

Report by the Health and Safety Executive's Railway Inspectorate into the train accident at Lewes on 18 October 1999

Originally published on HSE Internet on 10 March 2000

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Summary

1 At about 19.15 on 18 October 1999, at Lewes in East Sussex, the 17.52 passenger train from Victoria to Hastings collided with a train of empty coaches at a combined speed of about 30 mph. There were four members of staff and about twelve passengers on the trains. No-one was hurt, although one person was treated for shock at the scene.

2 The collision took place at a crossover near the junction where the lines from Haywards Heath and Brighton to Lewes meet. There is no record of any previous train accident in this area.

3 Both trains were electric multiple-units. The passenger train consisted of twelve carriages, and the empty train of eight carriages, of class 421 'Mark 1' slam-door rolling stock.

4 HSE investigations have concluded that the collision and subsequent derailment of the passenger train was caused by the driver of the passenger train starting his train away from Lewes station and passing a signal at danger. This was a result of human error. Both the signalling and braking systems have been tested and no evidence of any malfunction has been found. The signal involved had not previously been passed at danger.

5 Both trains sustained some damage in the collision. The crashworthiness of the trains has been reviewed by the Health & Safety Laboratory.

6 Consideration has been given to the prosecution of individuals and companies involved in the accident. However, it is the view of the Inspectorate that there is insufficient evidence to provide a realistic prospect of a conviction.

7 The Train Protection and Warning System (TPWS) is due to be fitted across the network and to all trains by the end of 2003. TPWS consists of equipment on the track and the trains which will apply the brakes automatically: if a train is travelling above a predetermined speed on the approach to a red signal; if a train passes a red signal; and at some other key locations where passing a signal results in a high risk of collision. The signal involved in this accident is one that is due to be fitted with TPWS and the accident would have been prevented if it had been.

8. HSE is satisfied with the recommendations made by the railway industry's Formal Inquiry into the accident, and by action taken by Connex Rail to address some staff management issues. Implementation of these actions will be monitored by HSE. Accordingly, we have no additional recommendations to make.

9. Work to reduce the number of trains passing signals at danger (SPADs) is continuing, following the report produced by HSE in September 1999 on the railway industry's management of SPADs. This work is the subject of separate reports which are being made available to the public.

The incident

1. At approximately 19.15 on Monday 18 October 1999, a short distance east of Lewes station in East Sussex, a collision took place between the 17.52 passenger train from Victoria to Hastings (train 1F34) (referred to as the passenger train in the rest of this report) and a train of empty coaches which should have formed the 17.16 Victoria to Eastbourne and Seaford train (5F30) (hereafter referred to as the empty train).

2. Both trains were operated by Connex South Central. Each train had a driver and a guard, and there were about twelve passengers on the Hastings train. There were no injuries in the collision, although one person was treated for shock at the scene.

3. The signalman at Lewes, whose box is directly opposite the site of the collision, called the emergency services who arrived within ten minutes. Evacuation of people from the passenger train took place immediately via the two rear carriages which were still in the platform. Two other trains were trapped in open country at signals outside Lewes station. Passengers on one

of them were detained by the driver and walked to the station, and those on the other train were walked to a nearby level crossing and collected by a bus. These operations were completed by 22.00.

4. The Sussex Police declared the accident site a "scene of crime", allowing them to restrict access to it pending an investigation. After evacuation was completed, the scene was taken over by the British Transport Police (BTP). Initial investigations were conducted by the BTP and HSE, following which the area was handed back to the railway authorities at 02.45 on Tuesday 19 October. Recovery operations began immediately and following repairs to the track and conductor rails and testing of the signalling, normal working was resumed at 14.10 on the same day.

5. The weather at the time of the accident was dry and clear.

The trains

6. Both the trains were electric multiple-units, formed of 4-car class 421 (4-CIG) units of "mark 1" rolling stock. The passenger train consisted of twelve carriages (units 1850, 1805 and 1739), and the empty train 8 carriages (units 1845 and 1738). These trains were built between 1964 and 1972 at British Rail's York works. They have slam doors and are not fitted with central door locking. All the units were fitted with the BR Automatic Warning System (AWS) and the Driver's Reminder Appliance (DRA). AWS is a device which alerts drivers to the indications shown by signals, and which will apply the train brakes automatically if the driver does not respond to it on the approach to a signal at "caution" or "danger". The DRA consists of a button and warning light on the driver's console which the driver should use to isolate the traction power when the train is stopped at a red signal.

7. Following the accident, all the carriages of both trains were removed to the Connex depot at Brighton, where full testing of their AWS, DRA, and braking systems was carried out. No faults were found.

