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MINISTRY OF TRANSPORT & CIVIL AVIATION

RAILWAY ACCIDENTS

REPORT ON THE DERAILMENT

which occurred on

23rd January 1955

at

SUTTON COLDFIELD

in the

LONDON MIDLAND REGION
BRITISH RAILWAYS

LONDON: HER MAJESTY'S STATIONERY OFFICE

1955

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Fig. 2. Gradient and curvature diagram.

Fig. 3. General plan.

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Fig. 5. Survey of track at commencement of curve through Sutton Coldfield station.

Fig. 6. Marks of derailment through crossover lead.

Fig. 7. Engine No. 45274, Class 5 M.T.

MINISTRY OF TRANSPORT AND CIVIL AVIATION,
Berkeley Square House,
London, W.1.
10th June, 1955.

SIR,

I have the honour to report for the information of the Minister of Transport and Civil Aviation, in accordance with the Order dated 25th January 1955, the result of my Inquiry into the serious derailment which occurred at about 4.13 p.m. on Sunday, 23rd January 1955, in Sutton Coldfield station on the double line between Wichnor Junction and Birmingham (New Street) in the Western Division of the London Midland Region, British Railways.

The train concerned was the 12.15 p.m. Express from York to Bristol via Sheffield, Derby, Burton-on-Trent and Birmingham*, comprising ten bogie coaches hauled by a 4-6-0 type mixed traffic engine. It had been booked to run between Wichnor Junction (South of Burton) and Birmingham on the secondary line via Lichfield and Sutton Coldfield, owing to routine permanent way renewals on the usual main line route to Birmingham via Tamworth; the train driver, who was stationed at Gloucester, was unfamiliar with the Sutton Coldfield route, so a local driver had joined the engine at Burton to act as "conductor" as far as Birmingham.

The speed, however, was not reduced at Sutton Coldfield in accordance with the permanent "Appendix" restriction of 30 m.p.h. which is in force through the station on account of the severe left handed curvature, and the train entered the curve at 55—60 m.p.h., with the result that the engine and all of the coaches except the 10th were derailed to the outside of the curve between the platforms. The engine and tender were overturned and there was heavy damage to the rolling stock which included the destruction of the 1st, 4th and 5th coaches. There was also considerable damage to both the platforms and to the tracks between them, and a part of the Down platform awning was carried away.

There were about 300 passengers in the train, and I regret to state that 17 persons lost their lives, twelve passengers, the conductor driver and the fireman were killed outright, and two passengers and a driver travelling on duty subsequently died of their injuries in hospital. In addition, 40 passengers were taken to hospital, 17 of whom were discharged the same afternoon after treatment; 23 passengers were detained, some with very serious injuries, also the regular driver of the train, who was not on the engine at the time, and a goods guard, who was travelling on duty. Twenty four others complained of minor injury or shock.

The derailment blocked both the lines. As the signal box was switched out of circuit all the Sutton Coldfield signals were clear, and with no local passenger service over the line on Sundays the station was closed and unattended. The 1.20 p.m. express passenger train from Bristol to York was already in the section on the Down line but it was stopped at the home signal well clear of the wreckage owing to the very commendable initiative of Train Ticket Collector G. A. Attenborough and Fireman D. H. Smith who were travelling in the derailed train, and lost no time in running forward to the unoccupied signal box. Credit is also due to two lineside residents, Mr. and Mrs. Fairey, who saw that the train had come to grief and ran along the line to warn opposing traffic; they might well have succeeded in stopping the Bristol to York express if the signals had not been placed against it by Attenborough and Smith. This train was eventually drawn back to Birmingham with uninjured passengers from the derailed train, some of whom continued their journey in a special train which left Birmingham at 7.32 p.m. after refreshments had been provided.

It is probable that the first call for emergency assistance was sent by Marine H. Swann, a passenger in the derailed train, who dialled 999 from a public telephone after he had forced his way out of the locked station. Superintendent G. C. Gardner of the Warwickshire County Police, who had heard the noise of the derailment and seen the wreckage, made sure at once that all the emergency services in the area were notified from his headquarters close by, in accordance with the standing arrangements drawn up by the Police and the Railway Authorities to deal with a serious accident. He also took immediate steps to summon Police reinforcements. A minute or so later the Railway Control, who had been informed of the accident by Train Ticket Collector Attenborough from the Sutton Coldfield signal box, put the railway emergency

*Note:—The Down direction is Southward on the main line between Derby and Bristol and Northward on the Sutton Coldfield route between Wichnor Junction and Birmingham.

plans into action and also notified the Birmingham City Police; the time of this message was recorded as 4.17 p.m.

There was a rapid and complete response to these calls. The first ambulance arrived before 4.30 p.m. and the first doctor at about the same time. More ambulances, doctors, nurses and other medical staff were quickly on the scene, together with the Police in force, Fire Brigades, Civil Defence Units, R.A.F. Detachments, the Home Guard and the Women's Voluntary Service. With the help also of local railwaymen, passengers in both the trains and members of the public, the relief work in all its aspects was promptly organised and carried through most efficiently. The first loaded ambulance left the site at 4.35 p.m., and the last of the injured passengers was removed from the wreckage by 7.10 p.m. All who worked so unselfishly under very difficult and distressing conditions deserve the highest praise, and a special tribute is due to the Warwickshire County Police who made such a valuable contribution to the organisation on the site under the direction of Superintendent Gardner.

Four heavy steam breakdown cranes from Saltley, Bescot, Rugby and Crewe arrived between 7.0 p.m. and 9.0 p.m., but the work of clearing the site was slow and laborious, as it was necessary for the most part to work the cranes end on to the wreckage between the platforms, and to relay the track piecemeal as the formation was cleared by successive lifts; difficulty was also experienced in making a firm base for the cranes on the clay subsoil. The fire brigades remained on duty to keep the cranes supplied with water, and the refreshments which were handed out by the Women's Voluntary Service were much appreciated by the breakdown gangs.

All traffic through Sutton Coldfield was suspended on Monday 24th and Tuesday 25th January, and the local passenger traffic was covered by special road services during these two days. As this is not an important through line, the general dislocation of traffic was not severe, and alternative routes were used for a few additional trains and diversions. The Up and Down lines through the station were finally restored to traffic at 6.5 a.m. and 6.55 a.m. respectively on Wednesday 26th January, though the use of the station was restricted pending final clearance of the debris and repairs to the platforms.

The accident occurred in full daylight. The weather was fine and clear, and the rails were dry.

I. Description of Engine and Train

1. The engine was No. 45274, of the 5 M.T. (mixed traffic) Class with 4-6-0 wheel arrangement—see the diagram Fig. 7. It is driven from the left hand side and weighs 125¼ tons in working order with its six wheeled tender. The coupled wheels, of 6 ft. 0 ins. diameter, are driven by two outside cylinders, 18½ ins. by 28 ins., and the rated tractive effort at 85% of the boiler pressure of 225 lbs per sq. in. is 25,455 lbs. With a total weight of 54¼ tons on the coupled wheels, the adhesion factor is 4.77. The coupled wheel base is 15 ft. 0 ins. and the driving (middle) wheels have thin flanges of 'G' profile. The bogie side control springs are designed to exert an initial force of 3.134 tons rising to 4.03 tons at the maximum displacement to one side of 2¾ ins. The steam brake acts on the coupled and tender wheels under the control of the vacuum equipment working the train brakes. No speedometer is fitted.

2. Engine No. 45274 was stationed at Bristol Motive Power Depot and had run 747,517 miles since it was built in 1936. It had run 102,283 miles since the last general repair in October 1952, and 24,928 in the five months since the last "heavy intermediate" repair in August 1954. The repair history of this engine and its condition are dealt with more fully in paragraphs 61—66 below, in view of the statements which were made that it was riding roughly at the time of the accident, with heavy knocking in the coupled axle boxes.

3. It should be mentioned that no less than 782 mixed traffic engines were built to this design for the London Midland and Scottish Railway and British Railways between 1934 and 1949, and all are still in service. They are simple and robust, and with the 6 ft. 0 ins. coupled wheels and ample cylinder and boiler power have proved to be very successful general purpose machines. They have a good reputation for steadiness of running, and are suitable for all but the heaviest classes of passenger and freight traffic.

4. The total weight of the 10 corridor bogie coaches was 304 tons. They were screw coupled throughout, with British Standard gangways, and all were equipped with long stroke shock absorbing buffers of London Midland and Scottish Railway design. All the underframes were of steel. The body of the leading coach, a corridor third built in 1923, was of all-timber construction. The remaining nine were built between 1931 and 1950, and their bodies were framed in hard wood with sheet steel panels. The front brake compartment of the train was at the leading end of the 2nd coach, the leading coach having been attached at Sheffield, and the guard was travelling in the brake compartment at the extreme rear of the train. All the wheels of the coaches were vacuum braked, and all except the 1st and 7th were fitted with direct admission valves which accelerate the response of the brake to the driver's application. The combined brake power of the engine and train was approximately 76% of their total weight of 429¼ tons.

The total length of the train was 225 yards.

II. Description of Route and Site

5. With reference to Fig. 1 of the attached plans, the "West of England" main line of the Midland Division between Derby and Birmingham (42 miles) which is the normal route of the cross-country express services from Yorkshire and the Midlands to the South West, runs via Burton-on-Trent (11 miles from

Derby), Wichnor Junction (16 miles) and Tamworth; it is maintained as a Class A line, on which a maximum speed of 75 m.p.h. is permitted, and is easily graded and curved except for the last 3 miles to Birmingham.

6. The Western Division double line from Wichnor Junction to Birmingham (23¼ miles) via Lichfield (Trent Valley, High Level), Lichfield (City) and Sutton Coldfield provides a convenient alternative route to avoid the main line via Tamworth and so enable the latter to be closed on Sundays for permanent way relaying or other civil engineering works which are so much facilitated if there is no interruption by traffic. During the twelve months ending on the day of the accident, express trains had been diverted for this reason via Sutton Coldfield on 17 Sundays.

The Sutton Coldfield route, however, is not of main line character and is maintained to Class C standards with a maximum permitted speed of 60 m.p.h. It runs across the hilly country in "switchback" fashion with ruling gradients of 1 in 100 and considerable curvature, as will be seen from Fig. 2.

