RAILWAY ACCIDENTS

REPORT ON THE DERAILMENT which occurred on the 10th November, 1946, at MARSHMOOR on the London and North Eastern Railway

LONDON: HIS MAJESTY'S STATIONERY OFFICE 1947
MINISTRY OF TRANSPORT,
Berkeley Square House,

24th January, 1947.

SIR,

I have the honour to report for the information of the Minister of Transport, in accordance with the Order dated 12th November 1946, the result of my Inquiry into the derailment which occurred at about 10.35 p.m. on Sunday, 10th November 1946, near Marshmoor signal box, between Hatfield and Brookmans Park, on the four-track main line of the London and North Eastern Railway. I was assisted by Brigadier C. A. Langley.

The 4.45 p.m. express passenger train, No. 177, from Newcastle to King’s Cross, comprising 12 bogie vehicles hauled by a 2-6-2 type tender engine of the V.2 class, was travelling at about 55 m.p.h. on the Up Main line, when it became completely derailed, except for the leading pony wheels of the engine, as it entered an easy right handed curve, approximately 400 yards south of Marshmoor signal box. There were screw couplings in front and rear of the leading coach; otherwise the train was Buckeye coupled throughout.

The train ran for approximately 205 yards beyond the first mark of derailment, and all the couplings held. The engine and the 12 coaches remained in fair line and, except for the fourth which was overturned on its right hand (corridor) side and the fifth which was partially overturned, came to rest upright or nearly so; apart from broken window lights and other superficial damage, the coach bodies were intact, though there was a good deal of damage to bogies and undergear. Except for the brake rigging, the engine was practically undamaged. The train was lightly loaded and fortunately there were no serious casualties: 7 passengers complained of minor injuries and shock, but none required hospital attention. Local ambulances and first aid trained members of the Company’s staff from Hatfield arrived promptly in response to an immediate call from the Marshmoor signalman.

The track of the Up Main line was destroyed for a length of 260 yards, and that of the Down Main for 100 yards; the Up and Down Slow lines on the outside of the formation were fouled by the derailed coaches, but were very little damaged. The engine and the coaches were rerailed or moved clear of all lines by 11.55 a.m. on the following day, 11th November. The Down Slow line was opened to traffic by 10.50 a.m. and the Up Slow by 1.30 p.m.; normal working was resumed under speed restriction with the restoration of the Up and Down Main lines by 6.0 p.m., after an interval of 19½ hours.

The weather on the night of the derailment was fine, and it had been fairly dry during the preceding week.

SITE AND TRACK.

1. The Up direction is from North to South and the order of the four tracks from East to West is Up Slow, Up Main, Down Main, and Down Slow. With reference to Fig. 1 of the attached plan, the site of the derailment was approximately 400 yards south of Marshmoor signal box, just beyond a brick arch overbridge. Marshmoor box is 2 miles south of Hatfield and 15¾ miles from King’s Cross. In the Up direction the gradient is generally falling for approximately 5 miles from Woolner Green to the valley of the River Lea just north of Hatfield; thence it rises, mainly at 1 in 200 with local variations, for the next 6 miles past Marshmoor to the summit at Potters Bar. At present there is an overall speed restriction of 60 m.p.h. south of Hatfield pending the restoration of the track generally on this section to pre-war standard.

2. The initial derailment was to the inside of a long right handed curve of 93 chains radius, approximately 130 yards beyond its commencing tangent point, and 40 yards beyond the end of the transition. The Up Main line from 1,072 yards in rear of the point of derailment had been resleepered and rechaired in July 1946, four months before the accident, retaining the 100 lbs. R.B.S. rails which were very little worn (average 96 lbs.). Continuing southward, a further 2 miles 1,160 yards had been completely relaid with 110 lbs. flat bottomed track, which, however, played no part in the derailment.

