DEPARTMENT OF TRANSPORT

RAILWAY ACCIDENT

Report on the Collision that occurred on 19th September 1986 at Colwich Junction

IN THE LONDON MIDLAND REGION OF BRITISH RAILWAYS

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First published 1988

ISBN 0 11 550853 8

Her Majesty's Stationery Office

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RAILWAY INSPECTORATE
DEPARTMENT OF TRANSPORT
2 MARSHAM STREET
LONDON SW1P 3EB
29th February 1988.

SIR,

I have the honour to report for the information of the Secretary of State for Transport in accordance with the Direction dated 22nd September 1986, the result of my Inquiry into the collision that occurred at 18.28 on Friday, 19th September 1986, between a Euston to Manchester express and a Liverpool to Euston express at Colwich Junction in the London Midland Region of British Railways.

The Euston – Manchester train was 1H20, the 17.00 Euston to Manchester Piccadilly express passenger train, electrically hauled and consisting of 13 vehicles. It had been diverted from the Down Fast line to the Down Slow line some 800 yards from the switch diamonds forming the Junction between the Down Slow-Down Manchester line and the Up Crewe – Euston line and ran past the signal protecting the Junction at Danger, coming to a stand, or nearly so, with the locomotive straddling the switch diamonds of the Junction, 259 yards beyond the signal.

The Liverpool – Euston train was 1A76, the 17.20 Liverpool Lime Street – Euston express passenger train, electrically hauled and consisting of 12 vehicles. It was travelling under clear signals at a speed of 95 – 100 mile/h on the Up West Coast Main Line closely approaching Colwich Junction when, without time for the driver to apply the brakes, the locomotive of the Manchester train was seen ahead astride the junction. The two locomotives collided with tremendous force, being derailed all wheels and turned over onto their sides, followed immediate into derailment by the leading eight coaches of the Liverpool train and the leading three coaches of the Manchester train, some of which turned onto their sides and all of which were extensively damaged.

All running lines at the junction were blocked by the derailment and three overhead electrification structures were demolished, which resulted in three miles of contact and catenary wire being destroyed.

The emergency services were immediately summoned, and with great efficiency arrived on site within minutes. Out of the 373 passengers in the Manchester train and some 500 passengers in the Liverpool train, 75 were injured, the majority being discharged from hospital after treatment. Of the 32 who were detained in hospital, 17 were discharged by Sunday, 21st September, a further 9 during the course of the following week and 2 on 29th September. Of the remaining 4 seriously injured passengers, 2 were discharged by 11th October while the other 2 were still in hospital at the time of my Public Inquiry on 23rd October but were progressing satisfactorily. They were eventually discharged on 20th November and in mid December 1986.

I regret to report that the driver of the Liverpool train, Driver Eric Goode from Crewe, was trapped in the cab of his locomotive and fatally injured. His death was particularly tragic in that, travelling at high speed, as was his right, he had no chance to take any action to avoid the accident or to protect himself or his many passengers. The large number of uninjured passengers from both trains, some 800 in all, were evacuated from the site and taken by an emergency bus service to Stafford for onward movement by rail to their destinations.

Clearance and re-railing operations were carried out by the Crewe and Bescot breakdown trains, together with two road mobile cranes with lifting capacities of 300 tons. By 21.50 on 20th September nine severely damaged coaches and both locomotives had been lifted clear of the site and placed in a field adjacent to the railway in readiness for cutting up or for removal on road vehicles. The remaining vehicles were re-railed and hauled to Rugby for examination and/or repair.

Repairs to the track, signalling and overhead line equipment continued throughout the weekend with the switch diamonds, which were destroyed, being temporarily replaced by plain line on the Up West Coast Main line. The overhead line equipment was re-energised at 16.32 on Tuesday, 23rd September, and the lines, with the exception of the route from the Down Slow line to the Down Stoke/Manchester line, were re-opened to normal traffic at 20.15 the same day, subject to a temporary speed restriction of 50 mile/h. The route to Stoke was re-opened at 04.20 on Monday, 6th October.

The weather at the time of the accident was fine and dry, and the visibility was good.

Description

The Site

1. Colwich Junction is located on the West Coast Main line 127 miles from London. Approaching the junction from the London direction there are four lines, reading from south west to north east, the Down Fast, Down Slow, Up Fast and Up Slow. There is a facing crossover, Down Fast to Down Slow, 804 yards before the geographical junction and a further facing crossover, Down Slow to Down Fast, 231 yards before the junction. The actual junction consists of switch diamonds which enables the Up Fast line from Stafford and Crewe to cross the Down Slow line which from that point becomes the Down Stoke/Manchester line.

2. The West Coast Main line to the north west of the junction consists of only two lines, the Down and Up Main lines, due to its passage through Shugborough Tunnel. In the Up direction, immediately after crossing the junction, there is a facing crossover from the Up Fast to the Up Stoke/Manchester line which then becomes the Up Slow line, while some 800 yards further to the south east there is a facing crossover Up Slow to Up Fast. The Stoke line proceeds north east from the junction as a twin track line, the first junction being at Stone, some 11 miles away, where it is joined by the line from Norton Bridge on the West Coast Main line, north west of Stafford. Plans showing the track layout at Colwich Junction and on its approaches, together with the signalling relevant to the accident are given at Figures 1 and 2 at the back of this Report.

Signalling

3. Trains over all lines approaching the junction are signalled in accordance with the Track Circuit Block Regulations, all signals being of the four aspect colour-light type. Prior to 17 August 1986 a train approaching the junction along the Down Fast line and routed over Crossover No. 24 to the Down Slow in preparation to proceeding through the junction onto the Down Stoke line received a single Yellow aspect at Signal CH 103 and approached Signal CH 28 at Red until Track Circuit 524 had been occupied, which released the signal to the appropriate proceed aspect together with a Junction Indicator. Signal CH 23, protecting the junction for a train proceeding to the Down Stoke/Manchester line, had no approach release provided, nor did Signal CH 25 taking a train from the Down Slow to the Down Main line. A Banner repeater is provided for signals CH 23/CH 25.

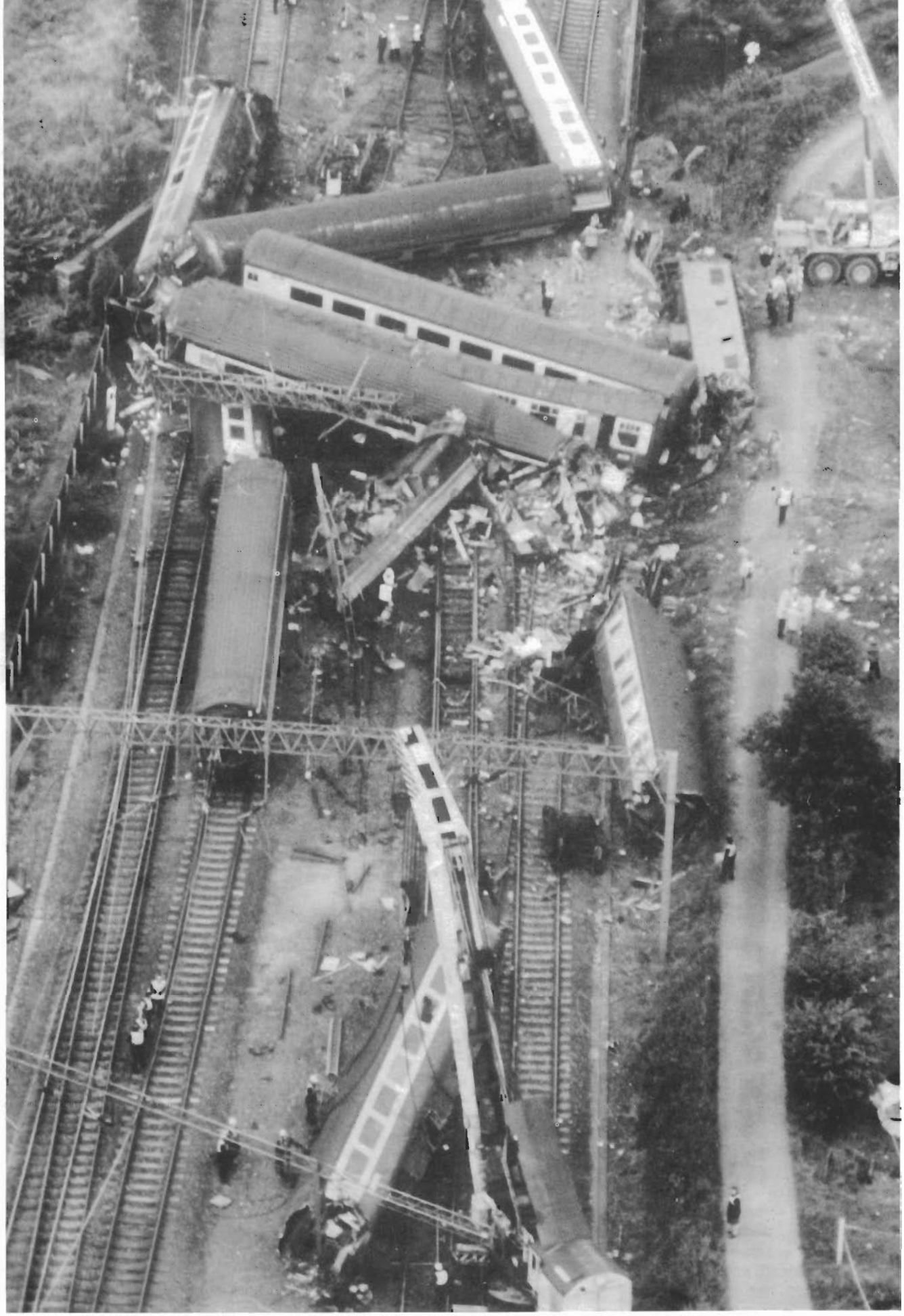
4. The signalling was then altered on 17th August 1986 to enable the Crossover between the Down Fast and Down Slow line on the approach to Colwich Junction to be traversed at its designed speed of 50 mile/h. This was achieved by introducing the use of flashing Yellow aspects at Signals CH 105 (double Yellow) and CH 103 (single Yellow) followed by Signal CH 28 with a Position 4 Route Indicator leading a train from the Down Fast across Crossover No. 24 to the Down Slow line up to Signal CH 23, 259 yards from the geographical junction between the Down Slow – Down Manchester line and the Up Main-Up Fast/Slow line. Signal CH 28 was fitted with an approach release and would only show a single Yellow aspect of the junction signal, CH 23 until a train closely approached, when it would change to the aspect allowed by the signalling ahead.

