RAIB

Rail Accident Investigation Branch

Rail Accident Report

Person trapped in doors and pulled along platform at King's Cross station, London 10 October 2011

Department for Transport

Report 09/2012
May 2012

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.

Any enquiries about this publication should be sent to:

RAIB
The Wharf
Stores Road
Derby UK
DE21 4BA

Email: enquiries@raib.gov.uk
Telephone: 01332 253300
Fax: 01332 253301
Website: www.raib.gov.uk

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

Person trapped in doors and pulled along platform at King's Cross station, London 10 October 2011

Contents

This page is left intentionally blank

Summary

A passenger became trapped in a train door and was pulled along a platform, for a distance of approximately 20 metres, at London King's Cross station on 10 October 2011. She suffered bruising to the fingers of her left hand.

The passenger's hand became trapped when she attempted to board the train while the doors were closing. The train started to move before the passenger's fingers were released because a member of staff on the platform did not fully check the train doors before signalling that the train could depart. The requirement to check doors is given in the railway Rule Book.

It is possible that the passenger could have withdrawn her fingers from the doors, before being pulled along the platform, if alternative door edge seals had been fitted on the Class 365 train involved in the incident.

When the passenger alarm was operated during the incident, the train did not stop immediately because the driver decided to continue to the next station. This decision had no effect on the incident but was contrary to the railway Rule Book and, in slightly different circumstances, could have increased the severity of the accident.

The RAIB has identified two learning points from this accident:

- the importance of fully checking train doors before trains depart; and
- the need for drivers to stop trains immediately if the passenger alarm is operated when any part of the train is within a station.

The RAIB has also recommended that, the design of door edge seals on Class 365 trains is reviewed, and if appropriate modified, when the seals are renewed as part of a mid-life refurbishment due in 2013.

Introduction

1 The purpose of a Rail Accident Investigation Branch (RAIB) investigation is to improve railway safety by preventing future railway accidents or by mitigating their consequences.

2 The RAIB does not establish blame or liability, or carry out prosecutions.

3 The descriptions of equipment and events, and the explanations of people's actions, contained in this report are based on site visits, reviewing written statements, interviewing witnesses, reviewing industry reports, analysing data collected by the on train data recorder and reviewing training material.

Background

4 On 10 October 2011, the 17:53 hrs service from King's Cross to Royston was an eight coach train formed by two Class 365, four-coach, electric multiple units, numbers 365501 and 365528 (figure 1). As is normally the case, the train was being operated in the driver-only mode of operation. The train was owned by Eversholt Rail (365) Limited and managed on their behalf by Eversholt Rail UK (Ltd). It was operated by First Capital Connect (FCC), who also employed all the staff involved in the incident.

5 Each Class 365 coach has two pairs of sliding doors on each side. Orange coloured indicator lights, mounted externally near the roof of each coach, illuminate until the doors on that coach are fully closed (figure 1). When all indicator lights are extinguished, the driver receives a visual indication in the cab. The driver cannot (under normal operating conditions) apply power to move the train without this visual indication.

6 The train was due to depart from platform 9 at King's Cross. This is a terminal platform which departing passengers normally reach by going through a ticket barrier at the rear of the departing train.

