Rail Accident Investigation Branch

RAIB Bulletin 07/2009

Freight train derailed in May 2009

Description of the accident

1 In May 2009, two wagons of a freight train derailed at a set of points in a siding which formed the entrance to a crossover leading to a main line. The train ran on beyond the point of derailment such that the Down main line at that location was blocked by the two derailed wagons and the adjacent Up main line was blocked by the leading portion of the train which was not derailed.

2 The train involved comprised a locomotive and 19 empty coal hopper wagons. It was making a signalled shunting move from the Down siding over a crossover onto the Down main line and then over another crossover onto the Up main line (Figure 1). It was travelling at a speed of around 10 mph (16 km/h) at the time. The permitted line speed over the crossover was 15 mph (24 km/h).

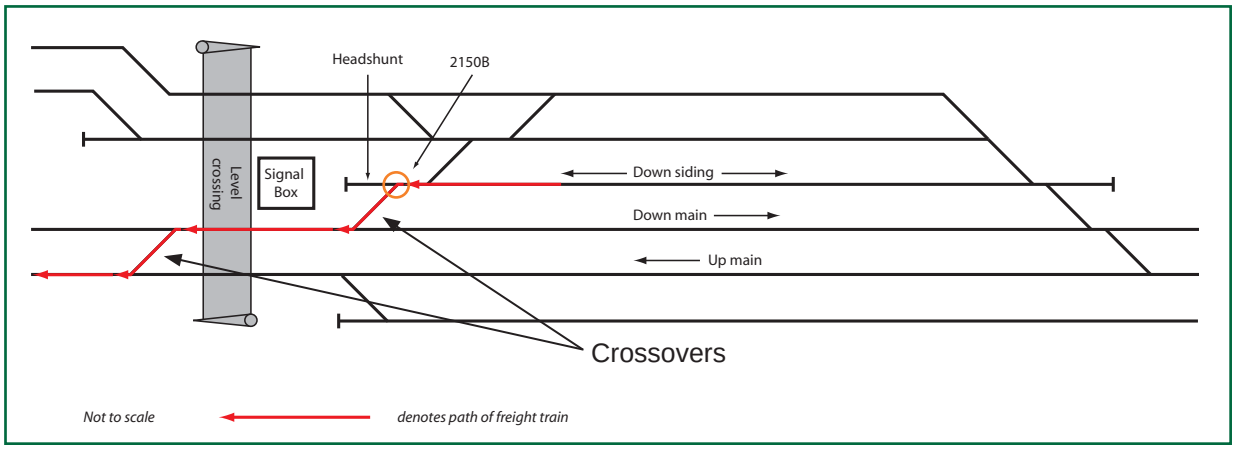

Figure 1: Layout of track and path of the freight train

3 After approximately half the train had passed over 2150B facing points, the 11th and 12th wagons became derailed. The 11th wagon was derailed by both bogies and the 12th wagon was derailed by its leading bogie. During the derailment the coupling between the derailed wagons parted and the brakes were applied automatically at the same time as the driver applied the train brake, having been made aware of the derailment by the shunter.

4 The derailed vehicles suffered damage to the wheels and to the coupling, drawhooks and buffers at the interface between the 11th and 12th wagons. There was damage to the track on the crossover and the straight route beyond 2150B points into the head shunt. No one was injured in the incident.

Findings of the RAIB

5 The initial point of derailment was traced to the switch toes of 2150B points (Figure 2). The switch blades were set in the correct position for the train's intended movement but derailment marks at this location indicated that a wheelset had flange climbed onto the top of the right-hand switch rail and had run for approximately 7m before falling onto the ballast and sleepers of the straight route into the head shunt (Figure 3). This was the initiating event.

