



Rail Accident Investigation Branch

Rail Accident Report



**Passenger trapped and dragged by a train at
Hayes & Harlington station
25 July 2015**

Report 12/2016
June 2016

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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Preface

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. It is not the purpose of such an investigation to establish blame or liability. Accordingly, it is inappropriate that RAIB reports should be used to assign fault or blame, or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The RAIB's findings are based on its own evaluation of the evidence that was available at the time of the investigation and are intended to explain what happened, and why, in a fair and unbiased manner.

Where the RAIB has described a factor as being linked to cause and the term is unqualified, this means that the RAIB has satisfied itself that the evidence supports both the presence of the factor and its direct relevance to the causation of the accident. However, where the RAIB is less confident about the existence of a factor, or its role in the causation of the accident, the RAIB will qualify its findings by use of the words 'probable' or 'possible', as appropriate. Where there is more than one potential explanation the RAIB may describe one factor as being 'more' or 'less' likely than the other.

In some cases factors are described as 'underlying'. Such factors are also relevant to the causation of the accident but are associated with the underlying management arrangements or organisational issues (such as working culture). Where necessary, the words 'probable' or 'possible' can also be used to qualify 'underlying factor'.

Use of the word 'probable' means that, although it is considered highly likely that the factor applied, some small element of uncertainty remains. Use of the word 'possible' means that, although there is some evidence that supports this factor, there remains a more significant degree of uncertainty.

An 'observation' is a safety issue discovered as part of the investigation that is not considered to be causal or underlying to the event being investigated, but does deserve scrutiny because of a perceived potential for safety learning.

The above terms are intended to assist readers' interpretation of the report, and to provide suitable explanations where uncertainty remains. The report should therefore be interpreted as the view of the RAIB, expressed with the sole purpose of improving railway safety.

The RAIB's investigation (including its scope, methods, conclusions and recommendations) is independent of any inquest or fatal accident inquiry, and all other investigations, including those carried out by the safety authority, police or railway industry.

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Passenger trapped and dragged by a train at Hayes & Harlington station, 25 July 2015

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Summary

At around 13:10 hrs on 25 July 2015, a passenger was dragged along the platform at Hayes & Harlington station, London, when the 11:37 hrs First Great Western service from Oxford to London Paddington departed while her hand was trapped in a door. The passenger, who had arrived on the platform as the doors were about to close, had placed her hand between the closing door leaves.

The train driver did not identify that the passenger was trapped and the train moved off, dragging the passenger along the platform. After being dragged for about 19 metres, the passenger lost her footing and fell onto the platform. The passenger suffered head, hand and back injuries.

The RAIB investigation found that the passenger had deliberately placed her hand in the closing door in the expectation that it would re-open as a consequence. The RAIB has concluded that after closing the doors of the train, the driver either did not make a final check that it was safe to depart, or that the check was insufficiently detailed to allow him to identify the trapped passenger. The driver may have been misled into thinking that it was safe to depart because a door interlock light in his cab had illuminated, indicating that the doors were closed and locked and he was able to take power. The RAIB's investigation identified that the train driver and other railway staff held the same misunderstanding: if someone had a hand trapped in a door it would not be possible for the door interlock light to illuminate and a driver to take power. This is not the case.

The RAIB has made two recommendations. The first is addressed to RSSB and seeks the review, and if necessary the extension, of its research into the passenger-train interface to understand passenger behaviour and identify means for deterring members of the public from obstructing train doors. The second recommendation, addressed to operators and owners of trains similar to the one involved in the accident at Hayes & Harlington, is intended to continue and expand upon a current review into the practicability of fitting sensitive door edge technology to this type of train.

The RAIB has identified three learning points. The first of these relates to improving awareness among train drivers of the limitations of train door interlocking technology and the importance of the final safety check when dispatching a train. The second concerns the potential for drivers to be distracted by the use of mobile communication devices while driving. The third emphasises the importance of train operators having the necessary processes in place to identify drivers who are showing signs of sub-standard performance or not engaging positively with measures agreed as part of a Competence Development Plan. It also highlights the need to provide briefing and guidance material for driver managers to enable them to identify behaviours and attitudes which are inconsistent with those expected of train drivers.

Introduction

Key definitions

- 1 Metric units are used in this report, except when it is normal railway practice to give speeds and locations in imperial units. Where appropriate the equivalent metric value is also given.
- 2 The report contains abbreviations and technical terms (shown in *italics* the first time they appear in the report). These are explained in appendices A and B. Sources of evidence used in the investigation are listed in appendix C.

The accident

Summary of the accident

- 3 At around 13:10 hrs on 25 July 2015, a passenger was dragged approximately 19 metres along the platform by a train departing from Hayes & Harlington station after her left hand became trapped in the train door when it had closed. As the train moved off, the passenger lost her footing and fell onto the platform, suffering hand, head and back injuries. The driver was unaware of the accident and the train continued on its journey.
- 4 The train was the 11:37 hrs First Great Western service from Oxford to London Paddington, train reporting number 2P48.

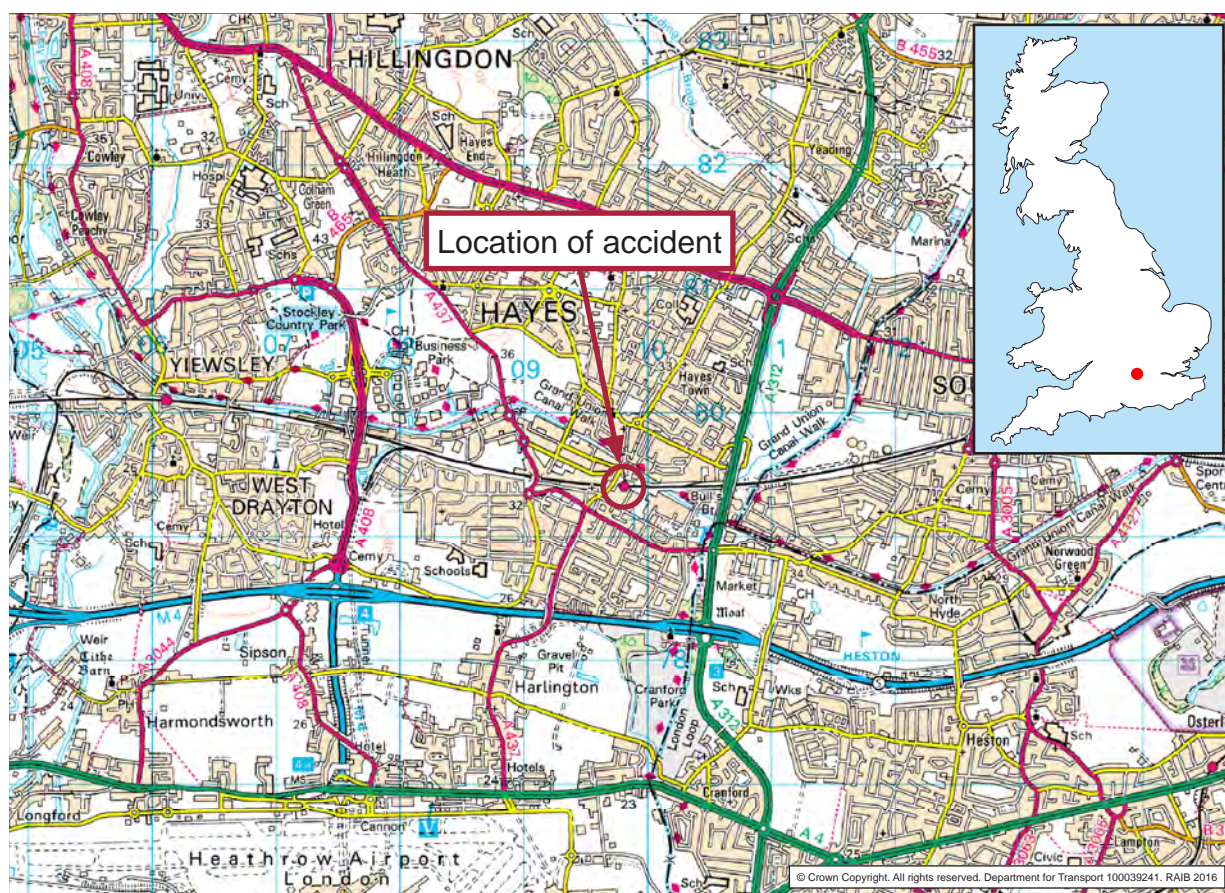


Figure 1: Ordnance Survey map showing location of accident

Context

Location

- 5 Hayes & Harlington station is located on the route between London Paddington and Reading (figures 1 and 2), 10 miles 71 *chains* from London Paddington. The station has four platforms. Platform 4, where the accident occurred, is a bi-directional platform, although it is predominantly used by trains running in the up direction, towards London Paddington (figure 3).