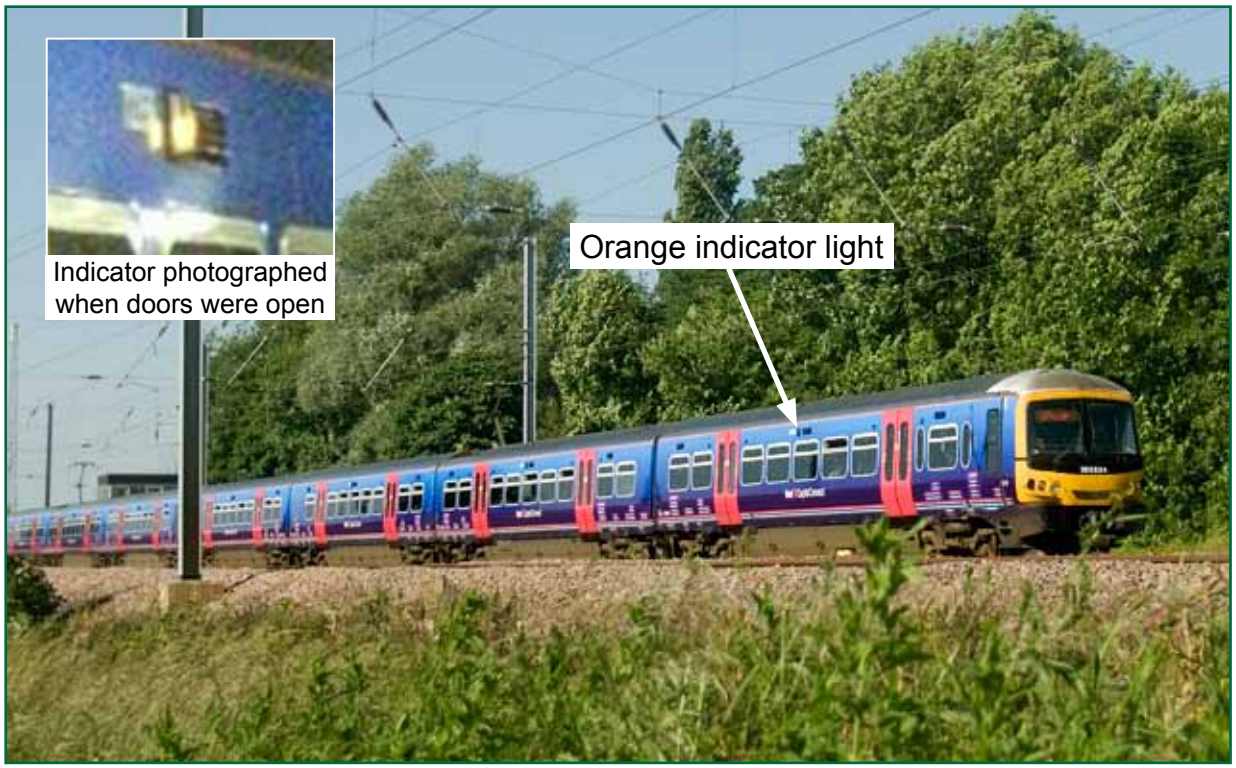

Figure 1: Class 365 train

7 The normal dispatch procedure for a train of this type departing from King's Cross includes the following:

- A member of station staff, known as a dispatcher, goes to the dispatch point (figures 2 and 3). This is adjacent to controls which operate a CD/RA indicator visible to the train driver. At platform 9 the indicator is located above a ground mounted signal near the front of the train (figure 4).
- When it is time for the doors to be closed, the dispatcher turns a switch which causes a 'close doors' (CD) indication to be displayed on the indicator.
- The driver then operates controls in the train cab to close the passenger doors.
- The dispatcher checks that the doors have closed safely, and then operates a switch which causes a 'right away' (RA) indication to be displayed on the indicator.
- After receiving the RA, and checking that the ground mounted signal is displaying a proceed (green or yellow) aspect, the driver then drives the train out of the station.

8 When this method of dispatch is in use, drivers are not expected to view the train doors in order to check that they have closed safely, and no equipment is provided allowing them to view the full length of the train.

The accident

9 The dispatcher reached the dispatch point midway along platform 9 at about 17:50 hrs, three minutes before the incident train was due to depart. From this position he would have been able to see the full length of the train (figure 3) provided that the platform was unobstructed. About 20 seconds before departure time, while some passengers were still hurrying to board the train, the dispatcher blew his whistle as a warning that the doors were about to close.

