RAILWAY ACCIDENT

Report on the Derailment and subsequent Collision that occurred on 31st July, 1967, at Thirsk

IN THE
EASTERN REGION
BRITISH RAILWAYS

LONDON: HER MAJESTY'S STATIONERY OFFICE
1968

Price 4s. 6d. net
RAILWAY ACCIDENT

Report on the Derailment and subsequent Collision that occurred on 31st July, 1967, at Thirsk

IN THE
EASTERN REGION
BRITISH RAILWAYS

LONDON: HER MAJESTY'S STATIONERY OFFICE
1968
RAILWAY ACCIDENT

Correction

Page 12. Paragraph 76.
1st Line. delete 'reducing' and insert 'reduce'

2nd Line. delete '66' and insert '65'

Ministry of Transport
November, 1968.
Sir,

I have the honour to report for the information of the Minister of Transport, in accordance with the Order of 2nd August 1967, the result of my Inquiry into the derailment of a freight train and the subsequent collision between an express passenger train and a derailed wagon of the freight train that occurred in fine weather at about 15.17 on 31st July 1967, just south of Thirsk, which is some 22 miles north of York on the four-tracked East Coast Main line of the Eastern Region, British Railways.

The freight train was the 02.40 Cliffe (in Kent) to Uddingston (near Glasgow) "Company" train and it comprised 26 loaded 4-wheeled bulk cement wagons and two 20-ton brake vans, one at each end, drawn by a Type 4 diesel-electric locomotive; the wagons were of modern design and were equipped with the vacuum brake, and each weighed about 35 tons. The train was travelling on the Down Slow line at about 45 m.p.h., the maximum speed permitted at the time for trains conveying loaded wagons of this type, when the rear axle of the 12th wagon became derailed towards the cess on plain track. There was no apparent cause for the derailment but subsequent investigations have revealed that the condition of the wagon was such that it was prone to lateral oscillation and that on track having some minor defects, but maintained nevertheless to within the laid down tolerances, such lateral oscillations could lead to derailment.

As the train proceeded, the derailed wheels moved further towards the cess smashing the timber sleepers in the track until, after travelling some 170 yards, the coupling between the 11th and 12th wagons fractured and the vacuum hose pipe parted, causing the brakes to become fully applied on both portions of the train. The front portion proceeded along the line for 470 yards and then stopped. The 13th to 20th wagons in the rear portion became derailed and went down the embankment, and came to rest mostly on their sides. The 23rd wagon, however, was slewed round more or less at right angles to the line and stopped with its leading end some 2 ft. foul of the Down Fast line.

The passenger train was the 12.00 express from King's Cross to Edinburgh, and it comprised 13 coaches drawn by a Type 4 diesel-electric locomotive. It was running under clear signals on the Down Fast line at about 80 m.p.h. close behind the freight train, when the driver saw at a distance of about 600 yds. what seemed to him to be a cloud of dust and then he saw the cement wagon foul of the line on which his train was travelling. He applied the brakes fully but he could not prevent a collision, and the left-hand side of the locomotive struck the wagon at a speed of about 50 m.p.h. The locomotive and the leading seven coaches were derailed towards the Up Fast line but they remained upright and in line; the remaining six coaches remained on the track. The left-hand side of the locomotive was extensively damaged and the driver and second man were fortunate to escape injury. The derailed coaches were all severely damaged, but the most serious damage was to the leading coach which had its left-hand side ripped away, and to the next two coaches which were severely torn, all by contact with the wagon.

The train was well filled and I regret to report that seven passengers were killed, and 45 were injured and removed to hospital where they were detained; the injuries to 15 passengers were serious.

The collision was witnessed by a farm-hand working nearby who immediately went to a telephone and summoned assistance. The driver of the freight train also rang the signalman at Thirsk from the telephone on a signal near which his locomotive had stopped, and asked for the emergency services to be sent urgently. These services responded with commendable promptitude and, despite the difficult access to the site, the first ambulance arrived at 15.40; the last of the injured had been removed by 16.30.

The Up and Down Fast lines and the Down Slow line were blocked, but the Up Slow line was not damaged and after the introduction of single line working, a special Down train was run on it to Thirsk and thence on the Down line to Newcastle, to take the uninjured passengers on their way. The Up Slow line was also used later for the passage of both Up and Down trains, but then it was used only for Up trains, Down trains being diverted via Harrogate over the Harrogate–Northallerton line which, though it had been closed for all traffic, was re-opened for the purpose at very short notice. Sleeping car trains were diverted via Carlisle. Special bus services were introduced between Leeds and Northallerton and between York and Thirsk.

Breakdown cranes were ordered from York, Leeds and Gateshead, and the derailed vehicles were cleared from the track by 23.30 on 1st August. After repairs to the track, the Down Fast line was re-opened at 08.20, the Down Slow at 14.25 and the Up Fast at 16.20 on 2nd August, all with an initial speed limit of 20 m.p.h.

**DESCRIPTION**

*The site*

1. The East Coast Main line runs roughly north and south. The derailment occurred about 19½ miles north of York and 2½ miles south of Thirsk. Pilmoor signal box is 4 miles farther south. At the point of derailment the four tracks are, from east to west, the Up Slow, Up Fast, Down Fast and Down Slow. The lines are on an embankment some 15 ft. high and are straight; they are almost level.
2. The track in the Down Slow line on which the derailment occurred comprises 95 lb. R.B.S. rails in 60-ft. lengths joined together with two hole fishplates nine inches long, and held in cast-iron chairs with wood or steel keys. The chairs are fixed to the timber sleepers with coach screws and the sleepers, of which there are 28 per rail, are supported by a good bed of crushed slag ballast. The track was laid in 1942 and the average weight of the rails now, as measured, is 90 lb. per yard. The track is not programmed for renewal. The track in the Fast lines comprises 100 lb. flat bottom rails in continuous welded lengths of 200 yds. and secured to concrete sleepers with Mill's clips. The spacing between the Down Fast and Down Slow lines is approximately 12 ft. and between the two Fast lines 6 ft. The maximum speed permitted on the Slow lines is 60 m.p.h. (traffic requirements do not call for a higher speed), and on the Fast lines 100 m.p.h.

The signalling

3. All the lines are fully track-circuited and the signals are colour lights worked automatically by the track circuits. All signals are equipped with telephones and those on the Down lines are connected with the Thirsk signal box. The position of the relevant signals is shown on the drawing at the end of the report.

The trains

4. As mentioned above, the freight train comprised 26 loaded bulk cement wagons and two 20-ton brake vans, one at each end; it was fully vacuum braked and was drawn by an English Electric Type 4 diesel-electric locomotive. Each wagon weighed about 35 tons and the total weight of the train including the engine was 1,080 tons; the length of the train was 828 ft. The engine, leading brake van and 11 cement wagons forming the front part of the train which proceeded forward, weighed 536 tons of which 355 tons, or 68 per cent, was available as brake power. The rear portion of the train, 15 cement wagons and a brake van, which became derailed, weighed 544 tons. A description of the bulk cement wagons is given in paragraph 6 et seq. below.