The regular passenger service consists of about 15 local trains in each direction daily between Birmingham (New Street) and Lichfield (City), a few of which run to and from Burton-on-Trent via Wichnor Junction; the majority stop at all stations, and all stop at Sutton Coldfield. In addition there are three or four freight trains in each direction daily and a number of light engine movements. There is no booked passenger service over the line on Sundays during the winter.

7. Southbound expresses diverted to this route are not booked to stop except at Lichfield (T.V.) for water, as on this occasion. They restart to face a continuous climb at 1 in 145 and 1 in 100 for nearly 3 miles, in the middle of which there is the 20 m.p.h. speed restriction through Lichfield (City). After a dip at 1 in 100 for less than a mile followed by a short level stretch, a further 3½ mile climb begins at Shenstone, almost entirely at 1 in 100. This is followed by a descent of nearly 2 miles through Four Oaks, also at 1 in 100, which terminates at the entrance to Sutton Coldfield tunnel. The line rises again at 1 in 101 through the short tunnel and through the station, and then continues to rise less steeply for 1½ miles to a summit between Wylde Green and Chester Road, after which there is a descent for more than 2½ miles, for the most part at 1 in 107 and 1 in 95. In the 9¾ miles from Lichfield (T.V.) to Sutton Coldfield there is a net rise of 139 ft.

8. The left handed curve of 15 chains nominal radius through Sutton Coldfield station is subject to a permanent speed restriction of 30 m.p.h., and this is preceded by a restriction of 40 m.p.h. through the 1¼ mile section from Four Oaks to Sutton Coldfield so that the speed of trains may be kept well in hand on the steep falling gradient with the sharp curve ahead. These permanent speed restrictions have been in force for many years, and are listed in the Sectional Appendix to the Working Timetables, which is issued to all drivers and others concerned with train operation.

All the speed restrictions on the route are shown by Fig. 2. The 20 m.p.h. restriction through Lichfield (City) does not require much reduction of speed for fairly heavy Southbound passenger trains on the rising gradient, if they have started from Lichfield (T.V.), and they are not affected at all by the restrictions of 40 and 50 m.p.h. round the curves between Lichfield (City) and Shenstone and through Blake Street. The observance, however, of the 40 m.p.h. restriction on the 1 in 100 falling gradient between Four Oaks and Sutton Coldfield, and of 30 m.p.h. through Sutton Coldfield station, requires the brakes to be applied with some force.

In accordance with the general practice in the London Midland Region, there are no lineside speed restriction notices.

9. Fig. 3 shows the general features of the section between Four Oaks and Sutton Coldfield. The Up line through Four Oaks station is on a left handed curve of 40 chains radius. This curve is followed by a 530 yard length of straight on a fairly high embankment, and the embankment continues for about two thirds of the way round the succeeding 30 chain right handed curve, the length of which is about 1,210 yards. The country on either side of the long embankment is of outer suburban character, with scattered houses, gardens and playing fields.

For its last 350 yards the curve is in cutting which is crossed by overbridges Nos. 5 and 4 close together carrying a road and a double line railway respectively. Beyond these overbridges high retaining walls extend for a distance of about 45 yards to the entrance to Sutton Coldfield tunnel which practically coincides with the end of the long right handed curve and with the change of gradient from 1 in 100 falling to 1 in 101 rising. The tunnel is 171 yards long and is straight. The left handed curve through the station begins a few yards before the end of the tunnel.

As has been mentioned, the nominal radius of this curve is 15 chains, but in actual fact it sharpens to a minimum radius of 8¼ chains at one point in the short distance between the tunnel mouth and the platform ramps, where there is a trailing crossover, and then eases out again to the radius of 15 chains which is maintained through the platforms—see also paragraph 14 below.

10. The layout of Sutton Coldfield station itself is shown to a larger scale by Fig. 4, which also indicates the positions of the engine and vehicles after the derailment, as described later in the report. There are two through platforms on the curve, each 145 yards long between ramps, and a terminal bay on the Down side. Owing to the configuration of the ground, which slopes away rapidly from the ridge above the tunnel, the main station offices and the station house, which was occupied by Station Inspector Overton (see later) are situated at the Lichfield end of the station on the Down side, at a higher level than the platforms.

The signal box at the Birmingham end of the station was switched out of circuit at the time with all the signals clear for through running in both directions, and the block section was from Four Oaks to Erdington, a little less than 4 miles. The positions of the signals are shown by Fig. 3. The Up distant on the high bank comes into view from the driver's (left hand) side of the footplate at a range of about 160 yards on the right handed curve, but it can be seen much earlier from the fireman's side.

11. It was not possible to determine the exact point of the initial derailment, and the following summary of approximate distances in the Up direction of running are given with reference to the commencing tangent point of the left handed curve through Sutton Coldfield station:—

Derby station	31½ miles		North	East
Burton-on-Trent station	20½	,,	,,	,,
Wichnor Junction	15½	,,	,,	,,
Lichfield (Trent Valley, High Level) station	9¼	,,	,,	,,
Lichfield (City) station	8½	,,	,,	,,
Summit	7	,,	,,	,,
Shenstone station (in dip)	5½	,,	,,	,,
Summit	2	,,	,,	,,
	Miles	*Yards*		
Four Oaks station signal box	1	366	,,	,,
Commencement of long R.H. curve	–	1368	,,	,,
Sutton Coldfield Up Distant signal	–	903	,,	,,
Sutton Coldfield Up Home 1 signal at overbridge No. 5	–	238	,,	,,
Entrance to Sutton Coldfield tunnel End of long R.H. curve Change of gradient from 1 in 100 falling to 1 in 101 rising	–	161	,,	,,
Commencement of L.H. curve through Sutton Coldfield station ...		—		
Exit from Sutton Coldfield tunnel	–	10	South	West
Commencement of platforms	–	42	,,	,,
Front of overturned engine	–	181	,,	,,
End of platforms	–	201	,,	,,
Sutton Coldfield signal box	–	248	,,	,,
Engine of Northbound express—stopped	–	468	,,	,,
Erdington signal box	2	1514	,,	,,
Birmingham (New Street) station	7¼ miles		,,	,,

III. Description of Track

12. For the most part the plain track on this route between Wichnor Junction and Sutton Coldfield is laid with bull head rails weighing 85 lbs per yard (85 lbs R.B.S.), including the length of the Up line from Four Oaks onwards through Sutton Coldfield station. All points and crossings are, however, of 95 lbs R.B.S. material. The Up track through the tunnel and the station was relaid with 85 lbs material in June 1950, and the trailing crossover between the tunnel mouth and the platforms was relaid at the same time with 95 lbs R.B.S. material.

My impression from a footplate trip from Lichfield (T.V.) to Sutton Coldfield, which is described later, was that the tracks as a whole were well maintained for a line of this character. I also made a close examination on foot of the Up line at the site, walking back through the tunnel and for some distance round the long curve in the section from Four Oaks. I was accompanied by the Chief Civil Engineer of the London Midland Region, Mr. J. Taylor Thompson, and members of his staff, including the Walsall District Engineer, Mr. W. A. Robertson.

Round the 30 chain right handed curve and through the tunnel beyond it on the straight the sleepers and the fastenings were in sound condition with no important variation from the correct gauge, and there was plenty of fairly clean ballast on a well drained formation. The regularity of the curve alignment was good, with only slight variations from the designed cant of 2¼ ins., and although there was no planned transition, the curve was "eased" smoothly into the straight at the entrance to the tunnel, with a regular "run off" of the cant. The "top" generally was well maintained.

13. The exact commencing tangent point of the left handed curve through Sutton Coldfield station was difficult to determine, as the straight line through the tunnel was eased very gradually into the curve. A versine measurement showed a radius of 165 chains at a point 13 yards before the end of the tunnel, and at 7 yards before the end of the tunnel the radius had sharpened to 30.93 chains. For all practical purposes the commencement of the curve may be considered to lie somewhere between these two points, say 10 yards before the end of the tunnel—see paragraph 11 above.

14. Fig. 5 represents a record of a survey of the Up track which was made as soon as possible after the accident, and before any repairs or adjustments had been carried out. It extends from the commencement of the curve 10 yards inside the tunnel to the rail joint at which heavy damage to the track began, just beyond the switches of the trailing crossover.

It will be noted that the radius of the curve diminished rapidly though progressively from about 19 chains at the tunnel mouth to a minimum of 8¼ chains in a distance of 27 ft. and then increased again rather less rapidly through the 1 in 9 V crossing and the trailing lead. I understand that this sharp "knuckle" in the curve, which was very noticeable to the eye, has been in existence for a considerable time, and that when the tracks through the crossover were renewed in 1950 no changes were made in their alignment.

15. I was also informed that no provision was made for any cant in the Up line between the commencement of the curve and the ends of the switches, in order to avoid negative cant for crossing movements, though in actual fact a maximum cant of $\frac{5}{8}$ in. was measured. The cant of the 15 chain curve through the platforms was $1\frac{1}{2}$ ins., and the "run up" began at the end of the switches, but the damage to the track prevented any check of the regularity of the cant or of the truth of the alignment on this part of the curve.

16. It will also be seen from Fig. 5 that the check rail protecting the crossing uose was extended towards the tunnel round the sharpest part of the curve. Its standard gap of $1\frac{3}{4}$ ins. had worn to $1\frac{7}{8}$ ins., which was no more than was to be expected under the conditions, and there was a certain amount of slack gauge over this length (max. $\frac{3}{8}$ ins.). The gauge was also slack through the crossover lead (max. $\frac{7}{16}$ ins.), though it was correct at the crossing nose and at the tie plate at the ends of the switches. (The tight gauge measured through the length of the closed switch had evidently been caused by the crippling of the switch rail by some derailed wheels—see later). There was only slight evidence of movement of the chairs on the fairly new sleepers and crossing timbers, and it is possible, though this could not be verified, that the track had been laid slightly slack to gauge, as is often done on very sharp curves.

17. The ballast through the crossover was rather dirty, but it was well consolidated and was evidently holding the tracks firmly in position. There were no signs of wet formation, and I noticed that there was a free flow of water at the bottom of a manhole of the "six foot" drain.