The Trains and Their Damage

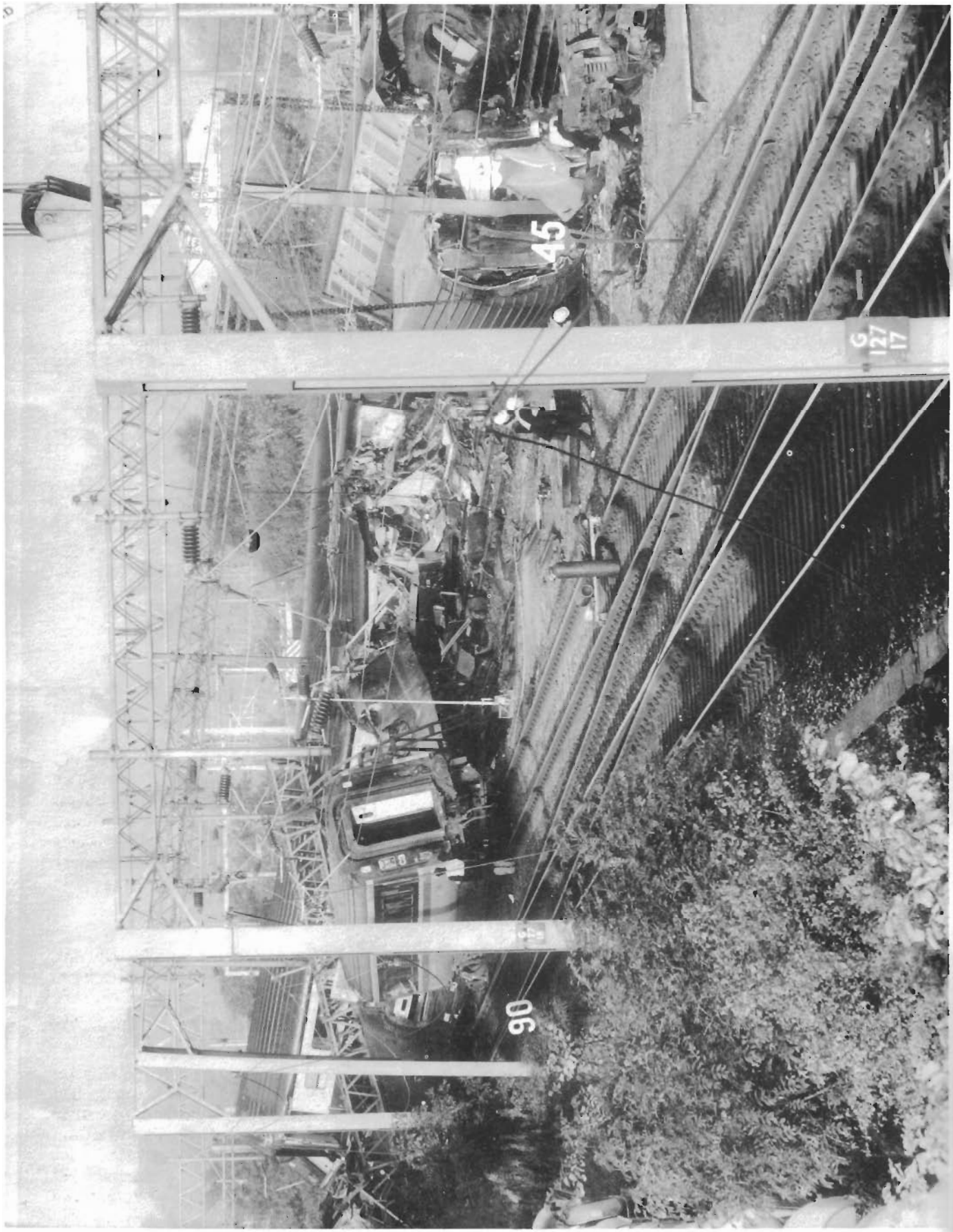
5. As will be seen from Figure 1 at the back of the Report and the photographs opposite, the locomotives of both trains were derailed and thrown on their sides well clear of the tracks on which they were travelling, as were two coaches of the Liverpool train and one of the Manchester train. The centre of the collision consisted of the four coaches of the Liverpool train straddling the tracks and resting on top of the second coach of the Manchester train. A summary of the damage to the locomotives and coaches of both trains is given below:—

Euston – Manchester Train (1H20)

Locomotive 86429	Derailed all wheels and lying on side. Extensive damage — beyond repair.
Coach M5923 MK2f (TSO)	Derailed all wheels and lying on side. Extensive damage — beyond repair.
Coach M5990 Mk2d (TSO)	Derailed all wheels and lying on side under vehicles M11061, M1732 and M6169. Extensive damage beyond repair — cut up on site.
Coach M12074 Mk3 (TSO)	Derailed leading bogie. Extensive damage requiring heavy repair and new bogies.
Coach M12042 Mk3 (TSO)	Extensive damage to leading end of vehicle.
Coach M12032 Mk3 (TSO)	Superficial damage
Coach M12040 Mk3 (TSO)	Superficial damage
Coach M12041 Mk3 (TSO)	Superficial damage



PHOTOGRAPH No. 1. General aerial view of accident area, showing Liverpool coaches piled on top of Manchester coach, also both locomotives. *Photograph by courtesy of the Sunday Mirror*



PHOTOGRAPH No. 2. View of damaged coaches and locomotive 'Times' in central area of collision.
Photograph by courtesy of the Sunday Mirror

Coach M12110 Mk3 (TSO)	Superficial damage
Coach M1738 Mk1 (RBR)	Superficial damage
Coach M11026 Mk3 (FO)	Superficial damage
Coach M11044 Mk3 (FO)	Superficial damage
Coach M11034 Mk3 (FO)	Superficial damage
Coach M92180 Mk1 (BG)	Superficial damage

Liverpool – Euston Train (1A76)

Locomotive 86211	Derailed all wheels and lying on side. Extensive damage — beyond repair.
Coach E92024 Mk1 (BG)	Derailed all wheels and resting at angle of 45°. Extensive damage beyond repair — cut up on site.
Coach M11025 Mk3 (FO)	Derailed all wheels and lying on side. Extensive damage — beyond repair.
Coach M11061 Mk3 (FO)	Derailed all wheels and slewed across tracks, upright, resting on top of coach M5990. Extensive damage — beyond repair — cut up on site.
Coach M1732 Mk1 (RBR)	Derailed all wheels and slewed across tracks, upright, resting on top of coach M5990. Extensive damage — beyond repair.
Coach M6169 Mk2f (TSO)	Derailed all wheels and slewed across tracks, upright, resting on M5990. Extensive damage — beyond repair.
Coach M6441 Mk2f (SO)	Derailed all wheels and slewed across track, upright. Extensive damage requiring heavy repair and provision of new bogies.
Coach M6426 MK2f (SO)	Derailed all wheels, lying on side. Extensive damage requiring heavy repair and new bogies.
Coach M6433 Mk2f (SO)	Derailed leading bogie. Superficial damage.
Coach M6443 Mk2f (SO)	Superficial damage
Coach M6451 Mk2f (SO)	Superficial damage
Coach M9480 Mk2d (BSO)	Superficial damage
Coach M6432 Mk2f (SO)	Superficial damage

Damage to Permanent Way, Signalling Equipment and Overhead Line Equipment

6. 180 yards of plain C.W.R. had to be replaced on the Down Slow line, as did the switch diamond crossing between the Down Slow, Up Fast and Down Stoke/Manchester lines. Three type HW 2000 point machines were damaged, seven multicore cables had to be replaced over a distance of 200 metres plus several tail cables to point machines and some 70 metres of cable route and lids had also to be replaced. Three overhead line structures were destroyed and two other structures damaged. The 25kV feeder cable was damaged, requiring renewal, over a length of some 70 metres. Approximately three miles of contact and catenary wire and associated fittings were destroyed.

Evidence

7. *Signalman P.T. Millward* was on duty at Colwich Signal Box at the time of the accident. He said that he received details from Stafford on his train describer of the approach of the Liverpool – Euston express, 1A76, at approximately 18.23 and the Euston – Manchester express via Stoke, 1H20, at approximately 18.20. He decided to give the former train preference as it could then travel through the junction at line speed, whereas the Manchester express, which was running slightly late would need to be checked in any event.

8. Millward said that he set the route for the train 1A76 through the junction and routed train 1H20 on the Down Slow line to signal CH23, protecting the junction, at Danger. In his opinion, train 1H20 approached Signal CH23 perfectly normally and he was surprised to see the train pass the signal at Danger at a speed he estimated to be between 20 and 30 mile/h. He was not aware of any brake application being made on the train as it passed his signal box, although he agreed that its speed was reducing gradually the whole time. He did not hear the sound of any brakes being applied, nor did he hear the sound of any wheel slide prevention equipment operating on the MkIII coaches on the train, but he pointed out that on other trains fitted with disc brakes, he had not heard any appreciable brake noise even when an emergency application of the brakes had been made.

9. As the locomotive of train 1H20 approached the switch diamonds of the geographical junction it appeared to come to a halt actually on the crossing, although most of his attention was on train 1A76 which

was approaching at about 100 mile/h on the Up Fast line. He witnessed the collision between the two locomotives and it appeared as though that of the Liverpool train struck the rear cab of the locomotive of the Manchester train, but a cloud of dust rising from the site of the collision soon obscured his vision. He immediately alerted the emergency services and placed all his siguals to danger to prevent other trains approaching the site of the collision.