5. The express comprised 13 coaches and was drawn by a 2700 H.P. type D.P.2. diesel-electric locomotive which was owned by the English Electric Company; it was a prototype and incorporated many new features of locomotive design and was on prolonged test with British Railways. The length of the train was 931 ft. and its total weight, including the locomotive, was 575 tons, of which 453 tons, or 78 per cent, was available as brake power. The leading coach was a corridor composite brake, the 2nd and 3rd coaches were corridor and its total weight, including the locomotive, was 575 tons, of which 453 tons, or 78 per cent, was available as brake power. The leading coach was a corridor composite brake, the 2nd and 3rd coaches were corridor and the 4th, 5th and 6th coaches were respectively a corridor composite, corridor second brake and corridor second brake and corridor second brake and the 7th vehicle was an open second. All the vehicles were of modern all-steel construction and were equipped with Buckeye couplings.

The bulk cement wagons

6. These wagons, which are of a type known as "Cemflo", were specially designed and developed to the requirements of the Associated Portland Cement Manufacturers Ltd., which company owns the wagons, for the economic transport of cement in bulk, having a higher capacity and lower tare weight than an earlier type used for this purpose. The design of the wagons was approved by the British Railways Board.

7. The wagons consist of aluminium bottom discharge tanks of 27 tons nominal capacity rigidly mounted on 4-wheeled steel or aluminium underframes of 15 ft. wheelbase. The tare weight of the wagons varies between 8½ and 8¾ tons, giving a gross load of between 35½ and 35¾ tons, an axle load of between 17½ and 18 tons and the very high gross load/tare ratio of approximately 4.2 to 1. They are fitted with vacuum brakes with direct acting valves and "loaded" and "empty" staging. "Oleo" pattern self-contained hydraulic buffers and screw couplings; they were designed to run at speeds up to 60 m.p.h.

8. The original batch of 190 wagons, numbered LA 0001 to LA 0190, was built in 1961 by the Gloucester Carriage and Wagon Company, Ltd. The wagons were fitted with eyebolt and rubber auxiliary suspension, and originally incorporated 8-plate laminated springs; these were very stiff and, in combination with the naturally stiff tank body, produced a torsionally stiff vehicle which was prone to derailment when running empty. The suspension was then modified twice, in consultation with the British Railways Board, first to incorporate softer 9-plate springs and later 10-plate Duplex springs. The tyre profiles were to the British Railways' standard.

9. A further batch of 94 wagons, numbered LA 200 to LA 293, was built by Metropolitan-Cammell Ltd. between 1963 and 1965. These wagons are fitted with a double-link suspension of the International Union of Railways (U.I.C.) type. The suspension was designed by Metropolitan Cammell and incorporated 15-plate laminated springs; the tyres have Continental type profiles. This new design was again approved by the Railways Board.

10. "Cemflo" wagons are run mainly on a daily "Company" train conveying cement in bulk from the Associated Portland Cement Manufacturers' Works at Cliffe, in Kent, to the Cement Marketing Company, Ltd., at Uddingston near Glasgow, via the East Coast Main line. The train that became derailed there were 13 Gloucester built and 13 Metropolitan Cammell built wagons. The wagon that first became derailed was of the latter type; its number was LA 233.

11. On account of the high incidence of broken springs and the appearance of cracks in the underframes of some wagons, the maximum permissible speed for loaded "Cemflo" wagons had been reduced from 60 m.p.h. to 50 m.p.h. in 1965, and it had been further reduced to 45 m.p.h. in 1966 following two derailments which were caused by broken springs. The maximum permitted speed was still 45 m.p.h. when this derailment occurred. Empty wagons were, however, permitted to travel at 50 m.p.h.
The Cause of the Derailment

12. As already mentioned, it was the wheels of the rear axle of the 12th cement wagon that first became derailed towards the cess. As the train proceeded forward they moved farther over towards the cess until the right-hand wheels were almost halfway between the rails. The wheels initially damaged and then, because of the heavy load on them, smashed the sleepers. They were able to move laterally to such an extent because the coupling between the 12th and 13th wagons was slack.

13. It seems that the 13th and 14th vehicles then became derailed, again towards the cess, crippling the track and swinging the 12th vehicle still further over until it was at an angle of about 45° to the track and its front wheels also became derailed. The greatly increased load on the draw bar between the 11th and 12th wagons, arising from the resistance to movement of these derailed wagons, caused it to break and the vacuum hose pipe to part.

14. The leading portion of the train proceeded forward with the brakes rapidly becoming full on, from the back forwards, and it stopped after travelling 470 yards. The brakes also started to become fully applied on the rear portion, from the front backwards. The 12th wagon must have stopped abruptly, with the rear left-hand wheel embedded in the embankment and, in stopping, slightly distorted the line ahead of it towards the Down Fast line.

15. With this abrupt stop of the 12th wagon, the wagons in rear became derailed. The 13th to 20th wagons, which were already on crippled track, went down the embankment, landing either on their sides or upside down. When the 21st to 23rd wagons ran on to the crippled track they became derailed, and the rear three wagons, 24th to 26th, then also went down the embankment, landing in a similar way. The brake van became derailed but broke away from the wagons and remained on line. During the course of the derailment of the 21st to 23rd wagons, the 23rd (No. LA 264) swung round almost at right angles and the front end of it fouled the Down Fast line by about 3 ft.

16. Wagon No. 264 was struck by the left-hand leading end of the locomotive of the express and was swung round. The locomotive became derailed towards the Up Fast line and dropped the leading seven coaches into derailment, but they remained upright and in line; all of them also struck the cement wagon. The train stopped before the rear six coaches reached the wagon, and they remained on the track. The headstock, drawgear and coupling tackle from the cement wagon were found in a field on the far side of the Up Slow line 71 yds. from the point of impact.

The Damage

17. The express locomotive was very severely damaged, the left-hand side of the leading cab being crushed and the main frame bent. As mentioned, it was a prototype belonging to the English Electric Company. The damage to the leading three coaches was severe. The leading coach, a corridor composite brake, had the corridor on the right-hand side, and the compartment side was ripped off and the compartments demolished. The next two coaches, both corridor seconds with the corridors on the left-hand side, had their sides badly torn and crushed. The shoulders of all these vehicles were bent and much other damage done.

The damage to the next three coaches, all of which had their corridors on the right-hand side was not so severe but some parts of their compartment sides were crushed or torn: the damage to the 7th coach was not heavy.

