

Derailment of First Great Western high speed train at Southall East on Sunday 24 November 2002

Summary

1. At around 20.05 on Sunday, 24 November 2002 the leading bogie of the fifth coach of the Swansea to Paddington express derailed at a set of points east of Southall station. It was travelling at approximately 120mph. The train remained upright and in line, and finally came to a halt just before West Ealing station, some two miles further on. There were no serious injuries, but because of the catastrophic potential of this incident the Health and Safety Executive's (HSE) HM Railway Inspectorate (HMRI) launched an immediate investigation. ORR took over responsibility for the investigation from HSE in April 2006.

2. A summary of the key interim findings are:

- The bogie was derailed when the flange of a wheel struck one half of a broken fishplate which had lodged in the nose of a cast manganese steel crossover forming part of the points;
- The fishplate had been securing the running rail to the crossover. It broke under fatigue stresses and became detached as a result of the bolts securing it coming undone. The exact mechanism of why the bolts came undone, and the sequence of events which led to the fishplate breaking, are the subject of further forensic investigation;
- Further investigation is being undertaken to assess whether the overall condition of the track could have been a factor in the breaking of the fishplate;
- There were no defects on the train that would have contributed to the incident.

3. HSE worked closely with Network Rail and their engineering consultants AEA Engineering Solutions (AEA), Amey Rail Ltd and First Great Western (the train operator) in the investigation of this incident. Amey Rail Ltd were the infrastructure maintenance contractor at the time of the incident, but this work has since been brought "in house", and is now performed directly by Network Rail. The investigation is continuing, and when it is complete ORR will decide what action to take.

Details of the Incident

4. The 16.30 Swansea to Paddington express service on Sunday the 24 November 2002, operated by First Great Western, was a high speed train (HST) made up of eight Mk 3 coaches and two power cars. Coach H was immediately behind the front power car with the other coaches in reverse alphabetical order behind. At about 20.05, whilst travelling on the up main line between Slough and Paddington and passing over a set of points east of Southall Station at approximately 120mph, the leading bogie of coach D (the fifth coach) derailed towards the down main line.

5. The driver felt what he described as a 'tug' on the train as if the rear power car had shut down. At about the same time ballast was being thrown up under coach D, which quickly filled with dust, and a Network Rail Mobile Operations Manager working on the lineside at the same location was showered with ballast as the train passed.

6. A passenger in the coach operated the passenger communication system and the driver, realising that there was an emergency, applied the full service brake. The train finally stopped 200 yards before West Ealing station having passed over a viaduct and through Hanwell & Elthorne station. It had also passed another HST travelling on the down line. A Heathrow Express train following the derailed train passed over the derailment site without incident before being stopped at signals.

7. There is some evidence that the derailed bogie was constrained by a length of rail in the six foot between the up and the down lines. Had the coach been able to move further across towards the down fast line or had more vehicles derailed then the consequences of a collision with a train on the adjacent line could have been catastrophic.

8. As it was the train remained upright and in line and fortunately there were no serious injuries. The driver and train manager, although shocked, were

able to assist in dealing with approximately 450 passengers. The driver contacted Slough Integrated Electronic Control Centre signal box from the train to arrange protection of the adjacent lines. Some three hours later the passengers were detrained and escorted along the track to West Ealing station.

The Site Investigation

9. AEA investigators, acting on behalf of Network Rail, arrived on site shortly after the event. An HMRI Inspector arrived early the following day.

10. The derailment happened at 8175A points, located about half a mile east of Southall station. These form part of a high speed turnout between the up main and the down relief line on the west of England main line. Line speed on the up and down main lines is 125mph, 90mph on the down relief and 85mph on the up relief line. Line speed through the turnout is 70mph.

11. The points consist of a pair of switch blades that determine the direction of travel in conjunction with a crossover arrangement that permits the right hand rail of the turnout to cross the left hand running rail. This crossover was of cast manganese steel. The crossover had been attached to the plain line by means of a pair of bolted fishplates. The fishplates were of a forged design, with a 2mm lift incorporated into them, and secured by four bolts with their associated nuts and washers.

12. As part of the investigation the crossover, a length of plain line that had been adjoining it and a number of fishplates and bolts were taken into HMRI possession for further forensic testing.