10 Around ten seconds later, passenger A (the injured party) was walking along the platform. She had passed the rearmost train doors and was walking towards the front of the train, following a group of four or five people who did not intend to board the incident train. At about this time, another passenger ran onto the platform, behind passenger A. That this passenger was running was one of the factors which led the dispatcher to conclude that everyone wishing to join the train was aware that the doors were about to close.

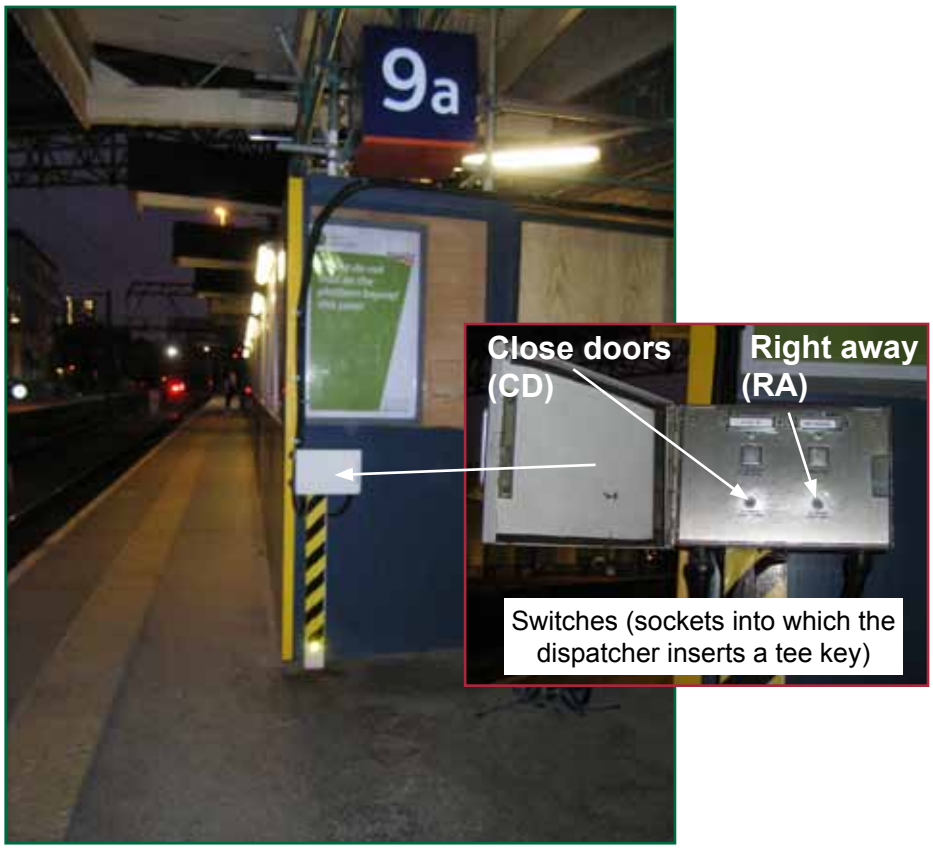

Figure 2: Dispatch point with CD/RA controls mid-way along platform 9

Figure 3: Views from dispatch point

11 The dispatcher then operated the CD control and the driver operated the door close controls in the cab. The 'door closing' audible alarms started to sound and then the doors started to close.

12 Passenger A, who was a regular commuter into King's Cross, heard the door closing alarms, but initially believed that they related to another train which normally leaves an adjacent platform one minute before the incident train. She had walked past two coaches (four sets of doors) before realising that her train was about to depart. She then tried to enter the first set of doors on the next coach, as these doors were closing, and the fingers of her left hand became trapped in the doors shown on figure 3. She believed that the doors would reopen, as with lift doors, if there was anything between them.

13 Passenger A was now standing facing the train, expecting the doors to reopen and release her fingers before moving off. The dispatcher could not see that her hand was trapped; he could only see her head and shoulders because the group of people was restricting his view. The dispatcher noted that all the train's indicator lights were extinguished to indicate that all the passenger doors were closed.