On the chained section, where the derailment occurred, there were 25 sleepers per 60 ft. rail length, at standard spacing with short two-hole fish plates; the sleepers on either side of the joints were 8 ft. 6 ins. by 12 ins. by 6 ins. and the remainder 8 ft. 6 ins. by 10 ins. by 5 ins. All the sleepers had been chained in the depot, with three coach screws per chair; the keys were of hard wood. The curve was aligned to pegs which had been put in by a fresh survey in April 1946, with a transition length of 90 yards, in which the cant is run up from zero at the tangent point to the designed figure of 2 ins. for the circular curve. This, according to the Company’s standard tables, corresponds to a speed of approximately 85 m.p.h. on a curve of 93 chains radius.

3. At the site of the derailment the tracks are practically level with the land on either side, though a shallow cutting (3-4 ft.) commences about 50 yards beyond. The underlying formation is blue clay, on which layers of slag dust, gravel, etc., have been laid from time to time owing to continual and long standing trouble with drainage. The ballast was a mixture of flint and slag extending to a depth of 3-4 ins. below the sleepers. It was somewhat dirty, and had been cleared from the ends of a few sleepers to drain the water out; otherwise the sleepers were well boxed in at the centres and at their ends.
shown by Fig. 1, ridges of clay were working to the surface in the 6 ft. space between the Up and Down Main, and in the 10 ft. space between the Up Main and the Up Slow, and the original concrete curve monuments had become displaced. The old 9 in. pipe drain between the Down Main and the Down Slow was blocked by clay and some of the pipes had been pushed up almost to the surface; there was also practically no flow in the drain between the Up Main and the Up Slow. Both these drains lead, with ample fall, to a large culvert about 80 yards north of the bridge. Owing to the constant lifting of the track on either side of the bridge, there is a slight dip in the line under it; local gradients are 1 in 440 falling north of the bridge and 1 in 264 rising south of it.

5. Comprehensive drainage works were being undertaken at the site on the day of the accident (Sunday), and on the three previous Sundays. The formation was being excavated by a mechanical shovel from under the Down Main line south of the bridge, and a blanket of sand and ashes was being laid on the clay to a depth of about 2 ft. 7 ins. below rail level (see Fig. 1, and the cross section Fig. 4); at the same time the drain between the Down Main and the Down Slow was being reconstructed with 9 in. earthenware pipes surrounded by brick rubble. It was necessary to dismantle a 60-80 yard length of the Down Main line for each Sunday’s work, after which the track was relaid on the ashes, and was subject to a speed restriction of 20 m.p.h., pending final settlement and permanent ballasting; there was, however, no restriction on the Up Main apart from the general 60 m.p.h. limit. It had been arranged for similar attention to be given to the corresponding length of the Up Main after the work on the Down Main had been completed.

6. The gauge and superelevation of the Up Main were measured after the derailment before any work had been done to the track, and the depression of each rail under a slowly moving engine was recorded by void-meters. For 280 yards in front of the bridge on the straight plain track and through a trailing slip connection, the gauge varied from correct to \( \frac{1}{2} \) in. slack, and there was no material variation in the cross level (zero cant). From the tangent point onward the increase of cant was progressive through the transition for approximately 50 yards, but thereafter there were marked irregularities which continued almost to the point of the derailment, the first clear indication of which was a mark on a chair key of the low rail. So far as could be seen by eye, the variations in cant were mainly on the high rail.

Fig. 2 shows the actual cant measurements to an exaggerated vertical scale as taken at 45 ft. intervals compared to the designed cant through the transition and on the circular curve (2 in.) as shown by the dotted line; the drop from 2\( \frac{3}{4} \) ins. to 1\( \frac{1}{4} \) ins. in 45 ft., followed by a rise to 2\( \frac{1}{2} \) ins. in the next 45 ft. will be noted. The void-meter readings showed a maximum depression of \( \frac{1}{4} \) in. At my own preliminary examination with the Company’s Engineers on the morning after the derailment I measured the cant at rail joints and middles; I noted a drop of 1\( \frac{1}{4} \) ins. in 30 ft., but this was not inconsistent with the Company’s subsequent measurements taken at a different interval.