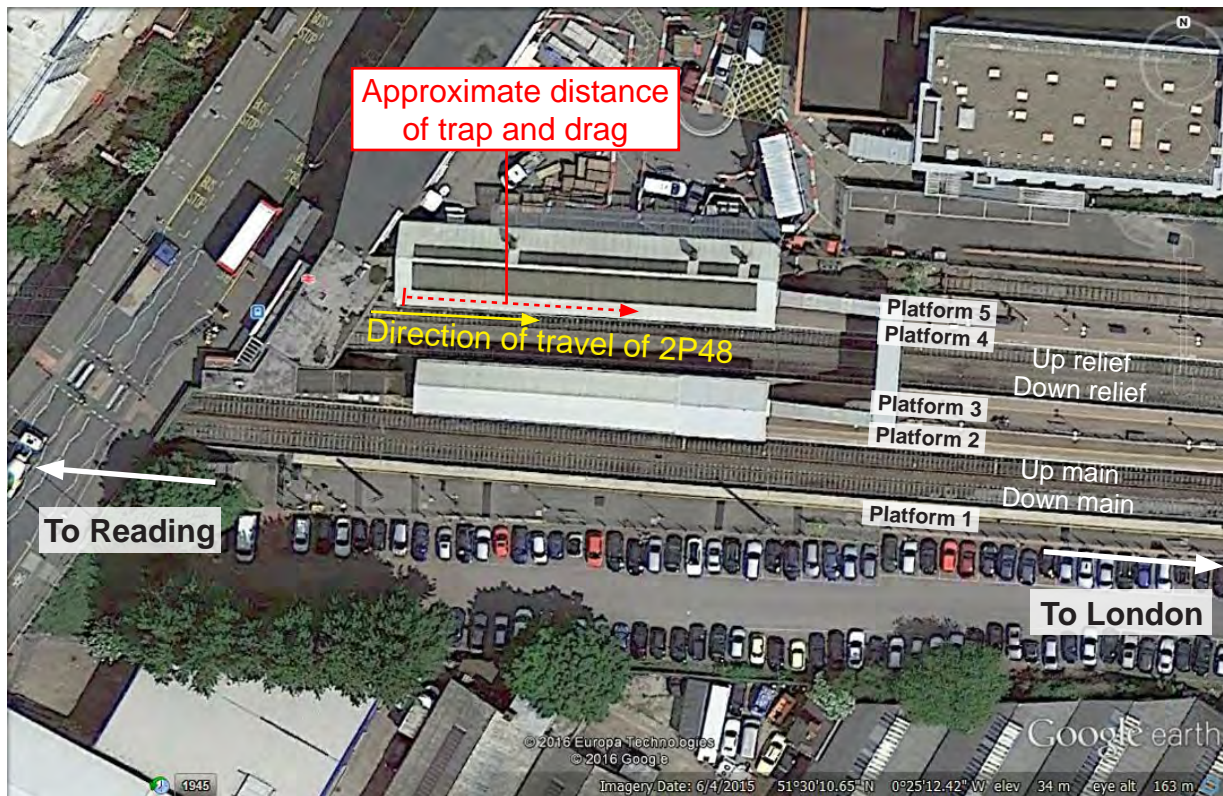


Figure 2: Overview of site/incident showing geographical relationship of key features

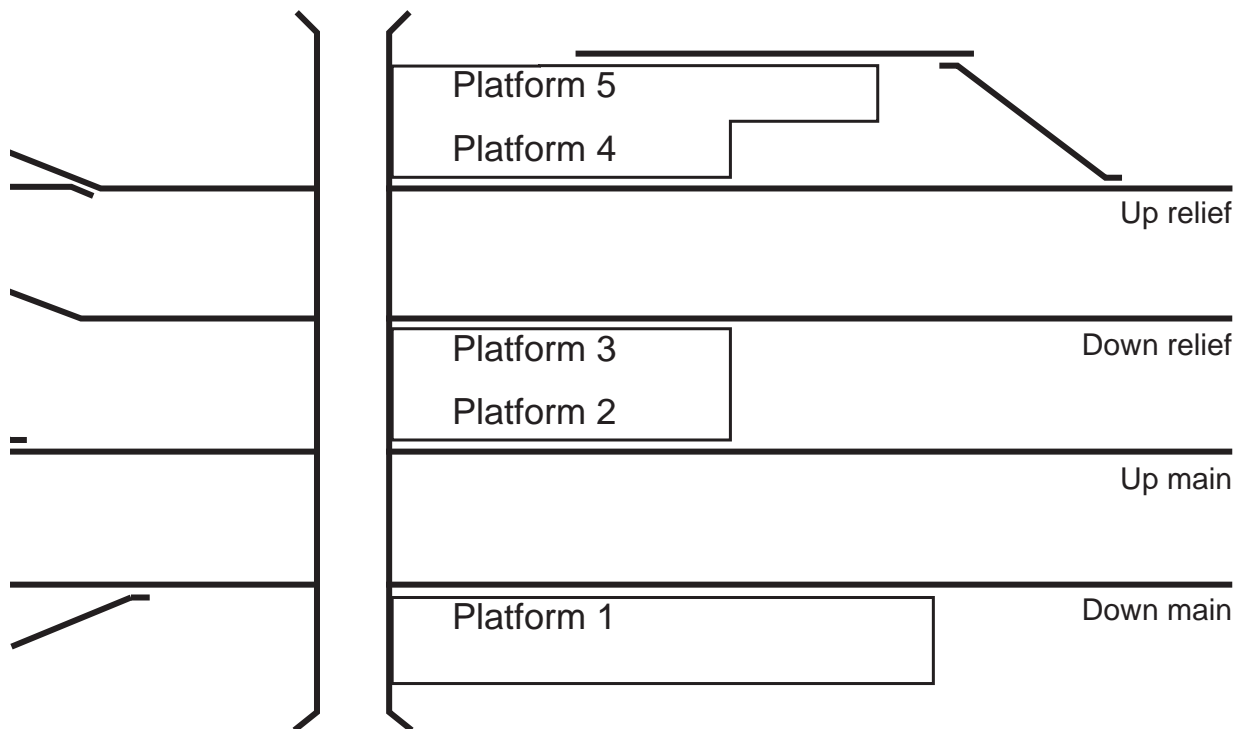


Figure 3: Track layout showing platform 4 at Hayes & Harlington station

Train involved

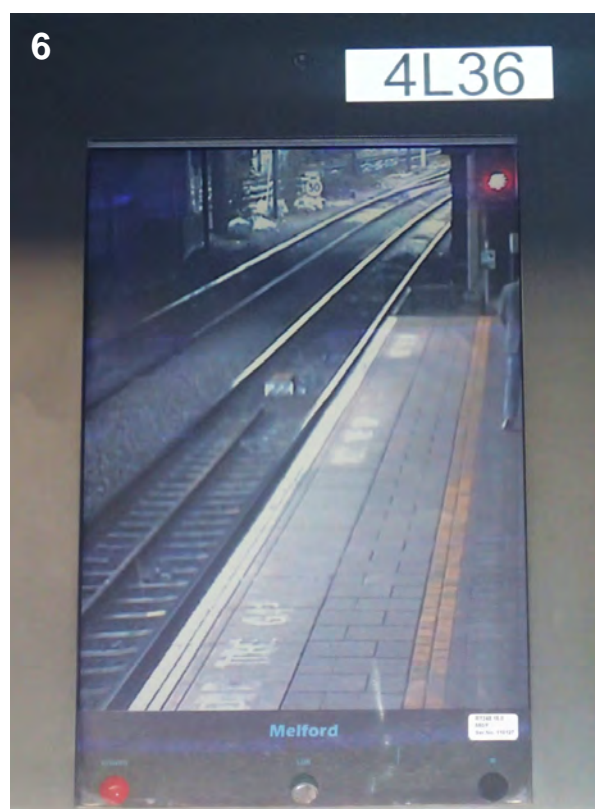
- The train involved in the accident was a class 165 Diesel Multiple Unit (DMU) (165101) formed of three carriages. The passenger involved in the accident had been attempting to board through the rear door on the third carriage (figure 4).



Figure 4: Class 165 vehicle layout and position of passenger attempting to board the rear set of doors of the carriage

Rail equipment/systems involved

- For all trains calling at Hayes & Harlington station, drivers are responsible for door operation and train dispatch (this method of working is commonly known as 'Driver Only Operation' (DOO)).
- Closed Circuit Television (CCTV) monitors on platform 4 (figures 5, 6 and 7) are provided to assist drivers to dispatch the train. The three screens are located within a shrouded cover and provide train drivers with a colour view of the side of the train and all the passenger doorways.



Figures 5 and 6: CCTV at the three-car stopping position on platform 4



Figure 7: Platform 4 (Up relief line) at Hayes & Harlington

Organisations involved

- 9 Network Rail owns the station infrastructure and is responsible for the inspection and maintenance of the CCTV system used by train drivers during dispatch.
- 10 First Great Western was the operator of train 2P48. On 20 September 2015, First Great Western (FGW) changed its name to Great Western Railway (GWR). The remainder of the report refers to the company using the abbreviation FGW as was current at the time of the accident. FGW employed the train driver, and station and control room staff involved in the aftermath of the accident.
- 11 All parties freely co-operated with the investigation.

People involved

- 12 The injured passenger was 60 years old. She was a frequent train traveller, and she regularly made the journey between Hayes & Harlington and Ealing Broadway.

Train driver

- 13 The driver of train 2P48 started employment with FGW in July 2001 and was passed competent to drive class 165/166 DMUs in 2002. Details of the driver's service and competence history are provided in paragraphs 86 to 89.

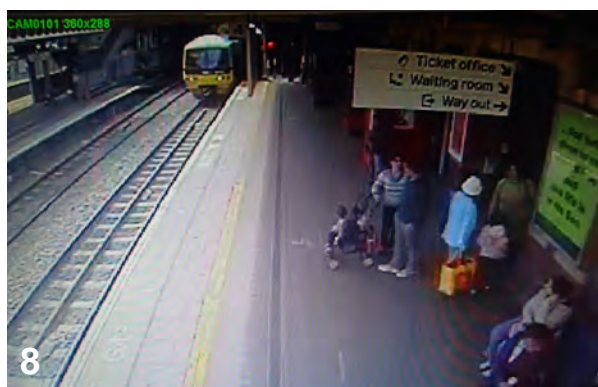
External circumstances

- 14 The weather at the time of the accident was warm (21°C). The cab window was closed, allowing the cab air cooling system to work effectively. No issues relating to the visibility through the cab windows were reported by the train driver.