14 The dispatcher, who had remained at the dispatch point, could see the head and shoulders of passenger A adjacent to the doors, and judged that she was in a safe position, and operated the RA control. He was unaware that her hand was trapped.

15 When the train started moving in response to the RA indication, passenger A walked, and then ran, as the train pulled her left hand forwards. The dispatcher saw what was happening but had no means of stopping the train. Passenger A pulled her fingers from between the doors when the train had travelled about 20 metres, possibly aided by passengers inside the train who were pulling at the door seal. She was left standing on the platform, and was given first-aid by staff at King's Cross before she subsequently caught a later train. She then went to a hospital near her home, where her fingers were found to be badly bruised but not broken.

16 At about the time that passenger A was released from the doors, the passenger communication apparatus (PCA) was activated when a passenger on the train pulled an alarm handle[1]. The train did not stop immediately, but continued to Finsbury Park, the next station.

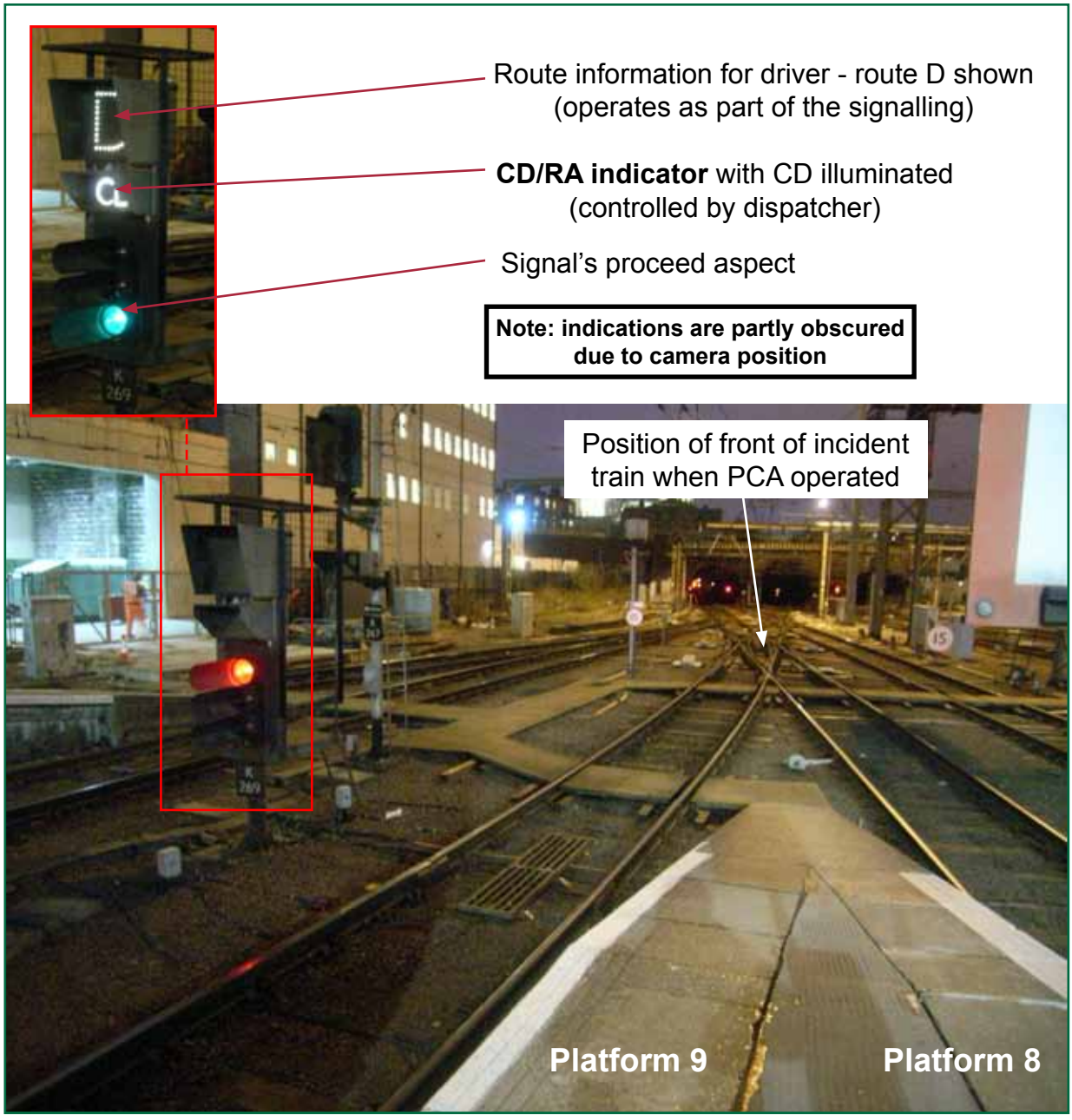

Figure 4: CD/RA indicator and trackwork used by trains leaving platform 9

[1] A second handle was also pulled. The train's on board recording equipment did not record when this happened because the first handle had fully activated the PCA system.

Identification of the immediate cause[2]

17 The train departed with the passenger's fingers trapped in the train doors.

Identification of causal factors[3]

Boarding train while doors closing

18 The passenger attempted to board the train while the doors were closing and then expected the doors to reopen, and release her fingers, before the train moved off.

19 Train operators have, for many years, recognised the risks of delay and possible injury associated with people and objects becoming trapped in sliding doors. Notices describing the proper use of sliding doors, or warnings against improper use, are found in proximity to most sliding doors on trains. Typical notices fixed around Class 365 doors are shown in figure 5.

20 Train operators also run poster campaigns dealing with correct use of train doors. FCC had run this type of campaign in trains and at stations during the two years before the incident.

Inadequate check that nobody was trapped in doors

21 The dispatcher did not carry out a full safety check before permitting the train to depart.

22 The railway Rule Book[4] requires that, after the train doors are closed and before giving the ready-to-start signal, the dispatcher must check that nobody is trapped in the doors (this is known as the train safety check). To carry out this check properly, a dispatcher must be able to have a good view of the whole of the side of the train for its full length.