7. The first positive sign of derailment was a deep flange mark on a chair key of the right hand or low rail, followed 3 sleepers further on by broken chairs under both rails. No flange marks on the rails could be traced, but some 21 yards in front of the first marked key there was a continuous streak of black grease 4 yards long on the running edge of the high rail. There was also sinusoidal distortion of the track without appreciable widening of the gauge, which commenced approximately 54 yards in rear of the grease mark on the high rail and 75 yards in rear of the first marked key on the low rail. The extent and direction of this distortion is shown by Fig. 3; it was similar in character but not so pronounced as the track distortion which was a feature of the derailment at Hatfield on 15th July 1946, on which I reported on 8th November 1946.

From the first broken chairs onwards there were marks on the chairs which were evidently caused by wheels running derailed to the right within a few inches of the track alignment. These marks continued up to the joints with the flat bottomed track which were burst asunder as their fishbolts were broken by the derailed wheels; thereafter the track was practically destroyed for 260 yards until the train came to rest. Fortunately, the pony wheels, which were not derailed, held the engine to within a foot or so of the track alignment; this, and the restraining effect of the Buckeye couplings, kept the train more or less in line and undoubtedly prevented more serious results. The adjacent Down Main line was destroyed for a distance of 100 yards.

8. The following is a summary of the relevant distances with reference to the first marked key:—

<table>
<thead>
<tr>
<th>Distance</th>
<th>Mileage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marshmoor signal box</td>
<td>0.695 North</td>
</tr>
<tr>
<td>Commencing tangent point of curve</td>
<td>0.130</td>
</tr>
<tr>
<td>Overbridge</td>
<td>0.109</td>
</tr>
<tr>
<td>Commencement of track distortion (about)</td>
<td>0.075</td>
</tr>
<tr>
<td>Low point in high rail (1( \frac{1}{4} ) in. cant)</td>
<td>0.056</td>
</tr>
<tr>
<td>End of transition</td>
<td>0.049</td>
</tr>
<tr>
<td>Commencement of grease mark on running edge of high rail</td>
<td>0.021</td>
</tr>
<tr>
<td>First marked key on low rail</td>
<td>0.0297</td>
</tr>
<tr>
<td>Commencement of track destruction</td>
<td>0.033 South</td>
</tr>
<tr>
<td>Front of engine after derailment</td>
<td>1.297</td>
</tr>
</tbody>
</table>
9. The engine was No. 905 of the V.2 class, stabled at King's Cross shed. It was similar in all material respects to the engine involved in the derailment at Hatfield on 15th July 1946, which I have mentioned, and a full description was given in my report on that case. It is a fast and powerful 3-cylinder mixed traffic type with 2-6-2 wheel arrangement, weighing 145 tons in working order with tender; the maximum axle load is 22 tons. The side control of the leading pony truck, on which there are 11 tons, is by swing links, and the rear carrying axle is of radial type with lubricated bronze Cartazzi slides. Engine No. 905 was built at Darlington in 1940, and up to the time of the derailment had run 390,864 miles since new and 49,625 miles since the last general repair in December 1945. It is usual for these engines to run about 70,000 miles between general repairs.

10. There was no evidence of any material defect in the engine prior to the accident, and except for the brake work and bruising of the treads and flanges of the derailed wheels, it was practically undamaged, though the main frames of the tender were strained. There were indications that some of the accumulation of dirt and grease had been rubbed from the face of the tyre of the left leading coupled wheel, which may have been responsible for the black grease mark on the running edge of the high rail, as the wheels were derailed to the right.

11. The engine was subsequently stripped and examined in Doncaster works. All the axles were found to be true and none of the axleboxes had been binding in the horns. There was appreciable wear in the bushes of the pony swing links, but as the links are always under load, the side control action was not thereby affected. With regard to tyres and flanges, maximum hollowness on the treads was 5/32 in. and the maximum wear at the roots of the flanges was 1 in. except for that of the right leading pony wheel where it was 9/32 in.; this was approaching but still within the permissible limit. The flange of the left hand pony wheel was much less worn.

