speed of the train because he believed that Signal T168 'always came off' allowing the train to continue.

3.11 Mr Morgan was an experienced and responsible driver but it is known that such drivers may suffer from an uncharacteristic lapse in concentration when caution signals are not recognised and the AWS is reset leading to a signal being passed at Danger. Fortunately, as Mr Warburton explained in his evidence, few of these incidents cause an accident but, nevertheless, the risk is there. This human behaviour problem has been recognised by all those involved in railway safety for some years and considerable research has been undertaken into it. The problem is complex and the work has not yet produced any positive measures which can be implemented to eliminate the problem.

3.12 The AWS used by British Railways was developed to attract the driver's attention to signals. When first introduced it was a significant and positive safety development but it has weaknesses. It does not distinguish between single and double yellow signals, it does not provide a lasting display of the signal aspect the warning referred to, and it can be reset unheeded by a driver whose concentration has lapsed. I believe that because of these inherent weaknesses the existing AWS equipment is not capable of usefully being developed further. While it is possible to devise other forms of AWS, which would address these problems, the timescale and resources involved are similar to those required for the development of an ATP system.

3.13 The newer Automatic Train Protection (ATP) systems are mandatory rather than advisory. If the driver does not take the appropriate action to control the speed of the train in accordance with the signalling the ATP will take over the control of the train and bring it to a stand if necessary. Such systems cannot be reset and ignored by the driver. ATP is now employed by a number of Metro railways and some main line railways. I accept, however, that none of the existing systems matches exactly what is required for the British Railways network with its different types of trains and density of traffic. The problem that the application of any of the existing intermittent ATP systems would extend the headways is a significant one. The investment needed and the amount of work to be undertaken to install an ATP system is massive.

3.14 It is unclear why Signal T168 should have a higher than usual number of incidents of being passed at Danger. Although Signal T168 is more likely to be displaying a red aspect than, for instance, an automatic signal which only goes to red when a train is occupying the section of track it protects, I do not believe that this provides a satisfactory explanation. The minimum sighting time to be provided for any signal on a line with a maximum speed of 90 mile/h to comply with British Railways own standards is 7 seconds. When compared with many of the signals in the Purley area the sighting of Signal T168 is poor being obstructed by Purley Station buildings. Its sighting distance is, however, marginally better than what is required to give the minimum 7 seconds.

3.15 Of perhaps greater importance is the sighting of the two previous Signals T178 and T182 which provide the advance warning that Signal T168 is at Danger. Both Signals T178 and T182 have sighting distances considerably better than the minimum requirement; Signal T178 can be seen from Signal T182 a distance of over 1,100 yards. The braking performance of an EMU is such that there is no need to make the brake application until after passing Signal T182 and by then Signal T178 is in sight. Driver Morgan referred to looking ahead to see what aspect Signal T178 was displaying. I believe it is possible that the extended sighting of this signal may cause a driver to relax his concentration, not control the speed of the train properly and then find himself surprised by the short sighting distance of Signal T168.

3.16 The Southern Region are examining other signals with a higher than usual history of being passed at Danger to see if a similar arrangement and sighting of signals exist. If my deduction is correct there appears to be no orthodox solution to the problem. I believe it would probably be worthwhile, as a short term expedient, to increase the sighting distance of Signal T168 by the provision of a banner repeater signal even though the conditions which would normally make one necessary are not present. The provision of the banner repeater may help reinforce the single yellow caution aspect of Signal T178.

3.17 I was concerned by the mistaken, but clearly sincerely held, belief of Mr Lambert that he did not need to tell anyone about the abnormal signal aspect he believed he saw because others would also know the aspect being displayed. This is, of course, not so and could only be achieved by installing elaborate monitoring equipment which would increase not only the cost of signalling systems but would also probably adversely affect the reliability of the system. It is of concern that some reports from drivers do not reach the signal engineering staff in time for them to carry out an investigation. Of equal concern is the absence of explanation back to the member of staff who made the initial report.

3.18 The initial collision took place at a closing speed of 30 to 40 mile/h with the two trains at a slight angle. The damage caused was consistent with the front right corner of the leading coach of the train from Littlehampton striking the rearleft hand corner of the trailing (fourth) coach of the train from Horsham before sliding alongside the fourth coach and striking the rear righthand corner of the third coach. The

damage to the rear end of the leading coach of the train from Littlehampton was extensive and the body was almost entirely destroyed. Those killed were, I understand, all travelling in this part of the train. The initial damage appears to have been caused by the heavy leading bogie of the second coach striking the body of the leading coach as the train 'jack-knifed'. The body structure having been seriously weakened by the impact was further damaged by the large trees growing on the embankment.