18. The "Camilla" wagons which became derailed were all extensively damaged, some of them beyond repair.

19. For a distance of approximately 30 yds. beyond the point of derailment the track in the Down Slow line was damaged, most sleepers being gouged and many chairs broken. For the next 50 yds., to the point where the first cement wagon to become derailed stopped, the track was virtually destroyed, the cess rail particularly being grotesquely twisted. The track in the Up Fast line was distorted and many concrete sleepers were broken.

Evidence

Evidence of the train staff

20. The cement train was single-manned and it was being driven by Driver J. Walker, who was stationed at York. He took over the train at Skelton New Sidings, York, which was an engine changing point for this train. Walker, who had driven "Camilla" trains on five or six previous occasions, described his journey northwards from York. He was aware of the 45 m.p.h. restriction on the "Camilla" wagons and, having attained that speed, he kept the speed between 43-45 m.p.h. by small adjustments of the controller which was about three-quarters open. He never shut off power completely, and there had been no smacking.

21. The run was quite uneventful with signals at Green all the way until he noticed the brakes rubbing and the vacuum gauge falling as he approached Signal 19 BS. At first, thinking he had accidentally allowed the driver's safety device to operate, he tried to recreate vacuum by starting the exhaustor, but he quickly realised that something was wrong and allowed the train to come to a stand.

22. Looking back, Walker saw that the train had parted and was derailed so he jumped down and ran to the telephone at Signal 19 BS which he had passed by about 100 yds. Before he had time to speak to the signalman he saw the passenger train come into collision with the derailed wagons of the cement train. Walker told the signalman to call for assistance and got an assurance from him that he had stopped trains on the Up lines. Walker estimated that the time lapse between his train coming to a stand and the collision was between half a minute and a minute.
23. Goods Guard H. P. Wake, who was stationed at Tyne Yard, was in charge of the cement train. He took over the train from a New England guard at Skelton, where it had arrived at 14.37. He said that, while the train examiner was going over the train, he made a personal examination of the couplings because, from his experience, they were sometimes not all well tightened. On this occasion he found one, towards the rear of the train, very slack and he tightened it until the buffers just touched. Otherwise he found no fault with the train.

24. The train left Skelton at 14.52 and Wake described the journey from there to the point of derailment. He travelled in the rear brake van and looked forward from the left side bucket from where he could observe the behaviour of the train and watch for signals. Wake said that he always looked out continuously when in charge of "Cemflo" trains because he was somewhat apprehensive about the oscillation, which was often severe, and he always took the opportunity of seeing the whole length of the train where the curvature of the track allowed it. The last point at which he had a good view forward was on the left-hand curve at Sessay Wood, about 31 miles short of the point of derailment. He could see nothing unusual until, between Signals D19 S and D19 BS, he saw a bulge develop in the middle of the train and almost immediately 9 or 10 wagons rolled down the embankment; he estimated the speed at the time as 45 m.p.h.

25. Wake saw also that the Down Fast line was obstructed so, collecting his red flag and detonators, he set out at once to protect in rear, and was immediately aware of a train approaching on the Down Fast line. He ran towards it waving his red flag and had got about 100 yds. from his brake van when the express passed him. He noticed that the brakes were hard on.

26. The driver of the express was Driver J. M. Evans, stationed at Gateshead. He had relieved a King's Cross driver at Doncaster and made his last stop at York. He described his trip from York onwards as a normal run under clear signals and, after slowing down to observe a 20 m.p.h. temporary speed restriction near Tollerston, he had regained a speed of 75/80 m.p.h. just before reaching Signal D19. At this point he would normally have been increasing speed but, feeling uneasy about the view ahead—he should have been able to see the next signal, but it seemed to be obscured by dust or haze—he closed the controller and started to make a brake application rather as a reflex action than because he was consciously aware of any danger. After passing Signal D19, it became apparent that there was a cloud of dust ahead and through it he saw the detailed train about 400 yds. ahead with a tank wagon foul of the Down Fast line. Evans at once made an emergency application of the vacuum brake and applied the straight air brake on the locomotive; he also operated the sanding device to improve the adhesion of the brakes. In addition, he shut down the engine of his locomotive to reduce the chance of a fire in case the derailed tank wagon contained petrol. As the train approached the obstruction Evans became aware of a man waving his hands on the line ahead of his train but there was then nothing more he could do. He estimates his speed at the moment of impact as somewhere between 40 and 50 m.p.h.

27. Secondhand D. Smith generally confirmed Evans's evidence. He also described his first impression of the smoke or dust cloud ahead which obscured the signals beyond D19, and also hid the derailed train until they were very close to it. He also saw the guard of the cement train and estimated he was about 30 yds. from his van when they passed him.

28. Passenger Guard W. J. Anderson was in charge of the express train which he had taken over at York; they left three minutes late at 14.36. He had not observed signals after leaving York except at Tollerston, where the driver had slowed down for the permanent way restriction. After the train had regained speed, somewhere to the north of Signal D19, Anderson became aware of a brake application, and saw the vacuum gauge drop to zero. He went to look out of the window but before he could do so the collision occurred and he was thrown across the van. As soon as the train stopped he got down and together with Guard Wake of the cement train, went back to an Up line signal to telephone the signalman at Pilmoor to block the lines and call out the emergency services.

Evidence of the traffic staff

29. Signalman M. Fraser was on duty in the signal box at Pilmoor. With track circuit block working in operation, his duties in connection with these trains were merely to describe them on and to record their passing times, which were 15.11 for the cement train on the Down Slow line and 15.13 for the express on the Down Fast line. He noticed nothing unusual about the cement train as it passed on the line nearest to his signal box. He noted its tail lamp as it drew away and saw the characteristic lateral oscillation of the "Cemflo" wagons.

30. He received his first intimation of the accident when the signalman at Thirsk sent "Obstruction Danger" at 15.18, and about one minute later the guard of the cement train came on the telephone from an Up line signal calling for the emergency services. Fraser immediately got on the Control telephone but the signalman at Thirsk was already on the line to Control, and was asking for assistance.

31. Signalman J. Russell was on duty in the box at Thirsk. His first knowledge of the accident was when Driver Walker telephoned from Signal D19 BS at 15.18 and reported both the derailment and collision. He restored his Up signals to Danger bringing an Up express to a stand in Thirsk station, sent "Obstruction Danger" to both Pilmoor and Northallerton, and rang Control to call out the emergency services. With him in the signal box at the time was Mr. J. Reed, Stationmaster, Thirsk. He at once contacted the station and told the staff to call out ambulances, police, fire service and doctors, and, after returning to the station to confirm that all necessary action had been taken, went to the scene of the accident, arriving there at about 15.50, by which time the ambulances were in the field at the lineside.