IV. Effects of the Derailment

18. The rubbing face of the check rail beyond the tunnel mouth bore signs of nothing more than normal wear, and the first marks of derailment on the track were in the lead of the trailing crossover—see Figs. 4 and 6. It appeared that they had been made by a single pair of wheels, and the right hand wheel had evidently crossed over the outside rail without marking it. There were fairly heavy indentations by its flange and tread on crossing timbers 236, 237 (Fig. 6), and Nos. 237 and 238 bore corresponding marks by the opposite wheel.

After that the derailed axle had been twisted to the left as the back of the flange of its left hand wheel bore against the outside of the crossover rail which was heavily grazed for about 5 ft. Beyond this point there were no markings at all on the left hand side, but the right hand wheel had broken chairs and damaged coach screws on the inside of the opposite crossover rail. Wheel marks on the switch Z anchor and on the outside bottom flange of the closed switch rail suggested that this right hand wheel had burst the switches open, and this was confirmed by the buckling of the stretcher bars. It was difficult to account for the damage to the inside chair screws on the right hand side unless another pair of wheels had become lifted off the track at this point. The character of the track damage so far described suggests that it was not caused by the engine wheels, and that it probably resulted from the secondary derailment of a carriage bogie by transmitted shock after the engine was derailed a little further ahead.

19. In the 60 ft. rail length next beyond the crossover the outer rail of the curve was forced off the sleepers and badly bent as the fastenings were torn out or the cast iron chairs broken. There were wheel marks on the sleepers increasing in number and severity on a course more or less tangential to the curve, and it seems reasonable to assume that the engine became derailed to the right on this rail length, though the exact point could not be determined owing to the confused nature of the markings on the rail and the sleepers. The next outer rail was twisted and broken, and a piece of it was thrown across the Down line, which was intact so far except for some damage to three sleepers at their "six foot" ends (X on Fig. 4).

It appeared that the engine and possibly the first four coaches had then followed the alignment of the Down track under the restraint of the Down platform face which was damaged to an increasing extent until it was completely destroyed under the overturned engine. The Down track was considerably damaged by these vehicles, but others in rear appeared to have taken a course along the six foot way leaving the "inner" rail of the Up track intact until both the tracks were broken up for the last 30 yards of movement, probably as the engine was overturned and threw the following vehicles into disorder.

20. In reaching its final position the engine had travelled approximately 125 yards from the point where it probably became derailed, just beyond the trailing crossover at the Lichfield end of the station. It was turned over through more than 90° to the right and lay at an angle of about 45° to the tracks with its front end on the Down line and its rear end raised on to the severely damaged platform. A cleanly cut groove, about 2 ins. wide and $1\frac{1}{2}$ ins. deep in the front flange of the right hand cylinder casting had most probably been made by sliding on the edge of a rail, and indicated that the engine was on its side for some distance before it came to rest. The tender was thrown up on to the surface of the Down platform and was on its right hand side, partly embedded in the clay platform filling.

21. The engine received severe damage to platework including the cab sides and roof and to external fittings, and the chimney was broken off as the smokebox was crushed. The right hand front foot step was torn off and was found in the position marked Y on Fig. 4. There was also much damage to the boiler clothing on both sides, and the right hand top feed casting was broken away. The main frames, however, were not severely buckled, and damage to the cylinder castings was confined to broken flanges. The bogie remained in position and there was only a slight twist in its frame though the bolster carrier steel casting was bent on the right hand side. The bogie axles were out of truth, but the coupled wheels and axles were virtually undamaged. The boiler shell withstood the shock well, but the water was lost when a firebox corner inspection door was torn out, also through the broken top feed casting; there were signs of slight overheating of the copper crown plate, but the two fusible plugs were intact. The brick arch had partly collapsed, probably as the engine was overturned.

The front buffer beam of the tender and its side frames were bent, but the main damage was to the tank plating on the right hand side. The wheels, axles and axle boxes were practically undamaged, though the tyres of all the engine and tender wheels were bruised and scored.

22. The regulator was found to be slightly open to steam in the "drifting" position, with the reversing screw in forward gear at 45% cut off. The blower was open by three quarters of a turn of its screw valve. The brake handle was "off" but with the vacuum destroyed it would have been loose and may well have been thrown to the "off" position by the overturning of the engine.

23. The leading coach, Corridor Third No. 1224, was turned almost end for end and came to rest upright across both the tracks with its (original) front end on the Down platform and its rear end deeply embedded in the brake compartment of the 2nd coach. Both the bogies were detached, one overriding the other, and the end of the underframe on the platform was badly twisted and bent towards the tender. The compartment side of the all-timber body was severely damaged as it was forced against the engine wheels which penetrated some of the compartments. Both the end compartments were demolished.

24. The 2nd coach, Brake Third No. 26972, was leaning against the Up platform face at about 15° to the vertical. The leading bogie was driven back but the trailing bogie was in position and the underframe was not very severely damaged. The right hand side of the front brake compartment was wrecked, but there was only minor damage to the four passenger compartments in rear.

The 3rd coach, Corridor Third No. 12863, remained coupled to the 2nd and came to rest across both the tracks at an acute angle to them and leaning over to the right at about 30°. Both the ends were pushed in, but otherwise there was little structural damage to the body, and the compartments of this coach also were almost intact. The underframe, however, was severely damaged as the underframe of the 5th coach, which had overtaken the 4th, was thrust below it.

25. In contrast to the state of the two vehicles ahead of them, the 4th and 5th coaches were wrecked. The 4th, Corridor Composite No. 4212, was overturned to the right. The body was partly detached from the underframe, and its right hand (compartment) side was ripped out by the edge of the Down platform. This coach was probably overturned as the underframe of the 5th was driven below it on the left, lifting the coach as a whole into contact with the wooden platform awning, which was torn down with its supporting beams for a length of nearly 60 ft.

Little was left of the body of the 5th coach, Corridor Composite No. 4146. It was swept away by the underframe of the 4th coach, and its underframe then continued forward under the middle of the 3rd coach, taking with it both the bogies of the 4th coach as well as its own.

26. The greater part of the shock caused by the sudden stoppage of the engine was absorbed by the destruction of the 4th and 5th coaches and the violent disturbance to the leading coach, which was also damaged beyond repair. The 6th, 7th and 8th coaches were derailed all wheels, with a varying degree of damage to bogies and undergear, but there was no severe structural damage to their bodywork; all three were leaning over to the right to a maximum of about 45° (6th coach). The 9th coach was also completely derailed and was buffer locked with the 10th which was still on the rails in the lead of the trailing crossover; these two coaches were practically undamaged.

27. Having regard to the nature and extent of the wreckage, also to the fact that the 50 ton tender was flung bodily on to the Down platform, experienced railway officers of all Departments considered that the speed of the train at the moment of the derailment could not have been less than 50 m.p.h. and may well have been appreciably higher. I agree with this opinion which was confirmed by the experience of the trial runs described in paragraphs 48—59 below.

V. Summary of Events

28. According to its normal main line timing, the 12.15 p.m. express from York to Bristol on Sundays is booked to leave Derby at 3.0 p.m., and to arrive at Birmingham (New Street) at 4.8 p.m. with one intermediate stop at Burton-on-Trent; this represents an average speed of 37.1 m.p.h. for the 42 miles. The booked average speeds for the 82½ miles from York to Derby and for the 89 miles from Birmingham to Bristol are very similar, with three intermediate stops in each case.

29. The closure of the main line near Tamworth for engineering works on the Sunday in question, and the details (including the timings) of the consequent train diversions in both directions via Sutton Coldfield were notified to all concerned by the printed weekly "notices" of the Midland and Western Divisions. The following was the revised timing of the train concerned between Derby and Birmingham:—

Booked average speeds		*Miles*		
		0	Derby	arr. 3.0 p.m.
		11	Burton-on-Trent	arr. 3.16 p.m. dep. 3.22
		16	Wichnor Junction	pass 3.31 p.m.
		21½	Lichfield (T.V.)	arr. 3.43 p.m. stop for engine water dep. 3.48
31.8 m.p.h start to stop	39.0 m.p.h. start to pass	31¼	Sutton Coldfield	pass 4.3 p.m.
		36¼	Aston	pass 4.13
	25.8 m.p.h. pass to stop	39	Birmingham (New St.)	arr. 4.21 p.m.

I refer later to the "unbalance" of the Sutton Coldfield passing time of 4.3 p.m.

30. The engine crew from Derby were Driver J. T. Martin and Fireman J. T. A. Howell of Gloucester Motive Power Depot, who had worked a northbound express from Gloucester that morning via Sutton Coldfield, arriving at Derby at 1.3 p.m. Driver Martin had signed for the relevant weekly "notices", and as it was known that he was unfamiliar with the Sutton Coldfield route, arrangements had been made in advance for a local driver to accompany him on the engine as conductor from Birmingham to Burton-on-Trent on the northward journey and from Burton-on-Trent to Birmingham on his return with the 12.15 p.m. express from York to Bristol. The relationship of the train driver and the conductor is governed by the Notes to Rule 127 (iii)—see Appendix. Briefly, the conductor must drive if he is familiar with the type of engine, but the train driver must always be with him on the footplate.

31. When the train arrived at Derby from the North at 3.9 p.m., 30 minutes late, Driver Martin and Fireman Howell took charge of engine No. 45274, which was working home to Bristol, and they were told by the Sheffield men whom they relieved that the engine was riding roughly with some knocking in the axle boxes. The guard from Derby was F. J. Harrison, and the times given below have been extracted from his journal.

Time was saved at Derby station, and the train left at 3.13 p.m., 13 minutes late. Owing to permanent way work, 20 minutes were occupied in running the 11 miles to Burton-on-Trent instead of the 16 allowed, and the train stopped there at 3.33 p.m., 17 minutes late. The conductor driver, H. E. Allen of Burton (Horninglow) Motive Power Depot, joined the engine at the platform; he also had signed for the weekly "notices."

32. The station time at Burton was cut from 6 to 4 minutes, and the train started again at 3.37 p.m., 15 minutes late, with Driver Allen seated at the controls and Driver Martin standing behind him; I refer later to the extent of Driver Allen's experience of this type of engine and train. The passing time at Wichnor Junction was not recorded, but 17 minutes were occupied in running the 10½ miles from Burton to Lichfield (T.V.) instead of the 21 minutes allowed by the section timing, and the train arrived there at 3.54 p.m., 11 minutes late.