3.19 The remaining vehicles survived the fall down the embankment remarkably well; the body structures were not seriously broken, most windows remained intact, and the main internal fittings stayed fixed in place. There was however, a number of passengers seriously injured by being thrown about within the coaches as they plunged down the embankment. The evidence of some of the passengers, and of Mr Knights', graphically illustrated what occurred. I do not believe the newer designs of rolling stock would have survived significantly better in this form of accident.

3.20 Members of the Railway Inspectorate have encouraged the concept of 'black-box' recorders being installed on trains. Such devices, while not an accident prevention measure, would be of great assistance in the investigation of accidents. British Railways are now actively pursuing the installation of such equipment. The specification outlined by Mr Warburton was an impressive one and while obviously possible for new rolling stock a simpler version may be necesssary if it is to be introduced quickly or its installation extended to existing rolling stock.

3.21 Having arrived on site the emergency services co-ordinated their activities effectively and carried out their difficult tasks with their usual skill. The Fire Brigade and Police quickly took charge of the accident site and liaised with the railway staff in a way which I believe was generally satisfactory. I believe, however, the liaison arrangements could be improved still further in two aspects. Firstly, in addition to the emergency services incident control at the foot of the embankment, British Railways opened their own incident control at Purley Station. There was no direct communication links established between these two incident controls and liaison took place between individuals at the scene rather than between the controls. I believe the liaison arrangements would have been strengthened with better liaison between the emergency services and railway incident controls.

3.22 Secondly, having quite properly taken charge of the site the emergency services then regulated access of other persons to the site. Clearly a number of responsible railway engineers did not gain access to the site and the rolling stock as quickly as was desirable. The post-accident condition of the trains and the position of the driver's controls provide important evidence towards the investigation of any train accident. Had the braking performance of the train been in question much valuable evidence would have been lost by the time the examination was made. Clearly the police officers have a responsibility to protect property and evidence at the scene but it is equally important that railway officers (and members of the Railway Inspectorate) have access to the site as well. I welcome the concept of police officers accompanying the railway officer during the inspection and testing; it must be beneficial to both parties. The respective roles were not fully understood at Purley and action has already been taken to improve understanding and co-ordination.

3.23 All the witnesses appearing on behalf of the emergency services remarked on the tragic coincidence that brought them together again after all being personally involved in the accident that had occurred at Clapham Junction. The lessons learned at the earlier incident had been put to very good effect in dealing with the Purley accident. The liaison and co-operation between the emergency services and British Rail had been of the highest order and the value of the debriefing conference had proved their worth. The control of the site, the recovery, rescue and treatment of the casualties and the eventual recovery of the trains had been a credit to all involved.

3.24 The witnesses paid tribute to the assistance and help so willingly provided by the residents of Glenn Avenue and the surrounding neighbourhood and that provided by officers of the Salvation Army and their mobile catering vehicles and all wished to convey their grateful thanks to everyone involved.

3.25 Immediately following the accident there was doubt as to whether current had been cut off from the conductor rails. This was due in a large part to the difficulties caused by the loss of the supervisory circuits between the electrical control and the remote sub-stations. The circuits were lost when the lineside cables were destroyed by the derailed train. I believe that, while this risk cannot be totally eliminated, greater protection or duplication of these control and supervisory circuits would reduce the risk and the consequences.

3.26 The railway staff at the site of the accident quite properly, because there was doubt, applied short-circuiting bars and treated the conductor rails as if they were energised. Mr Foster, the Electrical

Controller, did well in conjunction with the controllers of adjacent electrical areas to protect quickly the site and provide what assurances he could. Suggestions were put forward at the Inquiry that all trains should be equipped with indicator devices which when placed on the conductor rail would show whether or not it was energised. I believe such devices could be of assistance but would have to include some system for 'self-testing' to eliminate the possibility of a dangerous 'wrongside' failure.

3.27 I believe that in general the train crews and other railway staff involved in the emergency arrangements and the evacuation of passengers behaved in a commendable fashion. I was less happy with the part played by the Station Manager who did not ensure on his arrival that the necessary liaison with the emergency services had been established. I was also concerned that a Signal Technician began a series of physical disconnections of the signalling equipment without fully checking and recording the state of the signals. While his actions were apparently motivated by safety considerations and in accordance with the Rule Book and Departmental Instructions, they may have made the investigation more difficult. British Railways have this matter under review and additional advice has been given.

Conclusion

4.1 There is corroborated evidence that Signal T170 was showing a proceed aspect (a single yellow) and junction indicator lights for the movement of the train from Horsham from the Up Slow line to the Up Fast line. There is also clear evidence that the switch blades of the crossover tracks from the Up Slow line to the Down Fast line and from the Down Fast line to the Up Fast line were lying properly secured in the reverse direction required for such a movement.