The sequence of events

Events preceding the accident

15 Train 2P48 departed from Oxford on time at 11:37 hrs, and remained on time throughout its journey to London Paddington. On arrival at Hayes & Harlington station¹ (figure 8), the driver released the doors at 13:08:36². A few passengers alighted and by 13:08:57 all passengers on the platform intending to travel had boarded (figures 9 and 10). A small number of passengers remained on the platform, waiting for a later train. At 13:09:26, a male and two female passengers arrived on the platform and boarded the train (figure 11).



Figures 8 to 11: CCTV images showing train 2P48 arriving at Hayes & Harlington and subsequent activity on the platform (courtesy of GWR)

16 At 13:09:48 the passenger involved in the accident ran from the stairwell onto platform 4 (figure 12). The RAIB has established using CCTV evidence that this is around the same time at which the train driver pressed the door close button to initiate their closure. The passenger continued to run (figures 13 and 14) towards the train doors which were still open, but with the audible 'hustle' alarm sounding indicating imminent closure.

¹ Analysis of the platform CCTV for the rear of the train shows the 3 car train had correctly stopped at the 3 car marker point on the platform. Platform CCTV files showing the front of the train had been overwritten due to the delay in the FGW identifying the serious nature of the incident.

² Due to the delay in FGW identifying the serious nature of the incident (paragraph 26) the On Train Data Recorder (OTDR) for train 2P48 was overwritten. Therefore all timings relating to the operation of the train doors are approximate as they are based on timings (hour: minute: second) obtained from the platform CCTV.



Figures 12 to 14: CCTV images showing the passenger running from the stairwell and onto the platform towards the stationary train as the doors were closing (courtesy of GWR)

17 At 13:09:50 the passenger put her leg and left hand between the rear door leaves (which were by now almost closed) on the last coach of the train, in an attempt to prevent them from fully closing. Almost immediately, she retracted her leg, leaving her left hand in the door (figure 15). At 13:09:51 the *Body Side Indicator light* on the rear carriage was extinguished. The driver's *door interlock light* illuminated in the cab a second or two later, once the safety circuits had identified that all the train doors were closed and locked (figure 16) (the CCTV evidence does not show all of the doors on the train so it is not possible to be precise about the time that the door interlock light illuminated).

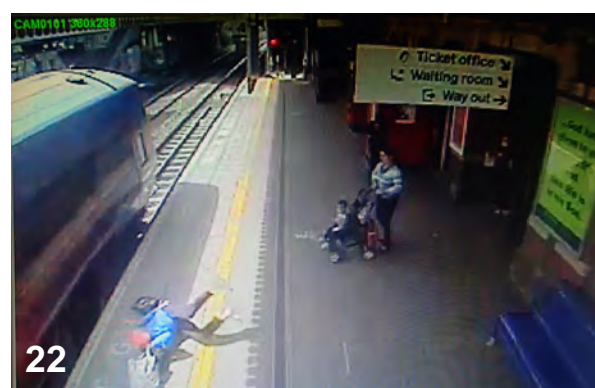
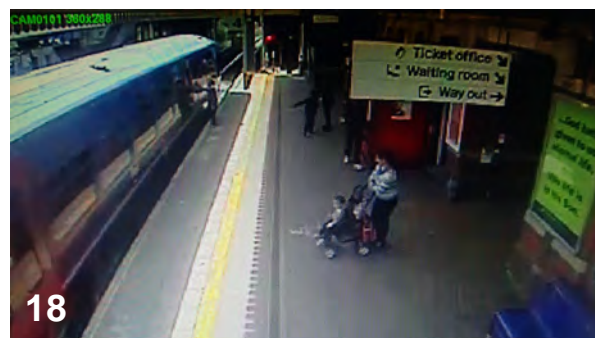


Figures 15 and 16: CCTV images showing the passenger running towards the train and trapping her hands in the door of the rear carriage of train 2P48 (courtesy of GWR)

Events during the accident

18 The passenger stood still, looking towards the front of the train with her hand still trapped. She did not immediately attempt to remove her hand. A second or two later she realised the door was not re-opening and then attempted to pull her hand out (she may have been reacting to the sound of the train's engines revving up).

- 19 At approximately 13:10:01, the train started to move. At this time other passengers on the platform became aware of the trapped passenger (figures 17 and 18). The train gathered speed, dragging the passenger along the platform (figure 19) until 13:10:07 hrs, when the speed of the train caused her to lose her footing and she became airborne (figure 20). The weight of her body falling and the angle of her trapped left hand resulted in her hand becoming free from the doors, and she fell heavily onto the platform. Fortunately, she rolled away from the platform edge (figures 21 and 22).



Figures 17 to 22: CCTV images showing the passenger being dragged along the platform and falling away from train 2P48 (courtesy of GWR)

Events following the accident

- 20 The injured passenger remained lying on the platform for approximately one minute and members of the public came to her assistance (figure 23). When she was able, she got up and reported the full circumstances of the accident to a member of station staff (who was located in the ticket office).

- 21 The member of staff asked the passenger if she required an ambulance, but she declined the offer and said that she would make her own way to hospital. The member of staff (who was not trained or competent in train dispatch duties), mistakenly believed that a train driver would not have been able to start the train with a hand trapped in a door.
- 22 First Great Western safety procedures SMS-2005-00, 'Accident and Near Miss Reporting & Investigation', and SMS 1650 'Accidents involving staff, contractors or passengers' prescribe the actions to be taken when an incident or accident is reported to a member of FGW staff. The procedures split accidents and near miss incidents into two main categories, depending on their potential for harm (trap-and-drag events are not specifically mentioned):
- High-potential incidents, where the event is uncontrolled and a passenger is involved.
 - Low-potential incidents such as a wet floor or existence of a trip hazard.
- 23 In both cases, the event must be reported to the FGW Route Information Specialist (RIS), who is based in the FGW control room at Swindon. The RIS decides whether to deal with the incident as a low-risk event (in which case an accident form is completed or local investigation undertaken) or as a high-risk event needing further immediate action, in which case they must notify the Duty Control Manager (DCM).



Figure 23: CCTV images showing the passenger on the platform after falling away from train 2P48 (courtesy of GWR)

- 24 At around 13:25 hrs, and before contacting the RIS at Swindon, the member of station staff contacted the FGW on-call station manager to advise him of the event. He also contacted the Duty Station Manager at London Paddington station to request that the driver of the train involved be met on arrival at the terminus and asked to telephone the Hayes & Harlington ticket office.
- 25 When the train arrived at Paddington, a station assistant asked the train driver to telephone Hayes & Harlington station. The driver declined to do this as his next train was due to depart in ten minutes. He subsequently booked off duty without phoning Hayes & Harlington station.

- 26 At around 14:00 hrs the member of station staff at Hayes & Harlington contacted the RIS based at Swindon (paragraph 23). He told the RIS that the passenger had reported that she had been trapped in the doors and dragged along the platform, but expressed his doubts that a trap and drag accident had actually occurred. The RIS, who also believed that the train door interlocking system would not allow the train driver to drive away when a hand was trapped in a door, agreed with this conclusion and they decided to classify the event as a minor station (low-potential) accident rather than a high-potential accident. The RIS did not bring the accident to the attention of the DCM. As a consequence of these decisions, key evidence was not gathered (such as immediate post-accident door testing, drugs and alcohol screening of the driver and recovery of information from the train's OTDR equipment).
- 27 In accordance with FGW station accident procedures (low-potential incidents) the RIS generated a pager message at 14:30 hrs notifying all FGW on call managers that an accident at Hayes & Harlington had been reported. He also emailed a station accident form to the FGW Safety Department.
- 28 At around 03:00 hrs the following morning (26 July 2015), the night turn RIS reviewed the log for the previous day and took a different view of the accident at Hayes & Harlington from the RIS who had originally dealt with the notification. He brought the accident to the attention of the night turn DCM. The DCM requested that the platform CCTV at Hayes & Harlington be downloaded and arranged for the train to be taken out of service to Reading maintenance depot where standard post-incident door testing was undertaken (paragraph 43).
- 29 On 27 July 2015, a member of the FGW Safety Department reviewed the station accident report (paragraph 27) and a station accident investigation was started. The details of the assumed low-potential near miss incident were amended to a high-potential trap and drag accident and entered onto the Safety Management Information System (SMIS)³.
- 30 On 28 July 2015, the train driver involved in the accident was identified by the FGW safety manager, who subsequently asked a Driver Standards Manager (DSM) to meet the driver at the end of his shift to find out if the train driver had been aware of the accident, and if necessary obtain his first account. At this stage, the station CCTV had still not been viewed and the true nature of the accident had not yet been established. The DSM, who had been the train driver's line manager for the previous five years, met the driver and obtained an initial report from him (paragraphs 57 to 60).
- 31 The following day, 29 July 2015, FGW managers conducting the investigation viewed the platform CCTV and realised the serious nature of the accident.
- 32 FGW notified the Office of Rail and Road (ORR) on 7 August 2015. On 25 August 2015 the ORR contacted the RAIB; this was the first time the RAIB became aware of the accident.

³ The Safety Management Information System (SMIS) is the rail industry's database for recording safety-related events that occur on the national rail network.

Key facts and analysis

Identification of the immediate cause

- 33 The train departed from the platform with the passenger's hand trapped in the train door.**
- 34 The sequence of events described in paragraphs 15 to 20 is based on witness evidence and recordings from CCTV cameras located on platform 4 at Hayes & Harlington station.

Identification of causal factors

- 35 The accident occurred as a result of the following factors:
- a. the passenger placed her hand into the gap between the closing door leaves (paragraph 36);
 - b. the passenger could not remove her hand once the door had closed (paragraph 38);
 - c. the driver was able to start the train with the passenger's hand trapped in the door (paragraph 48); and
 - d. the train driver started the train with the passenger's hand trapped in the door (paragraph 52).