At this point Driver Martin left the footplate and took a seat in an empty compartment of the leading coach; he gave the reason that he had found it uncomfortable standing up on the rough riding engine, and thought it a good opportunity to take a rest as he considered that Driver Allen was competent to handle the train without his advice. Four minutes instead of the five allowed were spent in taking water and station duties at Lichfield (T.V.) and the train restarted at 3.58 p.m., 10 minutes late, with Driver Allen and Fireman Howell on the footplate.

33. Though it was not possible to determine the precise time of the derailment at Sutton Coldfield, it probably occurred between 4.12 and 4.13 p.m., as Guard Harrison noted the time by his watch as 4.14 p.m. when he began to go forward along the station platform after collecting his hand lamp and some detonators; he subsequently noted "Sutton Coldfield—4.14 p.m." in his journal. The block signal times recorded in the train registers of the signal boxes at Lichfield (T.V.), Lichfield (City), Four Oaks and Erdington were not of much service to establish the time of the derailment owing to the considerable variation in the clocks, and moreover the times were booked to the nearest minute in accordance with the usual practice. All that can be said is that they were not inconsistent with the times recorded by Guard Harrison.

34. If the time of the derailment is taken as 4.13 p.m. the elapsed time from the start at Lichfield (T.V.) at 3.58 p.m. was 15 minutes, as allowed by the section timing—see paragraph 30 above. Subsequent tests, to which I refer later, indicated that the average speed of 39.0 m.p.h. for the 9¾ miles of difficult road would have required an exceptional output of power from the Class 5 M.T. engine with the load of 10 bogie coaches, though the booked average speed of 31.8 m.p.h. over the 17½ miles from Lichfield (T.V.) to Birmingham (New St.) was well within its capacity, allowing for strict observance of the various speed restrictions.

35. There was very little evidence on the running between Lichfield (T.V.) and Four Oaks, and none of the signalmen on the route noticed anything of Driver Allen on the footplate, but a photograph was taken of the train from the Four Oaks station footbridge, and it showed clearly that the engine was still under steam on the 1 in 100 falling gradient. The photographer was Mr. A. Reason, an engineering apprentice, who lived nearby and took a great interest in railways; he was an intelligent and careful witness. He stated in his evidence that the train was running at about 45 m.p.h. and accelerating. The Four Oaks signalman thought that the engine was under steam when it passed his box 65 yards beyond the footbridge at a speed which he estimated as not less than 40 m.p.h., and a lineside resident in Boswell Road (see Fig. 3) said that he saw steam as well as smoke streaming back from the engine when he looked out on hearing the sound of a train running unusually fast.

It is not known when steam was shut off, but as the train approached the Sutton Coldfield tunnel, Guard Harrison and Train Ticket Collector Attenborough who was with him in the rear brake compartment, thought that it was running too fast in view of the sharp curve ahead, so the former made a light application of the brake in order, as he said, to attract the driver's attention. He did not, however, keep the valve open long enough to effect any noticeable retardation of the train, and the derailment occurred as already described, probably at 55—60 m.p.h.

36. Attenborough, who was uninjured, got out of the rear brake van directly it came to rest between the tunnel mouth and the platform ramps. He saw that both lines were blocked and then recollected that the 1.20 p.m. Down express from Bristol to York was due, so he ran forward to the signal box. He reached the box just after Fireman Smith (see page 1) had entered it through the unlocked door, and they succeeded between them in reversing all the signals before the distant came into view from the engine of the Down train. Smith then took some of the signal box detonators and put them down about 50 yards in rear of the

home signal, and as he did so he saw the Down express approaching, well under control. It should be mentioned that Smith had been travelling in the brake compartment of the second coach with Driver E. Blount to take duty at Birmingham. Driver Blount was killed as the right hand side of the compartment was wrecked, and Smith sustained severe shock and some injury when he was thrown out on to the ballast through the gap which had been torn in the front end of the coach.

VI. Evidence

Trainmen

37. Guard F. J. Harrison, who is 61 years of age, is stationed at Birmingham (New Street) and has been a passenger guard for eight years. He was confident of his knowledge of the Sutton Coldfield route, which he had learned about twelve months before the accident, and since then he had worked over it four times with diverted express trains. He was travelling in the brake compartment at the extreme rear of the train, together with Train Ticket Collector G. A. Attenborough who was going to work with the train from Birmingham onwards.

Harrison described the journey as perfectly normal as far as Four Oaks where he thought the speed was about 40 m.p.h. He stated that he was aware of the 40 m.p.h. speed restriction through the section to Sutton Coldfield, and that he began to take particular notice of the running when the usual brake application was not made as the train approached the Sutton Coldfield distant signal at increasing speed. As it got nearer to the two overbridges he and Attenborough remarked to each other that it was travelling too fast in view of the sharp curve ahead. Harrison then got up out of his seat and lifted the brake valve. He thought that the speed at this moment was 45 m.p.h. "at the least".

So far as I could ascertain by close questioning, he kept the valve open for about three seconds bringing the needle of his van gauge down to 12-15 ins; he said, however, that there was no noticeable braking effect and that the gauge needle came back quickly to the full 20-21 ins. when he let go of the handle. He then looked out through the right hand window and saw the engine going into the tunnel, but he could not say whether it was under steam. As his van entered the tunnel he felt a sharp retardation (probably as the engine became derailed).

He went on to say that the van came to rest between the tunnel mouth and the platform ramps after some more violent surges. Attenborough (who was a much younger man) jumped out at once, and Harrison then "pulled himself together", collected his hand lamp and detonators and started to walk forward along the platform. He had gone only a little way when he pulled his watch out "automatically" and noted the time as 4.14 p.m; he suggested that the derailment might have occurred three or four minutes earlier, but this was probably an overestimate especially as he said later that the train had passed Four Oaks at about 4.10 p.m. He continued forward to the signal box and having found that Attenborough "and another man" had already put the Down line signals to danger, he went back again and protected the rear of the train in accordance with the Rules.

Harrison was asked why, having once decided to act, he did not keep the valve open so as to make a strong application of the brake. He replied that his object had been to attract the driver's attention, and that he thought that he had reduced the vacuum sufficiently for this purpose; he was hoping all the time that the driver would apply the brake himself and he had hesitated to take the control of the train out of his hands.

38. Train Ticket Collector G. A. Attenborough, who is 31 years of age, is stationed at Birmingham (New Street). He lives at Lichfield and it was clear that he has a thorough knowledge of the Sutton Coldfield line, and of the running of all the services on it, including diverted express trains.

He joined the train at Lichfield (T.V.), and as he was not yet on duty he sat down in the "lookout" seat on the six foot side of the rearmost brake compartment. He said that he kept a fairly continuous lookout towards the rear, and he noticed nothing unusual in the running until the train entered the long 30 chain right handed curve between Four Oaks and Sutton Coldfield, where the smoothness of running was broken by what he described as a feeling of retardation "like going over points". He thought that the train was already travelling too fast, perhaps 45 m.p.h., and he confirmed that he and Harrison had exchanged remarks to this effect a few seconds later when the train was about 250 yards from the two overbridges. Attenborough would not say that he was alarmed, but he "felt that something ought to be done". He saw Harrison go over to the brake valve on the right hand side and heard the sound of the air going into the train pipe. He described the brake application as a short one and the sound did not suggest to him that the valve had been opened fully. He began to feel some severe bumps a few seconds later and estimated that the speed had then risen to 55—60 m.p.h. Attenborough's subsequent actions to stop opposing traffic have already been described.

The train ticket collector on duty, T. A. Gray, was unable to say anything about the running of the train, except that he noticed no brake application before the derailment.

39. As has been mentioned, the train driver was J. T. Martin of Gloucester Motive Power Depot and his fireman was J. T. A. Howell, who lost his life in the derailment together with the conductor driver, H. E. Allen. Driver Martin is 63 years of age and he has long experience of express train working over the west of England main line of the Midland Division. At the time of the derailment he was travelling in the middle of the leading coach and received facial injuries and severe shock for which he was detained in hospital for a considerable time. He was not fit to give evidence at my Inquiry until 10th March, although he made a statement in hospital to the Regional Officers on 26th January, three days after the accident.

This statement was to the effect that he and Fireman Howell booked on duty at Gloucester at 8.56 a.m. on the Sunday in question, after sixteen hours rest, in order to work a northbound express which left Gloucester at 9.23 a.m. This train was diverted via Sutton Coldfield, with a conductor driver from Birmingham to Burton-on-Trent. On leaving Derby at 3.0 p.m. on his return trip with the 12.15 p.m. express from York to Bristol, Martin had found the engine "very rough" and he said that the Sheffield men whom he relieved had told him that the engine was rough. He considered, however, that it was fit to work the train.

Driver Allen had taken charge from Burton onwards as he (Martin) was travelling over a line he did not know. During the stop for water at Lichfield (T.V.) he "observed" an empty compartment in the first coach and told Allen that he would travel in it and rejoin the engine at Birmingham, having satisfied himself that Allen was competent to work the engine. He stated that owing to the roughness of the engine it was not very comfortable riding as third man and standing behind the driver, partly on the engine and partly on the tender.

He did not take any notice of the running between Lichfield and Sutton Coldfield as he was writing up his daily statements at the time, and he was not conversant with the road. He had however been "piloted" over it twice about twelve months before, and he recollected that the speed had been reduced at Sutton Coldfield on the northward journey earlier in the day. He did not notice any brake application immediately before the derailment.

40. Martin told much the same story at my resumed Inquiry on 10th March. He explained that by "roughness" of the engine he meant heavy knocking or "bumping" of the rear axle under the footplate, possibly caused by slackness in the axle boxes, and he would have reported it when he booked off duty. This knocking was very noticeable when the engine was working hard but less so when it was "maintaining the speed", and it ceased altogether when the regulator was closed. The engine was uncomfortable for this reason, but he had no impression that it was unsafe to work, and he said that it was in good order otherwise; it was steaming well and was light on coal and the fireman had no trouble with the injectors. The brakes were in good working order and there had been no difficulty in stopping at the usual point at the Burton-on-Trent platform.

Martin knew Driver Allen slightly and said that he was in his usual good spirits when he joined the engine at Burton. He noticed that Allen worked the engine at a rather later cut off than he would have done himself, but the regulator was not opened beyond "the first valve", and he did not think that the speed had risen beyond 40 m.p.h. at any point between Burton and Lichfield. He was vague about the handling of the train through the sharp right handed diversion at Wichnor Junction (15 m.p.h. speed restriction), again saying that he was not conversant with the road; he did not, however, think that the brake had been applied.