4.2 It is clear that Signal T168 on the Up Fast line was showing a red stop aspect protecting the route set for the train from Horsham. There is no eye-witness evidence as to the aspect being displayed by the two signals before Signal T168 on the approach to it along the Up Fast line. I conclude, however, from the exhaustive technical evidence that the two signals were displaying the correct caution aspects, that is, a double yellow aspect at Signal T182 and a single yellow aspect at Signal T178.

4.3 The brakes of the train from Littlehampton were in proper working order as was the AWS equipment. I must conclude, therefore, that the driver of the train from Littlehampton failed to heed the caution aspects of Signals T182 and T178. He must also have failed to heed the alarm from the AWS which he must have twice reset. He made a brake application when the red aspect at Signal T168 came into view. Despite the full emergency brake application it was by then impossible for the collision to be avoided.

4.4 I find that the collision was caused by the failure of the driver of the train from Littlehampton to control the speed of the train, in accordance with the preceding signals to enable him to bring the train to a stand at Signal T168.

Remarks and Recommendations

5.1 This accident would have been prevented by an Automatic Train Protection (ATP) system. Justification of the capital expenditure involved in the installation of such a system cannot be provided on the basis of normal investment criteria. It is clear, however, that momentary lapses of concentration by train drivers do occur and that the Automatic Warning System (AWS), which is at present in use, can be reset without the driver heeding its warning. In order to ensure the continuation of the generally high safety standard of railway travel I recommend the installation of an ATP system on all 'high speed' and on all intensively used lines as quickly as possible.

5.2 The British Railways Board have already taken the decision to proceed with the development and installation of an ATP system. Having examined the various systems in use by other railway administrations they have concluded that none of the systems presently in use can be used with British Railways existing signalling and traffic patterns without some development. While acknowledging that this is correct I nevertheless recommend that the provision of ATP should not be delayed by an extended development period and that an existing system, which is proven and validated, should be used with a minimum of development.

5.3 As an interim measure in respect of the signalling arrangements at Purley I recommend that a

'banner' repeater signal which can be seen on the approach to Purley Station should be provided for Signal T168. (This signal was provided on 3 September 1989).

5.4 The British Railways Board are already considering the provision of 'black-box' incident recorders. I recommend all new builds of locomotives and multiple-units should be equipped with such recorders and that existing ones should be retrospectively fitted if it is practicable to do so. It may be appropriate to use a simpler recorder for existing rolling stock.

5.5 It is important that any signalling irregularities, whether actual or perceived, should be reported and investigated promptly, and any necessary remedial action taken immediately. It is equally important that those making the reports are kept as fully informed as possible. I consider the present arrangements for reporting, actioning, recording and reporting back on action taken are not as comprehensive as they should be. I recommend that a better regulated system be introduced as quickly as possible.

A COOKSEY
Deputy Chief Inspecting Officer of Railways.

The Permanent Secretary
Department of Transport

Footnote:
As mentioned in paragraph 2.20, Driver Morgan received a limited immunity from prosecution to enable him to give evidence to my Inquiry. However, he was subsequently charged with manslaughter and endangering life and it was not possible to publish my report while proceedings against him were outstanding.

On 3 September 1990 Driver Morgan appeared at the Central Criminal Court and pleaded guilty to the charges of manslaughter and endangering life. He was sentenced to 18 months imprisonment with 12 months suspended.

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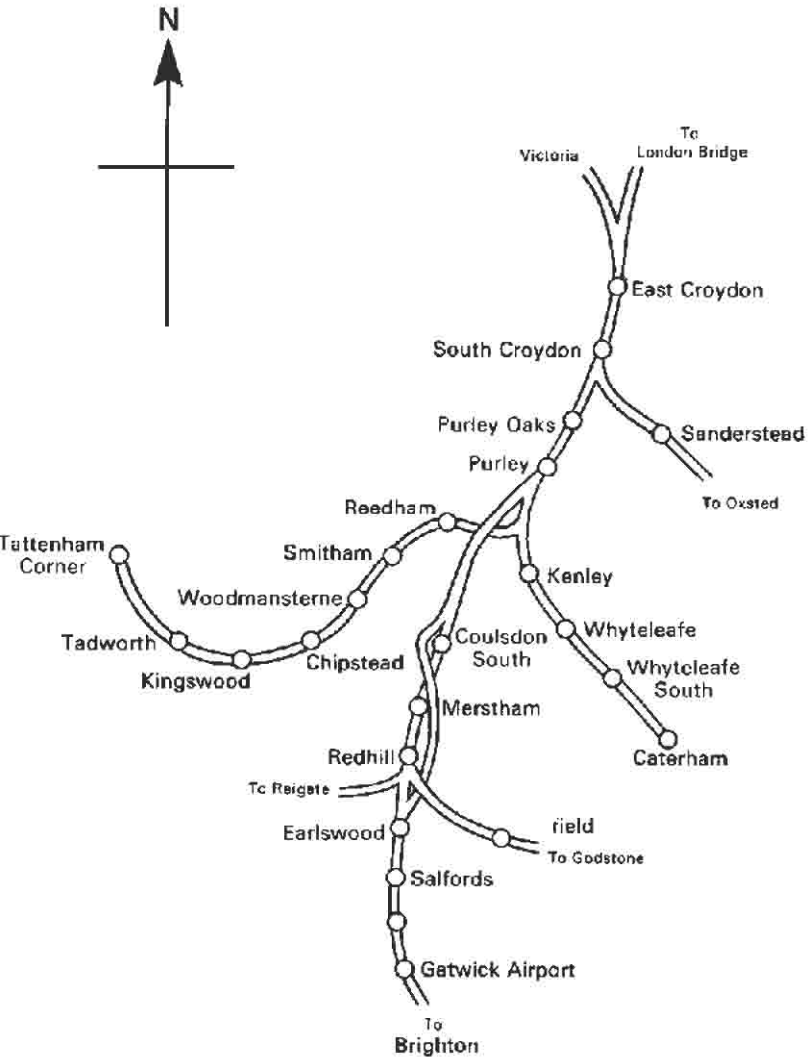
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DIAGRAM 1