10. Millward had been a signalman in Colwich Signal Box for eight years and was one of the most experienced signalmen on that part of the line. He agreed that he had stopped Down trains in similar conditions at Signal CH23 on a considerable number of occasions, probably three or four times a week. There had also been a small number of instances of trains passing Signal CH23 at Danger due to a driver misjudging his braking, but in all these cases the train had come to a stand well short of the actual junction. Since the introduction of the flashing Yellow Signals CH105 and CH103 on the Down Fast line on the approach to the Down Fast to Down Slow crossover about ½ mile from the geographical junction, Manchester trains were able to pass through the junction area as a whole more quickly, but were still limited to 50 mile/h over Crossover No.24 and on the approach to Signal CH23, and 45 mile/h over the geographical junction. He was not aware of any other cases of Signal CH23 being passed at Danger since the installation of the flashing Yellow aspects.

11. The first member of the crew of either train to enter the signal box was Guard Sharif of 1H20 who was suffering badly from shock. He said little and wanted to get back to assist his passengers. Five or ten minutes later Driver Shaw from 1H20 came in, asking what had happened. Millward could recollect little of their conversation except that Shaw had referred to flashing Yellows. He was not certain whether he had asked Shaw why he had passed Signal CH23 at Danger, but he agreed he might have done. Certainly Shaw did not give him any impression that the Signal was other than at Red.

12. *Senior Technician R. J. Morgan* was in Colwich Signal Box at the time of the accident, having been rectifying a train describer failure. He was washing his hands with his back to the windows of the signal box when the signalman shouted "Where's he going?". He immediately went to the window and saw the locomotive of the Manchester train closely approaching the junction. By the way the train was braking he thought that he must have passed Signal CH23 at Danger. He then saw the Liverpool train approaching at speed on the Up Main line. He considered that the Manchester train was still moving at about three of four miles an hour when the actual collision between the locomotives took place. Almost immediately the Liverpool train locomotive came flying over the top of the Manchester train, followed by a coach which nearly reached the signal box. Then a cloud of dust obscured the whole area, although he heard three large bangs which he thought must be coaches folding up on each other. Finally the electric overhead line equipment came down causing a number of large blue flashes.

13. While Millward was alerting the emergency services, Morgan contacted the Electrical Control who informed him that an emergency isolation of the Colwich Junction area had already been applied and that all the wires in the area of the collision were 'dead'. He then assisted by answering various calls from drivers at signal post telephones who wanted to know why they were being held at signals at Danger. Morgan estimated that the first engine arrived about four minutes after the collision, closely followed by police cars and another fire engine.

14. Morgan was a very reliable witness and I questioned him closely about the speed and braking of the Manchester train. He said that when he first saw the train the leading coaches were travelling past the signal box at between 20 and 30mile/h, the speed slowly decreasing as the locomotive approached the geographical junction. The train appeared to be gliding past the signal box and, although it was obviously braking, it was not like any previous occasion that he had witnessed emergency brake applications following the passing of a signal at Danger. Previously, the braking had appeared to be a lot harder with much more noise from the track and the wheels. From what he saw and what he heard it appeared to Morgan that the driver was braking normally and not making an emergency brake application.

15. Morgan said he definitely heard two noises from the MkIII coaches, however, as they went by. One noise appeared to be coming from the air suspension on the bogies and the other noise was an air noise, repetitive in nature, similar to the noise heard when a lorry's air brakes were being applied and released. This noise, which was without doubt the operation of the wheel slide prevention equipment, was coming, according to Morgan, from several of the MkIII coaches near the front of the train, but could not say exactly how many wheel sets were making the noise.

16. Morgan confirmed that he was qualified as a signal technician as well as telecommunications technician and that he was competent to check the positions of the levers in the frame. He said that on examining the frame he found that the levers were arranged to bring a Down train from the Down Fast line to the Down Slow line over Crossover No. 24 up to Signal CH23 at Danger. On the Up Main line signal CH8, the signal protect-

ing the junction, had been at Green, as was Signal CH9 on the Up Fast line after the junction. Signal CH8 being clear not only locked the switch diamonds set for the Up Main/Fast line, but also locked Signal CH23 at Red unless a route was set from the Down Slow to the Down Fast over Crossover 21. Had the signalman wished to divert the Manchester train as it closely approached him away from the junction, it would have been impossible for him to do so as Signal CH28 would have locked the Crossover and the Crossover would also have been approach track locked, as the train was so closely approaching Signal CH23 and the Crossover is in the overlap.

17. *Guard M.M. Sharif* was in charge of train 1H20. He went to see the driver before leaving Euston, gave him details of the train and told him that he would carry out a brake test; the driver, Shaw, appeared to be perfectly normal.

18. The journey from Euston was without any incident. He had been checking tickets and was on his way back to his brakevan as the train approached Colwich; he was aware of the train's location when it reduced speed to go through the Crossover from the Down Fast to the Down Slow line. He estimated that the speed of the train as he entered his van was 45/50 mile/h, but he did not hear or feel the brakes being applied thereafter.

19. Sharif had just started sorting parcels when he was thrown heavily to the floor, injuring his elbow. Having picked himself up, he went to the nearest passenger compartment where he found a number of passengers had been thrown from their seats and, on looking from a window, he saw many passengers jumping out of open doors. A railway official, travelling as passenger, then approached him and offered his assistance, while he went back to his brakevan, collected his detonators and a track circuit operating clip to protect his train. As he got down from the train he found he was adjacent to a signal post telephone and so he announced who he was to the signalman and, on requesting that the emergency services be summoned, was informed that they were already on their way. He protected the Down Fast line with his track circuit operating clip and then placed detonators some 300 yards behind the rear of his train before making his way up to the signal box, where the signalman assured him that his train had been fully protected. He then returned to his train and assisted in the evacuation of his passengers.

20. Sharif was unable to estimate the speed of the train immediately before the collision, nor was he conscious of any heavy braking before he was thrown onto the floor. He said he was aware of the noise made on many occasions by the wheel slide prevention equipment operating on MkIII coaches, but had heard no such noise as he walked back to his brakevan after the train had crossed from the Fast to Slow line.

21. *Mr. M.J. Heathcote* was the Chief Steward on the Manchester train, 1H20. As the train approached Colwich Junction he walked into the first-class open coach immediately to the rear of the restaurant/buffet car (RBR) to deliver the bills to passengers who had taken dinner/high tea. He was not aware that the train was braking and thus it was quite without warning that he found himself propelled the length of the coach and striking the vestibule door.

22. Heathcote was unable to give any estimate of the speed of the train immediately prior to the collision. He was adamant, however, that he had not felt any excessive braking and that he would have known if the driver had made an emergency brake application. He was aware of the train slowing down to cross from the Down Fast line to the Down Slow line as it approached Colwich but could not estimate at what speed it was travelling thereafter.

23. *Guard B. Mason* was in charge of the Liverpool – Euston express, 1A76. He said that the guards van from which he was carrying out his duties was marshalled next to the locomotive at the head of the train which was full and standing. He talked briefly to Driver Goode at Stafford, while the train was waiting to depart, to make himself known. The latter merely replied "Alright Mate", but appeared to be in good health which was borne out by the completely uneventful and normal journey up to the time of the collision. When the collision occurred, Mason has just commenced his examination of tickets. There was a bang and he was sent flying between the seats of the leading first-class open coach. He managed to grab one of the seats and hung on while the coach turned over onto its side and slid along the track until coming to rest.

24. Mason said that he climbed up and did his best to calm the passengers as he made his way to the rear of the coach, as it was clear that it was impossible to get out of the front. His coach had come to rest adjacent to Colwich Signal Box and he reported to the signalman who confirmed that the power was off and that his train was protected. He returned to the train and assisted his passengers out of the coaches. He managed to obtain the services of a doctor to help free the staff of the buffet car who were trapped and injured. While assisting people to detrain he was approached by Driver Shaw, the driver of the Manchester train. He asked Shaw what had happened, to which the latter replied "We had the flashing Yellows" and then asked Mason if he had any detonators. Mason gave him what detonators he had and told him that there was some more in his guards van.

25. At the request of the Chief Fire Officer he accompanied him to the locomotive of his train and was asked to point out which cab Driver Goode would be in. Members of the fire service used a scanner on the cab and confirmed that Goode's body was in the wreckage. This upset Mason very much and he asked to be relieved of his duties. He made his way back to Liverpool where he was met by the Area Manager who took him to the Royal Hospital for treatment of his minor injuries and for shock.

26. In answer to my questions, Mason said he saw no evidence of furniture being thrown around in the various coaches, even those at the front of the train. He confirmed that every seat of the train was full and that people were standing in the vestibules. He estimated that there were over 500 passengers in the train.

27. *Driver F. A. Warner* had worked 1A76, the Liverpool – Euston express, as far as Crewe where he handed over to Driver Goode. On taking over locomotive No. 896211 to work the train he could find no faults. The DSD, brakes and power were all working correctly. Having attached the locomotive to the train he had carried out a brake test in conjunction with the guard; this was satisfactory. On the journey to Crewe the brakes on the locomotive and on the train operated thoroughly satisfactorily, as had the locomotive as a whole. It was a dry day and he had good vision through the windscreen throughout. All the AWS indications, including caution ones, were correct. The whole journey had been without incident. Warner said that when he handed over to Driver Goode at Crewe the latter appeared to be in good health and cheerful.

28. *Driver M. R. Organ* was a driver in training based at Brighton. Although not authorised to travel in the cabs of locomotives on the London Midland Region, he asked Driver Shaw if he could travel with him in the cab of the locomotive of the 1H20, the 17.00 Euston to Manchester express, as far as Stoke-on-Trent, as he had been studying overhead electric traction and also the use of flashing yellow signals in the Southern Regional Training School. Shaw agreed that he could travel with him.

29. He discussed various matters with Shaw during the journey up to Colwich and noted that the latter had to reduce speed to 50 or 60 mile/h on two occasions for two temporary speed restrictions. As the train approached Colwich, Shaw explained that they were approaching a junction with flashing yellow aspects. Later in his evidence Organ admitted that he had made a similar journey the previous Friday on the Manchester Pullman, and thus had observed the flashing yellow aspects on that occasion.