41. In excusing himself for contravening Rule 127 (iii) by leaving the footplate at Lichfield, Martin referred to an injury to a muscle of his leg which he had sustained while turning an engine on a turn-table about two years ago. This had left him with some weakness in the leg and as the knocking of the engine was making it rather painful for him to stand he sat down in the compartment until he could sit at the engine controls again. He knew that this was against the Rule, but he said that he was thinking of his own personal comfort and the fact that he would have to carry on with the train from Birmingham.

With regard to the obligation to study a strange road Martin said that he was "a main line driver and not a diversion route driver" and did not suppose he would ever have to go over the Sutton Coldfield route again, so he was "not interested". He had travelled on the engine on the northward journey via Sutton Coldfield, but he said that he did not recollect anything of the road. He had not discussed the question of speed restrictions with the conductor driver as he (Martin) did not know the road, and the conductor had been "given to him to take charge of the train".

42. On the matter of his leg trouble, the British Railways Medical Officer at Swindon reported that he was off duty with sciatica from January to May 1952. He remained under medical advice until December 1952 when the Medical Officer at Swindon expressed the opinion that he was fit to continue his normal duties, subject to re-examination in twelve months' time. At this re-examination, on 2nd December 1953, the same Medical Officer again reported that Martin was fit to continue his duties. No complaint had been received from Driver Martin since that time.

43. The conductor driver, H. E. Allen, was 54 years of age and had spent the whole of his 37 years of railway service at Burton (Horninglow) Motive Power Depot. He had been a driver for 17 years on local passenger and freight duties, and had driven stopping passenger trains over the Sutton Coldfield route regularly for a considerable time; he had confirmed his knowledge of it by his signature on the route card as lately as 17th January 1955, six days before the accident. His experience of conducting express trains over the route was, however, limited, and the last occasion had been on 4th July 1954 with Driver J. B. Chapman of Derby as the train driver (see the next paragraph).

There are no engines of the 5 M.T. Class stationed at Burton (Horninglow), but there are a good many at other sheds in the area, and it is probable that Driver Allen had had some experience of the class on relieving turns with freight trains. In any event they are simple machines, and the layout of the footplate controls is practically identical with that of the rather less powerful 2-6-4 type tank engines which are regularly used to work the local passenger services via Sutton Coldfield.

Driver Allen had returned home from duty at about 1.30 p.m. on Saturday, 22nd January. He slept a little in the afternoon and had a good rest that night. On the Sunday morning he went to church, and at about 1.20 p.m. he received a message at his home that he was to act as conductor for the 12.15 p.m. express from York to Bristol; he accepted this duty cheerfully, as usual, although he did not care for Sunday work. The Shed Chargeman stated that he seemed to be fit for duty in every way when he booked on at 2.45 p.m., and that he was then given his "working sheet", on which were entered the departure times from Burton, the

times of the water stop at Lichfield and the arrival time at Birmingham. As has been mentioned he had also received a copy of the weekly "notices" giving the detailed timings of the train.

The District Motive Power Superintendent, Mr. W. Bramley, did not know Driver Allen personally, but there was no doubt from the careful enquiries which he made that Allen was a reliable and temperate man of the highest personal character, and that he was much respected by all who came in contact with him on and off duty. He had an excellent service record. His health was stated to be good, and he had never suffered from temporary loss of consciousness. He passed a sight test successfully in March 1951.

44. Driver J. B. Chapman, of Derby Motive Power Depot, had been regularly employed on express work between Derby and Gloucester for some years. He said that he had a fairly good recollection of his trip over the Sutton Coldfield line in the previous July, on which he had been conducted by Driver Allen with a "5X"* Class engine and a load of 10 coaches. He had not known Driver Allen before and he remembered that when the latter joined the engine at Burton he (Chapman) had asked him "Are you going to work her?" and that Allen had replied "Yes".

Chapman said that he had stood behind Allen for most of the way and that he had felt every confidence in his handling of the train. He was always interested in travelling over a strange road, and recollected the tunnel and the sharp left handed curve at Sutton Coldfield; Allen had reduced the speed for this curve and the train had gone round it quite comfortably. He thought that on the whole Allen had worked the engine rather harder than he would have done himself, and had suggested to him on leaving Burton that he should "pull her up a bit".

Other staff

45. Ganger J. H. Gilbert had been in charge of the Sutton Coldfield gang for 22 years, and was responsible for the maintenance of 3½ miles of the double line through Sutton Coldfield and Four Oaks stations. Before that he had worked with the Erdington gang for 20 years, and he said that the speed restrictions of 30 m.p.h. through Sutton Coldfield and 40 m.p.h. over the Up line between Four Oaks and Sutton Coldfield had been in force for the whole of his 42 years' service. He had never had any special difficulties in maintaining his length, and since the relaying in 1950 there had been no need for any attention to the gauge or the alignment of the Up line through Sutton Coldfield, including the sharpest portion of the curve just outside the tunnel mouth.

On the Sunday in question he had been in his garden near Four Oaks station when the 12.15 p.m. express from York to Bristol passed, and he thought that it had been going faster than most diverted expresses, but he had felt no anxiety.

46. Permanent Way Inspector E. Nunnerley stated that no repairs had been required to the Up line through Sutton Coldfield during the 8 months for which he had been in charge, apart from the usual attention to crossing bolts and the replacement of keys. He thought that diverted expresses sometimes exceeded the 30 m.p.h. restriction, but he had never felt that the excess was sufficiently serious to report, and he confirmed that there had been no trouble with the alignment or the gauge on the curve.

47. Station Inspector G. W. Overton, who had lived at the Sutton Coldfield station house for 20 years, said that there was always some vibration from Up trains passing through the tunnel, but on this occasion the vibration and noise was so much more than usual that he remarked to his daughter "If he keeps up that speed he will be in trouble", on which she went to the door which leads on to the Down platform and saw that the train had been wrecked. Inspector Overton also said that on a previous occasion, in October or November 1954, he had felt some unusual vibration from a diverted Up express and had gone to the door to make sure that everything was all right.

I should mention that I received a letter paying special tribute to Inspector Overton and his wife for the attention which they gave in their house to some of the passengers in the derailed train.

VII. Trial Runs

48. On 31st January, the day before my Inquiry, I travelled over the route in rainy weather on the engine of a representative train, starting from Lichfield (T.V.). The engine was No. 45052 of the 5 M.T. Class, and the train consisted of 10 bogie coaches, including a dynamometer car coupled next to the engine; the total empty weight of the coaches was 324 tons compared to the 304 tons weight of the 10 coaches of the train concerned in the accident. The driver was D. J. Redmill of Burton (Horninglow) Motive Power Depot who had considerable and recent experience of conducting diverted express trains over the route, sometimes with engines of the 5 M.T. Class; he was given complete discretion to work the engine just as he would have done in ordinary service. I stood behind Driver Redmill on the left hand side, and Mr. S. T. Clayton, Motive Power Superintendent, London Midland Region, was also on the footplate. The description which follows should be read with reference to Figs. 2 and 3.

49. After starting in full gear, Driver Redmill maintained the cut off at 45% with the regulator half open for the whole of the first 2¾ miles to the summit between Lichfield (City) and Shenstone. On passing the summit at 22 m.p.h., the regulator was brought back to the first valve and the cut off reduced to 30%, and a maximum speed of 41 m.p.h. was attained on the short level stretch before Shenstone at the foot of the three-mile ascent through Blake Street. The speed through Shenstone was 39 m.p.h. and it fell away gradually as the ascent began. Once the train was on the 1 in 100 gradient Driver Redmill opened the

*Note:—The 4-6-0 type engines of the "5X" class (now reclassified 6P) are slightly more powerful than those of the 5 MT class. They have 3 cylinders 17 ins. x 26 ins. with coupled wheels of 6 ft. 9 ins. diameter.

regulator again to the half way position and dropped the reversing gear down to 45% cut off and then to 55%. Blake Street was passed at 28 m.p.h. with the engine working hard; by fairly heavy firing the boiler pressure was kept at just under the blowing off point of 225 lbs per sq. in. for the whole of the way, and there was little variation in the boiler water level from the midway position in the gauge glass.

50. On passing the summit between Blake Street and Four Oaks at 24½ m.p.h., Driver Redmill again brought the regulator back to the first valve and the reversing gear to 30% cut off, and the speed had risen to 35 m.p.h. when he shut off steam about 600 yards before reaching Four Oaks station. The speed was exactly 40 m.p.h. as the train coasted through Four Oaks down the 1 in 100 falling gradient, and it had risen to 43½ m.p.h. when Driver Redmill made a moderate application of the brake at Mile Post 6 (Fig. 3), just as the Sutton Coldfield distant signal came into view from the right hand side of the engine. He released the brake again when the speed had fallen to just over 30 m.p.h., and made another moderate brake application as the train was approaching the two overbridges, which brought the speed down to 22 m.p.h. as it entered the tunnel. He then released the brake and the train pipe vacuum was fully restored to 21 ins. as the engine emerged from the tunnel and entered the left handed curve. It passed through the sharp "knuckle" of 8¼ chains radius smoothly at 18½ m.p.h. Driver Redmill opened the regulator again at the beginning of the platforms and the coupled wheels slipped momentarily when he did so, but there had been no slipping at any other point in the journey. This trial was not continued beyond Sutton Coldfield.

51. The time taken for the 9¾ miles from the start at Lichfield (T.V.) to passing Sutton Coldfield was 21 minutes, representing an average speed of 27.9 m.p.h. compared to the booked time of 15 minutes, or 39 m.p.h. Mr. Clayton considered that the engine might have been worked harder on the rising gradients, and he drew my attention to the fact that Redmill had never opened the regulator beyond the half way mark. He also said that Redmill might have got going a good deal faster in the dip through Shenstone, so as to get a better run at the long rising gradient beyond. He suggested that 2 or 3 minutes might have been saved in this way.