Each of these factors is now considered in turn.

The actions of the passenger

- 36 The passenger placed her hand into the gap between the door leaves as they were closing.**
- 37 CCTV and witness evidence shows that the passenger attempted to board the train as the doors were closing. The passenger believed that if she placed her hand into the gap between the door leaves, it would cause them to re-open. She said that as she ran towards the train she did not see the cautionary sticker (figure 24) placed on the outside of the door requesting passengers not to attempt to board the train as the doors are closing. Although she was aware that obstructing the doors was potentially unsafe, she thought that the train would not be able to move if her hand was caught in a door, and that in any case the driver would see her and would re-open the doors. As a result, when her hand first became trapped and the train was still stationary, she made no attempt to pull it out of the doors⁴.

⁴ RSSB project (T426) Minimisation of accidents at the platform-train interface (2006) identified that passengers perceived train doors were similar to lift doors in that they would reopen if they encountered an object. The behaviour of the public suggested that the risk is poorly understood. The research recommended that a campaign message should cover both information on the door mechanism and alert passengers to not attempt to obstruct the doors once they are closing. The research resulted in changes being made to the signage on train doors and this research has now been extended to understand passenger behaviour and optimising door closure arrangements to improve boarding and alighting (T1102).



Figure 24: Cautionary sticker on the outside of the class 165 trains requesting passengers to not attempt to board the train when the doors are closing. Inset image showing 'sharks teeth' graphic design on the livery of a TransPennine Express train to warn passengers of the dangers of obstructing a door.

The forces exerted by the closed door leaves

38 The passenger could not remove her hand once the door had closed.

- 39 Although the passenger did not initially attempt to pull her hand free from the train door, once she realised that the doors were not going to re-open she attempted to extract her hand, but was unable to do so.
- 40 The class 165 and 166 trains, which are the diesel units in the Networker family of trains⁵, were built between 1990 and 1993. This was before the introduction of the British Rail Standard GO/OTS 300 'Power Operated External Doors on Passenger Carrying Vehicles' (December 1993) and the current Railway Group Standard GM/RT2473 'Power operated external doors on passenger carrying rail vehicles' which superseded it.
- 41 Both standards defined design requirements for passenger doors. Although the doors on the class 165 units were not designed in accordance with either standard, FGW had transposed certain values from each standard into its own standards for testing the doors after incidents.

⁵ Networker trains also include classes 365, 465 and 466.

- 42 One such test relates to the maximum permissible forces required to extract an object from train doors. The long edge of a test object with a rectangular cross section of 10 x 50 mm is placed between the door leaves and trapped. The standard requires that the object should be capable of being withdrawn, with a force not higher than 150 N. The 150 N is to be applied at right angles (ie pulling at 90° to the door), which is similar to the position of the passenger's hand in the accident at Hayes & Harlington when she was attempting to pull it from the door before the train started to move. The post-accident tests on the door involved in the accident showed that the train doors were compliant with the standard (the force required to extract the test object ranged from 98 N to 143 N, ie within the 150 N limit).
- 43 Although the post-accident door tests showed that the train door was compliant with the standard, FGW decided to undertake an additional series of extraction tests as part of a reconstruction for its own investigation. The reconstruction took place on 1 August 2015 at Hayes & Harlington station using a class 165 train and members of staff. The tests undertaken and the results from those tests were as follows:
- i. A hi-visibility vest was placed in the closed train door. The vest could not be pulled from the doors by the male volunteer.
 - ii. Fingers were placed in the closing doors. The door closed but the volunteer was unable to withdraw his fingers.
 - iii. A hand was placed in the closing doors. The door closed and the volunteer was unable to pull his hand out.
- 44 The reconstruction tests identified that there were obvious differences between the compliant sub-150 N forces required to extract a 'test object' as specified in standard GM/RT 2473 (upon which FGW's test was based) and the forces required to extract the objects used in the reconstruction.
- 45 CCTV footage from the platform shows the passenger trying to pull her trapped hand from between the door leaves. At this time she was carrying three shopping bags, which may have restricted her ability to pull her hand out from the door. As the train began to move this task would have been made more difficult as her angle relative to the door changed and she attempted to keep her balance.
- 46 Previous RAIB investigations⁶ into trap and drag incidents, involving units from the same family of trains as the class 165 unit involved in the accident at Hayes & Harlington, have identified that the type of material trapped, the angle at which it is pulled out and the strength of the passenger are critical in determining whether a passenger can successfully extract an object trapped in train door.

⁶ Huntingdon (15 February 2006) involving a class 365 unit, King's Cross (10 October 2011) involving a class 365 unit and West Wickham (10 April 2015) involving a class 465 unit.

The door interlock system

- 47 **The driver was able to start the train with the passenger's hand trapped in the door.**
- 48 Class 165 trains are fitted with a door safety system or interlock, which is designed to detect the presence of an obstruction of defined dimensions. If an obstruction of size equal to or greater than the defined dimension is inserted between the door leaves, the system should detect its presence. Should an obstruction be detected, the interlock circuit should not complete, the interlock light in the driver's cab should remain unlit and the driver will thus be unable to start the train.
- 49 For the purposes of testing whether the door interlock is working properly, a test object is used. FGW specifies a test object 25 mm thick for testing the door interlock (this is derived from the British Rail Standard GO/OTS 300 and therefore more onerous than the requirement in the current equivalent Standard GM/RT2473, which specifies a test object 30 mm in width). The test involved inserting the object into the closing leaves of a train door and confirming that interlock prevents the driver from taking power (figures 25, 26(a) and 26(b)).



Figure 25: Train driver pressing the button to initiate the door closure



Figure 26: (a) Interlock light providing the driver with indication that the doors are closed and locked and (b) interlock not obtained

- 50 When FGW tested the door involved in the accident to determine if it met the requirements of its test specification, the door passed the test; interlock could not be obtained when the object of 25 mm width was inserted into the closed door leaves. However, because the passenger's hand was less than 25 mm thick, the interlock circuit could be made, which illuminated the door interlock light in the driving cab and enabled the driver to start the train. This was confirmed by the reconstruction exercise at Hayes & Harlington referred to in paragraph 43. In all three tests, the driver was able to obtain door interlock and move the train. One further test was undertaken, involving the member of staff placing a foot in between the closing doors. Because the width of the obstruction exceeded 25 mm, the doors partially re-opened and the driver was unable to obtain door interlock and start the train. This was consistent with a further requirement of GM/RT2473 which required that the 150 N door closing force be reduced, or the door automatically reopen, if the door leaves detect an obstacle of a given width or greater (25 mm or greater in the case of class 165 doors).
- 51 The door involved in the accident met or exceeded the requirements of Standard GM/RT2473, but the accident still happened.

The actions of the driver

52 The train driver started the train with the passenger's hand trapped in the door.

Competency and training

53 The train driver's record showed that he had attended safety briefings where hazards associated with train dispatch and the platform-train interface were discussed on 5 June 2014 and 15 July 2015. In June 2015 he had passed his biennial competence assessment, which included the DSM observing the train driver's driving technique and dispatch procedures. The assessment incorporated questions on the relevant sections of the rule book and FGW dispatch procedures which are explained in the following paragraphs.

The rule book

- 54 Section 3.8, 'Dispatching a DO (Driver Only) train from an unstaffed platform' in Module SS1 ('Station duties and train dispatch') of the railway rule book, GE/ RT8000⁷ describes the following actions for the driver:
- check that the platform starting signal, if there is one, is showing a proceed aspect;
 - make sure all passengers are clear of the train doors;
 - check the whole length of the train to make sure that it is safe to close the doors, using the monitor or mirror, if provided. After you have closed the doors, you must check the door interlock light is illuminated;
 - you must then carry out the 'train safety check' (as referred to in Section 3.2.) and only start the train if it is safe to do so.
- 55 Section 3.2 in the same module of the rule book states that all train drivers must carry out a 'train safety check' before departure from a station by making sure that:
- the train doors are properly closed;
 - nobody is trapped in the doors, for example by clothing; and
 - it is safe to start the train.

FGW Professional Driving Policy

56 FGW's Professional Driving Policy (module ARB 48) supplements the requirements of the rule book. The policy outlines the key responsibilities of a train driver and incorporates much of the guidance from RSSB RIS-3703 'Rail Industry Standard for Passenger Train Dispatch and Platform Safety Measures' (Issue Two, March 2013) on the hazards a train driver should look for before and after closing the train doors (paragraph 127b). The policy also states that a train driver must ensure that during station arrival and departure, all procedures are undertaken correctly as accidents where people come into contact with a train can result in them sustaining life-changing or fatal injury (figure 27).

⁷ Issue 3 was current at the time of the accident.



Figure 27: Image showing a train driver checking the platform during the dispatch process. Various methods of DOO dispatch were observed by RAIB (door open / door closed with window open and closed).

The driver's actions

- 57 The train driver has stated that he checked the CCTV monitors after closing the doors and no-one was close to the doors to the train, prior to him starting it moving.
- 58 RAIB reconstructions and CCTV evidence (taken from the security cameras) show that the CCTV monitors would have provided the train driver with full coverage of the rear of the train and of passengers attempting to board the rear carriage. Analysis of the CCTV evidence shows that within 20 seconds of the doors opening the initial period of passengers' alighting and boarding was complete. The platform then remained relatively empty, with the train not due to depart for another minute. In the remaining 50 seconds before the doors closed, only two female passengers and one male passenger boarded the train (figure 11). This happened approximately 22 seconds before the train driver pressed the door close button.
- 59 The CCTV evidence shows that the person involved in the accident was:
- the only person seen running towards train 2P48 (this happened at about the time when the train driver pressed the doors close button); and
 - the only passenger who stood near to the train in the period immediately before the train moved (figure 16).

