

Rail Accident Report



Derailment of a tram on the Seaton Tramway 18 March 2007

This investigation was carried out in accordance with:

- the Railway Safety Directive 2004/49/EC;
- the Railways and Transport Safety Act 2003; and
- the Railways (Accident Investigation and Reporting) Regulations 2005.

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18 March 2007

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Introduction

1. The sole purpose of an investigation by the Rail Accident Investigation Branch (RAIB) is to prevent future accidents and incidents and improve railway safety.
2. The RAIB does not establish blame or liability, or carry out prosecutions.
3. Access was freely given by the Seaton and District Electric Tramway (Seaton Tramway) to their staff, data and records in connection with the investigation.
4. Technical terms (shown in *italics* when they first appear in this report) are explained in appendix A.

Summary

5. On 18 March 2007 at 12:55 hrs tram No 10 was approaching Seaton station on the Seaton Tramway, when it derailed at the points at the entry to the station. There were no casualties.
6. The derailment was probably caused by persons unknown placing an object in the points.
7. The RAIB has made two recommendations with regard to modifying the operation of points on the Seaton Tramway.

The derailment

8. The Seaton Tramway is a 3 mile line from Seaton to Colyton, built to a track gauge of 2 ft 9 ins (838 mm) (Figure 1). It has been in operation since 1970, operating mainly on the course of a former British Railways line. Seaton station, the southern terminus, lies adjacent to a large car park, which is not fully fenced from the tramway



Figure 1: Extract from Ordnance Survey map showing location of accident

9. The tramway uses a fleet of electrically powered trams, some rebuilt from historic vehicles, and some purpose built for the system. The most modern trams are a fleet of three, purpose built for the line between 2002 and 2005. The tram involved in the derailment, No 10, was one of these trams, and was operating on the 12:31 hrs service from Colyton to Seaton (Figure 2). The only crew on the tram was the driver, and it was carrying ten passengers.



Figure 2: Seaton Tram no. 10

10. Located at the entry to Seaton station is a pair of points, leading to a siding (Figure 3). These points are normally set so that trams run into the station platform. The points are operated by a weighted lever, which is secured by a pin; the pin, in turn, is padlocked in position, and are not *detected*. A tram can only enter the siding if the pin is removed and the points fully thrown to *reverse*. However, the pin allows sufficient movement of the lever for trams to *trail* the point when leaving the siding; the weight of the lever then ensures that the points then return to their normal position. As a result the lever can be manually lifted sufficiently that the *switches* partially open (Figure 4).
11. The safe operation of the points depends on the points being fully closed, or the driver, acting in accordance with Seaton Tramway Rule 60, being able to see whether they are set correctly as he drives his tram towards the points.