6
Evidence of members of the public

32. Mr. R. Burn, who was working on a potato harvester in a field about 800 yds. from the lineside, was an eye-witness to the accident. He had a good clear view of the cement train just at the moment it became divided and he saw the back portion go down the embankment leaving the guard's van on the track. He saw the guard running back towards the approaching express and thought he had moved about 100 yds. from his van before the express reached him. The express seemed to be slowing down before it hit the cement train, which it did with a loud bang, throwing up a cloud of dust. Mr. Burn estimated the time between the parting of the cement train and the collision with the express as no more than a minute. As soon as he saw the collision he ran to the telephone at his home, about a quarter of a mile away, called the police and asked them to send ambulances.

33. Amongst the last persons to view both the trains before the accident were two retired Electricity Board staff, Messrs. H. J. Jackson and J. W. Young. They took a keen interest in railway matters and on the afternoon of the accident were observing traffic from the east side of the line near Pilmoor. They both estimated the speed of the cement train as 30/35 m.p.h. and thought that the express was travelling somewhere between 65 and 75 m.p.h., and they noted their passing times as 15.12 and 15.15 respectively. They had often seen those cement trains before and Mr. Young had remarked that they did not go through Pilmoor at an excessive speed, rarely over 40 m.p.h. when southbound.

34. The trains normally seemed to run smoothly when viewed from the side, but on this occasion Mr. Young had watched the offside axle boxes as they passed over the trailing end of a crossover and noted that what he believed to have been the leading axle of a wagon somewhere just forward of the halfway point of the train drop heavily into the gap of the crossing and then rebound higher than the others. This unusual movement was not accompanied by any particularly noticeable noise and it was only when he heard about the accident that he thought he should bring it to the attention of the railway authorities. This unusual movement of an axle box was not noticed by Mr. Jackson who was watching the couplings and brake connections. He thought that the buffers had been evenly tightened throughout the whole length of the train with the buffers just in contact.

35. Another member of the public, Mr. A. P. Main, was sitting in his car at the roadside some 100-150 yds. from the line near Pilmoor. He did not have a particularly good view of passing trains since he could not see their running gear or wheels on account of the intervening field of standing corn, but he saw the cement train go by under power at a speed he estimated as 40 m.p.h. and noticed that one wagon at the rear of the train, probably the second one ahead of the guard's van, was oscillating from side to side in a very noticeable manner whilst the rest of the train was riding evenly. Some time later he had heard about the accident and thought that he should draw attention to this point in case it was relevant.

Evidence of permanent way staff

36. Mr. J. R. Stockdale, Area Assistant District Engineer, described the routine for inspection and maintenance of the line where the derailment occurred. It was inspected three times a week by a patrolman, who reported to the Section Inspector who himself inspected it at least once each fortnight. He in turn reported to the Permanent Way Inspector who inspected about once a month. Mr. Stockdale had himself walked through the section from Sessay to Topcliffe Road (about 1 mile north of the point of derailment) on 21st July, 10 days before the derailment, primarily looking at ballast conditions but with a general eye on track conditions as a whole. He considered that there was adequate ballast on the Down Slow line and that the track was in a generally satisfactory condition.

37. The Section Inspector was Ganger R. Watson (Acting Sub-Inspector), and the last time he had inspected the line before the derailment was also on 21st July, when he had found nothing amiss. He had known the area for 20 years and, though there were one or two places where the underlying formation was a little soft, the track in the area of the derailment was sound. The last time any work had been done on the Down Slow line was at the end of April when a number of low joints had needed attention.

38. The Permanent Way Inspector in charge of the section of the Main line between York and Northallerton was Mr. T. E. Watson. He had last walked through from Thirsk to Pilmoor on 4th July 1967. He had observed a few low joints on the Down Slow line, but nothing that needed to have the ganger's attention drawn to it. In his opinion the track was in a satisfactory condition to carry traffic at a maximum speed of 60 m.p.h.

39. The most recent run of the track recording trolley over the Down Slow line before the accident was on 13th July 1967. The trolley was accompanied by Sub-Inspector R. Coldwell, standing in for Mr. Watson who was on leave. The run was a routine one, as normally carried out at four to six-month intervals, and Inspector Coldwell found the Down Slow line in very good condition; at only three points between York and Northallerton was the gauge greatest steeper than 1 in 270 and nowhere as steep as 1 in 240. These points were at Skeleton Bridge, at Sessay and near Topcliffe Road Bridge. There was nothing of significance in the area where the derailment occurred.

Evidence of the Carriage and Wagon Staff

40. Before the various carriage and wagon examiners gave their evidence, Mr. C. Scott, Chief Mechanical and Electrical Engineer, British Railways, Eastern Region, described the special arrangements which existed for the examination of the loaded cement wagon trains while they traversed the Eastern Region. Each train is examined five times, at Fornho Park, Peterborough, Doncaster, York and Newcastle. The train involved in the derailment would thus have been examined four times since it came into the Region.
Owners of the Portland Cement Manufacturers, Ltd., had only hid down carrying specification and had been concerned on their risk on having a damping effect on lateral oscillation, but as the links wore so the damping effect decreases.

Mr. Appleby was of the opinion that once the coupling had snapped the 12th wagon did not move forward, and the vehicles behind, pushed forward onto destroyed track by the tail of the train most of which was as yet underridden, were forced off the track towards the cess.

In examining the 12th wagon, "Comflo" No. LA 233, Mr. Appleby, looked for defects which might have caused its initial derailment. He noted that there were signs of heavy wear inside the axles guards indicating that the wagon, had been running at some time with worn and extended suspension links allowing excessive lateral oscillation to occur. The links he found on the wagon, however, were not extensively worn and appeared to have been changed recently. The only part missing from the wagon was a brake block from the offside leading wheel, but he was satisfied that this had been done in the derailment.

Other Evidence

Evidence was also given by Mr. J. B. C. McCann, Scientific Officer, British Railways Research Department. He had reached the scene of the accident on the following day, and though the 12th wagon had by then been moved from its original position to the lineside, he also reached the conclusion that it was the first vehicle to become derailed. He examined the tyre profiles, which give an indication of the ride of a specific vehicle, and though he was only able to get access to three wheels he noted that the flange of the left trailing wheel was severely worn and noticeably more worn than that of the right trailing wheel, and that at the tip of the flange there had been "rolling over" of the steel. Subsequent measurements revealed that the rolling diameter of the right-hand trailing wheel was 4 in. greater than that of the left-hand wheel, and this would tend to make the wagon run with the left flange in contact with the rail. In Mr. McCann's view the wagon showed signs of having been liable to hunt, or oscillate laterally bringing the left flange into contact with the rail, and that this could have been a major contributing factor to the derailment.

Mr. McCann explained that, with the U.I.C. type suspension, when the links were new and unworn their friction had a damping effect on lateral oscillation, but as the links wore so the damping effect decreases. Oiling or greasing the links would similarly reduce the friction and hence increase the tendency towards lateral oscillation.