The site and signalling

8. Lewes station, which is roughly triangular in shape, stands immediately west of the junction where the double track lines from Haywards Heath and Brighton converge. East of Lewes a double track runs towards Newhaven, Seaford, Eastbourne and Hastings. Trains travelling from and to Haywards Heath and London use platforms 1 and 2, while platforms 3, 4 and 5 serve the line to Brighton. A crossover east of the junction enables trains from both directions to reverse.

9. The lines from London, via Haywards Heath, curve sharply to the left on a radius of 200 yards as they pass through platform 1. The track is then straight from the junction, opposite the signal box, for some 22 yards before curving to

the right at a radius of 460 yards. The crossover where the collision occurred is 110 yards east of the junction.

10. Signalling in the area is controlled from Lewes signal box, located on the south side of the line a short distance from the point of collision. It is an old building, but contains an entrance-exit panel controlling two and three aspect main colour light signals and position light shunting signals, which dates from 1976. Track Circuit Block regulations apply throughout the area. Extensive testing after the accident failed to reveal any faults in the signalling installation and HSE is satisfied that it was in good working order.

11. The signal involved in the accident, LW3, is a three aspect colour light mounted on a short post at the top of the ramp at the east end of platform 1. It comes into view as a train rounds the curve through the platform (where speed is restricted to 20 mph) at a distance of about 80 yards. It has not previously been passed at danger. The overlap beyond the signal, intended to provide a safety margin in cases where a train driver misjudges braking, is 110 yards, which is better than the standard for the line speed. This overlap extends over the junction between the Brighton and Haywards Heath lines. Accordingly, signal LW1 (the preceding signal to LW3 for trains approaching from Haywards Heath) cannot be cleared to allow a train to enter the station unless the junction itself is clear.

12. All running lines in the area are electrified at 750 volts DC on the conductor rail system. The supply is controlled from Railtrack's electrical control room at Brighton.

The course of events

13. Earlier in the day there had been severe disruption to train services caused by an incident when a car drove onto the line at a level crossing near Arundel, and caught fire. Consequently, trains were being turned short of their destinations in an attempt to restore the booked service. The 17.16 had run empty from Victoria to Lewes because no guard was available. While it was en route a decision was taken to reverse it at Lewes and send it empty to the depot at Brighton.

14. The passenger train had started from Gatwick Airport instead of Victoria because of this disruption, and was running about fifteen minutes late as it approached Lewes. Signal LW1 was at caution (yellow) on the approach to the station and as the train entered platform 1 the driver noted that the signal at the end of the platform, LW3, was at danger (red). He received and acknowledged a correct AWS indication for this signal. The train stopped with the front of the cab at the '12 car' stop marker, which is fixed to the signal post at the top of the ramp at the end of the platform.

15. The empty train had passed through Lewes about five minutes before. It ran slowly through platform 1 and, as it passed through, the platform staff

confirmed with the driver that the train was to be reversed at Lewes. After passing through the station, the train came to a stop at a position clear of the crossover points, no. 77. The driver changed ends by walking through the train then, driving from the west end cab, began the journey back through the crossover onto the up line. For this manoeuvre, which is regularly done at Lewes during disruptions to the service and engineering works, position light signal 58 was cleared by the signalman, who routed the empty train through platform 4 towards Brighton.

16. The passenger train stopped at platform 1 and about 30 passengers left the train. Since the train had started from Gatwick Airport rather than Victoria, it had many fewer passengers than usual, and only about a dozen people were still on board when it left Lewes. The train started, passing signal LW3 at red, and accelerated until it reached about 20 mph.

17. The signalman on duty in Lewes signal box, which is located almost opposite the junction between the Haywards Heath and Brighton lines, was alerted by the sound of the passenger train moving off. Realising that a collision was imminent, he immediately transmitted a "General Stop" message on the Cab Secure Radio (CSR) system. Evidence from the data logging equipment which is part of the CSR indicates that this message was transmitted only seven seconds after the train occupied track circuit AH, thus fouling the junction. This very rapid response is much to the signalman's credit.

18. The driver of the passenger train, travelling on the down line, saw the empty train approaching from the opposite direction but because of the curvature of the line he thought it was on the up line. It was only when his train got very close to it that he realised that the empty train was coming through the crossover. At the same time he received the "General Stop" message on the radio display in his cab, together with an audible warning, and immediately applied the emergency brake. However, his train was still travelling at about 15 mph when it collided sidelong with the rear of the first carriage of the empty train, which was probably moving at about 15mph in the opposite direction. Neither train was fitted with a data recorder.

19. The leading bogie of the first carriage of the passenger train was derailed to the left and the right front corner of this carriage was badly damaged. The empty train was not derailed. However, the first carriage suffered superficial damage to its rear end, while the second carriage was more severely damaged. The damage to the carriages and the crashworthiness of them is discussed in more detail below.