30. At both the Railway Officers' internal Inquiry and at my Inquiry Organ was questioned at very great length concerning the signals approaching Colwich Junction, proving to be a most unreliable witness. He agreed that he saw a double flashing Yellow signal (CH105) approaching which Shaw cancelled the A.W.S warning and then a single flashing Yellow (CH103) where Shaw again cancelled the A.W.S., but he vigorously denied passing Signal CH28 displaying a single steady Yellow aspect with a Junction indicator taking the train from the Down Fast through Crossover No. 24 to the Down Slow line and he also stated that he could not recall the train passing through the crossover or Shaw reducing speed to do so. Time and again it was pointed out to him that the aspect shown by Signal CH28 was the most important part of the whole signal sequence starting with the double flashing Yellows, also that it was virtually impossible to be unaware when the locomotive was traversing from the Down Fast to the Down Slow line. The only reason that Organ could give for not seeing the signal or feeling the train traversing the crossover was that he might have been looking in his jacket or his bag for something, although when pressed, he could not remember what he might have been looking for.

31. Organ said that the next signal he saw after Signal CH103 was Signal CH23 was at Danger. He was unable to estimate how far away the signal was when he first saw it but thought that it was after the locomotive went under Bridge No. 130A, some 150 yards from the signal. Asked if Shaw had said anything on seeing the signal at Red, Organ said that he thought he said "It is still on" or words to that effect. He was unable to say whether Shaw was applying the brakes normally when he first saw the signal at Red, but he was quite certain that as they closely approached Signal CH23 Shaw did make an emergency brake application as he saw the brake handle being pushed round as far as it would go.

32. Again Organ was unable to help about the speed that the train was travelling when they passed Signal CH23 at Danger, or when they passed Colwich Signal Box, other than to say that they must have been travelling quite slowly to come virtually to a stand on the switch diamonds of the junction. As they approached the switch diamonds Shaw had suggested that they should jump from the locomotive. Organ went over and opened the door on the driver's side behind the partition and jumped out towards the Down Main line. From the fact that he landed on his feet and had no grazes on his hands he considered that the locomotive could not have been travelling at more than walking pace. The Liverpool express was quickly approaching and the locomotives collided almost immediately. Organ said he was quite close to the point of impact and that he turned his head away because of flying glass.

33. Organ assured me that, while he had talked to Shaw from time to time during the journey, he had not distracted him from his driving duties and, in particular, that he did not distract him as they approached the

flashing Yellow signals at Colwich. Finally he categorically denied that at any time in the journey did he take over the controls of the locomotive or interfere with them in any way.

34. *Driver B. Shaw* was the driver of the 17.00 Euston – Manchester express, 1H20. He had booked on duty at Manchester, Piccadilly, at 11.50, worked the 12.15 train to Birmingham, New Street, and then caught the 14.18 train to Euston, travelling as a passenger. After having a couple of sandwiches and a mug of tea he made his way to his train on Platform No.15, meeting the guard near the locomotive, who informed him that they had 13 coaches on the train, equivalent to 444 tonnes. The guard then said that if Shaw would 'trap' the brake he would carry out a brake test.

35. Just prior to leaving Euston a young man knocked on the cab door and asked if he could ride with him to Stoke-on-Trent. Thinking that he was a driver 'learning the road', Shaw agreed and it wasn't until a few minutes after leaving Euston that he learnt that Organ was not learning the road and indeed had no right to be travelling in the cab. Had Shaw known that Organ was merely travelling on the locomotive because Free Passes could not be used on that particular train, he would certainly not have allowed him to ride in the cab.

36. The journey from Euston was an uneventful one with no signal checks and only two permanent way slacks, one of 60 mile/h between Atherstone and Polesworth and one of 50mile/h between Tamworth and Coton Crossing. Shaw said that on passing Rugeley he noted the next but one signal was displaying two flashing Yellow aspects for Colwich Junction and he commented on them to Organ who replied "Yes we had them here before".

37. Shaw said that he braked from 100 mile/h on sighting the two flashing Yellows to about 60 mile/h at the single flashing Yellow and then braked down further to 45 mile/h in preparation for going through Crossover No. 24 from the Down Fast to the Down Slow line. The signal controlling the crossover, Signal CH28, was showing a steady single Yellow aspect with a No.4 Junction Indicator. Shaw said that on emerging from under a bridge 100 yards beyond the crossover he was surprised to see Signal CH23, the junction signal, displaying a Red aspect. He braked still further, but expected the signal to clear to a proceed aspect as he approached it, as he was under the impression that the route had been set for this train to cross onto the Stoke line.

38. As Shaw closely approached Signal CH23, he realised that it was remaining at Red and made an emergency brake application, believing that he would stop at the signal. He passed the signal at Danger, reducing speed, and then saw an Inter City express approaching the junction at speed on the Up Main line. Shaw said that he still thought that his train would come to a stand short of the junction but, as they approached it, even though they were only travelling at 3–4 mile/h, it became obvious that a collision was inevitable. Both Organ and Shaw jumped off the locomotive from the left-hand door, the latter just as the front of the locomotive fouled the crossing. As soon as he left the locomotive the collision occurred, there was a tremendous crash and he was showered with debris.

39. Shaw made his way to Colwich Signal Box, shouting to the signalman "You had double flashing Yellows and the route was set for Stoke", to which the latter replied "You passed the Red Signal". He then helped the guard from the Liverpool train to de-train some passengers and took some detonators, placing three on the Down Fast line, three had already been placed on the Down Slow line, and then three more on Down Slow and Down Fast lines a further four hundred yards in the rear.

40. I questioned Shaw at length over the signals he received from Rugeley and the braking he carried out. He agreed that he had been running on Green signals through Rugeley and then had received a double flashing Yellow at Signal CH105. He braked on sighting the double Yellow from 100 mile/h to 80 mile/h on passing signal CH105 and then braked further until he reduced the train's speed to 60 mile/h on passing Signal CH103 displaying a single flashing Yellow aspect. Shaw said that he was still braking as Signal CH28 came into sight round the curve; he estimated that the train speed was down to 45 mile/h as he closely approached the signal. Shaw was certain that Signal CH28 was displaying a steady single Yellow aspect and also a No.4 junction indicator, showing that the train was being routed from the Down Fast to the Down Slow line via Crossover No.24. The signal retained its single steady Yellow aspect throughout the train's approach and did not change even as the locomotive's cab reached it.

41. Shaw said that he went over the crossover coasting at about 45 mile/h and then saw the banner repeater for Signal CH23 in the Danger position. He made a minor brake application, bringing the train's speed down to 40 mile/h because he expected Signal CH23 to change from Red to a proceed aspect, as he thought that the Signal had an approach release on it. As he went under Overbridge 130A Shaw saw Signal CH23 showing a Red aspect and still believed that it would change to a proceed one. At this time, while not looking at the speedometer, he estimated that the train was travelling at about 30 mile/h. As he closely

approached Signal CH23, Shaw realised that the aspect was not going to change from Red as he had expected and he made a full emergency brake application at a point he estimated to be about 40 yards before the signal. Shaw asserted that the train was only travelling at about 20–25 mile/h when he made the emergency brake application but, on further questioning, had to admit that all he would definitely state was that the train was definitely travelling at less than 40 mile/h.

42. I pointed out to Shaw that he had heard reliable witnesses in Colwich Signal Box state that in their opinion the train was just being braked normally as it passed the signal box and that no emergency brake application had been made. On the other hand, Organ travelling in the cab, had stated quite definitely that Shaw went from just rubbing the brakes to a full emergency brake application. Shaw confirmed that he had definitely made a full emergency brake application when the cab of the locomotive was at least 40 yards before the signal. He did not notice the pressure in the locomotive's brake cylinders after the emergency application.

43. I asked Shaw whether as an experienced driver, knowing that he would have an overlap of at least 200 yards from Signal CH23 to the fouling point with the Up West Coast Main Line, he seriously expected to stop short of the junction. He said that he fully expected to stop short of the switch diamonds and could not explain how he failed to do so. He had no explanation as to why the train failed to stop short of the junction. Even when 15–20 yards from the junction he still fully expected to stop before reaching it.

44. He was adamant that the train was not travelling faster than he had already stated, nor was it because he had not applied the brakes as soon as he had told me; he had certainly applied the brakes as he approached Signal CH23 and not after he had passed the signal. I questioned Shaw whether the braking of the train was as efficient as he expected it to be, but all he could say was that he expected the train to stop before the crossing and, on being pressed further about speeds as he approached the junction, he considered that he first saw the locomotive of the Liverpool express when his locomotive was about 40 yards from the crossing and his train was travelling at about 10 mile/h.

45. I questioned Shaw about his knowledge of the use of flashing Yellow signals. He agreed he was familiar with those at Hanslope Junction, at Armitage to go from the Fast line to the Slow line at 70 mile/h and, perhaps best of all, to go from the Down Fast or Down Slow line to the Stoke line at Norton Bridge. Shaw said that he had never had any formal training on flashing Yellows, he had never seen the pamphlet issued to drivers and guards in October 1978 on flashing Yellows or the video that had been made for train drivers on their use.

46. I next questioned Shaw concerning three Weekly Operating Notices issued shortly before the accident. Section C of NE21 dated 16–22 August which stated: "Sunday 17th August — Colwich; Down Fast line; Signal CH105 will display a flashing double Yellow aspect and Signal CH103 a flashing single Yellow aspect when Signal CH28 is showing a single Yellow aspect with a position 4 Junction Indicator reading to the Down Slow line" — he confirmed that he had signed as having seen this notice. He also confirmed that he signed for Section C on the following week, 23rd August to 5th September, giving the same information as the first notice and repeated because the information had not been inserted in the Southern Notices on the first week. He also confirmed that he had signed for Notice WE1 Section C, 7th–13th June, dealing with the installation of flashing Yellow aspects at Norton Bridge, which stated Signal NB150 (Down Fast) will be capable of displaying flashing double Yellow aspects and Signal NB148 (Down Fast) will be capable of displaying a flashing single Yellow aspect when the route is set from the Down Fast to the recess line ahead of Signal NB15 with a Position 4 Junction Indicator and Signal NB9 on the recess line is showing a proceed aspect.