52. In his evidence at my Inquiry Driver Redmill stated that there was no need to thrash the engine up the Blake Street bank, and that there was no difficulty in keeping to the 33 minute timing between Lichfield (T.V.) and Birmingham. It was his habit to begin braking "at the Sutton Coldfield distant" for the speed restriction through the station, and he thought that the speed at that point was usually about 40 m.p.h. A severe application of the brake was not necessary and he was accustomed to bring the vacuum down to about 7 ins. and then allow it to recover, reducing it again to about 12 ins. at the approach to the tunnel. He generally brought the speed down well below 30 m.p.h. to give a smooth run through the station and he had made up his mind to do this when he had first seen "the shape of the curve"; he thought that a lot of care was needed at this point. Driver Redmill considered that Engine No. 45052 was a fairly rough one to ride on; he had known other engines in similar but not worse condition.

53. Passed Fireman J. B. Riley, also of Burton (Horninglow), was conducting the 1.20 p.m. Down express from Bristol to York which was stopped clear of the wreckage, and he had acted as conductor for the 9.30 a.m. southbound express from Bradford to Bristol that morning, which had also been diverted via Sutton Coldfield. He had considerable experience of this work, and he said that he usually worked the brake after passing Four Oaks in much the same way as Driver Redmill had described. Riley added that he always reduced the speed to 15—20 m.p.h. through Sutton Coldfield on account of the curve, and he had never let a train go through as fast as 30 m.p.h.

54. Engine No. 45052 had been selected for the trial because it had run much the same mileage (22,558) as Engine No. 45274 since the axle boxes had last been refitted; as will be seen from the table in para. 63 below, the longitudinal play in the axle boxes of Engine No. 45052 was appreciably greater. Directly the train started from Lichfield (T.V.), I noticed a heavy thumping noise and sensation on the footplate which was typical of longitudinal axle box play. It occurred twice for each revolution of the coupled wheels, and thus increased in frequency as the speed rose until it could be felt as a fore and aft vibration at 25—30 m.p.h. The vibration diminished noticeably when the engine was being lightly worked, and ceased altogether when the regulator was closed on the falling gradient through Four Oaks. Although the vibration was uncomfortable when the engine was working hard, the discomfort was by no means intolerable, and I found that I could avoid any feeling of vibration by standing on the platform of the tender as distinct from the engine, though the knock could still be heard from this position. Otherwise the engine seemed to be in very good condition, with an even beat from the exhaust.

55. The main purpose of the trial run on 31st January was to give me some first hand knowledge of the route and of the proper handling of a train before I opened my Inquiry on the following day. A further trial was conducted on 24th May with a different object, i.e. to enable the Regional Officers to ascertain the practicability of the existing timings of 33 minutes from Lichfield (T.V.) to Birmingham (New Street), start to stop, and of 15 minutes from Lichfield (T.V.) to Sutton Coldfield, start to pass.

56. The engine was No. 45094, Class 5 M.T., which was in thoroughly good condition, having run approximately 4,000 miles since the last workshop repair, and the load again consisted of ten coaches, including the dynamometer car coupled next to the engine, with a total weight of 325 tons. Driver W. H. Hughes, who was an experienced man from Aston Motive Power Depot, was in charge, and he was instructed to work the engine so as to keep time as far as he was able with due observance of all the speed restrictions. Mr. Clayton and I travelled on the footplate.

57. The start was more rapid than in the trial on 31st January, and the train attained a speed of 30 m.p.h. through Lichfield (City) station, three-quarters regulator and 55% and 35% cut off having been used on the 1 in 145 ascent from Lichfield (T.V.). With five-eighths regulator and 37% cut off thenceforward the speed at the first summit had risen to 33½ m.p.h., and it was rapidly increased to 55 m.p.h. in the dip

through Shenstone station, the regulator having been eased to the half-way position from the summit. In climbing the three miles of 1 in 100 gradient beyond Shenstone, the regulator opening was increased to three-quarters and subsequently reduced to three-eighths approaching Blake Street which was passed at 42 m.p.h. The cut-off was maintained at 33-35% throughout the climb, the speed at the summit being 36½ m.p.h.

On the subsequent 1 in 100 descent steam was not shut off till the engine had reached the entrance to Four Oaks station, when the speed had risen to 52½ m.p.h; at the 6¼ mile post it had increased to 53½ m.p.h. as the train coasted down the gradient. Driver Hughes was then told to apply the brake. He reduced the vacuum to about 15 ins. and kept the brake on lightly for the rest of the way through the section to Sutton Coldfield. The speed at the entrance to the tunnel was 37 m.p.h., and it had fallen to 26½ m.p.h. as the train entered Sutton Coldfield station. Again the passage round the curve was quite smooth. The boiler pressure was maintained close to the blowing off point of 225 lbs. per sq. in. for the whole of the distance and, if anything, the firing was less heavy than in the test on 31st January.

58. The time from Lichfield (T.V.) to Sutton Coldfield, start to pass, was 16 minutes for the 9¾ miles, representing an average speed of 36.6 m.p.h. Mr. Clayton expressed the opinion that the engine had been very well handled in that Driver Hughes had realised the importance of making a good start from Lichfield (T.V.) and had taken full advantage of the dip through Shenstone to "rush" the subsequent three mile bank of 1 in 100. He did not think that the time of 16 minutes could have been bettered with the engine and load. He also considered that a booking of 16 minutes would be too "tight" for everyday working, especially as the 20 m.p.h. speed restriction through Lichfield (City) had been exceeded in the trial, and moreover the speed was much too high when the train entered the 40 m.p.h. restriction through the section from Four Oaks.

59. The remaining 7¾ miles from passing Sutton Coldfield to the stop at Birmingham (New Street) were covered in 15¼ minutes (30.5 m.p.h.) compared with the 18 minutes allowed (25.8 m.p.h.), with no particular effort from the engine and in spite of a long 15 m.p.h. relaying speed restriction through Gravelly Hill. Thus the overall time from Lichfield (T.V.) to Birmingham (New Street) was 31¼ minutes (33.6 m.p.h.), compared with the 33 minutes allowed (31.8 m.p.h.).

60. The following is a summary of the times and speeds achieved in the two trial runs:—

	Miles	Booked timings (mins.)	31st January 1955		24th May 1955	
			Time (mins.)	Speed (m.p.h.)	Time (mins.)	Speed (m.p.h.)
Lichfield (T.V.)	0	0	0	0	0	0
Lichfield (City)			3½	19	3¼	30
1st Summit			7½	22	6	33½
Shenstone			10	39	8	55
Blake Street			14½	28	11	42
2nd Summit			16¾	24½	12½	36½
Four Oaks			18½	40	13¾	52½
Maximum speed on 1 in 100 descent			–	43½	–	53½
Sutton Coldfield	9¾	15	21	18½-17½ (falling)	16	26½-22 (falling)
Erdington			Trial not continued beyond Sutton Coldfield		20¼	48
Gravelly Hill					21¾	15 m.p.h. temporary speed restriction
Aston	14¾	25			25¾	29
Birmingham (New St.)	17½	33			31¼	0

VIII. Condition of Engine No. 45274

61. In support of Driver Martin's statement that the engine was riding roughly, reports from a Gloucester driver to the same effect on 19th and 20th December 1954 led to a special examination by the Mechanical Foreman at Bristol Motive Power Depot who found nothing wrong except that there was about "45 thousandths knock in the trailing axle box horns". Five further reports of rough riding or bad knocking were received in January 1955, including one on the 16th which stated "trailing axle box knocking very badly —engine not fit for main line"; the latest of these reports was from the Sheffield driver who worked the engine northward on 22nd January, but the fitter at Sheffield Motive Power Depot, who again made a special examination, stated that he had found nothing wrong. The Sheffield driver, who was relieved at Derby by Driver Martin on the day of the accident, reported that the engine was knocking in the horns and consequently riding roughly, but not unduly so in his opinion.

62. The engine had run 24,928 miles since the last classified ("Heavy Intermediate") repair in August 1954. It had been specially proposed for this repair by the Saltley Depot on account of an extending crack in the frame, and the fact that it was riding roughly, with a knock in the horns of .090 ins. At this repair the frame crack was welded, and all six coupled axle boxes were remetalled on the "horn" faces and refitted to the horns; they were also furnished with new bearing brasses. New tyres were fitted throughout, also new cylinders, and other necessary work was done to bring the engine to virtually new condition.

63. With the assistance of the Regional mechanical engineers, I examined the engine at Crewe Works after it had been unwheeled and the running gear dismantled. The white metal surfaces of the axle boxes and the corresponding mild steel horn faces were in good condition and had evidently been well lubricated, although the horn surfaces appeared to have been rather roughly ground; the rubbing surfaces of the main journals and the brasses were also in good condition with no signs of heating. There was, however, considerable longitudinal play between the axles and the horns, as will be seen from the following table, which also gives the standard "new" clearances.

The table also gives the actual clearances between the axle boxes and the horns of two other engines of the 5 M.T. Class. One was No. 45052, on which I noticed a heavy axle box knock during the trial run on 31st January; as has been stated, it had run 22,558 miles since the axle boxes had last been refitted, about six months before the accident. The other was No.45345 which was representative of an engine in run down condition and due for "shopping". This engine had run 77,263 miles since the last classified repair, but there was no record that it had ever been reported for rough riding.

Coupled Axles

Longitudinal Play	Engine No.	R.H. Side			L.H. Side			Remarks
		Ldg. ins.	Int. ins.	Trl. ins.	Ldg. ins.	Int. ins.	Trl. ins.	
Journal in Box A	"New"	.0156	.0156	.0156	.0156	.0156	.0156	
	45274	.016	.036	.021	.018	.027	.025	Max. 1/32" approx.
	45052	–	–	–	–	–	–	Not measured
	45345	–	–	–	–	–	–	Not measured
Box in Horns B	"New"	.006	.006	.006	.006	.006	.006	
	45274	.015	.040	.030	.040	.045	.025	Max. 3/64" approx. (a)
	45052	.031	.030	.067	.012	.062	.051	Max. 1/16" approx. (a)
	45345	.028	.080	.030	.030	.073	.125	Max. ⅛"
Total A & B	"New"	.0216	.0216	.0216	.0216	.0216	.0216	
	45274	.031	.076	.051	.058	.072	.050	Max. 5/64" approx.
	45052	–	–	–	–	–	–	
	45345	–	–	–	–	–	–	

I was informed that the figures for longitudinal play of the order of (a) in the table were typical of engines with white metalled axle boxes which had run about 25,000 miles since refitting. Manganese steel liners are now welded to the axle boxes when engines come into the shops for general repairs and at the same time manganese steel faces are welded in to the horns; this modification has considerably reduced the rate of wear.