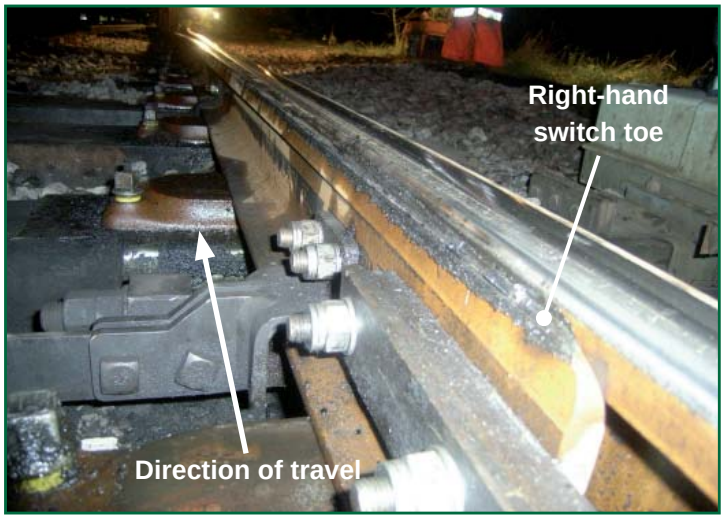

Figure 2: Right-hand switch of 2150B points

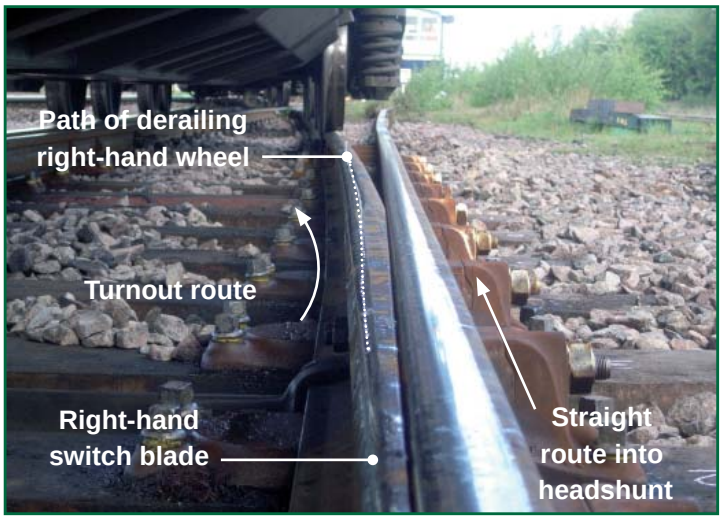

Figure 3: Path of right-hand wheel of first wheelset to derail

6 Vehicle examinations on site suggested that the first wheelset to derail was the leading wheelset of the trailing bogie on the 11th wagon (bogie 11T). Derailment of this wheelset was followed by derailment of the trailing wheelset of this bogie approximately 19m later, resulting in bogie 11T running completely derailed along the head shunt. Meanwhile the leading bogie of the 12th wagon (bogie 12L) had traversed 2150B points correctly and was taking the turnout route (Figure 3). As bogies, 11T and 12L, moved along diverging routes, the lateral forces generated caused bogie 12L to be pulled into derailment and bogie 11T to be pulled back off the head shunt route. Subsequently the leading bogie of the 11th wagon (bogie 11L) also derailed, probably as a result of the yaw angle developed by 11th wagon. The 11th and 12th wagons came to rest approximately 96m and 68m respectively from the toes of 2150B points along the turnout route.

7 Inspection of the right-hand switch of 2150B points against the requirements of Network Rail standard NR/L2/TRK/053 “Inspection and repair to reduce the risk of derailment at switches”, revealed that contact between a P8 wheel profile gauge and the switch rail on the right-hand side occurred below the 60 degree limit line (Figure 4) for a distance of more than 200 mm along the switch blade. The switch blade therefore failed the requirement that contact must not occur below the 60 degree line. Both switch rails of 2150B points were new, having been replaced on 25 April 2009. Following the incident, hand grinding was undertaken to steepen the angle of the right hand switch blade to comply with the above standard, thereby reducing the risk of derailment by flange climb.