47. While Shaw agreed that he had signed for all three notices, he admitted that, although the day of the accident was the first time that he had travelled from the Down Fast to the Down Slow line approaching Colwich with flashing Yellow aspects, he had failed to read the notices regarding Colwich in Section C. He had looked at the front of the notices to check on the temporary speed restrictions but had not looked at Sections B and C.

48. I asked Shaw if he understood what the flashing Yellow aspects approaching Colwich meant. He stated that, as at Norton Bridge, he thought that the flashing Yellow aspects took him not only from the Down Fast line to the Down Slow line, but through Colwich Junction onto the Down Manchester line. When he received a steady Yellow aspect at Signal CH28 he thought "They have altered it, it is different from Norton Bridge and they must still have the track approach". He knew he was entitled to go through the crossover at 45 mile/h and therefore braked down to 40 mile/h. Signal CH28 did not change from its single Yellow aspect as he passed it, but he still believed that the junction signal, CH23, which was displaying a Red aspect, first as he approached the banner repeater and then as he approached the actual signal would change from Red to a proceed aspect as the approach release cleared. When he realised that the Red aspect was not going to clear, he

made an emergency brake application at a point some 40 yards before the signal, or 300 yards from the junction.

49. Shaw admitted that his trouble, in addition to failing to study the notices outlining the alterations to the signalling at Colwich, was that he believed that the arrangement was similar to that at Norton Bridge and that the flashing Yellow aspects meant that the line was clear for him to proceed through the junction onto the Down Manchester line. I asked Shaw why, having received a single steady Yellow at Signal CH28 which did not clear to a less restrictive aspect as he passed it, he had any reason to expect Signal CH23 to clear from Red and allow a clear run across the switch diamonds to the Down Manchester line. He replied that on every occasion when he had encountered flashing Yellow aspects, he had never encountered a Red aspect. He accepted that, having passed Signal CH28 at a steady single Yellow aspect, he passed the banner repeater for signal CH23 in the 'On' position and then, despite his emergency application of the brake some 40 yards before Signal CH23, he passed the signal at Danger.

50. Finally, in answer to further questions regarding the emergency braking of the train on approaching the junction, Shaw said that he did not hear the rheostatic brake cooling fans start to operate on the locomotive, nor was he aware of any wheel skid under the locomotive.

51. *Signalling Technical Support Assistant A. Bowles* said that he arrived at Colwich Signal Box at 20.45 on the evening of the accident to check the position of the levers and the state of the signalling. He found that levers 8, 9, 17, 24 and 28 were in the reverse position and all the other levers were normal in the frame and was assured by the signalman that no levers had been moved since the collision occurred.

52. The illuminated track diagram, which shows white lights when a signal lever has been reversed for the particular route to which the lever refers, was displaying white lights from Signal CH28/18 via Crossover No.24 reverse as far as Track Circuit No.605. No detection was showing on Points Nos 12, 20 and 21 all the track circuits in the area of the junction were showing occupied due to the two trains and their wreckage.

53. The next day with additional testing staff he falsely energised the relevant track circuits and point detection to enable Signal CH28 to be cleared. On reversing lever No.28 it was proved that the aspect sequence was correct in accordance with the signalling plan, the wiring diagram and the control tables. Finally it was proved that, with Track Circuit 608 occupied, the overlap track circuit between Signal CH23 and the junction, Signal CH8 on the Up Main line reverted to Red. As an added precaution, all the cables involved in the points and signals possibly affecting the accident were subsequently tested and found to be in good order, while the relays involved were sent away for testing and found to be operating correctly.

54. In answer to my question, in addition to confirming that all the tests he carried out proved that the signalling was functioning correctly at the time of the collision, Bowles said that, if the lever of Signal CH18 was reversed, No. 20 points lever was locked normal in the frame. Similarly, if No. 21 Points were set reverse lever No.28 reverse would lock the former lever in the normal or reverse position. The Signalman was unable to normalise lever No. 28 until the overlap track circuit had been occupied and cleared, and the next track circuit occupied. If the berth track circuit to Signal CH23 was occupied, No. 21 points could not be altered until, with CH23 at Red, the track circuit had been occupied for 60 seconds, as the Crossover No. 21 from the Down Slow to Down Fast was in the overlap of Signal CH23. Thus even if the Signalman had realised that the Manchester train was going to run past Signal CH23 at Red and foul the junction in the immediate path of the Liverpool express there was nothing that he could do to alter the position of No. 21 Points to prevent the accident.

55. *Mr George Alcroft, the Electric Traction Maintenance Engineer, Crewe,* arrived at the site of the collision at 19.53. He had already called out the breakdown train, the breakdown road/rail vehicle with the MFD hydraulic jacking equipment and his overhead line staff from Stafford who had commenced to earth, secure and remove overhead line equipment entangled with the two trains. He informed the Fire Services command post that the MFD jacking equipment was available if required in rescue operations. He was informed that the body of Driver Goode was trapped in the crushed cab of locomotive No. 86211 and it was also believed that two other persons were trapped in inaccessible parts of the wreckage, but this subsequently proved false.

56. Eight coaches at the rear of the London – Manchester train, after entangled overhead line equipment and locked buffers had been removed, were moved from the site at 00.10 on 20th September. Similarly, five coaches from the rear of the Liverpool – London train were despatched to Stafford at 03.17 after one bogie had been re-railed and the overhead line equipment removed. Two very large 300 ton road mobile cranes, previously used in the major civil engineering remodelling at Crewe, were hired due to the large amount of damaged equipment and the necessity to clear the complete blockage of the West Coast Main line with the minimum delay.

57. Lifting work with the Bescot breakdown crane started at approximately 04.30 on 20th September and the road mobile cranes started work at 11.30. The site was cleared of both locomotives and all the coaches by 23.50 the same day. One major complication was that buffet car No. M1732 from the Livepool train was found to contain blue asbestos (Crocidolite) which had become exposed due to body damage. This was carefully sealed by Mr Alcroft's depot asbestos team, all loose asbestos carefully removed and polythene sheets fixed to the body side before the vehicle was lifted. Then, before despatch from the site, it was wrapped in large sheets of polythene over which wagon sheets were placed.

58. Mr Alcroft explained that, although both locomotives were carefully examined they were so seriously damaged that it was extremely difficult to give definite evidence regarding such items as brake equipment and the various controls in the cabs. The leading cab of the Liverpool train locomotive, No. 86211, although badly damaged, had most of its equipment still *in situ*. The AWS red isolation handle was sealed in the working position and the AWS traction control handle was in an isolated position having been displaced when the cab was crushed. The AWS indicator showed all black, as did the indicator from the rear cab which had been knocked out the cab. The driver's brake valve was free to move and without doubt had been moved by the impact, but it was not in the emergency position. The driver's brake valve in the rear cab was correctly in the shut-down position.

59. The leading cab of the Manchester locomotive, No. 86429, showed the AWS isolating handle to be sealed in the working position, and the AWS aspect showed black and yellow. From the rear cab, which was extremely severely damaged, it was only possible to check that the AWS aspect also displayed black and yellow.

60. Mr Alcroft agreed that the AWS aspects of the Liverpool locomotive clearly inductor that it had last passed an AWS indicator of a signal at Green, while the Manchester locomotive had passed over the ramp of a signal at a restrictive aspect, giving a warning which the driver had cancelled. He agreed that very severe jolts from the collision could have altered the indications but, as they had been able to ascertain, despite all the damage, that the indicator in the rear cabs showed the same aspects, he thought it to be unlikely.

61. The driver's brake valve in the cab of locomotive No. 86429 had been ripped from its mounting and when recovered from the site it was impossible to determine any useful information from its examination. The brake selector switch, however, was found to be correctly set for air-passenger operation. From his extensive examination of the brake equipment of the locomotive and the coaches forming the Manchester train, Mr Alcroft had been unable to find anything to explain why, according to other witnesses, the brake applications had not been as fierce as one would have expected in the circumstances. While he was unable to tell if an emergency brake application had been made or not, the brakes of the eight undamaged coaches removed from the site were all operating correctly.

62. On being asked the significance of a reliable witness' evidence that he clearly identified the noise of the wheel slide prevention equipment in operation on a number of coaches, Mr Alcroft stated, particularly as the rails were dry, that the driver must have made a very fierce brake application, almost certainly an emergency one.

63. *Mr K. G. Nicholson, Engineering Assistant (Brakes), London Midland Region* gave technical evidence at length regarding the braking of the London – Manchester express, of tests carried out subsequent to the accident by a similar train consisting largely of the undamaged coaches from the train involved in the accident and various specific technical aspects in connection with braking of MkIII disc braked stock in general and the effect of the operation of wheel slide prevention equipment in particular.

64. Mr Nicholson said that he had presented a report of results for brake tests carried out on 10th October (for details see paragraphs 70–78). The tests confirmed that the braking performance matched very closely the computer predicted performance figures originally provided for a train of this composition. He agreed that in the various tests carried out the front of the locomotive had only nearly reached the switch diamonds of the junction with an emergency brake application from a point approximately 30 yards before Signal CH23 when travelling at 45 mile/h.

65. The activation of the wheel slide prevention devices on the MkIII coaches as heard by Senior Technician Morgan from Colwich Signal Box, (paragraph 15) on dry rail would certainly indicate that the train was being heavily braked. While defects on individual units could not be ruled out, there were 36 wheel slide prevention units on the train involved in the collision and the failure of all of them would have been most unlikely. It would have had to be a long sustained operation of the wheel slide prevention devices on the most of the axles to have had any significant effect on the braking distance.

66. Mr Nicholson agreed that some of the conflicting evidence on the braking of the Manchester train prior to the collision might well stem from the different braking characteristics of the clasp brakes on MkI and MkII coaches and the disc brakes on MkIII coaches, particularly at speeds below about 20 mile/h. With a train composed entirely of clasp braked stock, an emergency brake application on dry rail would result in noise and sparks emerging from the brake blocks and a rapid increase in the coefficient of friction between the blocks and tyres, particularly at speeds of less than 10 mile/h. Disc braked stock, on the other hand, produces a smoother, quieter braking curve, more even throughout its whole range from 125 mile/h to a stand. Over the whole range of braking, disc braked stock gives a mean rate of retardation of 9%g, while clasp braked stock with cast iron brakes gives a retardation rate of about 7%g, until dropping to a very low speed, when the rate of retardation increases to that above the disc braked stock.