- 60 The RAIB has been unable to establish exactly why the driver moved the train with the passenger's hand trapped in the door⁸. However, the following possible causal factors have been considered:
- a. the train driver may have looked at the CCTV monitors before departing, but did not see the passenger in close proximity to the door (paragraphs 61 to 68);
 - b. the train driver may not have looked at the CCTV monitors at any time after pressing the door close button (paragraphs 69 to 74); or
 - c. the train driver may have been aware of the passenger, but did not perceive her to be at risk (paragraphs 75 to 77).

Each of these factors is now considered in turn.

Consideration of the possibility that the train driver may have looked at the CCTV monitor before departing, but did not see the passenger in close proximity to the door

- 61 The RAIB considered two potential reasons why the driver could have looked at the monitor, but did not see the passenger in close proximity to the door:
- i. the quality of the images in the monitors may have been suboptimal; or
 - ii. he may have quickly glanced at the monitors rather than viewing them thoroughly.

Adequacy of the monitors

- 62 In March 2014, FGW completed a biennial station risk assessment at Hayes & Harlington station in accordance with its own procedures (SMS-0320-00, 'Risk Assessment'). The risk assessment did not identify any deficiencies with the CCTV equipment used by drivers to dispatch trains.
- 63 Network Rail undertakes assessments of CCTV monitors in accordance with its standard NR/L2/TEL/30072 (issued in March 2009). The regime consists of an annual assessment (train cab rides undertaken in day and night time conditions) to inspect each platform where equipment used by drivers to dispatch a train is installed. The standard states that joint attendance with a representative of the relevant train operating company should be encouraged, but is not essential. Factors to be observed during the cab ride should include:
- the ability of the train driver to observe the monitor(s) and or mirror(s) from their normal driving position;
 - that the stop boards are correctly positioned in association with the CCTV monitor(s);
 - that the CCTV monitor(s) are displaying the correct images; and
 - the quality and contrast of the displayed picture(s).
- 64 The most recent Network Rail assessment was completed five days before the accident on 20 July 2015. No defects were identified, the DOO monitors were cleaned, and the CCTV camera angles were checked.
- 65 Analysis of the platform CCTV shows the train had stopped at the correct position (3 car marker point). No defects were reported by any driver on the day of the accident, and therefore the RAIB consider the quality of the images was unlikely to have been a factor in this accident.

⁸ The train driver passed his last medical on 18 January 2012. He did not wear glasses or contact lenses and there is no evidence of fatigue being a factor in the causation of the accident.

Driver's viewing of the monitors

- 66 After arriving at Hayes & Harlington station and opening the train doors, the train was waiting at the station for a total of 75 seconds before the driver initiated the closure of the doors. With the majority of passengers boarding or alighting from the train within the first 20 seconds (as shown in figures 9 to 13), the activity on the platform dropped away to almost nothing.
- 67 The railway industry uses techniques referred to as 'Z and S' scanning methods for reviewing platform monitors (which technique is used depends on the platform/direction of travel of the train and train operator's preference). The 'Z' scan method is described in FGW's professional driving policy and involves a driver looking at the monitors in a set order from top left to bottom right. FGW policy further states that after gaining door interlock and before taking power, the driver should take a minimum of two seconds to check the monitors. If the train driver has any doubt about their ability to depart from the platform safely they should not move the train until the situation has been made safe.
- 68 Analysis of the CCTV evidence shows that at the time the train driver pressed the button to close the doors, he could not see the passenger involved in the accident on the monitors (figures 28 (a) and (b) show that he would not have been able to see the passenger until she crossed the yellow line). He may have formed an expectation, having previously seen an empty platform, that there would be no-one in the vicinity of the train once the doors were closed and locked. As a consequence of this expectation, when he checked the monitors before starting the train he only glanced at them without really noticing what they were showing.



Figure 28: (a) showing Platform CCTV images of the rear portion of the train (note the position of the passenger running towards the train and yellow line) and (b) image of the same location on platform 4 from the drivers view of monitor 4L36 (note the position of the yellow line) (courtesy of GWR)

Consideration of the possibility that the train driver did not look at the CCTV monitors at any time after pressing the door close button and did not perform a final safety check

- 69 The trapped passenger would have been visible to the train driver on the CCTV monitors after he had closed the doors of the train and before departing from the station. The RAIB considers that there are four possible explanations why the driver may not have looked at the monitors after checking that it was safe to start the door closure sequence:
- i. he may not have expected anyone to be in the vicinity of the doors (this factor was previously described in paragraph 68, the only difference being that having observed an empty platform at the time he initiated the door close sequence, the driver did not look at the monitors again);
 - ii. he may have been distracted from doing his final safety check (paragraphs 70 to 72);
 - iii. he may have used the door interlock light as assurance that it was safe to depart (paragraph 73); or
 - iv. he may have simply forgotten to look (paragraph 74).
- 70 The investigation considered sources of distraction for the driver inside or outside the train cab. The RAIB found no evidence to suggest that the train driver had been distracted by something occurring on the station platform or outside the train and the driver has not stated that he was distracted in this way.
- 71 When interviewed by FGW, the train driver said that he had taken his time during his safety check, and that any apparent delay between the doors closing and him starting the train (4 to 6 seconds elapsed between those two events) was not due to any lack of concentration, but rather because he was being vigilant in completing the safety check before taking power.
- 72 The RAIB investigation identified that the train driver had used his mobile phone to send and receive text messages while driving train 2P48, before arriving at Hayes & Harlington station. He had not sent or received any text messages while his train was at the station. Nevertheless, the RAIB cannot dismiss the possibility that the train driver may have been distracted after closing the doors by whatever subjects had arisen during the earlier text exchanges. The driver's use of his mobile phone is further discussed in paragraphs 93 to 96.
- 73 The RAIB investigation identified that the train driver had misunderstood the meaning of the door interlock light, thinking that it was an indication that it was safe for him to depart. The driver believed that the train interlock would detect the presence of a hand or fingers trapped between the train doors and prevent him from starting the train.
- 74 A further possibility is that the train driver simply forgot to carry out his final safety check.

Consideration of the possibility that the driver may have been aware of the passenger, but did not perceive her to be at risk

- 75 Analysis of CCTV evidence from the platform shows that as the train driver pressed the door close button, the passenger was not visible in the CCTV monitors. However after the passenger had reached the train door, she would have been clearly visible in the centre of one of the screens during the time of the train driver's safety check (figures 29a and 29b).



Figure 29: (a) showing the passenger at the rear portion of the train on the platform CCTV image (courtesy of GWR), and (b) an image taken during the RAIB reconstruction of the events at the same location on platform 4 (from the driver's view of monitor 4L36)

- 76 Although the CCTV monitors would not have been clear enough to show the train driver that the passenger's hand had become trapped, they would have shown that she was in very close proximity to (and possibly touching) the train over a period of 8 to 9 seconds.
- 77 A possible explanation for the apparent delay in the time between the train driver obtaining the door interlock light and taking power (up to six seconds (paragraph 71)), is that he had seen the passenger in close proximity to the train, but believed that she would simply step away (it is not unusual to see passengers standing close to trains, although this behaviour is more likely when platforms are crowded). When she did not move, it is possible that the indication provided by the door interlock light reassured the driver that the passenger could not be trapped in the door (paragraph 72) and that it was safe to depart. The rule book and FGW procedures are clear that a driver should not start a train if a passenger is in close proximity to it ('close' proximity is defined as being near to or a small distance away from the train - no values are quoted).
- 78 As the train driver departed from the station he was not in a position to see the passenger as the train cab had now moved beyond the monitors⁹.

⁹ FGW DOO train drivers are not required to look back after departing any station as their focus is on the route ahead from a seated position. The RAIB observations showed that some train drivers did lower the train cab window and looked out and back at the platform as the train departed from Hayes & Harlington.

Identification of underlying factors

79 The train driver and other FGW staff believed that the door interlock system would detect the presence of an object such as a hand.

- 80 Witness evidence shows that the train driver understood some elements of how the door interlock system worked, but believed that the system would have detected an object such as a passenger's hand trapped in the doors. Although the CCTV monitors would have shown that the passenger was in close proximity to the train, the driver's misconception may have influenced his actions in the following manner:
- it provided him with reassurance that the passenger, although close to the train, was not trapped; thus it was safe for him to start the train; and/or
 - it promoted a lower level of vigilance while carrying out the visual tasks required when performing a final safety check.
- 81 Before the RAIB was informed of the accident, FGW identified in its reconstruction on 1 August 2015 that interlock could be obtained when a hand or fingers were trapped in a door. This surprised those present at the reconstruction.
- 82 The member of station staff on duty at Hayes & Harlington at the time of the accident and some staff in the control room at Swindon also shared the belief (paragraphs 20 and 26).
- 83 These examples suggest that there was a widespread misunderstanding within FGW that the train interlock could not be made with a hand trapped in the door, when in fact the Railway Group Standards and FGW's test specification effectively mean that it can. Most existing door systems in use on trains will not always detect the presence of very thin objects. For this reason, drivers, passengers and other rail staff must understand that interlocking can still be achieved with an object trapped in a door¹⁰.
- 84 When the RAIB shared with FGW the initial findings from its investigation, FGW immediately issued a safety briefing to all staff, and the RSSB supplemented its published PTI information to remind staff not to rely on the door interlock to confirm that a passenger was not trapped. The RAIB issued an Urgent Safety Advice (USA) on 30 November 2015 to highlight to the rail industry the importance of all staff completing a final safety check after interlock is obtained, and not to rely on the door interlock light as an indication that it is safe to proceed. The USA is included at appendix C.