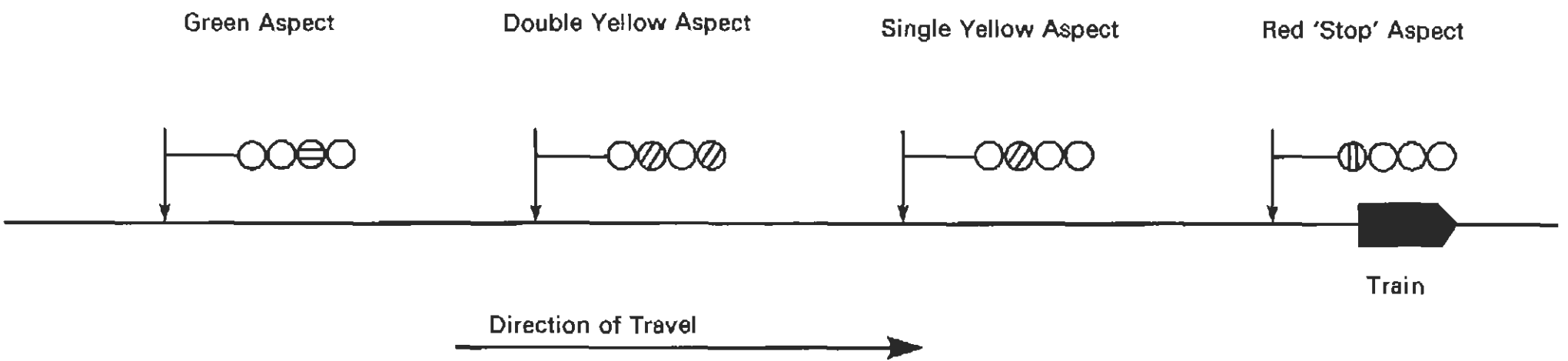
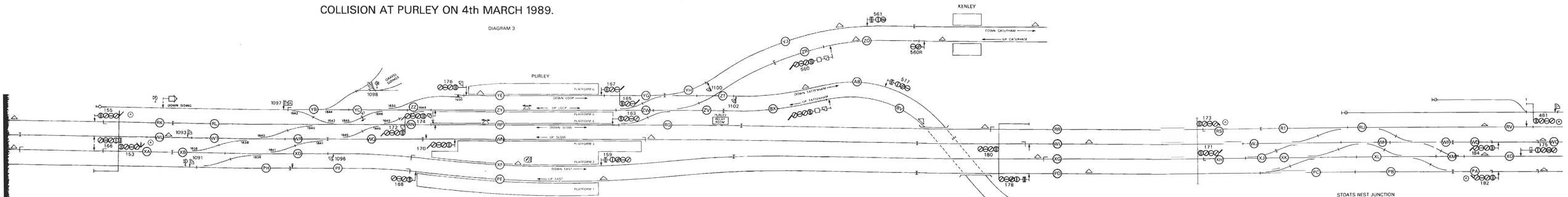


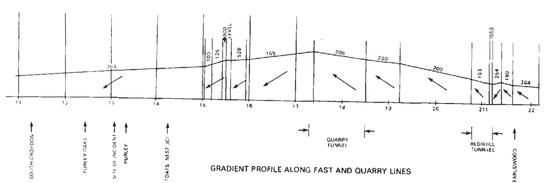
DIAGRAM 2

Aspect Sequence of Four-aspect Signals

COLLISION AT PURLEY ON 4th MARCH 1989.

DIAGRAM 3





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