Discussion — Signalling

67. Before the introduction of new flashing aspects at junctions on British Railways in October 1978 the following notice was issued by the Chief Operations Manager to Drivers, Guards and signalmen:—

Notice to { Drivers and Guards / Signalmen } B.R. 29775

BRITISH RAILWAYS BOARD

SIGNALLING AT JUNCTIONS: NEW FLASHING ASPECTS

1. **INTRODUCTION**

Flashing aspects are to be introduced into the signalling arrangements at certain diverging junctions. This is an important addition to established signalling practice, and this pamphlet has been prepared to explain the meaning and application of the new aspects.

2. **EXISTING PRACTICE**

The normal practice in colour light signalled territory, when a train is signalled to a diverging route through a speed restricted turnout, is to delay the clearance of the junction signal until the train has passed the signal next in rear.

At some locations (generally at the higher speed junctions) where the normal method would be too restrictive to enable trains to take advantage of the permitted speed through the junction, the arrangement is modified to permit the junction signal to display a proceed aspect as soon as the route is set and the line ahead is clear.

Although the latter arrangement has been satisfactory for conventional trains, it does not entirely meet the needs of the new High Speed Trains. To match the higher performance of the High Speed Trains it is necessary to provide a system of signalling at junctions which will give Drivers an advance warning of the diversion and so enable them to take full advantage of the permitted speed through the junction while still ensuring that the train will not be travelling at too high a speed, on reaching the junction, to negotiate the turnout points safely.

3. **NEW PRACTICE TO BE ADOPTED**

To meet these circumstances some change in the present signalling practice is necessary. In future, where circumstances require, two new signal aspects will be used to give a positive advance indication to Drivers that junction facing points are set for a diverging route over which speed must be reduced. These two new signal aspects will be flashing double yellow and flashing yellow respectively. In such case, the sequence of aspects approaching the junction, when the facing points are set for the diverging route, will be:—

In 4-aspect territory

- flashing double yellow
- flashing yellow
- steady yellow (with junction indicator)

In 3-aspect territory

- flashing yellow
- steady yellow (with junction indicator)

The diagrams attached illustrate aspect sequences which may be encountered.

At a junction where there is more than one diverging route from the main route, the new signal aspect sequence will only be applied to the highest speed diverging route (or routes, if of equal speed).

4. **MEANINGS OF NEW ASPECTS**

One flashing yellow light	— Preliminary Caution and indication of diverging route ahead of next signal — be prepared to find next signal exhibiting one yellow light (with junction indicator).
Two flashing yellow lights (vertically displayed)	— Advance indication of diverging route ahead of next but one signal. Next signal exhibiting one flashing yellow light.

(The Rule Book, Section C, clause 3.1.1. has been amplified accordingly).

Drivers must understand that the single flashing yellow aspect combines the function of the steady double yellow aspect in a normal aspect sequence, and in consequence, until the junction signal changes to a less restrictive aspect, Drivers must be prepared to stop at the signal next beyond the junction.

5. **INTRODUCTION OF NEW ASPECTS**

The new signal aspects will be introduced progressively at the junctions concerned throughout B.R. (except on the Southern Region) during the course of 1978.

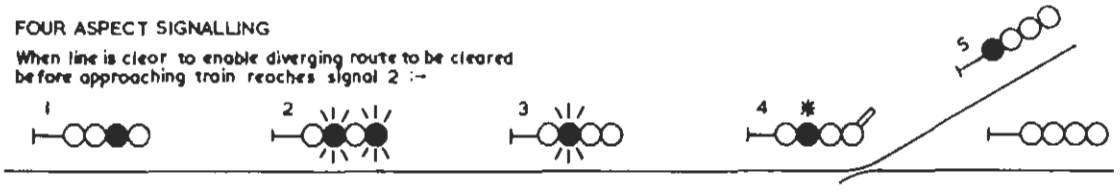
Chief Operations Manager,
222 Marylebone Road,
N.W.1.

October 1978

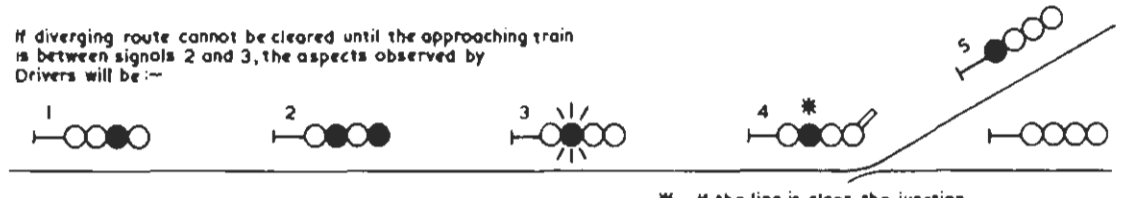
The following diagrams illustrate the signal aspects which will be observed by Drivers at the signals leading up to the junction depending upon the position of the approaching train at the time when the Signalman is able to set the diverging route and clear the junction signal:–

① FOUR ASPECT SIGNALLING

A When line is clear to enable diverging route to be cleared before approaching train reaches signal 2 :–

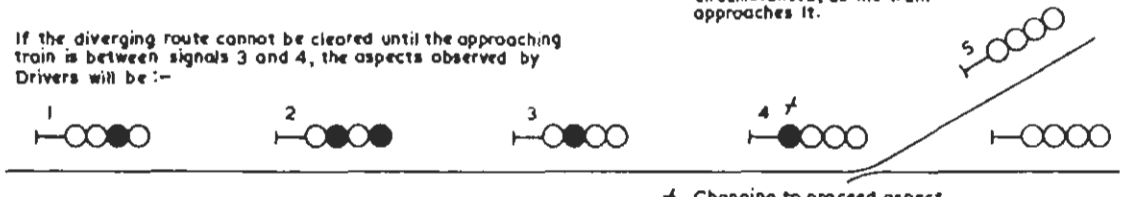


B If diverging route cannot be cleared until the approaching train is between signals 2 and 3, the aspects observed by Drivers will be :–



* If the line is clear, the junction signal 4 may display a double yellow or green aspect (with junction indicator) according to circumstances, as the train approaches it.

C If the diverging route cannot be cleared until the approaching train is between signals 3 and 4, the aspects observed by Drivers will be :–



✓ Changing to proceed aspect (with junction indicator) on the approach of train.

In addition. the re-issue in June 1977 of Section C of the British Railways Rule Book, Fixed Signals, sub-section 3.1.1., dealing with Main Aspects included:—

Section C. Fixed Signals

3. Description (cont'd)

3.1.1 Main aspects (cont'd)

(*b*) Approaching certain junctions the following proceed aspects may be exhibited at the signals in rear of the junction signal:—

Aspect	*Meaning*
One Flashing Yellow light	—Preliminary Caution and indication of diverging route ahead of next signal—be prepared to find next signal exhibiting one yellow light with junction indicator.
Two Flashing Yellow lights (vertically displayed)	—Advance indication of diverging route ahead of next but one signal. Next signal exhibiting one flashing yellow light.

Note: When there are two or more diverging routes ahead of the junction signal concerned, the flashing aspects will only be exhibited for the highest speed diverging route, or routes if of equal speed.

68. Both the notice to drivers, guards and signalmen, and Clause 3.1.3. of Section C of the rule Book referred to above gave the impression that the use of flashing yellow aspects would, where appropriate, be exhibited at the signals in rear of a diverging junction signal. In fact, of the first three installations, all on the Western Region, only one, at Wootton Bassett, was at a truly geographical diverging junction, the other two were at crossovers from Main lines to Relief lines. This latter use was extended throughout British Railways, apart from the Southern Region, during the period from 1979 up to the time of the accident at Colwich, but at no time was the notice to train crews and guards or Clause 3.1.1 of the Rule Book amended or amplified to make this clear.

69. While the extension of the use of flashing yellow aspects was in itself perfectly safe, I have no doubt that their extended meaning should have been more clearly explained, particularly where flashing Yellow aspects lead to a crossover which in turn leads to a signal controlling a true diverging junction, as was the case at Colwich at the time of the accident. A further alteration of Section C. Clause 3.1.1 of the Rule Book was introduced on 4 April 1987 which clarifies the meaning of main aspects, including flashing Yellow ones as follows:—

RULE BOOK

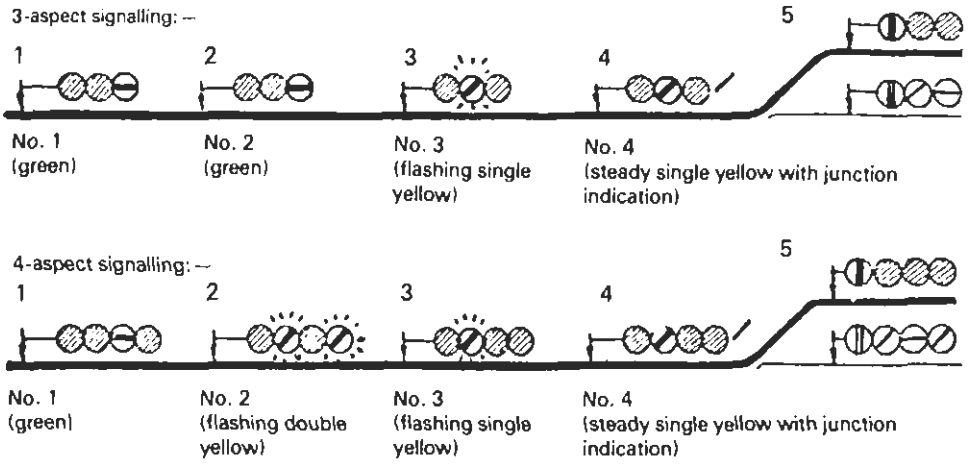
Section C Clause 3.1.1. *Delete and substitute:—*

3.1.1—Main aspects

The Driver must understand the meaning of main aspects as follows:—

Description	*Aspect*	*Meaning*
DANGER ASPECT	Red light	Stop
PROCEED ASPECTS:—		
— CAUTION	One yellow light	Be prepared to stop at the next signal.
— PRELIMINARY CAUTION	Two yellow lights (vertically displayed)	Be prepared to find the next signal exhibiting one yellow light (or caution indication if it is a semaphore signal).
	OR One flashing yellow light	Be prepared to find the next signal exhibiting one yellow light **with junction indicator for highest speed diverging route.**
— INDICATION OF DIVERGING ROUTE AHEAD OF **NEXT BUT ONE SIGNAL**	Two flashing yellow lights (vertically displayed)	Next signal exhibiting one flashing yellow light.
— CLEAR	Green light	Next signal exhibiting a proceed aspect.