12. The side play of the axles in the frame, total from one side to the other, was as follows:—

<table>
<thead>
<tr>
<th>Type</th>
<th>Designed</th>
<th>Actual</th>
<th>Increase due to wear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leading pony*</td>
<td></td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Leading coupled</td>
<td></td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td>Driving coupled</td>
<td></td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Trailing coupled</td>
<td></td>
<td>8</td>
<td>38</td>
</tr>
</tbody>
</table>

* In addition, the swing link controlled pony frame, and the radial Cartazzi axleboxes, have maximum displacements of 4 4/16ths in. and 2 1/4 in. respectively to each side of the centre line.

The side play of the tender leading, intermediate and trailing axlebox brasses had been increased by wear from the standard of 8/64 in. to 32/64 in., 60/64 in., and 30/64 in. respectively.

13. The bearing springs were found to be in good condition except that one of the four coil springs of the pony axle was found to have been broken for some time; it had, however, still been carrying its load. The engine and tenders were weighed before stripping and the distribution was found to be reasonably satisfactory; there was approximately 1 ton less than standard on the pony truck, and 1 ton more than standard on the leading coupled axle.

14. Except for the one broken bearing spring of the pony axle the engine appeared to be in normal condition generally having regard to the mileage run since the last general repair, and the increase in side play of the engine axles was not excessive, though the additional uncontrolled movement (about 1 in.) of the Cartazzi axle will be noted. The considerable increase in side play of the tender axles was not regarded as abnormal.

15. The 12 bogie vehicles all had heavy steel underframes carrying bodies of hard wood. Their weight was 392 tons (average 32.7 tons), and with the 145 ton engine the total weight of the train was 537 tons; its total length was 274 yards. The vacuum brake was in operation on the coupled and tender wheels, and on all wheels of the coaches. There was considerable damage to bogies and undergear throughout and both the bogies became detached from the fourth coach, No. 1485, and its underframe was twisted as it was overturned to the right; one bogie also became detached from the fifth coach which was partially overturned. As has been stated, damage to bodywork generally was superficial and was mainly confined to broken window lights.

**Evidence**

16. Driver E. J. Hills and Fireman C. E. Brooks, both of King's Cross Shed, had worked the train from Grantham where Engine No. 905 was attached. After leaving Grantham 12 minutes late, further time was lost by signal checks and Huntingdon was passed 24 minutes late. Thereafter the train had a clear run, and 2 minutes had been regained on passing Hatfield. According to the guard's journal, which was confirmed by the signal box timings, the average speed over the 414 miles from Huntingdon to Hatfield was 59.3 m.p.h., and 58.5 m.p.h. for the 144 miles from Hitchin to Hatfield, the first 7 of which are uphill and the remainder downhill, mainly at 1 in 200 in each case.
17. Driver Hills stated that the engine was in good general condition and no difficulty was experienced, apart from the signal checks, in keeping or even regaining time with the moderate load. He approached Hatfield descending the gradient with the engine running freely at 10 per cent. cut off and the regulator barely open. Up to that point the journey had been uneventful, but at Hatfield No. 2 box he experienced severe rolling and shut off steam; he was about to apply the brake but the engine steadied down, so he coasted for about 1 mile and then opened the regulator again to the first valve in order to negotiate the rising gradient (1 in 200) to Potters Bar. He estimated that he was travelling at about 50 m.p.h. or perhaps a little more through the overbridge at Marshmoor when the engine gave a sudden heavy lurch to the right and was derailed almost at once. Hills applied the brake fully and reversed the engine and directly it came to a stand as already described, Fireman Brooks went forward to protect the opposing lines. Hills' description of his experience was generally confirmed by Brooks, and the guard could give no useful information.

18. Signalman F. A. Temple of Marshmoor box was of the opinion that the train was travelling faster than any others on the Up line since he had come on duty at 6.00 p.m., and mentioned 70 m.p.h. I have no reason, however, to disbelieve Driver Hills' description of his working of the engine, and taking into consideration the booked times and the effect of the check at Hatfield, also the rising gradient for 2 miles thereafter, I think it is unlikely that the speed of the train was in excess of the 60 m.p.h. limit on this section. I conclude that it was probably in the neighbourhood of 55 m.p.h. at the moment of derailment.