¹⁰ Some modern door control systems are able to detect the presence of an object that is in contact with the door edge. One such technology, known as the 'sensitive edge', which is better able to detect trapped objects, is already found on certain types of modern train.

FGW's driver management processes

- 85 **FGW's driver management processes did not detect and adequately respond to the deteriorating safety performance of the driver involved in the accident.**
- 86 Although the train driver involved in the accident at Hayes & Harlington had not been involved in any operational incidents between the start of his employment in 2001 and 2011, from 2011 to 2015 he had been involved in the following operational incidents:
- January 2011 - the driver contravened the company's professional driving policy in two separate incidents when he took full power when starting on a single yellow signal at Reading depot and Reading West station.
 - August 2011 - the driver was removed from driving duties (24 August to 19 October 2011) after it was established that he was dealing with personal issues that might affect his concentration and driving.
 - November 2011 - the driver received an unsolicited brake application due to failing to cancel an in-cab vigilance device and was also involved in another incident in failing to call at Slough station. As a result of the two separate incidents the driver was placed on a ten-month Competence Development Plan (CDP). During the initial investigation, the driver was medically assessed and removed from driving duties for two weeks. Following another personal matter, the ten-month CDP was extended by a further month to October 2012.
 - July 2013 - the driver failed to call at Winnersh station and was placed on a twelve-month CDP.
- 87 The investigations into the incidents in 2011 concluded that personal issues may have affected the driver's concentration. As a result of other incidents taking place within the monitoring period his CDP was extended on a number of occasions.
- 88 Between 2011 and 2015 a Driver Standards Manager (DSM) had supported the train driver through the various incidents he had been involved in, generating an action plan to assist him in returning to duty and promoting his ongoing development. However, in March 2014 the DSM made an unannounced visit during a duty and observed the train driver not complying with the requirements of the CDP that was in force at the time. The DSM noted his concerns about the driver's lack of engagement with his CDP and recommended the driver's existing CDP be extended for a further 12 months, to 27 July 2015.
- 89 Although the DSM had noted an improvement in the behaviour and engagement of the train driver during 2015, he was concerned that the train driver may have only been displaying these attributes while he was under close observation. The train driver completed his biennial competence assessment on 5 June 2015 which included questions on the rule book and DOO dispatch procedures. Although this assessment identified a good standard of driving with no areas for concern, the DSM has stated that his underlying concerns about the train driver remained. However, he did not feel he had the necessary evidence to escalate matters within the company based solely on the driver's previous record and his own personal concerns. The driver's CDP was signed off as planned on 27 July 2015, two days after the accident (but before FGW was aware of the circumstances). The driver was suspended from duty two days later (29 July 2015) after FGW had identified what had happened at Hayes & Harlington station.

Observations

90 FGW's initial response to the accident resulted in the loss of key evidence.

- 91 Paragraph 26 described FGW's initial response to the passenger's report of her accident and the limited actions taken to gather evidence that would have helped in the identification of the sequence of events. As a consequence of that response, there was no immediate post-accident door testing, no drugs and alcohol screening of the driver, and critical information about the actions of the driver and the status of some on-train systems recorded on the train's OTDR equipment was lost. Furthermore, although some CCTV evidence from Hayes & Harlington station was captured before it had been over-written, images from other CCTV equipment at the station were not secured and were therefore lost.
- 92 During FGW's initial investigation into the accident, the issue of reporting the matter to RAIB was raised internally. The staff responsible for inputting the details of the accident to the industry's Safety Management Incident System (SMIS) mistakenly believed they had correctly notified RAIB using the SMIS system (ticking a box marked 'RAIB'). However, the ticking of the box did not generate a notification (it was actually meant to be ticked once the RAIB had been notified) and the process required the individual inputting the details into SMIS to notify RAIB by telephone as well as recording the details of the incident onto the database. The notification was overlooked and it was a month before the RAIB became aware of the incident (after contact from ORR).

93 The train driver had used his mobile telephone while in charge of a train.

- 94 FGW's Mobile Electronic Equipment Policy SMS-0120-00 (Issue 2, October 2013) states that the use of any mobile device (work and/or personal) is strictly prohibited and the mobile device must be turned off at all times during the train driver's shift (excluding breaks) unless it needs to be used in an emergency. The train driver's DSM had not previously identified any use of a mobile phone by the driver involved in the accident and had no grounds for thinking that he might be contravening FGW's policy.
- 95 The RAIB's analysis of data from the train driver's personal mobile telephone (correlated against data from other railway systems recording train movement) showed that there had been no mobile telephone data activity on the device while train 2P48 was at Hayes & Harlington station. However, the analysis did show that before the accident occurred the train driver had used his mobile telephone to respond to several text messages (presumably having read them) while the train was travelling between Reading and Maidenhead stations and while the train was stationary at Langley station¹¹.
- 96 The last text message sent to the train driver occurred while train 2P48 was stationary at Langley station, about eight minutes before the train arrived at Hayes & Harlington. The train driver did not respond to this message, but there is no evidence as to when he read it¹².

¹¹ The RAIB limited its analysis of the train driver's mobile phone to the journey in question and the preceding twenty four hours.

¹² RSSB Report T904 'Development of a train driver education programme on mobile phone risk' conducted a survey of over 370 train drivers. The survey showed 4% of train drivers had used a mobile telephone in motion once a day or more. An additional 3% had used it at least once a week while in motion. Almost one in five train drivers did not think that using a mobile phone would be detrimental to their driving performance.

Previous occurrences of a similar character

Huntingdon 15 February 2006 (RAIB report 11/2007)

97 A person who was seeing off a passenger and standing near to the train got his coat trapped in the closing doors. The train driver did not notice that a person was trapped and, as the train departed, the person was pulled along the platform and into the gap between the train and platform edge. The RAIB made a number of recommendations covering driver training, the platform monitor system, the train's door seals and door closing mechanism.

Tooting Broadway station (London Underground) 1 November 2007 (RAIB report 17/2008)

98 A passenger became trapped by the hem of her coat as she alighted from the train. The train driver had concentrated on the line ahead as he departed from the station and had not monitored the platform-train interface. The passenger managed to free herself but fell onto the platform and sustained injury.

Brentwood station 28 January 2011 (RAIB report 19/2011)

99 A passenger alighting from the last coach of a train at Brentwood station fell, head first, between the side of the train and the platform. Another passenger who had alighted from the same train saw her fall and was able to hold on to one of her legs. The train driver did not see the incident and departed from the station with the passenger still in the gap between the train and the platform. The passenger sustained injuries to her leg and head in the accident. A possible causal factor in this accident was that the driver had not undertaken the final safety check. Further details are in paragraphs 120 to 124.

King's Cross station, London 10 October 2011 (RAIB report 09/2012)

100 A passenger, who attempted to board the train while the doors were closing, became trapped in a door. The train dispatcher on the platform did not fully check the doors before giving the signal for the train to depart. The passenger was trapped by her hand and pulled along the platform for a distance of approximately 20 metres, before she broke free. She suffered bruising to her hand. The train involved was the same type (class 365) as that involved in the Huntingdon accident referred to above. The RAIB made a recommendation to review whether a modification could be made to the door seals of class 365 trains at the next planned refurbishment in order to reduce the risk of trapping of objects and people. Further details are in paragraphs 116 to 119.

Jarrow, Tyne and Wear Metro 12 April 2012 (RAIB report 26/2012)

101 A passenger became trapped in one of the doors of a train at Jarrow station. The passenger had arrived on the platform as the doors were closing and had placed her arm in the path of the closing door. The closing doors trapped her arm, and a few seconds later, as the train left the station, the passenger was forced to run alongside it. A timely activation of the emergency door release by a passenger inside the train allowed the passenger to free herself and she fell onto the platform. The passenger left the station immediately. CCTV evidence suggests that she did not sustain significant injury.

Norwich passenger train collision 2013 (RAIB report 09/2014)

102 The RAIB investigation into the accident at Norwich found that the driver involved in the accident had a history of being prone to lapses in concentration. These issues had not been identified by the train operator's internal audits or investigations into previous incidents. Lessons learnt relevant to the Hayes & Harlington accident related to driver managers recognising where incidents may be linked by a continuous underlying behavioural issue, and how to identify actions that could be taken within its competence management system.

Newcastle Central station 5 June 2013 (RAIB report 19/2014)

103 A passenger attempted to board a train at Newcastle Central station as the doors were closing. The passenger's wrist was trapped between the door leaves, and she was dragged by the departing train and forced to move beside it to avoid being pulled off her feet. A characteristic of the class 185 train doors was that, under certain conditions, a wrist could be trapped and not detected, thereby allowing the train to move.

104 The on-board conductor did not see the passenger trapped in the door because he did not do a final safety check before dispatching the train. This was because he either made an error due to confusion, or he consciously ignored what he had been trained to do.

West Wickham 10 April 2015 (RAIB report 03/2016)

105 A passenger was dragged along the platform at West Wickham station, when the train from which she had just alighted departed with her backpack strap trapped in the door. As the train moved off, she fell onto the platform and then through the gap between the platform and train. The passenger suffered life-changing injuries. The train was formed of two class 465 units, which are from the same family as the class 165 unit involved in the accident at Hayes & Harlington. One of the principal findings from the investigation was that the trapped passenger was not seen by the trainee driver or the instructor driver in the cab between the door closure sequence being initiated, and the train departing from the station. Further details are in paragraphs 125 and 126.

General comment - common areas of risk

106 The RAIB has previously recognised the risk associated with trapping forces of Networker train doors (marked with an asterisk (*) below), and drivers supervising the platform-train interface while doors are closing. These issues are included in the reports listed below and the recommendations they contain, relevant to the Hayes & Harlington accident, are described in paragraphs 112 to 126:

- Huntingdon* (RAIB report 11/2007) and King's Cross* (RAIB report 09/2012) – trapping forces of Networker train doors; and
- Brentwood (RAIB report 19/2011) and West Wickham* (RAIB report 03/2016) – driver's supervision of the platform while train doors are closing.