Mr. W. H. Brownfield, Transport Engineer of the Association of Portland Cement Manufacturers, Ltd., the owners of the "Comflo" wagons outlined the history of the wagons. He emphasised that the Associated Portland Cement Manufacturers, Ltd., had only laid down the carriage specification and had been concerned in the design of the leading and unloading systems. They were not rolling stock engineers, and the design

Carriage and Wagons, L. Portis, described the examination he made at Peterborough. He took 15 to 20 minutes to complete the examination during which time he found and "red-coded" two wagons with broken springs, and these were detached. He found no other defects, and all the couplings were correctly adjusted to the half-inch gap between the buffers, that is laid down by Instructions for hydraulic buffers. He had not observed any worn tyres and had no occasion to use his tyre gauge.

The train was examined again at Doncaster by Carriage and Wagons Examiner, J. W. Hathaway, who also completed his examination in about 20 minutes. He found and "red-coded" one wagon, about the 10th or 11th from the front, with a broken suspension plate. He had seen that the two were no loose couplings but he did not see the wagons coupled up again after the defective wagon had been detached.

Carriage and Wagons Examiner, T. H. Walker, who was on duty at Skelton Sidings, York, said that the train arrived at 14.39 and departed again at 14.55. He had found no fault with the train. In particular he was confident that the couplings were properly adjusted.

All three examiners were fully conversant with the "Comflo" wagons and aware of the importance of carrying out a proper examination. They were not hurried to complete their tasks within any specified time and each was confident that when the train left, it was in good running order.

After the derailment a very full examination was made of all the derailed wagons by Mr. G. A. Appleby, Technical Assistant (Wagons), in the Regional Headquarters, York. Only the flanges of the trailing wheels of the 12th wagon, "Comflo" No. LA 233, carried the typical marks that occur from having run in a derailed state for some distance, such as the bruising of the flanges by rail fastenings, and he thus concluded that this pair of wheels was in fact the first to leave the track: and it had done so towards the cess. He also formed the view that the only other wagons actually to have run derailed at all were the 13th and 14th, both of which had sustained damage to the axe guards. Behind the 14th vehicle there was no typical derailment damage, and the vehicles appeared to have been squeezed off the track towards the cess and so down the side of the embankment. Further back again, the damage to the 22nd and 23rd wagons was clearly caused by the collision.

Mr. Appleby examined the derailed wagons carefully for broken springs, and found two, one on LA 264, the vehicle which had been struck by the locomotive of the express, and one on another wagon which had also sustained collision damage. In each case he was satisfied that the spring had been damaged as a result of the accident. Mr. Appleby also described his assessment of how the division in the train between the 11th and 12th wagons had occurred. After the trailing end of the 12th wagon became derailed, it gradually ran wide towards the cess. and it was able to do so because the coupling between it and the 13th wagon was very slack; in doing so the drawbar face plate at the leading end of the 13th wagon was distorted and its drawhook was bent towards the cess side. This sideways thrust eventually caused the 13th wagon to derail to the left, followed by the 14th and also the leading wheels of the 12th wagon. These heavy wagons rapidly ploughed into the timber sleepered track and the increased resistance quickly caused the coupling at the leading end of the 12th vehicle to part at the traction screw, its weakest point. It had been established that there was no inherent defect in the material, which had failed as a direct result of a sudden severe overload. Mr. Appleby was of the opinion that once the coupling had snapped the 12th wagon did not move forward, and the vehicles behind, pushed forward onto destroyed track by the tail of the train most of which was as yet underridden, were forced off the track towards the cess.

In examining the 12th wagon, "Comflo" No. LA 233, Mr. Appleby, looked for defects which might have caused its initial derailment. He noted that there were signs of heavy wear inside the axles guards indicating that the wagon, had been running at some time with worn and extended suspension links allowing excessive lateral oscillation to occur. The links he found on the wagon, however, were not extensively worn and appeared to have been changed recently. The only part missing from the wagon was a brake block from the offside leading wheel, but he was satisfied that this had been done in the derailment.

After the derailment a very full examination was made of all the derailed wagons by Mr. G. A. Appleby, Technical Assistant (Wagons), in the Regional Headquarters, York. Only the flanges of the trailing wheels of the 12th wagon, "Comflo" No. LA 233, carried the typical marks that occur from having run in a derailed state for some distance, such as the bruising of the flanges by rail fastenings, and he thus concluded that this pair of wheels was in fact the first to leave the track: and it had done so towards the cess. He also formed the view that the only other wagons actually to have run derailed at all were the 13th and 14th, both of which had sustained damage to the axe guards. Behind the 14th vehicle there was no typical derailment damage, and the vehicles appeared to have been squeezed off the track towards the cess and so down the side of the embankment. Further back again, the damage to the 22nd and 23rd wagons was clearly caused by the collision.

Mr. Appleby examined the derailed wagons carefully for broken springs, and found two, one on LA 264, the vehicle which had been struck by the locomotive of the express, and one on another wagon which had also sustained collision damage. In each case he was satisfied that the spring had been damaged as a result of the accident. Mr. Appleby also described his assessment of how the division in the train between the 11th and 12th wagons had occurred. After the trailing end of the 12th wagon became derailed, it gradually ran wide towards the cess. and it was able to do so because the coupling between it and the 13th wagon was very slack; in doing so the drawbar face plate at the leading end of the 13th wagon was distorted and its drawhook was bent towards the cess side. This sideways thrust eventually caused the 13th wagon to derail to the left, followed by the 14th and also the leading wheels of the 12th wagon. These heavy wagons rapidly ploughed into the timber sleepered track and the increased resistance quickly caused the coupling at the leading end of the 12th vehicle to part at the traction screw, its weakest point. It had been established that there was no inherent defect in the material, which had failed as a direct result of a sudden severe overload. Mr. Appleby was of the opinion that once the coupling had snapped the 12th wagon did not move forward, and the vehicles behind, pushed forward onto destroyed track by the tail of the train most of which was as yet underridden, were forced off the track towards the cess.

In examining the 12th wagon, "Comflo" No. LA 233, Mr. Appleby, looked for defects which might have caused its initial derailment. He noted that there were signs of heavy wear inside the axles guards indicating that the wagon, had been running at some time with worn and extended suspension links allowing excessive lateral oscillation to occur. The links he found on the wagon, however, were not extensively worn and appeared to have been changed recently. The only part missing from the wagon was a brake block from the offside leading wheel, but he was satisfied that this had been done in the derailment.