Evidence

20. The passenger train left Lewes, passing signal LW3 at danger. This was admitted by the driver when he went to the signal box immediately after the accident. Evidence from the guard of the train and the station staff indicates

that errors by the driver, the guard and one of the dispatchers on the platform combined to cause the accident.

21. The procedure for despatching down trains from platform 1 at Lewes involves two platform staff (for a twelve car train), the train's guard, and the driver. Platform staff should give a hand signal to the train guard when station duties are complete, that all doors are closed and that the part of the train that they can see is safe to start. Where practicable, they are required to check that the platform starting signal is clear before giving this hand signal.

22. When the guard has received a hand signal from all the staff on the platform, has checked that the platform starting signal is clear, and that all the parts of the train that he can see are safe, the guard should give the "ready to start" (two rings on the bell) signal to the driver. On receiving this signal, the driver should first check that the platform starting signal is clear, and only then start the train, looking out as he does so to ensure that all is well with his train.

23. At Lewes (platform 1), the guard cannot see the platform starting signal from his position towards the centre of the train. To assist with despatch, an indicator is provided 125 yards back from the signal (about half way along the platform). The indicator consists of a double-sided sign which is blank when the signal is at danger and shows "OFF" when the signal shows a proceed (yellow or green) aspect. This indicator is about 1½ carriage lengths (30 yards) ahead of the guard's position in a twelve car train if the train is drawn right up to the platform starting signal.

24. During 1999, Lewes station was being extensively refurbished as part of Railtrack's Station Regeneration Programme. Amongst other things, this work involved demolition of a redundant building on platform 1 and subsequent rebuilding of the platform canopy. In the course of planning this work, the possibility of interference with the sighting of signals was identified. A signal sighting committee was convened in April 1999 and recommended that a surround be fitted to the "OFF" indicator for signal LW3 to make it stand out more in daylight. This was done. At the time of the accident, the old canopy and building had been demolished and there was temporary fencing and lighting on the platform. HSE is satisfied that this did not interfere with the sighting of signal LW3 or the "OFF" indicator.

25. There were two platform staff on duty at the time of arrival of the passenger train. One went to the back of the train to a position where he could not see the platform starting signal or the "OFF" indicator. Once station duties were complete, he held a white light above his head and kept it there until the train moved off, in accordance with the Rules. The dispatcher who was at the front of the train went right down to the platform starting signal by the train cab. Once the passengers had alighted, he began walking back along the train closing doors and blowing his whistle. He claims then to have been distracted by passengers asking for information about the disrupted train services, and says he did not give a signal to the guard, although he admits

that he would not have blown his whistle if he had realised the starting signal was at danger.

26. The guard of the passenger train was travelling in the brake compartment in the sixth carriage. He evidently did not notice that the "OFF" indicator was blank. He saw the white light from the rear, and claims to have received a hand signal from the dispatcher at the front. He gave the driver two rings on the bell, and the train started. After the collision he contacted the signal box and checked that the trains were protected, before escorting the passengers off his train. He has been a guard since 1978, working through Lewes for the whole of this time.

27. The driver of the passenger train saw signal LW3 at danger as the train ran in to the platform. He pulled the train right up to the "12 car stop" marker. In this position he was unable to see the signal itself without leaning to his left, because the left hand corner pillar of the train cab obstructed his view. The train was fitted with the Driver's Reminder Appliance (DRA), which is a device which, when activated by the driver pressing a red button in front of him, prevents power being applied to start the train until the button is reset. The button is illuminated while the DRA is active. Drivers are supposed to use the DRA as a reminder that their train is standing at a red signal. On this occasion, the driver did not use the DRA. Instead, he put the master switch into the neutral position, which was what he had been taught to do at a red signal in the days before the DRA was introduced. On receiving two rings on the bell from the guard, he allowed himself to fall into the habitual routine of putting the master switch into forward, putting the controller into notch 1, and looking out and back along his train to check on its safe departure. By the time he looked forward again his cab had passed the signal. The collision occurred a few seconds later.

28. The driver is 40 years old and has been qualified as a train driver for three years, and has been employed on the railway for six years. He had not previously been involved in a Signal Passed at Danger (SPAD) incident.

29. The pattern of train services through Lewes is such that trains using platform 1 hardly ever encounter signal LW3 at danger. It is clear that the possibility of this did not occur to the guard or the dispatcher, even though the dispatcher had dealt with the empty train only a few minutes before and should have realised, had he thought about it, that it was most unlikely to have shunted out of the way in that time.