Where flashing yellow aspects are provided as shown above, the following aspect sequence is given:



NOTE: If the train is between signals 2 and 3 in this diagram before signal 4 is cleared for the diverging route, signal 3 may exhibit one flashing yellow aspect even though a steady aspect may have been exhibited at signal 2.

When a caution (one yellow) aspect is exhibited with a junction indicator at signal 4 in the diagrams, the Driver must understand the usual meaning and be prepared to stop at signal 5 even though a flashing aspect may have been exhibited at signal 3.

In addition, where flashing Yellow aspects are provided, a diagramatic aspect sequence is shown both for 3-aspect and 4-aspect signalling which further clarifies the use of flashing Yellow aspects. A driver is also warned that when a caution (one Yellow) aspect is exhibited with a junction indicator, he must understand the usual meaning and be prepared to stop at the next signal, even though a flashing aspect may have been exhibited at the signal in rear of the junction signal.

DISCUSSION — SPEED AND BRAKING TESTS — INVESTIGATION INTO BRAKING AND WHEEL SLIDE PREVENTION PERFORMANCE

70. In view of the conflicting evidence given by various witnesses as to where the emergency brake application to train 1H20 was made by Driver Shaw in relation to Signal CH23 and also the speed of the train at that point and when opposite Colwich Signal Box, two sets of tests were carried out. First on 10th October 1986 with a train formation similar to that involved in the accident and including 8 of the vehicles from the original formation, the remaining five vehicles being of a type similar to those that had been damaged so much that they could not be used. For each test the train started from Signal CH104, approximately 1¼ miles before Signal CH23, and emergency brake applications were made from speeds of 30, 35, 40 and 45 mile/h at two points, 30 and 50 yards before signal CH23. A summary of these tests carried out on wet/damp rails is given below:—

Test No.	Brake application point. Distance before Signal CH23 in yards	Initial speed mile/h	Stopping Distance yards	Distance from Junction yards
1	50	40	247	62
2	50	35	199	110
3	50	30	147	167
4	30	40	230	59
5	30	35	188	101
6	30	30	148	141
7	30	45	309	+20
8	50	45	295	14
9	30	40	241	48

Note: + = distance beyond junction

71. On the basis of the above tests it would be reasonable to conclude that for train 1H20 to come to a stand with its locomotive on the switch diamonds of the junction following an emergency brake application, the brakes would have to be applied from a speed in excess of 40 mile/h, but probably no greater than the 45 mile/h, at a joint between 30 and 50 yards before Signal CH23, but this does not take into account the possible drop in braking efficiency due to the wet/damp rails, compared with the dry rails on the day of the accident, or any other factor causing unduly low adhesion.

72. A second series of tests were carried out, at which I was present, on 22nd October with the same train formation as used in the first tests, the only difference that locomotive No. 86405 was running with No. 2 cab leading as opposed to No. 1 cab previously. The purpose of these tests, apart from confirming the results of the previous tests, was to have the locomotive driven by Driver Shaw and for him to brake in the manner described in his evidence at the Railway Officers' Joint Inquiry. When these tests resulted in the train coming to a halt well short of the actual junction, I requested Shaw to make an emergency brake application from a point 30 yards before Signal CH23 at various speeds in an effort to reproduce the train's braking on the day of the accident. Arrangements were also made for Signalman Millward and Senior Technician Morgan, who were both in Colwich Signal Box at the time of the accident, to be there throughout the trials, to observe the speed of the train going past the Signal Box, its braking and with Morgan to listen in particular for the noise coming from the operation of the wheel slide prevention equipment fitted to the MkIII coaches.

73. These tests cannot be directly compared with the first series, as Shaw in his evidence was adamant that he made a minor brake application from the area of the crossover from the Down Fast to the Down Slow line. Thus the brakes were already partially applied at the moment that the emergency brake application was made, giving a quicker application than in the first series of tests. A summary of the second series of tests is given below:—

Test No.	Emergency Brake Application point. Distance before Signal CH23 in yards	Initial Speed mile/h	Stopping Distance yards	Distance from Junction yards
1	101	35	186	174
2	122	45	191	190
3	30	45	184	105
4	30	60	451	+162
5	30	25	127	62
6	30	25	132	57
7	30	45	305	+16
8	101	40	200	160

Note: + = distance beyond junction

74. The 1st test was carried out in the manner described by Shaw, although he was not actually at the controls. Shaw was driving during test No. 2 but, as will be seen from the results, the train came to a stand no less than 190 yards from the junction, even though the initial speed on emergency braking was 45 mile/h. The clear indication from both tests was that, if the braking characteristics of the test train were the same as the train involved in the collision, Shaw must have commenced braking prior to the collision much closer to Signal CH23 than he recollected. The next five tests were earried out from a braking point 30 yards before Signal CH23. Test No. 3, despite being from an initial speed of 45 mile/h, resulted in the head of the train stopping no less than 105 yards short of the junction. Test No. 4 was deliberately carried out at an excessive speed of 60 mile/h to see whether with dry rails the train would come to a stand well beyond the junction. The test clearly indicated that this was the case. The observers of Tests Nos. 5 and 6 stated that the braking was too hard and nothing like that which occurred on the day of the accident.

75. Test No. 7 was carried out when the rails were wet, giving appreciably different results from earlier tests. Comments from observers included that the speed was marginally high, that there was appreciable wheel slide prevention noise from the MkIII coaches, that the stopping distance was probably slightly shorter than that of the original accident and that the braking was as near as could be achieved to that leading to the mishap. In stating this, however, no account has been taken of the fact that the braking of train 1H20 up to the collision on 19th September 1986 took place on a fine clear day with dry rails, while this test took place on wet rails. The very different braking conditions are clearly demonstrated by tests Nos. 2, 3, and 7 of this series. The stopping distance from 45 mile/h on dry rail was 191 yards in Test No. 2 and 184 yards in Test No. 3, while no less than 305 yards on wet rail in Test No.7. One of the more significant aspects of Test No. 7 was the observation of appreciable wheel slide prevention noise by Senior Technician Morgan from Colwich Signal Box, similar to that heard on the day of the accident, although the rail conditions were quite different.

76. If one considers the tests carried out on dry rails and the braking efficiency during the tests to be similar to that leading up to the accident, the brakes would have had to be applied at a point some 68–75 yards beyond Signal CH23 at a speed of 45 mile/h (Tests Nos. 2 and 3) to come to a stand with the locomotive on the junction. This is contrary to the evidence of Shaw and Organ in cab and that of Millward and Morgan in the Signal Box.

77. Following the two sets of braking tests referred to above and the holding of the public part of my Inquiry into the accident, I held several meetings with the Director of Mechanical and Electrical Engineering, British Railways Board, and members of his staff, as a result of which it was agreed that detailed investigations would be initiated by the Board's specialist braking staff into the Colwich Accident with special reference to braking and wheel slide prevention performance.

78. The key points made from the report on the long and detailed investigation include:—

(i) Inspection of the surviving vehicles of train 1H20 involved in the accident, while revealing a number of wheelslide prevention faults, showed that only one, affecting a single axle, would have resulted in an increased level of wheelslide prevention activity.

(ii) The stopping tests on the re-constructed 1H20 train confirmed that braking distances, in the speed range 25–45 mile/h were reasonably close to the predicted levels and within the W-curve in both dry and wet conditions.

(iii) Observations at a number of main line stations have confirmed the existence of a population of HST and locomotive-hauled MkIII coaches whose wheelslide prevention exhibits spurious cyclic activity. This is virtually totally confined to BR MkII wheelslide prevention equipment and the cause remains to be established. All MkIII coaches on train 1H20 involved in the accident were fitted with Lucas Girling wheelslide prevention equipment, however, which has been found not to suffer from spurious cyclic activity.

(iv) Calculations show that the probability of spurious wheel slide prevention activity being responsible for taking up other than a very small fraction of the 15% margin provided on braking distance for HST from full speed are sufficiently remote to be discounted. The margin for locomotive hauled stock is substantially greater.

Conclusions

79. The immediate cause of this collision was that Driver Shaw, who was at the controls of the locomotive of train 1H20, passed Signal CH23 at Danger and, despite making an emergency application of brakes shortly before reaching the signal, failed to bring the train to a halt until the locomotive was on the switch diamonds of the junction with the Up Main – Up Fast line 259 yards beyond the signal.

80. There is no doubt that the reason for Driver Shaw passing Signal CH23 at Danger was his ignorance of the meaning of the Flashing Yellow aspects and the associated signals approaching Colwich Junction. He was clearly under the impression that a Flashing Double Yellow at Signal CH105 followed by a Flashing Single Yellow at Signal CH103 indicated that the route was set for him to go through the junction, even though the signal taking him through the crossover from the Down Fast to the Down Slow line, Signal CH28, displayed a single steady Yellow aspect with a Position 4 Route Indicator. Shaw agreed that this signal did not change to a less restrictive aspect, even when he closely approached it. I am certain that Shaw, on approaching Signal CH23 at Danger, was under the quite incorrect impression that this signal was approached released and would clear to a proceed aspect allowing him to proceed across the junction. He only realised that this was not the case when he was under 50 yards from the signal, by which time, despite an emergency application of the brakes, he was unable to stop short of the junction and avoid the collision.