19. According to Hills, it had been well known for a good many years that rough riding was to be expected on both Main lines at the site of the derailment, particularly after wet weather, and this was confirmed by other express train drivers. Reports of lurches at this point had been received by the Engineering staff from time to time through various channels, and on each occasion the track was examined at once and if necessary its line and level were corrected; sometimes the Marshmoor distant signal had been kept at caution pending examination of the track following a driver's report. The last occasion on which this was done was on 30th August, when the driver of an Up milk train had stopped specially at Potters Bar to report a violent lurch just south of Marshmoor bridge. It was stated, however, that no reports from drivers had been received during the two months preceding the derailment.

20. With regard to the condition of the track at Marshmoor during the hours preceding the derailment, written statements were furnished by the drivers of five Up express trains which passed the site on the Up main; the relevant extracts are given below:

<table>
<thead>
<tr>
<th>Train No.</th>
<th>Engine Type</th>
<th>Passed Marshmoor at</th>
<th>Probable speed m.p.h.</th>
<th>Driver stated</th>
</tr>
</thead>
<tbody>
<tr>
<td>165</td>
<td>A. 1 4-6-2</td>
<td>7.45 p.m.</td>
<td>55-60</td>
<td>&quot;I felt a violent lurch.&quot;</td>
</tr>
<tr>
<td>167</td>
<td>V. 2 2-6-2</td>
<td>8.2 p.m.</td>
<td>45-50</td>
<td>&quot;We felt nothing serious.&quot;</td>
</tr>
<tr>
<td>169</td>
<td>V. 2 2-6-2</td>
<td>8.55 p.m.</td>
<td>50-55</td>
<td>&quot;We got a lurch and a roll.&quot;</td>
</tr>
<tr>
<td>993</td>
<td>A. 4 4-6-2</td>
<td>9.21 p.m.</td>
<td>45-50</td>
<td>&quot;We got a bit of a kick which was not too serious.&quot;</td>
</tr>
<tr>
<td>975</td>
<td>V. 2 2-6-2</td>
<td>10.20 p.m. (Engine short of steam)</td>
<td>40</td>
<td>&quot;I felt three successive lurches in the first too yards from the bridge, not travelling at more than 40 m.p.h.&quot;</td>
</tr>
<tr>
<td>177</td>
<td>V. 2 2-6-2</td>
<td>10.33 p.m.</td>
<td>55</td>
<td>Train derailed.</td>
</tr>
</tbody>
</table>

The drivers of trains Nos. 993 and 975 confirmed their statements at my Inquiry; a report was also received from a passenger in train No. 993, referring to an unusually violent lurch at about 10.20 p.m. on the Saturday, and to an unusually violent lurch at about 10.15 p.m. on Sunday, 10th November. The probable speed at which each of these five trains passed Marshmoor has been roughly estimated from the signal box timings for the 4½ miles from Welwyn North to Hatfield; its relation to the drivers' statements will be noted.

21. All members of the Engineering staff, including Mr. H. S. Davies, the District Engineer, Chief Permanent Way Inspector A. J. Mowl, Permanent Way Inspector R. A. Adams, and the length ganger, J. Marlborough, were unanimous that the track of the Up and Down Main lines south of the overbridge had been troublesome for a long time. Mr. Davies recalled that some of the clay had been removed from the Down Main about 18 years ago and a blanket of slag dust laid on the formation; new drains had been put in at the same time. Ganger Marlborough, in describing his experience of the length from 1934 onwards, referred to steps which were taken about 10 years ago to reinforce the Up Main line by the insertion of longitudinal timbers under the sleepers opposite to the platelayers' hut.