---

[2] The condition, event or behaviour that directly resulted in the occurrence.

[3] Any condition, event or behaviour that was necessary for the occurrence. Avoiding or eliminating any one of these factors would have prevented it happening.

[4] The rule book, reference GE/RT8000, is published by the Rail Safety and Standards Board (RSSB). This requirement is paragraph 6.4 of module SS1.

Figure 5: Typical safety notices on Class 365 train doors

23 The dispatcher was standing at the dispatch point midway along platform 9, about 60 metres from the incident door and about 2 metres from the platform edge (figure 2). The distance to the incident door was significantly less than the 160 metres maximum viewing distance advised in RSSB publication RIS-3703-TOM[5]. Although there were few people on the platform, the group of people not intending to board the train were between the dispatch point and the incident door. This meant that the dispatcher did not have a clear view of passenger A and the incident door (figure 3). If the group had not been present, it is possible that the position of passenger A's body would still have prevented the dispatcher seeing her trapped hand.

24 The dispatcher believed that he had to remain at the dispatch point after he first operated the CD control. This was because the driver's CD indicator is extinguished when the dispatcher releases the CD switch at the dispatch point and, from past experience, the dispatcher believed that, if he released the CD button without immediately operating the RA control, the train driver might take this as a signal to reopen the train doors.

[5] Rail Industry Standard for Passenger Dispatch and Platform Safety.

25 Some FCC dispatch staff had adopted the practice that, if the platform was so crowded that they could not see all doors, they would use their experience, and observation of passenger behaviour, to determine whether it was appropriate to give the RA. However, the railway Rule Book requirement can only be met by viewing the full height of all train doors and, in some circumstances, particularly if there are still people on the platform, this can only be achieved if the dispatcher temporarily leaves the dispatch point to look along the side of the train. From such a position the dispatcher could have seen that passenger A was in an unsafe position, very close to the side of the train. Depending on the exact position of passenger A's body and hand, it is also possible that the dispatcher would have seen that her fingers were trapped in the door.