81. Shaw admitted that, while he had signed for the two Weekly Notices issued in August 1986 which included in Section C details of the signalling alterations on the Down Fast – Down Slow line approaching Colwich, including the use of Flashing Yellow Aspects, he had not in fact studied these sections of the notices, even though this was the first time he had driven over this route since the signalling had been changed. Had he done so, I have no doubt that he would have realised that the Flashing Yellow Aspects, together with Signal CH28 displaying a single Yellow Aspect with a Position 4 Junction Indicator, specifically dealt with the movement of trains from the Down Fast line to the Down Slow line over Crossover No. 24 and not directly connected with Colwich Junction protected by Signal CH23. Thus he would have treated the single Yellow Aspect at Signal CH28 as meaning 'Be prepared to stop at the next signal' and the Red aspect at Signal CH23 as meaning 'Stop'. The train would have stopped short of Signal CH23 and the collision averted. I am also convinced that Shaw, not having studied the Weekly Notices referred to above, was confused by the arrangements of the Flashing Yellow Aspects on the Down Fast line at Norton Bridge. He admitted that this was the

Flashing Yellow Aspect arrangement that he was most familiar with and pointed out that the Flashing Aspects there could only be displayed when the route was set from the Down Fast line to the Recess line and with Signal NB 9 on the Recess line showing proceed aspect. In other words Flashing Yellow Aspects indicated that a driver's route was clear from the Down Fast line over the junction onto the Down Stoke line. While this does not condone Shaw's lack of knowledge of the signalling at Colwich, I consider that special care should be taken in the variation of the signalling at or near geographical junctions, such as Colwich and Norton Bridge, which may easily cause confusion.

82. I have examined at length the efficiency of the braking of train 1H20 immediately prior to the collision. Suffice it to say that I am satisfied that Shaw, once he realised that he was about to run past Signal CH23 at Danger, made a full emergency application of the brakes and there is no substantial evidence to show whether or not the brakes operated within the normal limits of efficiency. Indeed the evidence of five witnesses indicate that the train's deceleration was slower than expected and less than at the subsequent tests other than when the rails were wet.

Remarks and Recommendations

83. The failure of Driver Shaw to examine either of the notices giving details of the alterations of the signalling approaching Colwich on the Down Fast line is, as I have already stated, inexcusable, but I consider that it also indicates the importance of motive power inspectors travelling in the cab to check the correct handling of locomotives by drivers and that their knowledge of the 'road' generally and signalling in particular is correct. The reduction in the number of motive power inspectors, as part of the general 'slimming' down of the railway staff, is, in my opinion, a retrograde step which can only lead to less efficient supervision on vital safety matters.

84. In addition, this accident emphasises the importance of the continual updating of the British Railways Rule Book, together with associated safety documents. I find the fact that Section C Clause 3.1.1. was not amended or expanded from its original issue dealing with Yellow Flashing Aspects on the approaches to diverging junctions in 1977 until after and resulting from this accident in 1986 most disturbing, particularly in view of the ever increasing use of Flashing Yellow Aspects on the approaches to crossovers from the fast lines to the slow lines and vice versa. I recommend that more attention be paid to updating the rules and other relevant safety documents immediately after changes in signalling and other matters affecting the safe running of the railway take place.

85. The signalling at Colwich Junction at the time of the accident was such that it was impossible to provide physical flank protection between the Down Slow – Down Manchester line and the Up Main – Up Fast line as to route the former away from the latter would necessitate routing it to the Down Fast – Down Main Line which is not only physically prevented by the interlocking, but could also result in a major collision in the event of a train running by Signal CH23 with an express train on the Down Fast. Similarly, to provide trap points in the very restricted overlap of Signal CH23 would in the case of a runby, run the risk of a major collision with a train on the Down Fast or Up Main line depending on which way it was laid. I am glad to report that, following the accident, the London Midland Region altered the signalling arrangement on the approach to Colwich so that Flashing Yellow aspects at Signals CH105 and CH103 can only be displayed to a train approaching crossover No. 24 on the Down Fast if Signal CH23 is showing a proceed aspect. That is to say the train is signalled to proceed across the junction onto the Manchester line.

86. A considerable part of this Report has dealt with the braking of train 1H20 immediately prior to the collision. Despite invoking the braking experts of the Director of Mechanical and Electrical Engineering and the Director of Research, also carrying out two sets of speed and braking tests using the coaches actually involved in the collision, or where that was not possible, similar coaches, I am still not completely convinced that the braking after the emergency brake application by Driver Shaw was as effective as one would have expected. Considerable attention has been paid to the effect of the operation of wheel slide prevention equipment on MkIII coaches and, while I accept that the Lucas Girling equipment, as fitted to the coaches on train 1H20, has not been found to suffer from spurious cyclic activity, I accept the evidence of Senior Technician Morgan that he heard considerable wheel slide prevention activity as the MkIII coaches passed Colwich Signal Box.

87. It is impossible to determine to what extent the operation of the wheel slide prevention equipment or any other factor reduced the efficiency of the braking, but there is no doubt that it was reduced to a certain extent. A full emergency application of the brakes is likely to introduce wheel slide, even on dry rails, particularly if adhesion is reduced by any contaminant, and thus activate the wheel slide prevention equipment where fitted. Full emergency brake applications, particularly of passenger trains, are made extremely rarely and almost inevitably only when there is a true emergency. A very small distance may make all the difference as to

whether an emergency develops into an accident or not and thus with the full emergency application of the brakes I believe that all brakes should be fully applied, even if wheel slide does occur and wheel flats are made on the wheels. I recommend, therefore, that consideration should be given to the fitting of equipment to automatically eliminate the operation of wheel slide prevention equipment in the event of an emergency brake application being made.

I have the honour to be,

Sir,

Your obedient Servant,

P M OLVER
Major

The Permanent Under Secretary of State
Department of Transport

Printed for Her Majesty's Stationery Office. Dd 240187, 3/88, C9, 434, 5673.

COLLISION AT COLWICH JUNCTION, LONDON MIDLAND REGION, FRIDAY 19th SEPTEMBER 1986

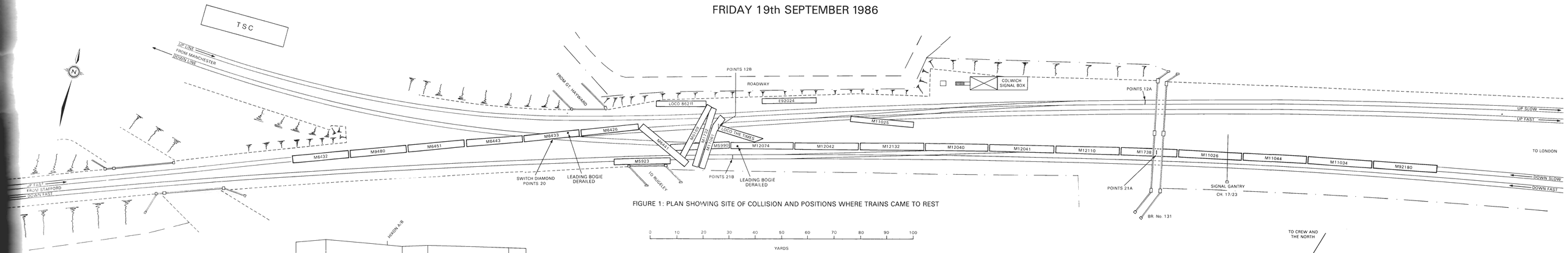


FIGURE 1: PLAN SHOWING SITE OF COLLISION AND POSITIONS WHERE TRAINS CAME TO REST

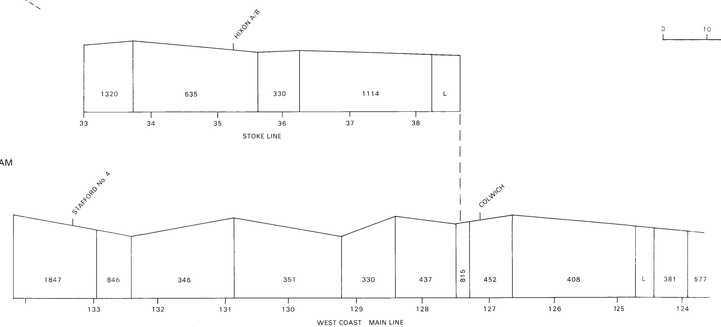


FIGURE 3: GRADIENT DIAGRAM

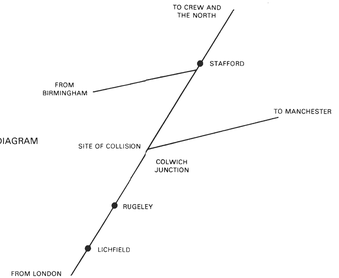


FIGURE 4: LOCATION DIAGRAM

NOT TO SCALE

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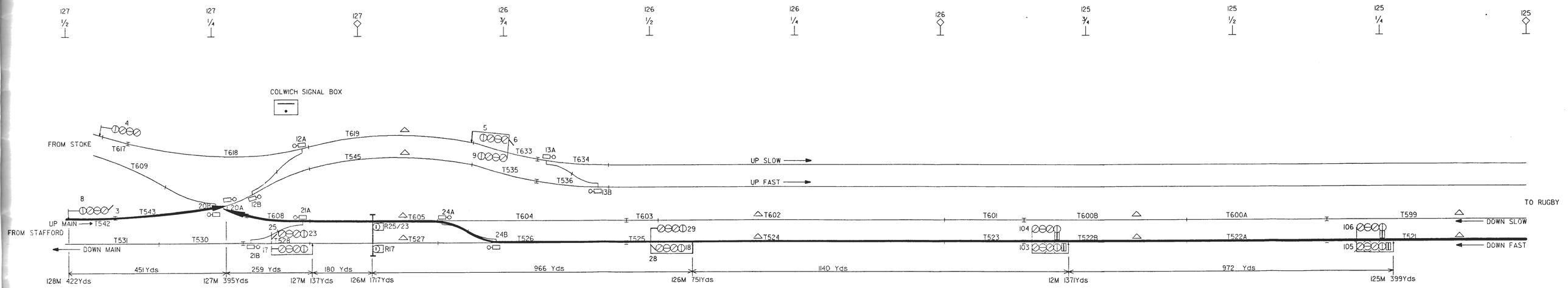
FIGURE 2: SIGNALLING DIAGRAM

NOT TO SCALE



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