Marlborough added that the line and level of both the Main lines for 300-400 yards south of the bridge had required constant attention in recent years, and he always examined this section first when he came on duty in the morning; with this exception, his two-mile length presented no particular difficulties in maintenance. A few weeks before the accident he had driven 3 stakes against the ends of the sleepers on the outside of the curve in an attempt to keep the Up Main line in place, but this had had little effect. He had not been on duty on Sunday, 10th November, but at about 11.00 a.m. on the Saturday he had found the Up Main track a little out of line, and had adjusted it.
22. The unsatisfactory conditions at Marshmoor had thus been recognised for some time, but drainage works there and at other points in the clay formation in the London area had to be postponed owing to shortage of labour during the war. This, and the accumulated arrears of track renewals, were factors in the Company’s decision to retain their general war-time restriction of 60 m.p.h. south of Hatfield when it was raised in November 1945 to 70 m.p.h. on other sections of the Main line. During 1946, however, approximately 25 per cent. of the main line track mileage south of Hatfield has been renewed and, as has been mentioned, comprehensive drainage works were in progress at Marshmoor at the time of the derailment. Mr. Davies said that he had realised their necessity ever since he assumed charge of the district in 1941, and had taken them in hand at the first opportunity, directly men were available.

Attention was first given to the Down Main as it was considered to be in the worse condition. As shown by Fig. 1, work was started on Sunday, 20th October, proceeding northward on successive Sundays, and on 10th November a 60 yard length of the Down Main track was dismantled opposite to the point where the derailment occurred a few hours later. Possession was taken of both lines and as the formation was excavated down to the firm clay, the sand and ash layers were tipped from wagons standing on the Up Main. By 4.30 p.m. the track had been replaced on the ashes and roughly levelled, after which both lines were handed back to traffic with a 20 m.p.h. speed restriction on the Down Main; a gang was left on duty to watch for possible settlement of the Down Main during the night.

23. Before traffic was resumed Permanent Way Inspector Adams and Relaying Ganger G. R. B. Compton examined the Up Main line and found it necessary to make some slight adjustments to its alignment and cross level. Compton stated that he had had to pack about 18 sleepers under the high rail at the worst place where the clay was working up, and when this was done he was satisfied that the track was “safe for normal express running.” This was confirmed by Permanent Way Inspector Adams.

24. Arrangements had been made in the first instance for a continuous speed restriction on the Up Main during the course of the work on the Down Main and the restriction had been included in the relevant Traffic Notices; on 27th October, however, Mr. Davies and Mr. Mowl found the clay under the Up Main to be firmer and drier than they had expected, and the speed restriction was withdrawn on Tuesday, 29th October. When I visited the site on Sunday, 5th December, excavation of the Down Main was proceeding just north of the bridge. I found the clay surface to be of the consistency of stiff plasticine; it was damp and water was trickling through at one point from under the Up Main. There was also a good deal of water in a pit which had been dug to ascertain the depth of the bridge pier foundations between the Down Main and the Down Slow.

Mr. Davies and Mr. Mowl felt that they had been fully justified in withdrawing the speed restriction on the Up Main, as they considered that its stability had not been affected by the excavation of the Down Main. They suggested that if this had been so the low rail would have gone down under traffic; this had not been the case to any marked extent and the irregularity of cant which was found after the accident had been due to subsidence of the high rail which was comparatively remote from the excavation. They agreed, however, that with irregularity of this order the track would have been unsafe for traffic without a severe speed restriction.

**CONCLUSION**

25. Although I have no hesitation in accepting the statements of Permanent Way Inspector Adams and Ganger Compton that the Up Main track was left in a satisfactory condition as regards alignment and cross level when the day’s work was finished at 4.30 p.m., this condition was not maintained under traffic, and had so deteriorated by 7.45 p.m. that a violent lurch was experienced by the driver of train No. 165 at 55-60 m.p.h. The drivers of the three subsequent Up trains experienced a degree of lurching which appears to have been roughly commensurate with the speed, and when train No. 925 passed at 10.20 p.m. the state of the track was such that three successive lurches were felt at 40 m.p.h. By this time there was practically no margin of safety at any higher speed, and when train No. 177 passed at 10.35 p.m. the disturbance to the engine at 55 m.p.h. was sufficient to cause derailment.

The character and comparatively slight extent of the damage to the track for the first 33 yards up to the broken joints where complete destruction began, may, I consider, be accepted as proof that derailment to the right was initiated by the leading coupled wheels of the engine. There were, however, no flange marks on the surface of the low rail, suggesting that the weight on the right hand side must have been relieved by severe rolling, set up by the irregular cross level towards the end of the transition curve; with this relief of weight, derailment probably resulted as the leading coupled wheels were thrusting to the right under the violent side to side nosing action which accompanied the rolling and was responsible for the track distortion.