Summary of conclusions

Immediate cause

107 The train departed from the platform with the passenger's hand trapped in the train door (paragraph 33).

Causal factors

108 The causal factors were:

- a. the passenger placed her hand into the gap between the door leaves as they were closing (paragraphs 36 and 37, **Recommendation 1**);
- b. the passenger could not remove her hand once the door had closed (paragraphs 38 to 46, see paragraphs 112 to 119 and **Recommendation 2**);
- c. the driver was able to start the train with the passenger's hand trapped in the door (paragraphs 48 to 60, see paragraph 129 and **Learning point 1**); and
- d. the train driver started the train with the passenger's hand trapped in the door. The following possible reasons for this were identified:
 - i. the train driver may have looked at the CCTV monitors before departing, but did not see the passenger in close proximity to the door (paragraphs 61 to 68, **Learning points 1 and 3**);
 - ii. the train driver may not have looked at the CCTV monitors at any time after pressing the door close button (paragraphs 69 to 74, see paragraphs 120 to 126 and **Learning points 1 and 3**); or
 - iii. the train driver may have been aware of the passenger, but did not perceive her to be at risk (paragraphs 75 to 78, see paragraph 128d, **Recommendation 3 and Learning points 1 and 3**).

Underlying factors

109 The underlying factors were:

- a. The train driver and other FGW staff believed that the door interlock system would detect the presence of an object such as a hand (paragraphs 79 to 84, **Learning points 1 and 3**); and
- b. FGW's driver management processes did not detect and adequately respond to the deteriorating safety performance of the driver involved in the accident (paragraphs 85 to 89, see paragraph 129 and **Learning point 3**).

Additional observations

- 110 Although not linked to the accident on 25 July 2015 the RAIB observes that:
- a. FGW's initial response to the accident resulted in the loss of key evidence (paragraphs 90 to 92, see paragraph 127a); and
 - b. The train driver had used his mobile telephone while in charge of a train (paragraphs 93 to 96, see paragraph 127c and **Learning Point 2**).

Previous RAIB recommendations relevant to this investigation

111 The following recommendations, which were made by the RAIB as a result of its previous investigations, have relevance to this investigation.

[Accident at King's Cross station, 10 October 2011, RAIB report 09/2012, Recommendation 1](#)

112 Recommendation 1 from the RAIB's investigation into a trap and drag incident at King's Cross in October 2011 was made in the context of an earlier recommendation made after the RAIB investigated a trap and drag accident at Huntingdon station in February 2006 ([RAIB report 11/2007](#)).

113 Following the accident at Huntingdon station, 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 (class 365 units are from the same Networker family as the class 165 unit involved in the accident at Hayes & Harlington). These requirements were introduced after the class 365 trains were placed into service and did not apply to trains which were already built.

114 The 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) (now the Office of Rail and Road) accepted that this recommendation should be closed after the train operator and the train owner submitted a report in June 2008 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);
- replacing 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).

115 After carrying out further testing, the train operator 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.

116 The RAIB's King's Cross report noted that the class 365 door seals were due to be replaced as part of a major overhaul to take place between 2013 and 2015 and considered that it provided an opportunity to implement measures intended to reduce withdrawal forces, at a time when the cost of replacing seals would be incurred as part of other planned activities.

117 Recommendation 1 from the King's Cross investigation therefore addressed one of the factors identified in this investigation; at King's Cross the class 365 train was able to start with the person's hand trapped in the door.

Recommendation 1

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.

118 As a result of the King's Cross incident, modified 'sensitive' door seals were developed and fitted to a class 365 unit in January 2016. The train owners are now reviewing the possibility of extending application of the same technology to other class 365 units.

119 At the time of writing Angel Trains is also considering the application of sensitive edge door technology to its units in classes 165, 166, 465 and 466 (the other units in the Networker family). The RAIB has made a recommendation in this investigation to encourage continued work in this area.

[Accident at West Wickham station, 10 April 2015, RAIB report 03/2016, Recommendation 2](#)

120 Recommendation 2 from the RAIB's West Wickham investigation was made in the context of an earlier recommendation made after the RAIB investigated an accident at Brentwood station in January 2011 ([RAIB report 19/2011](#)) involving a passenger falling between the train and the platform while alighting from a train as the doors were closing. Her fall was not observed by the driver and the train departed from the platform.

121 Recommendation 2 from the Brentwood report read as follows:

'The Rail Safety and Standards Board should, in consultation with train operators, consider the inclusion of guidance in Rail Industry Standard RIS-3703-TOM that those responsible for train dispatch (including the drivers of DOO trains) should, so far as is reasonably practicable, observe the closing of the train's doors and be alert for any dangerous occurrence while this is taking place'.

122 The ORR reported to the RAIB, on 27 February 2013, that action had been taken to implement this recommendation. The RSSB included guidance on this issue in RIS-3703-TOM 'Passenger train dispatch and platform safety' published in March 2013. This stated (in guidance note 23) that:

'When developing the train dispatch process, consideration should be given to the level of monitoring required during train dispatch, with specific emphasis on monitoring during the door close process and during train departure'.

123 In September 2015, and during the course of the RAIB's investigation into the accident at West Wickham, RSSB stated to RAIB that the RIS 'was really intended for station managers, and not train operators'. However, RSSB also noted that the RIS did state that 'railway undertakings responsible for developing their own train dispatch processes at stations operated by infrastructure managers may choose to adopt those parts of the [RIS] that apply to their operations'.

124 Before publishing recommendation 2 in the report on the Brentwood accident, the RAIB had met RSSB in September 2011 and proposed that railway rule book module SS1 'Station duties and train dispatch' include a requirement for the drivers of DOO trains to monitor the closing doors where it was practicable to do so. RSSB told the RAIB that this proposed requirement would sit better in RIS-3703-TOM, as this document shared good practice in train dispatch and covered all train dispatch methods.

125 Recommendation 2 from the RAIB's West Wickham investigation has attempted to ensure that the intent of Brentwood recommendation 2 is now met. It also addresses one of the factors identified in this investigation; a driver not observing a passenger attempting to pass through a train door as it closes:

Recommendation 2

The RSSB, in consultation with the railway industry, should include in suitable guidance that train crew undertaking dispatch duties should, where practicable, monitor train doors during the door closing period. This is additional to the existing railway rule book requirement for a train safety check after doors are fully closed.

126 The West Wickham report was published on 29 February 2016, and ORR has yet to report on industry's response to recommendation 2.

Actions reported as already taken or in progress relevant to this report

127 FGW has taken a number of actions following the accident. It has:

- a. re-briefed all staff who dealt with the accident to ensure events are promptly and correctly reported (initial briefing completed by December 2015 and ongoing review to be completed by September 2016);
- b. re-briefed station staff, train drivers, control room staff and their managers on the door interlock arrangements and the importance of the final safety check;
- c. re-briefed and given guidance to managers to ensure FGW mobile equipment policy is complied with during routine competency assessments and actions to be taken following an incident or accident;
- d. introduced a new policy to monitor and assess DOO dispatch processes;
- e. re-briefed its SMIS team so that all relevant events are correctly reported to the RAIB;
- f. commenced a full review of FGW DOO operations to ensure that the processes remain fit for purpose (to be completed by June 2016); and
- g. tasked the FGW safety group to consider how the public may be educated on operation of power doors; FGW has now introduced announcements on the train warning passengers not to obstruct the doors when they are closing.

The train driver involved in the accident is no longer employed by GWR (formerly FGW).

128 RSSB has:

- a. briefed all SMIS users on the correct process of notifying the RAIB of an accident and proposed a software change to the SMIS system in relation to notification to RAIB.
- b. continued its work to minimise accidents at the platform-train interface and published the Platform Train Interface Strategy. Research is being carried out to identify optimal door close arrangements and support consistent dispatch procedures, promote passenger understanding of the risk from closing doors, and reduce incidents occurring during boarding and alighting, such as passengers getting trapped in train doors¹³.
- c. published the platform safety 'Lend a helping hand' booklet. The wording of the booklet (figure 30) was supplemented after the West Wickham and Hayes & Harlington accidents to remind staff to do a thorough visual check of the doors before departing and not to rely on interlock indicators/lights to determine if it is safe to depart because door interlock can still be obtained even if something or someone is trapped in the door.

¹³ Accident data provided to the RAIB by the RSSB, showed that excluding the Hayes & Harlington accident, there had been 66 reported accidents attributed to people being trapped in train doors and then dragged (trap-and-drag) on the national railway network between April 2005 and the end of May 2015. The precise detail of these reported accidents is not always clear, and in around half of the reports the detail provided suggests that the passenger was not actually dragged along by the departing train.

- d. Initiated a research project (T1100) which will consider the issue of inward facing CCTV in train driving cabs. This technology may be of assistance in helping to establish the actions of drivers before, during and after incidents and accidents. The project is due to report in October 2016.
- 129 Following the publication of the RAIB's Urgent Safety Advice on 30 November 2015, the RMT and ASLE&F trade unions issued advice to their members. This said that if there was any doubt when performing a pre-departure safety check that it is safe to dispatch the train, the driver should perform a visual check and not rely solely on CCTV, stepping out onto the platform if necessary.



Figure 30: Cover of RSSB PTI 'Lend a helping hand' booklet

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

- 130 GWR has reviewed and improved its processes for dealing with drivers who are showing signs of sub-standard performance or not engaging positively with measures agreed as part of a Competence Development Plan. In addition, GWR has issued additional guidance to managers involved in the development of train drivers on the behaviours and attitudes which are inconsistent with those expected of train drivers (see paragraph 132 and Learning point 3).