13. Initial examination showed that both fishplates fitted to the left hand rail had broken. The two bolts, and their associated nuts and washers which were originally holding the fishplates on to the running on rail had become detached and were lying close by.

14. The half fishplate which fell into the four foot side was trapped in the narrow gap between the rails on the apron of the crossing and subsequently lodged in the nose of the crossover. When the flanges of the wheels struck this obstruction it caused the wheels of the bogie to be derailed. Marks on the wheels of the train, the fishplate and the crossing nose support this finding.

15. Both wheel sets of the bogie were derailed towards the down fast line. None of the classic wheel climb and rail head marks were to be seen on the rails, which supports the theory that on striking the broken fishplate, the wheel set was thrown from the track. The badly damaged fishplate was found in the ten foot side of the rail indicating that it had been thrown across the rail during the derailment.

16. Other site findings included:

- There was considerable track damage caused by the incident. About two miles of concrete sleepers had been damaged by the bogie following derailment, and a number of baseplates and chairs had been smashed.
- Marks in the throat of the crossover were consistent with impact damage from a fishplate being trapped between the casting and the wheel(s).
- There was a 17m length of rail in the six foot from the crossover in the up direction. This had been disturbed during the derailment.

17. Overall responsibility for maintenance of the infrastructure lay with Network Rail, although at the time the work was contracted to Amey Rail in this area. Maintenance work has since been brought “in house” and is now performed by Network Rail.

18. The wheel sets of the HST train were examined at the site of the derailment and subsequently at the First Great Western depot at Old Oak Common. The results of these examinations helped to identify the sequence of the derailment, but no defects were found which would have contributed to the incident.

Interim Findings

19. The immediate cause of this derailment was a wheel striking the broken fishplate that had lodged in the crossover. For this single event to occur there had to be three separate events leading up to it.

- a. The fishplates had to fail;
- b. The nuts and bolts securing the fishplate halves had to come completely undone; and
- c. The fishplate half (or bolt(s)) had to become trapped in the nose of a crossover.

20. The mechanism for the failure of the fishplates has been the subject of an investigation by AEA. It has also been established that the fishplates were changed in July 2002 after a previous instance when one was found to be cracked. The issue of whether the failure of the fishplate should have been identified during inspections is under consideration. A report by AEA suggests that gross ripping fatigue, in which a crack might advance rapidly (tearing or ripping) due to the variable loads applied, was involved in the failure of these fishplates. This might not have been visible until a short time before failure.

21 The mechanism by which the fishplate half ended up in the nose of the crossover is somewhat easier to foresee. The space between the rails at this "V" formation is very small and there would be no opportunity for the fishplate to fall harmlessly onto the ballast. Instead it would be constrained between the rails and sitting on the apron of the cast crossover. Vibration from a train transmitted through the track, particularly in an area of voids, could easily shake the component into the nose of the crossing.

22. The overall condition of all the track components, and their support, in the area around the point are being considered, including installation standards and subsequent maintenance, to establish the root cause of the fishplate failure.

Action Taken since the Incident

23. Because of the damage caused by the derailment remedial work was undertaken by Network Rail to the track in the vicinity of the derailment site and beyond before train services were resumed. HMRI carried out inspections to ensure that good track standards are being maintained.

24. Since the derailment Network Rail has conducted a national survey of tight fishplate joints to check for looseness of joints and fractures. In no circumstances were conditions similar in any way to those found at Southall East.

25. The investigation revealed numerous deficiencies in the track which had contributed to the failure of the fishplates. As a result of these legal proceedings were brought against Amey Rail Ltd, a rail services company working for Network Rail Infrastructure Ltd (then Railtrack), and against Network Rail Infrastructure Ltd for failing to maintain the mainline railway line in such a way as to ensure that persons not in their employment, including railway workers and passengers, were not exposed to risks to their health and safety. Both companies pleaded guilty and were sentenced at the Central Criminal Court (the Old Bailey) on 12 September 2006. [Amey Rail Ltd](#) was fined £300,000 and ordered to pay £19,714.50 costs. [Network Rail Infrastructure Ltd](#) was fined £200,000 and ordered to pay £19,714.50 costs.

ORR September 2006