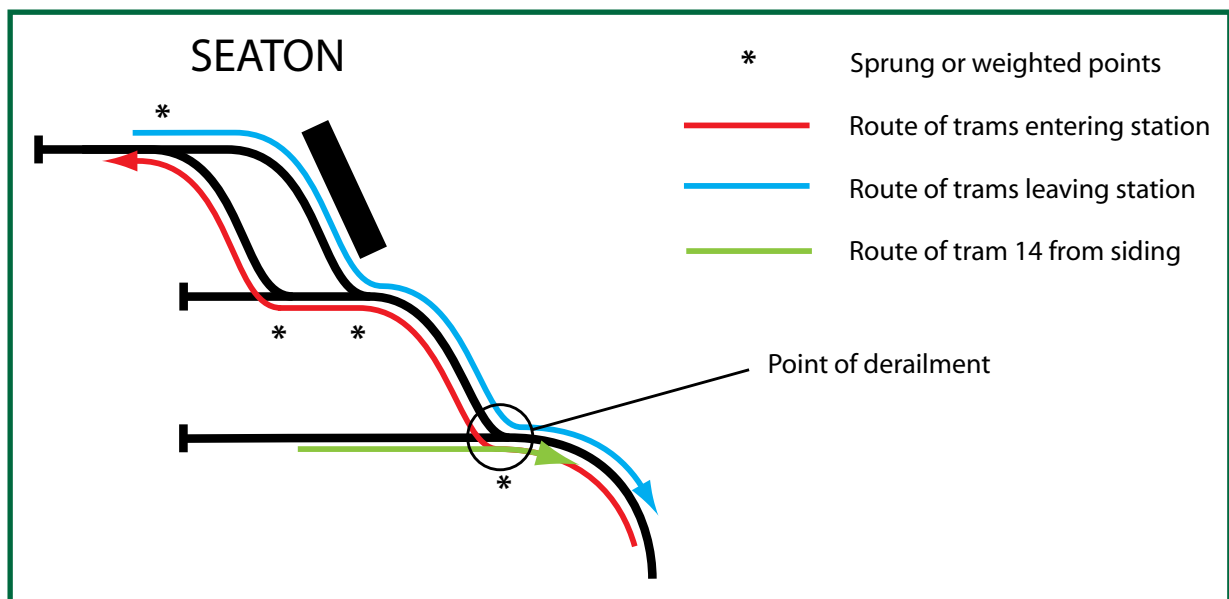


Figure 3: Track layout at Seaton



Figure 4: Points lever lifted and switch open with locking pin in position

12. At 11:30 hrs on the morning of 18 March 2007 the tramcar supervisor for that day, who is also the operations director of the line, drove tram 14 into the siding so that it was available for traffic later in the day. He noted that the point lever pin was difficult to reinstate. As there was a large number of passengers for the 12:40 hrs tram from Seaton the supervisor decided to use tram 14 for a duplicate service following the 12:40 hrs tram, which he would drive. He drove tram 14 from the siding, and assumed the points had returned to their normal position behind him. There is no requirement in the rule book for a tram driver to check points that have been trailed.
13. Tram 14 proceeded to the next loop on the line, where it passed tram 10 heading south.
14. When tram 10 approached Seaton some ten minutes after the departure of tram 14 its driver looked at the points from his driving position, as he is required to by Seaton Tramway Rule 60, and decided that they were fit to pass over. He then transferred his attention to ensuring that the trolley light, 22 metres beyond the points, which indicates that the tram's trolley pole has taken the correct route, illuminated, as required by Rule 81 (Figure 5). As the tram passed over the points it derailed; the leading bogie split the points and derailed all wheels. The trailing bogie correctly took the right hand route without derailling. The driver applied the brakes and stopped the tram 8.5 metres after it derailed (Figure 6). The tram's derailed wheels ran on a tarmac surface. Neither the driver nor the passengers were injured in the derailment.
15. The Seaton Tramway rule book, Rule 59, requires that drivers approach facing points at no more than walking pace. From the distance that it took the tram to stop, the RAIB is satisfied that excessive speed was not an issue.
16. The tram was re-railed and passenger services recommenced from 13:50 hrs the same day.



Figure 5: Trolley indicator



Figure 6: Marks from derailment

Cause of the derailment

17. The incident was not immediately reported to the RAIB (paragraph 28). After the derailment the tramway company found marks between the switch and stock rails of the points. They concluded that these marks indicated that there was an obstruction between the two rails, such that the switch rail was held slightly open. There were several incidents of vandalism around Seaton station at the time of the derailment, and the tramway company concluded that the derailment was caused by someone placing a stone in between the switch and stock rail, with the switches being just sufficiently open to lead to the derailment, but not so far open that the driver could see the risk.
18. Subsequent to the derailment, on 4 April 2007, there was a clear case of stones being placed in the blades of the points, and Devon and Cornwall Police are investigating this vandalism.
19. Subsequent examination of the switches by RAIB showed a small mark on the switch toe, on the stock rail side, such as would have been made by a wheel striking the switch toe and going between the switch and the stock rails (Figure 7). The derailment marks on the switch toe, and on the ground, accord with the points lying very slightly open, so that they were struck by the tram's wheel, which went to the wrong side of the switch rail. The design of the point lever (paragraph 10) would allow the points to be opened sufficiently to let an object be placed between the switch and stock rails.