26 The dispatcher used his experience of passenger behaviour, and his observation of passenger A's actions, to judge that she did not intend to travel on the train, and was in a place of safety.

27 The initial training given to the dispatcher by FCC, about one year before the accident, had included an instruction to check that doors are closed and free of obstructions before dispatching the train.

28 Briefing material in the form of 'RED' DVDs intended to be used for refreshing staff safety knowledge is distributed periodically by the Operations Focus Group (OFG), a cross-industry group whose aim is to improve railway safety through the development and promotion of campaigns, programmes and tools. Its members include Network Rail, the Rail Safety and Standards Board, trade unions and train operators. The OFG's October 2010 DVD highlighted the importance of checking that nothing was trapped in doors before giving the RA. The fictional scenario included on this DVD has similarities to the King's Cross incident.

29 FCC had not made any arrangements to show the OFG's safety DVDs to dispatch staff, except those trained from late 2010 onwards who saw it as part of their initial training.

Passenger could not remove fingers before train started moving

30 The passenger was unable to remove her fingers from the doors before being pulled by the train.

31 The passenger doors on Class 365 trains include a compressible rubber strip on the edges which touch when the doors close. These prevent draughts between the closed doors and must deform to provide a draught-free seal.

32 Class 365 trains also include safety circuits intended to prevent the train starting to move if any of the doors are not properly closed. These circuits rely on switches which detect when the doors have reached the closed position and are locked. The need for compressible seals means that it is possible for doors to be detected in this condition, and the train can start moving, when the seals have deformed around a small object.

33 The doors were designed on the basis that small objects might become trapped, but can then be pulled out. Therefore the doors can be detected as closed if a small object, not exceeding 25 mm in thickness, is trapped between them. The incident doors met the design criteria when tested after the accident. As adult female fingers are typically 11 mm to 14 mm thick when squeezed, these criteria mean that the doors can trap fingers.

34 Following an accident at Huntingdon station (RAIB report 11/2007), testing showed that the force required to withdraw objects trapped in Class 365 doors exceeded the maximum force permitted for trains built to current requirements as set out in Railway Group Standard GM/RT2473 (February 2003)[6]. These requirements were introduced after the Class 365 trains were placed into service and did not apply to trains which were already built.

35 RAIB's report on the accident at Huntingdon recommended a review of options to reduce the force required to withdraw objects trapped in Class 365 doors. The Office of Rail Regulation (ORR) accepted that this recommendation should be closed after FCC and the train owner submitted a June 2008 report showing that the following options had been considered:

- reducing the force used to hold the doors in the closed position (tested and found to be impractical);
- replace door seals with an alternative design (rejected because the original door manufacturer had no plans to produce a suitable alternative design and because it was considered that the use of an alternative supplier would import potential reliability and safety risks); and
- applying a low friction tape on the edge of the door seals (further testing required).

36 After carrying out further testing, FCC concluded that fitting low friction tape to the existing door seals was impractical. The possibility of using a low friction material with new door seals was rejected due to the cost of providing new seals.

37 All Class 365 door seals are to be replaced as part of a major overhaul of these trains expected to take place between 2013 and 2015. RAIB notes that this provides an opportunity to implement measures intended to reduce withdrawal forces, at a time when the cost of replacing seals will be incurred as part of other planned activities.

38 The risk to passengers on Network Rail managed infrastructure is assessed by the RSSB using its Safety Risk Model. As the risk associated with being pulled after being trapped in a door is relatively low, the model does not include a specific assessment of this risk.

39 The last occasion on which there was a fatal accident to a passenger who was dragged after becoming trapped in train doors was outside Network Rail infrastructure and occurred on 21 October 1997 at Holborn on the London Underground system[7].