Recommendations and learning points

Recommendations

131 The following recommendations are made¹⁴:

- 1 *The intent of this recommendation is to improve the rail industry's understanding of passenger behaviour when boarding and alighting from trains and to identify the best methods and technology to promote safe behaviour.*

RSSB, in consultation with the industry, and involving due industry process, should consider consolidating the findings from existing research and good industry practice, and undertaking new research as necessary to identify the optimum means for promoting safe behaviour by passengers when boarding and alighting from trains (paragraph 108a).

- 2 *The intent of this recommendation is for train owners to continue to review whether sensitive door technology can be applied to all fleets in the Networker family.*

Angel Trains and Eversholt Rail should extend current research on fitting sensitive edge door technology on class 365 trains to include other units in the Networker family (classes 165, 166, 465 and 466), and develop a plan for the fitting of modified doors to those units if the case can be made to do so (paragraph 108b).

¹⁴ Those identified in the recommendations have a general and ongoing obligation to comply with health and safety legislation, and need to take these recommendations 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, these recommendations are addressed to the Office of Rail and Road 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.gov.uk/raib.

Learning points¹⁵

132 During the course of this investigation, the RAIB identified important safety learning in respect of a lack of awareness among operational staff of the limitations of existing train door interlocking technology, the importance of the final safety check when dispatching a train and the use of mobile telephones by train drivers while in charge of a train and the management and guidance for driver managers who are managing train drivers who have been on a long term Competence Development Plan. Since the rail industry is making significant efforts to disseminate the safety information relating to these factors the RAIB has therefore chosen to publish three key learning points rather than recommendations.

1. Door interlocking and the final safety check

On 30 November 2015, the RAIB issued Urgent Safety Advice (appendix D) to the railway industry regarding the importance of drivers undertaking the final safety check and not relying on the door interlock light as an indication that it is safe for their train to proceed. The RAIB wishes to emphasise the importance of this safety learning. It is important that train drivers are briefed that illumination of the door interlock light only means that the doors are confirmed as closed and locked, but does not provide confirmation that nothing is trapped in them. The briefing should place particular emphasis on the importance of monitoring doors during closure and the final safety check after interlock has been obtained (paragraphs 108d and 109).

2. Use of mobile telephones by train drivers

This investigation has revealed that the driver concerned made use of his personal mobile telephone to send and receive text messages while in charge of his train. Such behaviour creates an unacceptable risk of distraction and is therefore dangerous. It is for this reason that company instructions states that mobile electronic devices should never be used by staff in charge of trains except in emergencies (paragraph 110b).

continued

¹⁵ 'Learning points' are intended to disseminate safety learning that is not covered by a recommendation. They are included in a report when the RAIB wishes to reinforce the importance of compliance with existing safety arrangements (where the RAIB has not identified management issues that justify a recommendation) and the consequences of failing to do so. They also record good practice and actions already taken by industry bodies that may have a wider application.

3. Competence Development Plan

This investigation has revealed that the driver concerned had been involved in a number of incidents between 2011 and 2015. He had been placed on a Competence Development Plan which had been extended on a number of occasions. The driver's manager continued to be concerned about the individual but did not feel he had the necessary evidence to escalate matters within the company based solely on the driver's previous record and his own personal concerns. It is important for all train operators to have the necessary processes in place to identify drivers who are showing signs of sub-standard performance or not engaging positively with measures agreed as part of a Competence Development Plan. The provision of briefing and guidance to driver managers to enable them to identify behaviours and attitudes which are inconsistent with those expected of train drivers will assist (paragraph 109b).

Appendices

Appendix A - Glossary of abbreviations

CCTV	Closed-Circuit Television
CDP	Competence Development Plan
DOO	Driver Only Operation
N	Newton (unit of force)
OTDR	On-train Data Recorder
PTI	Platform-Train Interface

Appendix B - Glossary of terms

Body side indicator light	Lights on the outside of each vehicle of the train which are illuminated when the doors of that vehicle have been released or are open. The lights go out when the doors are closed and locked.
Chain	An imperial unit of length measurement that is equivalent to 22 yards (approximately 20 metres).
Door interlock light	An illuminated light or indication provided in the train driver's cab that indicates the train's doors are closed and locked, and that the driver is able to take traction power.
Starting signal	In the context of a platform location, it is the signal that is normally provided at or near the end of the platform.
Trap-and-drag incident	An incident where a passenger is trapped in closed train doors, and then dragged along as the train moves away.

Appendix C - Investigation details


The RAIB used the following sources of evidence in this investigation:

- information provided by witnesses;
- closed circuit platform television recordings courtesy GWR;
- site photographs and observations; and
- a review of previous RAIB investigations that had relevance to this accident.

Appendix D - Urgent Safety Advice issued by the RAIB

URGENT SAFETY ADVICE



1. INCIDENT DESCRIPTION			
LEAD / INSPECTOR		CONTACT TEL. NO.	
INCIDENT REPORT NO	797	DATE OF INCIDENT	25 July 2015
INCIDENT NAME	Passenger accident at Hayes & Harlington station		
TYPE OF INCIDENT	Passenger trapped and dragged by train		
INCIDENT DESCRIPTION	<p>At approximately 13:10 hrs on 25 July 2015, the 11:37 hrs Oxford to London Paddington service departed from platform 4 at Hayes & Harlington station with a passenger trapped by her hand in the last door of the three-coach train. The passenger was dragged for a distance of 8 to 10 metres before falling to the ground. During the fall her hand became free.</p> <p>The train comprised a three-car class 165 diesel multiple unit. The train was being operated in DOO(P) mode and no staff were present (or required to be present) on the platform to assist with train dispatch. The driver, who was thus responsible for dispatching the train, was aided by CCTV cameras which provided him with a view of the side of the train on platform-mounted monitors alongside his cab.</p>		
SUPPORTING REFERENCES	 <p>Sequence of four photographs showing train before departure with passenger's hand trapped in the door, the train moving with the passenger's hand still trapped and the passenger falling to the platform, releasing her hand in the process.</p>		

2. URGENT SAFETY ADVICE	
USA DATE:	30 November 2015
TITLE:	The importance of drivers performing the final safety check when responsible for the dispatch of trains under DOO arrangements, even when they have obtained a door interlock indication.
SYSTEM / EQUIPMENT:	Train doors, door interlock equipment and DOO train dispatch monitors
SAFETY ISSUE DESCRIPTION:	<p>The RAIB's investigation into the circumstances of this accident indicate that after the driver had closed the train's doors and obtained the door interlock light, he either did not look at the monitors, or looked at the monitors but did not see that the passenger was in an unsafe position, before departing from the platform at Hayes & Harlington station.</p> <p>Subsequent discussions with other train drivers and driver managers indicates that there is a common misconception held by some drivers (and some other staff such as those in the Control Room and on stations) that it is not possible to obtain door interlock and for a train to depart if a person's hand is trapped in the door of the train. This is not the case, as illustrated by this incident.</p> <p>Historical and current Railway Group Standards have specified that train doors should reopen, or there should be a reduction in the closing force, when they close upon an obstruction that is a minimum of either 25 mm or 30 mm wide (depending on which standard is being applied) and that the doors should not be indicated (to the driver) as locked. The fingers of a hand trapped in a door, when the palm of the hand is parallel to the door seals, will sometimes measure less than 25 mm. An individual's ability to remove their trapped hand before the train moves is then dependent on the pulling force they apply and the force exerted on their hand by the closed door(s).</p> <p>Additionally the RAIB has noted in a number of investigations that members of the public often do not immediately attempt to pull trapped hands, wrists, coats, bag straps, etc. out of doors, expecting either that the door will reopen (like a lift door) or that the train is unable to move with the trapped object in it. These expectations exacerbate the danger.</p>

URGENT SAFETY ADVICE



CIRCUMSTANCES:	<p>The RAIB has investigated other accidents involving passengers becoming trapped in train doors and dragged along platforms: Huntingdon on 15 February 2006 (RAIB report no. 11/2007); King's Cross on 10 October 2011 (RAIB report no. 09/2012); and West Wickham on 10 April 2015 (still under investigation).</p> <p>The RAIB has also investigated a number of accidents involving trains departing from platforms where those responsible for train dispatch had not noticed passengers in unsafe situations or had not responded appropriately or did not carry out an adequate final safety check: Brentwood on 28 January 2011 (RAIB report no. 19/2011); James Street on 22 October 2011 (RAIB report no. 22/2012); and Newcastle Central on 5 June 2013 (RAIB report no. 19/2014).</p>
CONSEQUENCES	The passenger reported bruises to her hand and head to a member of staff at the station. Under slightly different circumstances, the passenger could have fallen between the train and the platform with the attendant risk of serious or fatal injuries.
SAFETY ADVICE:	<p>The RAIB is issuing this Urgent Safety Advice to Train Operators and to Trades Unions representing train drivers to alert them to the dangers associated with drivers assuming that it is safe to dispatch a train from a station on the basis of having obtained door interlock alone.</p> <p>Therefore, the RAIB is advising Train Operators and Trades Unions representing train drivers to remind train drivers operating DOO(P) trains that where they have responsibility for dispatching the train from a station, it is imperative that they perform a thorough final safety check after door interlock has been obtained and do not place sole reliance on the illumination of the door interlock light before driving the train out of the station. If, having performed the final safety check, they are not satisfied that it is safe to move the train, they should implement their own company's procedures for dealing with such a situation.</p>

USA SIGN-OFF*			
INSPECTOR NAME:		CI / DCI NAME:	Simon French
INSPECTOR SIGNATURE:		CI / DCI SIGNATURE:	
DATE:		DATE	

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