Figure 7: Mark on switch toe

20. There have been no previous derailments at these points caused by the switches lying open, and they have functioned satisfactorily since the derailment, although no further maintenance has been carried out. The points operated satisfactorily when demonstrated to the RAIB in mid April. In view of these, and the relatively fresh state of the mark on the switch toes, the RAIB is satisfied that it is associated with the derailment on 18 March 2007.

21. The subsequent vandalism of the points on 4 April 2007, the stiffness of operating the lever locking pin, and the marks on the switches, are supportive of the tramway company's vandalism theory. The earlier service trams entering the station on the morning of 18 March 2007 did not derail at the points, so any obstacle would have had to be placed in the points in the ten minutes or so between the departure of tram 14 and the arrival of tram 10 to explain the derailment; there is no positive evidence that this was so. Nevertheless, the RAIB is satisfied that the immediate cause of the derailment was the switch rail lying slightly open, and it is possible that this was caused by persons unknown placing an object between the switch and stock rails.

Detection of the points being open

22. The safe operation of the points depends on the driver, as he approaches the points, being able to see whether they are set correctly (Figure 8). In this case the driver did not see the small opening of the points.



Figure 8: Driver's view approaching Seaton station

23. The driver had been assessed as competent by the Tramway and had passed for driving in 2000. He had a further assessment in 2004 and refresher training in 2005. He had passed the company's medical examination, which is based on *Railway Group Standards*, and carried out annually for a driver of his age, as laid down in Seaton Tramway Rule 40. These standards and frequency comply with HMRI and Heritage Railway Association good practice. The driver was not required to wear glasses, and his vision is unlikely to have been a factor in this derailment.

24. The trolley indicator is situated 22 metres after the points, and is over to the right relative to the approaching tram; it illuminates when the driver has travelled only 8.8 metres past the points. The requirement of Rule 81 to look at the indicator means that the driver of a tram may tend to look at the points, in accordance with Rule 60, some distance before arriving at them, and then look up for the indicator. If viewed from a distance, and in the absence of any other indication of the lie of the points it is possible that the driver may not notice if the points are slightly open.
25. The use of sprung and weighted points that restore themselves to their normal position is common on lines carrying light traffic throughout the UK, and there several hundred examples on Network Rail, Light Railways (modern urban tramways) and Heritage Railways; there are, for example, 26 such points on the Seaton Tramway, of varying designs. The performance of such points across the UK is proven. However, in almost all cases there is some means of indicating to an approaching driver that the points are set correctly in sufficient time for him to stop before he reaches the points. HMRI publishes guidance for Heritage Railways (Railway Safety Principles and Guidance, Part 2H, 1996). Paragraph 71 of this guidance states that:
- ‘Some existing railways use spring loaded points or weighted levers at run-round and passing loops. They enable the train to run into a station, the locomotive to be detached and run round the train, without the need for staff to switch the points. There should be a means of clearly establishing that the point blade is fully closed, eg by providing a target disc behind the weighted levers, so that drivers can see more easily that the weights, and therefore the blades, are fully home.
- Note;* There is a risk with this type that the blades might not be fully closed, perhaps due to vandalism, say from children putting stones in the track, or to the wear of components. The driver is responsible for seeing that they are safely set in the correct direction when he approaches them, which may require a speed restriction.’
26. The aim of third sentence of paragraph 71 of the guidance is to ensure that, when the visual indication is not present, the driver has time to stop the train, descend from it and take appropriate action to ensure the security of the points before passing over them
27. On Network Rail, Light Railways and some Heritage Railways (eg the Ffestiniog and Welsh Highland Railways) indication is given by a light that is only illuminated when the points are detected as fully closed in their normal position. On other Heritage Railways (eg the Ravenglass and Eskdale Railway) the indication is given by target boards similar to those described in the HMRI guidance. Both solutions give more assistance to the driver than was present at Seaton.