40 Other incidents involving passengers at the interface between train or tram and platform, which have been investigated by the RAIB, include those at Huntingdon on 15 February 2006 (paragraph 34), Wellesley Road, Croydon on 15 June 2007 (report number 40/2007), Tooting Broadway on 1 November 2007 (report number 17/2008), and Brentwood on 28 January 2011(report number 19/2011). All of these incidents occurred at locations where there was no dispatcher so the train or tram driver was responsible for checking that passengers were clear of doors.

---

[6] This statement is based on measuring the force needed to withdraw an aluminium object from between closed doors; forces below the specified maximum can be obtained if low friction material objects (eg smooth plastic) are used for the test. GM/RT2473 does not specify the material to be used but aluminium is routinely used for this type of test.

[7] RAIB investigation report into the incident at Tooting Broadway on 1 November 2007 (report number 17/2008).

Observation

41 A passenger near the incident door pulled the PCA about 9 seconds after the train had started moving, when it had travelled about 17 metres. The driver operated an override control 3.5 seconds later and this prevented the PCA causing an emergency brake application. The train continued for about four minutes, until it reached the next station.

42 The driver's decision to override the PCA had no effect on this incident because passenger A's fingers were released from the doors shortly before he operated the PCA override. However, overriding the PCA could have resulted in passenger A sustaining more serious injuries if she had remained trapped in the doors, as occurred at Huntingdon (paragraph 34).

43 Override controls are fitted to some trains so that, in appropriate circumstances, the driver can prevent the train stopping at an unsuitable location, such as in a tunnel where it will be difficult to provide assistance to passengers.

44 The railway Rule Book[8], and the FCC training notes given to the incident driver during his training[9], both instruct drivers that:

- if the PCA is operated, you must, if possible, avoid stopping the train in a place where it might be difficult to deal with the emergency; and
- you must stop the train immediately if the PCA is operated as the train is leaving the station.

45 The Rule Book makes clear that, if a train is leaving a station, the requirement to stop the train takes precedence over any consideration of unsuitable places to stop. The training material does not explain this and the incident driver, who had completed his training three months before the incident, believed that he was required to make a rapid judgement call. He had no indication inside his cab of where in the train the PCA had been operated. He decided to continue to Finsbury Park station; this was not a scheduled stopping place for this train, but was the first location at which assistance could be provided relatively easily. He made a general announcement to the passengers, saying that he was aware that the PCA had been operated and that the train would continue to the next station.

46 When the PCA was operated, the front of the train had left the platform and was running on to the points at the exit from King's Cross station (figure 4). The driver assumed that there was a problem inside the train. He decided that an immediate brake application was inappropriate because this would delay evening peak services, and because the train would have stopped over points, a location where, according to his training, it would be difficult to provide assistance to passengers.

47 Although the incident driver acted contrary to the railway Rule Book, post incident enquiries by FCC showed that a significant number of its drivers would have made the same decision.

[8] Module TW1, paragraph 10.10.

[9] Module 3c, sessions 93-96.

Summary of conclusions

48 Passenger A was pulled along the platform due to:

- the passenger trying to board the train after the doors started to close, and expecting that the doors would reopen when her hand was trapped between them (**paragraph 18, action to be taken (paragraph 50)**);
- the dispatcher not fully complying with the railway Rule Book requirement to check that nobody is trapped in the train doors (**paragraph 21, actions in hand (paragraphs 51 and 52), Learning point 1**); and
- the difficulty of removing fingers trapped in Class 365 doors (**paragraph 30**, **Recommendation 1**).

49 The RAIB has observed that, in slightly different circumstances, the driver's decision to override the PCA could have led to a more serious outcome (**paragraphs 41 to 47, action taken (paragraph 53), Learning point 2**).

Actions reported that address factors which otherwise would have resulted in a RAIB recommendation

50 FCC intends to run another poster campaign covering the risks associated with passengers attempting to board trains after the doors start to close. It also proposes wider use of public address systems to educate passengers about the correct use of train doors.