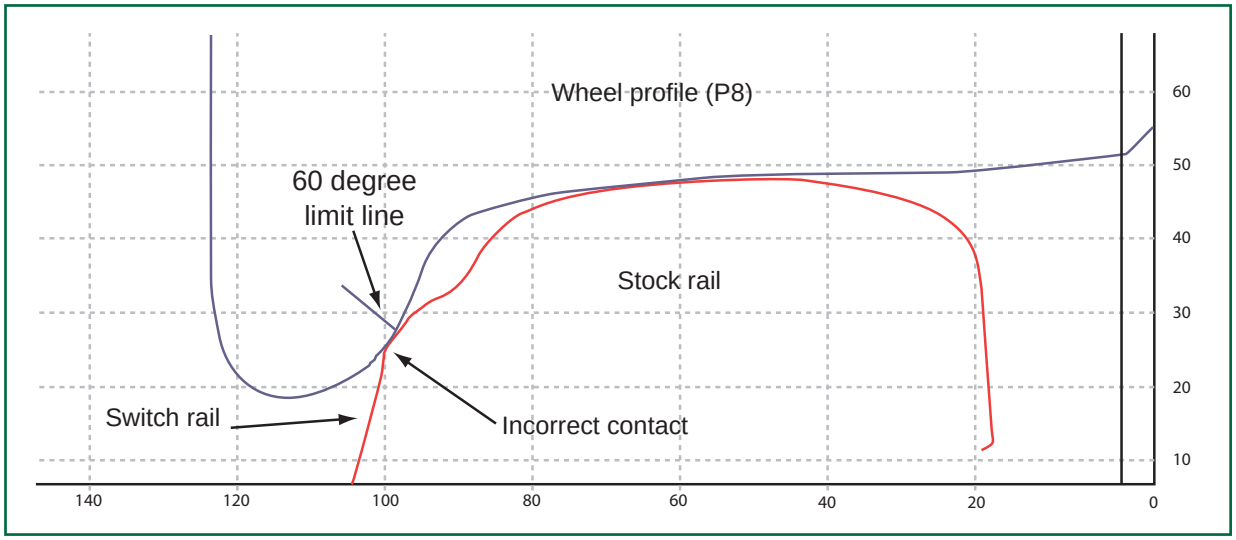

Figure 4: Measured profiles of the right-hand switch and stock rail against a P8 wheel profile, showing incorrect contact below the permitted (60 degree limit) line

8 Inspection of the wheels of the 11th and 12th wagons which derailed showed that they were compliant with the wheel flange height and thickness requirements specified in Railway Group Standard GM/RT2466, “Railway wheelsets”. However, it was noted that the wheel flanges showed signs of damage by an aggressive wear mechanism, in common with wheels of other wagons which did not derail.

9 Although the contact between the switch rail and wheel flange was not correct and posed a derailment hazard, whether or not a derailment occurred also depended on other factors such as wheel/rail friction, track twist and behaviour of the wagon suspension. In this incident ten wagons of the train has already passed over 2150B points without incident before the derailment.

10 Considering the risk of recurrence, there are approximately 20,000 points on mainlines and 5000 points in sidings on Network Rail infrastructure. Of these, around 1800 are of similar turnout geometry to the switch involved in this derailment. Maximum train speeds over such switches are typically 25 mph (40 km/h). Approximately 1200 half sets of switches and 450 full sets of switches are replaced annually. The infrastructure owner has reported to the RAIB that there have been two derailments on newly installed switches on their infrastructure within the last five years, indicating that this type of incident is relatively rare. The combination of low turnout speed and the rarity of derailments on new switches indicates the overall risk of recurrence is low.

11 Although post installation checks are carried out on newly installed switches, these do not currently include checks against relevant clauses of Network Rail standard NR/L2/TRK/053 such as the test described in paragraph 7. Reliance is placed on checks during the design, ordering, manufacturing, despatch and receipt stages for a set of new switches to detect any problems.

Learning Points

12 On the basis of the information collected during its preliminary examination of this accident, the RAIB has decided not to conduct a full investigation. This is because the RAIB considers the risk of recurrence is low and it does not believe that such an investigation would lead to the identification of any further significant lessons that would improve the safety of the railways or prevent railway accidents and incidents beyond that which a thorough industry formal investigation should identify. A formal industry investigation into the incident is under way.

13 The RAIB has identified potential learning points and has written to those conducting the industry formal investigation asking them to include these points in the formal investigation remit. They have agreed to do so. In addition to the need to identify why one bogie on the freight train derailed at 2150B points when many others had successfully traversed these points into the turnout route, the RAIB has identified the following particular learning points:

- robustness of manufacturing quality assurance checks undertaken on the replacement switches at 2150B points to ensure that the switch blade geometry was correct prior to installation; and
- applicability to new switches of previous RAIB recommendations, following the derailments at Waterloo (11 September and 24 October 2006) and Glasgow Exhibition Centre (3 September 2007), regarding checks to NR standard NR/L2/TRK/053, in particular whether new switches should be checked to relevant parts of this standard after installation, before being opened for traffic.

14 The RAIB has written to the infrastructure owner and freight operator involved informing them of its decision and conclusions.

The events described above took place at Sudforth Lane, North Yorkshire on 1 May 2009.

This bulletin is published by the Rail Accident Investigation Branch, Department for Transport.

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