The irregularity in cross level was of far different order from the comparatively minor variations at Hatfield last July, and was clearly the primary cause of the derailment. Other features, however, bore a marked resemblance, namely, the preliminary track distortion and the fact that the leading pony wheels were not derailed, and they add some confirmation to the conclusion in the Hatfield case that engines of this class may be more than ordinarily sensitive to track defects. Indeed, I think it is likely that at Marshmoor also disturbance caused by the irregular cant may have led to excessive flange pressure at the leading coupled wheels, under the comparatively light and undamped side control of the swing link pony track, which had been further diminished by normal wear of flanges and axlebox faces; there was also some additional freedom at the rear Cartazzi axle.
26. The track had recently been relaid, and I am satisfied that conscientious attention had been
given to its day to day maintenance by Ganger J. Marlborough. Further, it had been realised by
his superiors that the trouble was passing beyond the control of ordinary maintenance, and measures
to remedy the weakness of the foundation were in progress. On the other hand, I do not think it
had been fully appreciated how far the margin of safety had diminished within recent months,
following the wet summer, having regard especially to the characteristics of engines of the V.2 class;
all the evidence suggested that the foundation of the Up Main track at Marshmoor had not been fit
for unrestricted running, even at 60 m.p.h., for some time.

I am not prepared to express an opinion whether the foundation of the Up Main had been
weakened by the excavation of the adjacent Down Main to within 15 inches or so of the ends of the
sleepers, but this possibility had not been overlooked, and arrangements had been made in the first
instance for a continuous speed restriction on the Up Main during the course of the work; it had
only been withdrawn after careful examination of the exposed formation. As events proved, it would
have been wiser to retain the restriction, but in fairness to the Engineering staff it should be borne
in mind that local speed restrictions, additional to those required in the ordinary course of track
renewals, have a particularly adverse effect on traffic at the present time, when it is already seriously
handicapped by difficulties in locomotive maintenance and poor quality of coal.

REMARKS

27. Though track defects were the primary cause, this derailment and that at Hatfield, when
considered in conjunction with previous derailments of engines of the V.2 class, have drawn attention
to their behaviour in relation to such defects, or even to comparatively minor imperfections in
alignment and cross level. Improvement of the pony truck side control was recommended in my
report on the Hatfield case, and the Company are experimenting in this direction, having already
abandoned the swing link arrangement in favour of spring control where new designs are concerned.

A number of engines of the V.2 class are being fitted with a spring controlled pony truck,
similarly to the new 2-6-4 type tank engines, and the weight is taken by side bearing pads; there
will thus be some damping effect, and the arrangement generally should result in a more satisfactory
distribution of the flange forces, particularly as the springs can be set to provide some initial control.
Maintenance should also be simplified as the heavily loaded pins and bushes of the swing links are
difficult to lubricate satisfactorily, and are subject to considerable wear.

One engine has already been altered in this way, and 25 more will be dealt with as the necessary
equipment, which has been ordered, becomes available; the trial will thus be on a considerable scale,
and when it has proved itself in service, a decision will be taken on the alteration of the remaining
engines of this class. As a longer term policy, the Company are building a number of Pacific type
engines, some with 6 ft. 8 ins. and others with 6 ft. 2 ins. coupled wheels, which will enable a corres-
ponding number of V.2 engines to be released from express passenger work.

28. In the meantime, the majority of the class will be running in their original condition, and as
it is not practicable at present to discontinue their employment on express trains, the position is
being dealt with by a more rigorous policy of local speed restriction, following a close review of the
more troublesome sections of the track; in spite of the effect on traffic, a restriction of 20 m.p.h. has
been imposed at Marshmoor, pending completion of the drainage work, also at several other points,
including Hatfield, on the main line south of Doncaster. At the same time special attention is being
given to these weak points, which are largely the result of arrears of maintenance during the war.

I have the honour to be,

Sir,

Your obedient Servant,

The Secretary,
Ministry of Transport.

G. R. S. WILSON.
Lieut.-Colonel.