51 FCC have reminded existing dispatch staff that, before permitting trains to depart, they must visually check that all closed doors are clear of obstructions. FCC's trainers have confirmed that this message is included in the training being given to new dispatchers.

52 FCC are reviewing dispatch arrangements and expect this review to consider whether OFG's DVDs should be shown to dispatchers.

53 FCC has issued a notice to all drivers reminding them that trains must always be stopped immediately if the PCA is operated while the train is leaving a station. FCC also intends to give this requirement greater prominence in driver training.

Learning points

54 The RAIB has identified two key learning points[10] for the railway industry:

Learning point 1

Trains must be stopped immediately if the passenger communication alarm is activated while *any part of the train* is in, or has just left, a station.

Learning point 2

Operators must ensure that dispatch arrangements include visual inspection of all train doors to ensure that nothing is trapped. There is value in monitoring compliance with such arrangements by means such as unobtrusive monitoring. Further advice is given in RSSB publication RIS-3703-TOM, 'Rail Industry Standard for Passenger Dispatch and Platform Safety'.

55 RAIB acknowledges that visual inspection of all doors can be problematic, particularly on busy platforms. In order to ensure that all train doors are viewed by dispatchers, operators should consider:

- instructing dispatchers to position themselves, and move where necessary, so that they can get an unobstructed view of the whole side of the train;
- moving CD/RA control positions to a location with an improved view of the side of the train, or providing a wireless hand set for operation of these indicators;
- using public address systems to ask passengers to move away from the train; and
- use of closed circuit television (CCTV) or mirrors to assist dispatchers.

[10] An issue which the RAIB wishes to draw to the attention of industry bodies and railway staff so that they can take appropriate action.

Recommendation

56 The following recommendation is made[11]:

1 *The intent of this recommendation is that the practicability of providing a modified door seal arrangement on Class 365 trains, when the existing seals are replaced during the major overhaul due between 2013 and 2015, should be assessed. If such modifications are practicable for Class 365 trains, consideration should be given to:*

- *modifying any similar doors on other classes of trains; and*
- *using modified seals if these are available when seal replacement is undertaken before the next major overhaul (eg following damage).*

As some trains with similar doors are owned by other organisations, the owner of Class 365 trains should make available to these organisations the information needed for them to determine whether they should consider modifying doors on any of their trains.

Eversholt Rail UK (Ltd) should determine whether the next planned replacement of Class 365 door seals provides an opportunity to modify the seal arrangements to reduce the risk associated with trapping of objects and people to be as low as reasonably practicable. If such modification is found to be reasonably practicable, Eversholt Rail UK (Ltd) should:

- determine whether a similar modification is appropriate for other classes of train owned by the Eversholt Rail Group;
- determine whether such modifications should be applied if seals require replacement before the scheduled date; and
- make available to other train owners suitable and sufficient information for these owners to establish whether a similar approach should be considered for any of their train doors (paragraph 48).

[11] Those identified in the recommendation, have a general and ongoing obligation to comply with health and safety legislation and need to take the recommendation into account in ensuring the safety of their employees and others.

Additionally, for the purposes of regulation 12(1) of the Railways (Accident Investigation and Reporting) Regulations 2005, the recommendation is addressed to the Office of Rail Regulation to enable it to carry out its duties under regulation 12(2) to:

(a) ensure that recommendations are duly considered and where appropriate acted upon; and

(b) report back to RAIB details of any implementation measures, or the reasons why no implementation measures are being taken.

Copies of both the regulations and the accompanying guidance notes (paragraphs 200 to 203) can be found on RAIB's website www.raib.gov.uk.

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

Any enquiries about this publication should be sent to:

RAIB
The Wharf
Stores Road
Derby UK
DE21 4BA

Telephone: 01332 253300
Fax: 01332 253301
Email: enquiries@raib.gov.uk
Website: www.raib.gov.uk