64. In other respects the running gear of the engine and tender were in good condition apart from damage caused by the accident. The weight distribution was satisfactory, though the right hand bogie wheels were rather lightly loaded with corresponding excess weight on the left hand side; there is little doubt that this was due to the weakness of the right hand bearing spring which had been noticeably strained by the derailment. With this exception, all the laminated bearing springs and the bogie side control coil springs showed no important variation from the designed rate of deflection in relation to load. All the tyre profiles were very good.

65. There were no boiler or steam pipe defects which might have resulted in a blow back of steam and flame through the fire hole door and the blower fittings were in good order and properly aligned; nor were there any signs of paint scorching or soot on the footplate which are often noticed after a blow back has occurred. Both the water gauge glasses were intact and, except for damage obviously caused by the accident, there were no signs of any defect on the footplate or elsewhere which might have distracted Driver Allen's attention. Both the injectors worked properly when tested and the boiler clack valves were free in their guides with no evidence of foreign matter which might have held them off their seats to cause a failure of the boiler feed.

66. No defect was found in the brake equipment of the engine and tender after a thorough examination, nor in any of the vacuum cylinders of the coaches. As has been mentioned, Driver Martin stated in his evidence that the brakes were working satisfactorily during the time he was in charge of the engine.

IX. Conclusions

67. The track was well maintained for a line of this character and there were no defects in the engine or rolling stock which might have caused or contributed to the derailment, which was due solely to the complete disregard of the 30 m.p.h. speed restriction through Sutton Coldfield station. I am of the opinion that the derailment would have occurred even if the curve had been regular, without the sharp knuckle of 8¼ chains radius just outside the tunnel, as it is most unlikely that the train could have negotiated a 15 chain curve in safety at the speed at which it was running.

68. From Mr. Reason's photograph and Signalman Gilbert's statement (para. 35 above) it can be assumed that the engine of the 12.15 p.m. express from York to Bristol which was derailed was still under steam at least as far as the Four Oaks signal box, and it is clear from the evidence of the surviving trainmen that there was no effective braking before the derailment. It will also be noted that Driver Allen had if anything improved on the time of 16 minutes between Lichfield (T.V.) and Sutton Coldfield achieved in the test run on the 24th May, and it is therefore reasonable to assume that he passed the summit between Blake Street and Four Oaks at not less than the 36½ m.p.h. recorded in this test. The test train also reached a speed of 52½ m.p.h. through Four Oaks after steam had been shut off at the entrance to the station, and I think it is probable that Driver Allen's speed at this point was at least as high.

In the trial run on 31st January the recorded average rate of acceleration while the train was coasting freely down the 1 in 100 gradient before the brake was applied by Driver Redmill was .12 m.p.h. per second and on this basis Driver Allen's train would have accelerated to a speed of at least 61 m.p.h. at the foot of the gradient at the entrance to the tunnel. The effect of the rising gradient through the tunnel would have reduced the speed by approximately 4 m.p.h. and I therefore conclude that the speed of the express at the moment of the derailment was at least 57 m.p.h., a figure which is entirely consistent with the nature and extent of the wreckage, as has already been stated.

69. Calculations by the Chief Civil Engineer based on well recognised formulae show that the theoretical overturning speed of Engine No. 45274 on a curve of 8¼ chains radius, assuming no cant, is 63 m.p.h, also that the theoretical speed at which the leading coupled wheels would begin to mount the rail is 47 m.p.h., leaving out of consideration the effect of weight transference from one side to the other by lurching. Corresponding figures for a curve of 15 chains radius are 84 m.p.h. and 55 m.p.h. respectively.

Thus the speed of the engine was not far from the overturning speed on the sharp knuckle of 8¼ chains radius at the beginning of the curve, and it was higher than the theoretical speed of derailment by flange mounting. There was, however, no sign at this point that a heavily loaded wheel had crossed the outer rail, nor was there any outward shift of the rail on the sleepers. It is probable, therefore, that the right hand wheels were held to the rail, and the rail pressed firmly on the sleepers by the very considerable transfer of weight to the right hand side which had been caused by the heavy lurch to the right as the engine was almost overturned. With a violent recovery of the springs as the curve became easier through the crossover lead much of the weight would have been taken from the right hand bogie and coupled wheels. There was then nothing to prevent the tangential derailment of the engine to the right under the excessive flange pressure required to guide it round the curve at the speed at which it was running. I think the initial derailment of the engine was probably brought about in this way, and that it occurred on the first rail length beyond the trailing crossover, as has been stated; its precise course, however, is not very material in the circumstances.

70. The excess of speed was too great to be accounted for by misjudgment, and I can only conclude that Driver Allen made no attempt to observe the 30 m.p.h. restriction through Sutton Coldfield; there is also no doubt that the speed of the train through the section from Four Oaks was much higher than the 40 m.p.h. laid down. It is indeed difficult to explain this extraordinary lapse on the part of a driver with such a long record of trustworthy service and who had an intimate knowledge of all the characteristics of the route. In view of his ordinary good health, his temporary incapacitation by sudden illness seems unlikely, and a careful examination of the engine disclosed no defect which might have distracted his attention. Nor was there any evidence that a blow back had occurred through the fire hole door, and moreover the blower was found to have been opened to a sufficient extent to prevent a blow back when the regulator was closed. It is possible,

however, for an injector in good order to fail temporarily through overheating, and nothing can be more distracting to a driver than apprehension of low water level in the boiler; if, however, an injector had failed in this way on the rising gradient through Blake Street, the first reaction of an experienced engineman would have been to shut off steam at the summit, and it is known that this was not done.

71. It seems from the statements of Driver Martin and Driver Chapman that Driver Allen was a man who liked to work an engine smartly, and he had succeeded in recovering four minutes of time on the 10½ mile run between Burton and Lichfield (T.V.) which required an average speed of 37 m.p.h. start to stop on generally rising gradients, with a midway speed restriction of 15 m.p.h. at Wichnor Junction; it should be noted, however, that the train was still 10 minutes late when it started again from Lichfield (T.V.). This was the first express which Allen had driven over the route for six months, and it may be that in his anxiety to regain further time on the journey to Birmingham, or even to keep to the very sharp 15 minute booking between Lichfield (T.V.) and Sutton Coldfield, the speed restrictions which required no special action with stopping trains passed completely out of his mind. Though there can be no certainty in the matter I think this is a possible explanation of what occurred.

72. Driver Martin failed to comply with the very practical requirements of Rule 127. I have no doubt that there was a fairly heavy knock in Engine No. 45274 when it was working hard, judging from my own experience with a similar engine with play in the axle boxes of the same order, but this condition was not exceptional having regard to the mileage run. In my opinion no driver who was physically fit to take the rough with the smooth in all the vicissitudes of main line work, as Driver Martin appeared to have been from his medical history, should have found the vibration unbearable or even disconcerting; it was clear from his evidence that he was thinking only of his own personal comfort, and I do not accept the excuse which he put forward for leaving his post of duty. Driver Martin is 63 years of age with 44 years of railway service and has been a driver for 21 years. His record hitherto has been fairly good.

73. Guard Harrison realised that the train was running too fast between Four Oaks and Sutton Coldfield, and he took some action; subsequent tests, however, showed that the time of about three seconds for which he kept his brake valve open was not long enough to make any noticeable reduction of vacuum at the front of the train, and the braking effect was negligible. He could have prevented the accident or at least lessened its consequences if he had made a full brake application, and it is much to be regretted that he did not have the courage of his first convictions. I think he was honest in saying that he was anxious not to take the control of the train out of the hands of the driver, but no such consideration should have affected him in view of the short time and distance available in which to reduce the speed. Guard Harrison has an excellent service record.

74. The initiative of Train Ticket Collector Attenborough and Fireman Smith in making their way so promptly to the signal box to stop approaching traffic deserves the highest praise. As has been mentioned, the latter was travelling at the front of the train and was injured and severely shocked.

X. Remarks and Recommendations

75. There is at least a strong possibility that the accident would have been prevented by lineside speed restriction notices or signs, acting either as a direct reminder to Driver Allen on the afternoon in question, or indirectly by impressing the location and severity of the restrictions firmly in his mind as he passed the signs regularly during his working of stopping passenger trains over the route.

76. Speed restriction signs have not been a general feature of British practice in the past, though some of the former Companies, notably the Great Western, provided illuminated notices of various types at places where it was considered that a speed restriction required special emphasis or where there were no distinctive physical landmarks by which a driver could locate himself accurately. The London and North Eastern Company, on the other hand, decided to mark all permanent speed restrictions by simple "cut out" numerals on iron posts by the side of the line, but they were not illuminated at night. Before this decision was reached there was some divergence of opinion on the usefulness of these signs, but experience has shown that they are of value to men learning the road.

No change was made on nationalisation, but the whole question was considered by the Railway Executive in 1949, when it was recommended "that indication signs be provided on the lineside at the commencement of restriction at places (1) where there are no landmarks to identify positions and (2) where there has been experience of persistent excessive speeds"; it was held that the illumination of such signs would improve them but that this was not essential. After consideration of this recommendation it was decided that no action should be taken at that time in view of the prevalent restriction on capital expenditure, but a few illuminated signs have since been provided to meet special circumstances.

77. This then is the position today, and the observance of permanent speed restrictions in this country has depended in the main on a thorough and intimate knowledge of routes by drivers, as confirmed by their signatures on the route cards, and of the printed instructions such as the Appendices to the Working Timetables which lay down the restrictions to be observed. British railway managements have always been strict in requiring drivers to have a thorough knowledge of all the routes on which they are required to work, and no obstacle is placed in the way of men who may request "refresher runs" over any of the routes. On the whole this system has worked well in practice, as this was the first case for 24 years of a serious derailment caused by disregard of a permanent speed restriction on plain track. The last occasion was at Canal Junction, Carlisle, in 1931, and the only other serious accidents of this type during the present century were at Aylesbury in 1904, Salisbury in 1906 and Shrewsbury in 1907; I exclude derailments caused by excessive speed at

diverging junctions or at facing crossovers between parallel lines which are in a different category as they are due in the main to disregard or misinterpretation of the fixed signals.