Other Evidence

Evidence was also given by Mr. J. B. C. McCann, Scientific Officer, British Railways Research Department. He had reached the scene of the accident on the following day, and though the 12th wagon had by then been moved from its original position to the lineside, he also reached the conclusion that it was the first vehicle to become derailed. He examined the tyre profiles, which can give an indication of the ride of a specific vehicle, and though he was only able to get access to three wheels he noted that the flange of the left trailing wheel was severely worn and noticeably more worn than that of the right trailing wheel, and that at the tip of the flange there had been "rolling over" of the steel. Subsequent measurements revealed that the rolling diameter of the right-hand trailing wheel was 4 in. greater than that of the left-hand wheel, and this would tend to make the wagon run with the left flange in contact with the rail. In Mr. McCann's view the wagon showed signs of having been liable to hunt, or oscillate laterally bringing the left flange into contact with the rail, and that this could have been a major contributory factor to the derailment.

Mr. McCann explained that, with the U.I.C. type suspension, when the links were new and unworn their friction had a damping effect on lateral oscillation, but as the links wore so the damping effect decreases. Oiling or greasing the links would similarly reduce the friction and hence increase the tendency towards lateral oscillation.

Mr. D. H. Brownfield, Transport Engineer of the Association of Portland Cement Manufacturers, Ltd., the owners of the "Comflo" wagons outlined the history of the wagons. He emphasised that the Associated Portland Cement Manufacturers, Ltd., had only laid down the carriage specification and had been concerned in the design of the leading and unloading systems. They were not rolling stock engineers, and the design

8
of the wagon as a vehicle was a matter for the wagon manufacturers, in the case of the wagons with double link suspensions this was Metropolitan-Cammell Ltd., it was also subject to the approval of the British Railways Board.

51. In his opinion the double link suspensions were unsatisfactory. They did not wear well and required frequent renewal. He had known cases during the early experiments with U.T.C. links when they had been fully extended after only 600 to 700 miles. At the present the average life varied between 2,000 and 6,000 miles.

52. Mr. Broomfield explained that the routine maintenance on the fleet of "Cefnfo" wagons was carried out under contract by Wagon Repairs Ltd., who had established depots at Cliffe and at Uddingston. Some items of maintenance, such as wheel turning, were done by British Railways. Each wagon was inspected before each trip both by Wagon Repairs staff and by a British Railways' examiner who visited the works to examine each train before departure.

53. MR. BROOMFIELD was aware that the "Cefnfo" wagons had a tendency to oscillate laterally when running, but as far as he was concerned the establishment of a safe running speed for them was a matter for British Railways; he was aware that running tests had been carried out on the open line with the Metropolitan-Cammell wagons in 1964 or 1965. As far as the lubrication of the links was concerned he explained that it was their current practice to grease them. British Railways had agreed to this some twelve months previously. With regard to the tightening of couplings, Mr. Broomfield understood that they should be tightened to a degree where the buffer faces were slightly under compression or just touching.

INVESTIGATIONS IMMEDIATELY AFTER THE DERAILED

The track

54. Detailed measurements of the track in the Down Slow line were made by the Chief Civil Engineer's staff soon after the derailment. Readings were taken at each sleeper for a distance of 360 ft. on the approach side of the point of derailment. A number of minor errors in cant and alignment were found and recorded but these were nowhere outside the permitted tolerances.

55. The measurements showed that up to a point about 130 ft. from the point of derailment, there were few irregularities in level, cant and line, though there had been some side-cutting on alternate rails at reasonably regular intervals, indicating that vehicles with a tendency towards lateral oscillation had been so doing on this stretch of line. The side-cutting was not however excessive, reaching a maximum of 20' as compared with 25' which is the maximum acceptable.

56. From that point onwards, however, a twist developed in the track. The cant under load changed from the 12 ft. rail being $\frac{1}{2}$ in. high to the cess rail being $\frac{1}{4}$ in. high in 40 ft., to the 12 ft. rail being $\frac{1}{2}$ in. high in the next 30 ft., to the cess rail being $\frac{1}{4}$ in. high in the next 32 ft., and then to the 12 ft. rail being $\frac{1}{2}$ in. high in the next 28 ft. and at the point of derailment. The maximum rates of change of cant, based on a 15 ft. wheelbase wagon, for these four reversals of cross levels were respectively 1 in 200, 1 in 262, 1 in 244 and 1 in 300. It should be noted that the cant gradient should not normally exceed 1 in 300. If it exceeds 1 in 270 attention should be given to it in due course and if it exceeds 1 in 240, it requires immediate attention. A four-wheeled goods wagon should, however, be able to negotiate a cant gradient of 1 in 130, and new stock is designed to achieve this.

57. The measurements also revealed slight kinks in the track. The greatest errors in alignment were at the point of derailment, and at points 8 sleepers (20 ft.) and 40 sleepers (100 ft.) short of it, where the versine to a 33 ft. chord reached a maximum of $\frac{1}{4}$ in.; the first kink was outwards and the latter two kinks were inwards in the cess rail. Somewhat farther back, at sleeper No. 88 (220 ft.), there was a slight kink in the track about $\frac{1}{4}$ in. inwards in the cess rail, followed by a kink of $\frac{1}{8}$ in. outwards. The gauge was even, being generally $\frac{1}{2}$ in. to $\frac{1}{4}$ in. slack, but it was $\frac{1}{2}$ in. slack at a point 30 ft. on the approach side of the point of derailment. None of these kinks nor the variation in the gauge was in any way significant. Some keys were loose or missing in the Down Slow line on the approach to the point of derailment, but again the number was in no way significant.

Speed test on freight train

58. At my request, a test was carried out with the same engine that hauled the cement train and the leading brake van and 13 cement wagons that formed the front portion of the train and were not derailed. It was made on the Up Slow line between Thirsk and Pilmoor on which the gradient is much the same as on the Down Slow line. After a preliminary run to check the speed, the flexible vacuum hosepipe at the rear was removed when the train was travelling at a checked speed of 46 m.p.h., to simulate the condition when this portion of the train broke away after the derailment and ran forward. On that occasion the train had stopped in 470 yds; on the test it stopped in 463 yds. A subsequent test of the speedometer showed it to be reading 2 m.p.h. fast at that speed. This was conclusive proof that the train had not been travelling above its authorised speed of 45 m.p.h. at the time of the derailment.

Test on springs of the derailed vehicles

59. Arrangements were made for the springs of the 12th wagon, LA 233, together with those from the 13th and 14th wagons, to be sent to Doncaster Works and tested for deflection. The 15-plate springs from the 12th and 14th wagon were in satisfactory condition, but one plate in a 9-plate spring from the 13th wagon broke while under test. I am satisfied that the condition of the springs did not contribute to the accident.
60. Since no clear cause for the derailment could be established from observations and measurements made at the site and in Doncaster Works, I asked for special tests to be carried out on a number of typical “Cemflo” wagons including Nos. LA 233, 0087 and 205, the 12th, 13th and 14th wagons of the derailed train, which were specially refurbished in workshops before further testing. The tests, which were arranged by the Chief Engineer (Traction and Rolling Stock), British Railways Board, included both roller rig tests carried out by the Research Department at Derby and riding tests on the open line.