Damage and Crashworthiness

30. After the accident, a team from the Health & Safety Laboratory (HSL) examined both trains. The most significant damage occurred to the second vehicle of the empty train, where the underframe of the leading vehicle of the passenger train overrode and made a significant penetrating gash in the body side as well as causing crush damage to the end of the vehicle, displacing a

partition and one set of seats. There was also one broken window. If passengers had been seated in this vehicle, or standing in the leading end vestibule, then serious injuries or worse may have occurred. However, little detachment of internal fittings occurred.

31. In the passenger train, only the leading cab was damaged. Seated and standing passengers would have been subjected to significant deceleration at impact and may have struck internal fixtures and fittings, but they would not have been at risk from structural deformation. The results of this study will be further used to inform HSE's continuing research into the crashworthiness of rolling stock.

32. The electrical wiring and switchgear in the leading cab of the passenger train was damaged in the collision. This caused the circuit breaker for the emergency lighting to trip, so that the train had to be evacuated in darkness. The emergency lighting is battery operated and designed to provide lighting for at least one hour after the loss of the traction supply. Systems in more modern trains have been designed to be more robust and resistant to collision damage.

Findings

33. HSE's investigation has concluded that the accident occurred because the driver of the passenger train passed a signal which was at danger. In doing this he was influenced by a "ready to start" signal which was given by the guard, who in turn was misled by a dispatcher on the platform. Each of these individuals contributed to the causes of the accident by failing to carry out his duties properly. Following a number of similar incidents, the railway operating Rules were changed some years ago to make platform staff and guards responsible for checking that signals are clear before indicating that the train may proceed.

34. The management of the staff involved has been considered as part of the investigation. Neither the driver nor the guard had previously been involved in any SPAD incidents, and HSE is satisfied with the arrangements in place for the regular monitoring and assessment of their performance. In particular, the failure to use the DRA has been made a mandatory disciplinary matter by Connex and Driver Standards Managers have for some time been actively enforcing this.

35. The platform dispatch staff at Lewes carry out duties which are regarded as being "safety critical". Responsibility for monitoring their performance, and for reviewing the adequacy of the platform despatch arrangements, rests with the local Connex management. During the Railway Industry's investigation, it became apparent that some aspects of these responsibilities were not clear, and that the platform despatch arrangements at Lewes had not been reviewed for some years. There was also evidence of deficiencies in the

monitoring of staff performance. Following this investigation, two members of the local management team resigned their posts.

36. Connex are reviewing the dispatch plans for all the stations in the South Central area, and have revised their Safety Manual to clarify the respective roles of operations inspectors, who assess the competence of platform staff, and station managers who have line management responsibility for these staff.

37. The accident is one which would have been prevented by the Train Protection and Warning System (TPWS). If signal LW3 had been equipped with TPWS, the brakes of the passenger train would have been applied immediately after passing the signal, and the train would have been stopped before passing beyond the safety overlap provided, which in this case is 110 yards. The fitting of TPWS at signals protecting junctions, such as LW3, was made compulsory by the Railway Safety Regulations 1999, introduced in August 1999. Following the disaster at Ladbroke Grove on 5 October 1999, Railtrack is committed to introducing TPWS at 12,000 sites on the national network by the end of 2002, beginning with the highest risk locations. All trains will be fitted with the necessary equipment by the end of 2003.

38. The possibility of legal proceedings against the individuals and companies involved has been considered as part of HSE's investigation. There is insufficient evidence to provide a realistic possibility of a conviction of any individual, although the driver, guard and dispatcher have been being given formal warnings by HSE as to their future conduct, in addition to disciplinary action taken by their employer. There is no evidence of any significant corporate failings that may have contributed to the accident.

Recommendations

39. HSE has reviewed the railway industry's Formal Inquiry into the accident. We are satisfied that this investigation identified the immediate and underlying root causes. Recommendations made by the Formal Inquiry include:

- The "12 car stop" marker on platform 1 at Lewes to be moved back 7m, to ensure that the signal is visible to drivers when stopped. This should be accompanied by extension of platform 1 at its north end to fully accommodate 12 car trains.
- A review of the present practice of positioning car stop markers on or near the posts supporting platform starting signals.
- A review of the Rule Book requirements to ensure that there is no ambiguity in situations where there is more than one member of staff on the platform in defining which person has ultimate responsibility to give the "station duties complete" signal to the train crew.
- Rebriefing to all drivers nationally of the importance of using the Driver's Reminder Appliance when stopped at a platform starting signal at Red.

HSE will monitor the implementation of these recommendations. Together with the action already taken by Connex to improve standards of train dispatch and the management arrangements for station staff, they fully address the issues arising from the accident. Accordingly, we have no further recommendations to make.

40. A reduction in the number of instances of signals passed at danger (SPADs) continues to be a high priority for HSE. Work is continuing with all sides of the railway industry to improve our understanding of why these events occur and to devise ways of preventing them. Details of SPADs nationally and the action being taken are being published monthly.