78. British Railways, however, are now entering an age of more precise working, with diesel and electric locomotives fitted with speedometers, as also are all new passenger and mixed traffic steam locomotives. It should therefore be possible in the future to regulate speeds more closely to permissible limits, and there is little doubt that as a result the civil engineers will be pressed to raise their restrictions as much as possible. Higher maximum and average speeds are also envisaged. Furthermore, the training of the driver in the future will probably be different from what it was in the old steam days, with fewer years of running experience, and engine runs may be longer with a greater strain on memory to recollect all the features of a route. Nor should it be overlooked that, with the more intensive use of engines, drivers are now required to have a knowledge of more routes than in the past. All these factors make it necessary to consider whether the past general practice of relying on memory for the observance of speed restrictions should not be changed, and a uniform procedure adopted for defining clearly the position and degree of speed restrictions by line-side signs. I recommend that this question should again receive the attention of the British Transport Commission, and at the same time I would observe that the practice of the former London and North Eastern Railway of using unlit signs at the beginning and end of restrictions has much to commend it.

79. It might also be desirable to consider whether speed recorders would not be preferable to speedometers. The former not only indicate the speed to the driver at any instant, but also provide a permanent record of the speed of the train throughout its journey. Records of this type have proved to be valuable in maintaining a high standard of performance in other countries, and with the contemplated introduction of higher speeds on British Railways it might be prudent to provide the more elaborate equipment.

80. The evidence of Driver Redmill, and the test of 24th May, showed that the overall timing of 33 minutes start to stop for the 17½ miles between Lichfield (T.V.) and Birmingham (31.8 m.p.h.) was a practical one, and this was also confirmed by some guards' journals from other diverted express trains. The same, however, cannot be said of the "start to pass" timing of 15 minutes for the 9¾ miles between Lichfield (T.V.) and Sutton Coldfield (39 m.p.h.) and, as I have mentioned, it may have had some bearing on Driver Allen's disastrous mistake. I understand that this timing for diverted expresses has been in existence for some years and was originally fixed for the purpose of traffic regulation and the reporting of train running, but it is certainly unrealistic and it will be modified or omitted altogether as an intermediate timing on the Lichfield (T.V.)—Birmingham run. It would also seem desirable to consider whether there are any such unrealistic timings in existence elsewhere on the system which might act as a temptation to the disregard of permanent speed restrictions.

81. The long standing speed restriction of 30 m.p.h. through Sutton Coldfield station conforms with the restriction laid down in the British Railways' standard tables for a curve of 15 chains radius and, of course, provides a considerable safety margin for excess. The corresponding speed restriction for a curve of 8¼ chains radius is 22 m.p.h. (20 m.p.h. in practice), but the irregularity of the curve cannot be considered to have been responsible for the derailment as it is very doubtful whether the train could have negotiated a regular curve of 15 chains radius in safety at 55—60 m.p.h. Nevertheless the variation in the curve radius, which was probably introduced when the crossover was put in many years ago, was an undesirable feature from all points of view, and was inconsistent with a restriction of 30 m.p.h., as indeed seems to have been appreciated by some drivers. Both the running lines are therefore being re-aligned through the trailing crossover so as to restore the smooth curves of 15 chains radius as they were originally designed.

I have the honour to be,

Sir,

Your obedient Servant,

G. R. S. WILSON,
Lieutenant Colonel.

The Secretary,

Ministry of Transport and Civil Aviation.

jp.
B.R.(L.M.R.)

EXTRACT FROM RULE 127

127. The Driver MUST—

- -

(iii) If not thoroughly acquainted with any portion of the line over which he is to work obtain the services of a competent Conductor.

NOTES—When the Conductor is familiar with the type of engine employed, he must work the engine.

When the Conductor is not familiar with the type of engine employed, he will give to the train driver the necessary instructions in regard to the signals, curves, gradients, speed restrictions, etc. applicable to the line over which they are working and leave the actual driving entirely in the hands of the train driver.

The Conductor will be responsible for the due observance of signals, speed restrictions, etc., and safe working of the train.

In every case the train driver must study the signals, speed restrictions, etc., for that part of the line over which he is being conducted.

The Conductor will be responsible in cases where it is necessary for the fireman to carry out the provisions of Rule 55, for seeing that this is done.

- -

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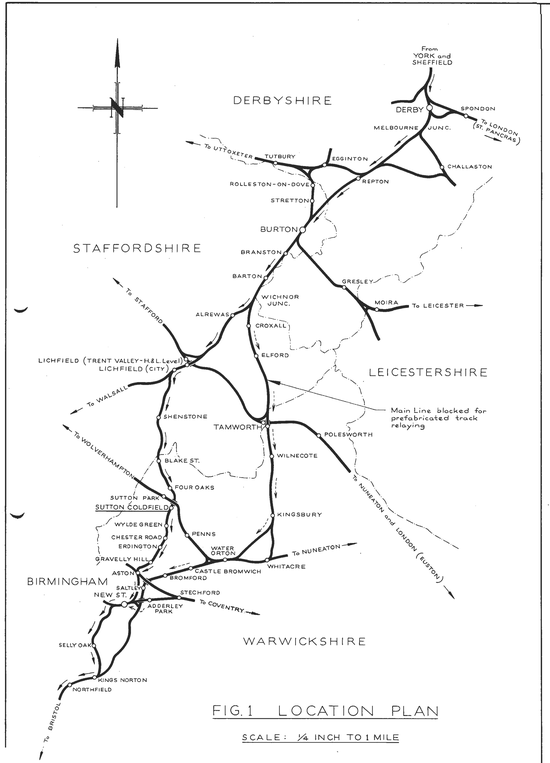


FIG. 1 LOCATION PLAN

SCALE: ¼ INCH TO 1 MILE

Normal Main Line route --- ---
Route of 1215 p.m. Express passenger train from York to Bristol as diverted on Sun., 28th. Jan., 1955 —— ——

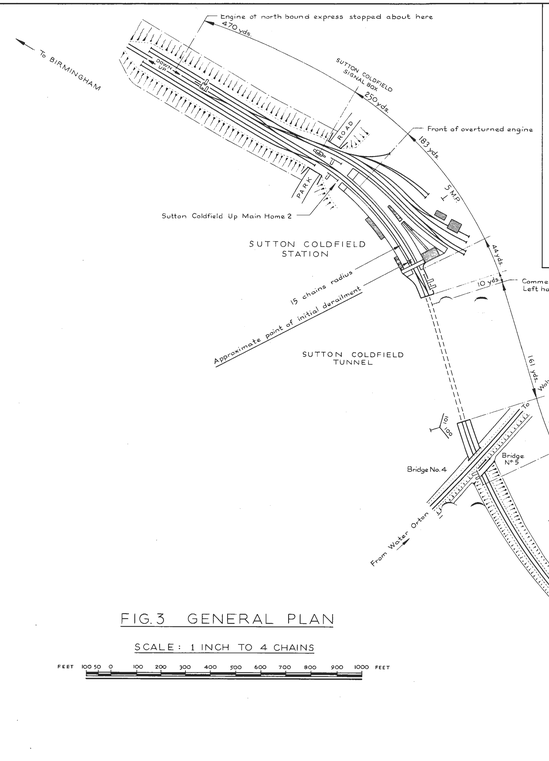


FIG. 3 GENERAL PLAN

SCALE: 1 INCH TO 4 CHAINS

FEET 100 50 0 100 200 300 400 500 600 700 800 900 1000 FEET

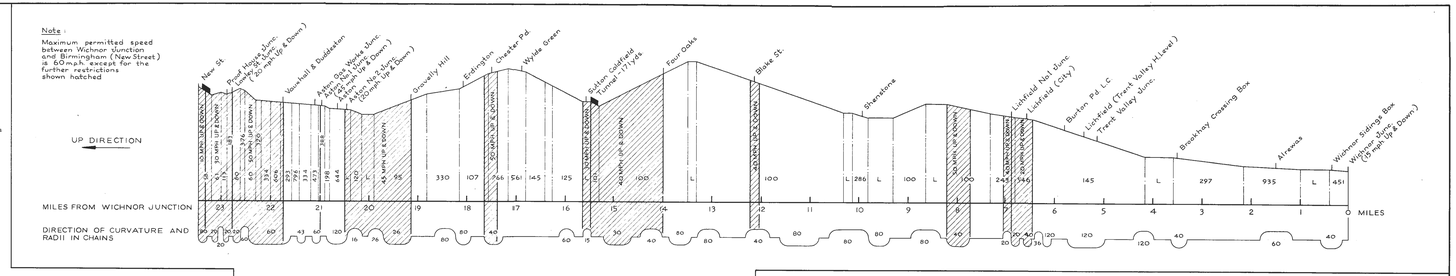


FIG. 2 GRADIENT AND CURVATURE DIAGRAM

SCALE: ¾ INCH TO 1 MILE

LONDON MIDLAND REGION

DERAILMENT AT SUTTON COLDFIELD

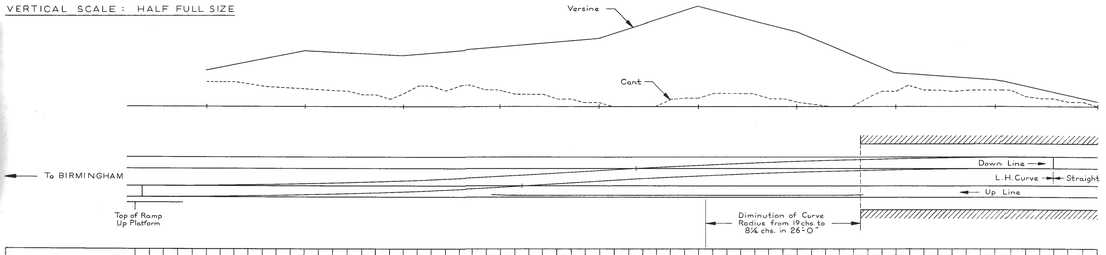
ON

23rd. JANUARY, 1955

309-263-10155. (M.F.P.)

J.W.W.

VERTICAL SCALE : HALF FULL SIZE



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GAUGE (ins.)	+ ⅛	− ⅛	− ⅛	− ⅛	− ⅛	− ⅛	− ⅛	− ¼	− ¼	+ ⅛	+ ⅛	+ ⅛

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