**Roller rig tests**

61. “Cemflo” wagon No. LA 201 was selected for the roller rig test as being in a similar condition to the first vehicle to be derailed, No. LA 233, in that the double link suspension had recently been replaced and the wear in the wheel flanges and the difference in wheel diameters were similar. The behaviour of the wagon was measured in the “as received” condition.

62. The “critical” speed, i.e. the speed at which a flange to flange hunting movement begins, was observed in both the tare and laden conditions and, since the vehicles were loaded at the time of the derailment, emphasis was placed on this condition during the roller rig tests. The critical speed in the loaded condition was found to be between 24 and 27 m.p.h.

**Riding tests on the open line**

63. These tests were carried out to observe the riding characteristics of typical “Cemflo” wagons under varying conditions as follows:

(a) Slack-coupled at rear of a train.

(b) Slack-coupled in a train (buffers, \( \frac{1}{2} \) in. clear).

(c) Tight-coupled in a train (“Oleo” pattern buffers, \( \frac{1}{4} \) in. compression).

(d) Tight-coupled in a train (spring buffers, \( \frac{1}{2} \) in. compression).

Test (a) was carried out in both the tare and laden conditions, the other tests only in the laden condition. In each case vertical and horizontal accelerations were measured at a point 1 foot from headstock, at which position a mean Ride Index of 4.4 is acceptable.

64. The general characteristics of all the wagons tested were similar, but the worst ride in the slack-coupled condition was recorded at the trailing end of wagon No. LA 233, the first wagon to be derailed. The actual ride characteristics of this wagon were as follows:

**LA 233 Slack-coupled in a train (loaded)**

<table>
<thead>
<tr>
<th>Speed (m.p.h.)</th>
<th>Lateral Ride Index</th>
<th>Maximum Safe Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>3.2</td>
<td>about 38 m.p.h.</td>
</tr>
<tr>
<td>35</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>4.65</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>5.2</td>
<td></td>
</tr>
</tbody>
</table>

The natural frequency of oscillation was about 1.2 cycles per second at 45 m.p.h.

**LA 233 Tight-coupled within a train (loaded) (spring buffers, 2 tons compression)**

<table>
<thead>
<tr>
<th>Speed (m.p.h.)</th>
<th>Lateral Ride Index</th>
<th>Maximum Safe Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>3.8</td>
<td>over 50 m.p.h.</td>
</tr>
</tbody>
</table>

The most stable lateral ride in the slack-coupled condition was given by the eyebolt-suspended wagon No. LA 0087 with a Ride Index of 3.9 at 46 m.p.h., but this wagon had very little tyre wear.

**The U.I.C. Link type suspension**

65. A special study was also made of the wear pattern of the U.I.C. link type suspension fitted to the “Cemflo” wagons built by Metropolitan-Cammell Ltd. This pattern of suspension, which has proved satisfactory in use in other applications, is designed as a friction-damped device, but in the case of the “Cemflo” wagons a characteristic wear pattern has been observed in which the link surface wears hollow with a corresponding ridge along the centre of the bearing radius. While the formation of this wear pattern is still not fully understood, a study of the link action during side pulling tests showed that for small displacements the link rolls on the surface of the bearing radius until the relative clearance is taken up. Further displacement causes the link to rotate and become off-centre in the bearing, with a tendency for metal to be rubbed off both the link and bearing surfaces and to be rolled towards the centre of the bearing, the displaced metal forming a ridge in the bearing with a corresponding hollow in the link section.

66. Once this wear pattern has established itself the suspension ceases to be a friction-damped device, but develops into a rocking bearing system of indeterminate performance allowing a wagon to become increasingly unstable in the lateral plane up to the critical speed.

67. The small external damping forces provided by coupling the wagons in a train are sufficient, however, to control body hunting to within reasonable limits at speeds up to 35 m.p.h. loaded and 50 m.p.h. empty, although the wheels will still be inherently unstable over about 30 m.p.h. on average welded track.
68. Side pulling tests to measure the lateral resistance of the link suspension within the limits of the axleguards gave the following results:

<table>
<thead>
<tr>
<th>Wagon</th>
<th>Lateral Resistance per End</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA 201</td>
<td>7,800 lbs/inch</td>
</tr>
<tr>
<td>LA 233</td>
<td>9,000 lbs/inch</td>
</tr>
</tbody>
</table>

When compared with the results of similar tests on a 45-ton (gross loaded weight) oil tank wagon after 70,000 miles in traffic which was found to have a lateral resistance of 13,500 lbs/in., the above resistance can be seen to be of a low order.

CONCLUSIONS

69. This derailment, which led to the unfortunate collision which followed almost immediately, was the direct result of the bad riding characteristics of "Cemflo" bulk cement wagon No. LA 233, which, as a result of excessive lateral oscillation giving rise to accelerations greater than the safe limit for four-wheeled goods wagons, became derailed at a point where there were minor track irregularities, which were nevertheless within the specified tolerances for the line concerned. The bad riding characteristics stemmed from the fact that the type of suspension provided, though satisfactory on other types of wagons and used extensively on the Continent, has, with the prevailing clearances in the suspension components, (see paragraph 77), proved unsuitable on this type of wagon.

70. The cement train was being properly driven at a speed not exceeding the laid down maximum of 45 m.p.h. and the driver was in no way responsible for the derailment. After the derailment occurred both he and the guard took immediate and correct action to warn approaching traffic, but it was already too late to stop the express, the driver of which had no chance of avoiding the collision. Despite the danger facing him, Driver Evans took thoughtful steps to minimise the effects of the inevitable collision and his secondman prepared to go forward and protect the Up lines as soon as the derailed locomotive came to a stand. Their actions and those of the other railwaymen directly concerned in this unfortunate accident were worthy of the highest traditions of the railway service.

71. The lateral oscillation (hunting) of "Cemflo" No. LA 233 was able to build up because wear in the U.I.C. link type suspension with which the wagon was fitted had eliminated the natural friction damping of this type of suspension. This wear is rapid, and it was particularly rapid on this wagon, and the reasons for it are not fully understood. The presence of cement acting as an abrasive is probably an important factor, because in other applications, notably on oil tank wagons running on British Railways, the U.I.C. link type suspension has been found to give a satisfactory performance with an average life of 80,000 miles against the 5,000 miles which is typical on "Cemflo" wagons.