Reporting of the derailment

28. The Seaton Tramway attempted to report the derailment by telephone to the RAIB before re-railing the tram. As a result of the RAIB's telephone system being out of action over the weekend of 17/18 March 2007 the RAIB had made alternative arrangements for emergency calls to reach it, and had notified, by email, all members of The Heritage Railway Association; the email had not been read by Seaton Tramway staff. The Tramway made no further attempts to contact the RAIB by telephone, email or fax, and submitted a written report dated 27 March 2007 that was received by the RAIB on 3 April 2007. As a result, the RAIB was unable to examine the site of the derailment until some weeks after it had occurred.
29. The RAIB has discussed the failure to notify the derailment, and to preserve the evidence, with the Seaton Tramway, and received assurances that prompt notification will take place, and evidence will be preserved, in any future such event.

Conclusion

30. The immediate cause of the derailment was the left hand switch of the points lying open, which may have been caused by the placing of an object between the switch and stock rail by persons unknown. A contributory factor was the lack of visual indication to the driver of the switch position at the approach to Seaton station. A contributory factor was the design of the weighted lever at the points, which provides the opportunity for unauthorised persons to open the switches and place a stone between the switch and stock rails.

Recommendations

31. The following safety recommendations are made¹:

1. The Seaton Tramway should replace the weighted lever at the entry to Seaton station with a point lever that is capable of being locked when not in use, in order to prevent it from being used to move the points without authority. The points could be operated from the lever via a slotted joint, and be spring loaded, so that operational flexibility is not lost.
2. The Seaton Tramway should implement, so far as is reasonably practicable, the provision of visual indicators that show to drivers whether sprung and weighted points on the system that are used by trams carrying passengers are correctly set for the normal route.

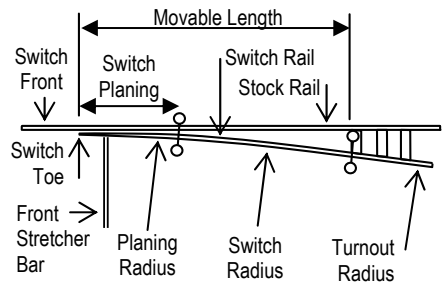
¹ Responsibilities in respect of these recommendations are set out in the Railways (Accident Investigation and Reporting) Regulations 2005 and the accompanying guidance notes, which can be found on RAIB's web site at www.raib.gov.uk

Appendices

Glossary of terms

Appendix A

All definitions marked with an asterisk, thus (*), have been taken from Ellis' British Railway Engineering Encyclopaedia © Iain Ellis. www.iainellis.com

Detected (points)	An arrangement that proves that a set of switches (set of points) are correctly set.*
Normal (points)	For a set of points or set of switches, this is the default position, decided generally as being the position which permits the passage of trains on the most used route.* At Seaton the normal route for the points was curved to the west, entering the platforms.
Railway Group Standards	A document mandating the technical or operating standards required of a particular system, process or procedure to ensure that it interfaces correctly with other systems, process and procedures. Network Rail (NR) produces Network Rail Company Standards (NRCS) that detail how the requirements of the Railway Group Standards are to be achieved on its system.* Railway Group Standards are not mandatory on heritage railways, but are often used by them as best practice.
Reverse (points)	For a set of points or lever this is the position permitting the passage of trains on the least used route.* At Seaton the reverse route for the points was straight on, into the siding.
Split points/split the points	a situation where the left hand wheels go one way and the right hand wheels go the other at a set of facing points.*
Switch(es)	An assembly of two movable rails (the switch rails) and two fixed rails (the stock rails) used to divert vehicles from one track to another. Generally referred to as a set of switches. One switch rail and one stock rail together make a switch half set.* 
Trail (points)	A movement through points from the reverse direction where the switches are automatically returned to their normal position by means of a spring or weight after the train or tram has passed.

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