72. The severe flange wear on the left-hand wheel (the one that became derailed) of the rear axle of LA 233 might have been started by the slight original dissimilarity in the diameter of the wheels on that axle, the right-hand wheel was 1/16 in. greater in diameter than the left, and this might also have caused the tread of the left-hand wheel to wear by 1/16 in. more than the right-hand wheel, thus increasing the dissimilarity in diameters to 1/8 in., and increasing the flange wear. The British Standards Specification No. 3117, Part 5, 1959, permits a maximum difference of 1/16 in. between the diameters of wheels on one axle, but the Railways Board inform me that they are considering applying the reduced maximum difference of ten thousands of an inch which they insist on for the wheels of passenger and freight liner bogies, to other freight stock also. Some slight misalignment of the frame of this wagon or of the axle could also have had a bearing on the flange wear although there was no evidence of any such misalignment, and it was not possible to check on this afterwards because the frame was distorted and the axle bent in the derailment. The flange of the right-hand wheel of the leading axle was also worn more than that of the left-hand wheel, but not to the same extent. The wagon was thus running crabwise and the hunting of the rear axle was not balanced but had a bias to the left. A vicious circle had in fact been created; the greater the amplitude of the hunting resulting from the wear in the suspension the greater the wear in the flanges became, and the greater the wear in the flanges the greater became the hunting and the wear in suspension. The wear in the flanges had not however exceeded the permitted limits.

73. Until this accident occurred the rate of wear of suspension links was regarded by all concerned as an economic problem rather than a safety problem. The lateral oscillation, which was a well recognised characteristic of these vehicles, was not regarded as dangerous and there had been no previous case of a derailment being caused in this manner. The extremely close and careful examinations to which these trains were submitted at frequent intervals on every journey were primarily directed at the discovery of broken springs, of which one or more, on average, were found on every loaded journey. Previous accidents involving these wagons had been caused by broken springs and the importance of this examination was well understood. In contrast, the wear pattern which develops in the link type suspension cannot be seen without dismantling the suspension and the dangers to which it gives rise are less apparent. Even if the overall wear in a suspension is within the permitted maximum, as it was in this case, it is still possible for the friction damping effect to be lost. None of the carriage and wagon examiners who inspected this train on the day of the accident can therefore be held in any way responsible for the derailment.

74. That the derailment occurred when and where it did must be regarded as to some extent fortuitous. This particular wagon was especially prone to develop a lateral oscillation and there was evidence from the intermittent side-cutting of the rails leading up to the point of derailment that wagons with a tendency to hunt had been doing so there. When hunting gives rise to lateral accelerations exceeding 0.4 g, representing a Ride Index of over 5.0, as demonstrated in the running tests on LA 233, minor track irregularities such as...
as those recorded in paragraph 56, which occurred just on the approach side of the point of derailment, could be sufficient to cause derailment if the lateral thrust of a flange on the rail caused by hunting coincided with a lightening of the load carried by that particular wheel as a result of the twist in the track.

75. The riding tests on the open line have shown that there should be no danger of excessive lateral accelerations occurring at speeds up to 35 m.p.h. and this maximum speed limit was imposed by the British Railways Board immediately after the accident on all "Cemflo" wagons when running loaded. Unloaded "Cemflo" wagons are still permitted to run at 50 m.p.h.

REMARKS AND RECOMMENDATIONS

76. The immediate step taken by the Railways Board to reduce the speed of loaded "Cemflo" wagons to a maximum of 35 m.p.h. should prevent any recurrence of a derailment of this kind. The effect of such a limit is, however, highly restrictive from a traffic point of view and thus cannot be regarded as a satisfactory long-term solution to the problem, but it will have to be retained until a satisfactory solution has been found.

77. As a result of the study of the development of the link wear pattern described in paragraph 66 et seq., running trials have been carried out on a "Cemflo" wagon with reduced clearances between the suspension pins, bearings and links, and this wagon had completed 39,670 miles up to 10th August last when it was necessary to change the components. These trials have been extended to three further "Cemflo" wagons and tests have been arranged to measure the effect that such modified components have on the lateral friction force when fitted to different types of vehicle. The results of these tests so far have indicated that there would probably be considerable advantages in fitting a single friction link suspension to these wagons, which would provide an even greater bearing area to reduce the rate of wear and to ensure a close running fit to control the friction force. A design on these lines is being prepared by the Railways Board.

78. I have discussed this matter at length with the technical officers of the Railways Board. They are arranging for the diameter of the wheels of all "Cemflo" wagons to be checked and, if excessive dissimilarity is found in the wheels on one axle, for it to be rectified. I would suggest also that a check should be made on the wheels for excessive flange wear and that, if uneven wear such as obtained on LA 233 is found on any wagon, its frame should be measured and its axles tested for trueness.

79. The running tests on the open line clearly demonstrated the effect of running "Cemflo" wagons more tightly coupled with the buffers in slight compression. The friction between the buffer faces has a considerable damping effect on lateral oscillation and allows higher speeds to be attained without the Ride Index rising to a dangerous level. The "Oleo" pattern buffers at present fitted to these wagons have apparently not given satisfactory service when coupled in this manner and, moreover, an Instruction has been issued by the Railways Board that the couplings of vehicles equipped with hydraulic buffers of any type should be tightened so that the buffers do not come into compression but remain up to ½ in. apart. Since the lateral stability, and hence the maximum safe speed, is increased significantly when the wagons are tightly coupled, I recommend that either the "Oleo" pattern buffers should be replaced by spring buffers, or that they should be modified to enable the wagons to be run tight-coupled in normal traffic.

80. I have mentioned that the irregularities in the track were minor; each was within the permitted tolerance and in themselves should not have caused a derailment. However, when such irregularities occur close together and combine to form a double reverse twist in the track, as they did in this case, they can create a situation in which the wheels of a wagon that is hunting badly can become derailed. I consider therefore that there is a need for a greater awareness by the permanent way staff of the hazard that such cyclic variations in cross levels can present, and that further steps should be taken to enable such variations to be recognised and rectified as soon as possible.

I have the honour to be,

Sir,

Your obedient Servant,

D. McMULLEN

Colonel.

The Secretary
Ministry of Transport
RAILWAY ACCIDENT AT THIRSK-EASTERN REGION - 31st JULY 1967

TEES SIDE

SCARBOROUGH

NEWCASTLE - PILMOOR TOLLERTON - SITE OF ACCIDENT

TO LEEDS

LOCATION PLAN

1942

POINT OF DERAILMENT

First wagon to become derailed

Telegraph pole

Platelayers cabin

Locomotive came to rest - at 20m 49yds

Down Slow

- - Down Fast

I

- - Up Fast

1 Wheel dropped off

TO THIRSK FROM YORK

Coaches not derailed

Diesel locomotive No. DP2

Headstock

Drawgear from LA264

Englefield type 4 D283 Coach

Partially derailed

SKETCH SHOWING POSITION IN WHICH 12.00am KING'S CROSS to EDINBURGH EXPRESS & 02.40am CLIFFE to UDDINGSTON

LOADED CEMENT TRAIN CAME TO REST AFTER DERAILMENT & COLLISION.

UIC TYPE DOUBLE LINK SUSPENSION AS FITTED TO

'CEMFLO' WAGONS No. 200 - 294

Model No. 1/43 (1/4" to 1')