



Rail Accident Investigation Branch

Rail Accident Report



Collision between a train and utility vehicle at Dollands Moor freight yard, Kent 4 September 2018

Report 05/2019
June 2019

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.

© Crown copyright 2019

You may reuse this document/publication (not including departmental or agency logos) free of charge in any format or medium. You must reuse it accurately and not in a misleading context. The material must be acknowledged as Crown copyright and you must give the title of the source publication. Where we have identified any third party copyright material you will need to obtain permission from the copyright holders concerned. This document/publication is also available at www.gov.uk/raib.

Any enquiries about this publication should be sent to:

RAIB	Email: enquiries@raib.gov.uk
The Wharf	Telephone: 01332 253300
Stores Road	Website: www.gov.uk/raib
Derby UK	
DE21 4BA	

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

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 words such as '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, words such as '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.

Information about casualties is based on figures provided to the RAIB from various sources. Considerations of personal privacy may mean that not all of the actual effects of the event are recorded in the report. The RAIB recognises that sudden unexpected events can have both short and long term consequences for the physical and/or mental health of people who were involved, both directly and indirectly, in what happened.

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.

This page is intentionally left blank

Collision between a train and utility vehicle at Dollands Moor freight yard, Kent 4 September 2018

Contents

4 September 2018	1
Preface	3
Summary	7
Introduction	8
Key definitions	8
The accident	9
Summary of the accident	9
Context	9
The sequence of events	16
Key facts and analysis	20
Background information	20
Identification of the immediate cause	21
Identification of causal factors	21
Underlying factor	28
Summary of conclusions	33
Immediate cause	33
Causal factors	33
Underlying factor	33
Actions reported as already taken or in progress relevant to this report	34
Recommendations	35
Appendices	36
Appendix A - Sources of evidence	36

This page is intentionally left blank

Summary

At about 03:39 hrs on Tuesday 4 September 2018, a train arriving at Dollands Moor freight yard struck a small petrol powered buggy which was stationary on a level crossing. The train driver only became aware of the buggy shortly before the accident and was unable to stop in time to avoid a collision. A shunter sitting in the buggy attempted to jump clear at the last moment, but suffered life-changing injuries.

Dollands Moor freight yard was built to serve the Channel Tunnel, becoming fully operational in 1994, and is operated by DB Cargo (formally DB Schenker). From the outset, small buggies were provided to transport staff and equipment around the extensive site. A subway, which could accommodate the buggies, was provided at each end of the yard to allow staff access to individual sidings without crossing any tracks. Level crossings were also provided for emergency use by vehicles after railway signals had been set to stop trains approaching the crossings.

Until 2010, safety documentation included a requirement that subways be used by buggies crossing the sidings, but by 2012 this requirement was no longer included. By 2014, only one of the two subways remained open, but lighting in this subway had failed. Use of this subway was not enforced so most shunters chose to drive across the level crossings instead. There were no barriers, signs or written instructions indicating that vehicles were not allowed to use the level crossings unless signals were being used to stop any approaching trains. The injured shunter started work at Dollands Moor yard in 2018 and had been trained to cross the sidings using the level crossings without signal protection.

The RAIB has found that the buggy driver was unaware he was in an unsafe position, but there is insufficient evidence to determine why. The investigation also found that custom and practice at Dollands Moor yard had normalised use of the level crossings by buggies without signals being used to stop approaching trains, and that the buggy was not conspicuous so the train driver could not see it until it was too late to avoid an accident. The underlying factor was that DB Cargo's management of the use of buggies, subways and level crossings at Dollands Moor yard was inadequate.

The RAIB has made two recommendations to DB Cargo to address significant gaps identified in the Dollands Moor yard safety management arrangements, and to review corporate oversight and verification of safety arrangements at locations across the UK.

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 References to left and right refer to the train or buggy's direction of travel when the accident occurred. Sources of evidence used in the investigation are listed in Appendix A.

The accident

Summary of the accident

- 3 At about 03:39 hrs on Tuesday 4 September 2018, a freight train entering Dollands Moor yard struck a small petrol powered utility vehicle (a buggy) being used by a member of the yard's groundstaff (the shunter). The buggy was stationary on a level crossing spanning multiple sidings at the west end of Dollands Moor yard. The train was travelling at 22 mph (35 km/h).
- 4 The shunter attempted to jump clear but was dragged over 20 metres and suffered life-changing injuries. The buggy was pushed about 105 metres to where the train came to a stand (figure 11). A serious fire ensued, which destroyed the buggy and caused damage to the locomotive's leading cab. The train driver was uninjured.

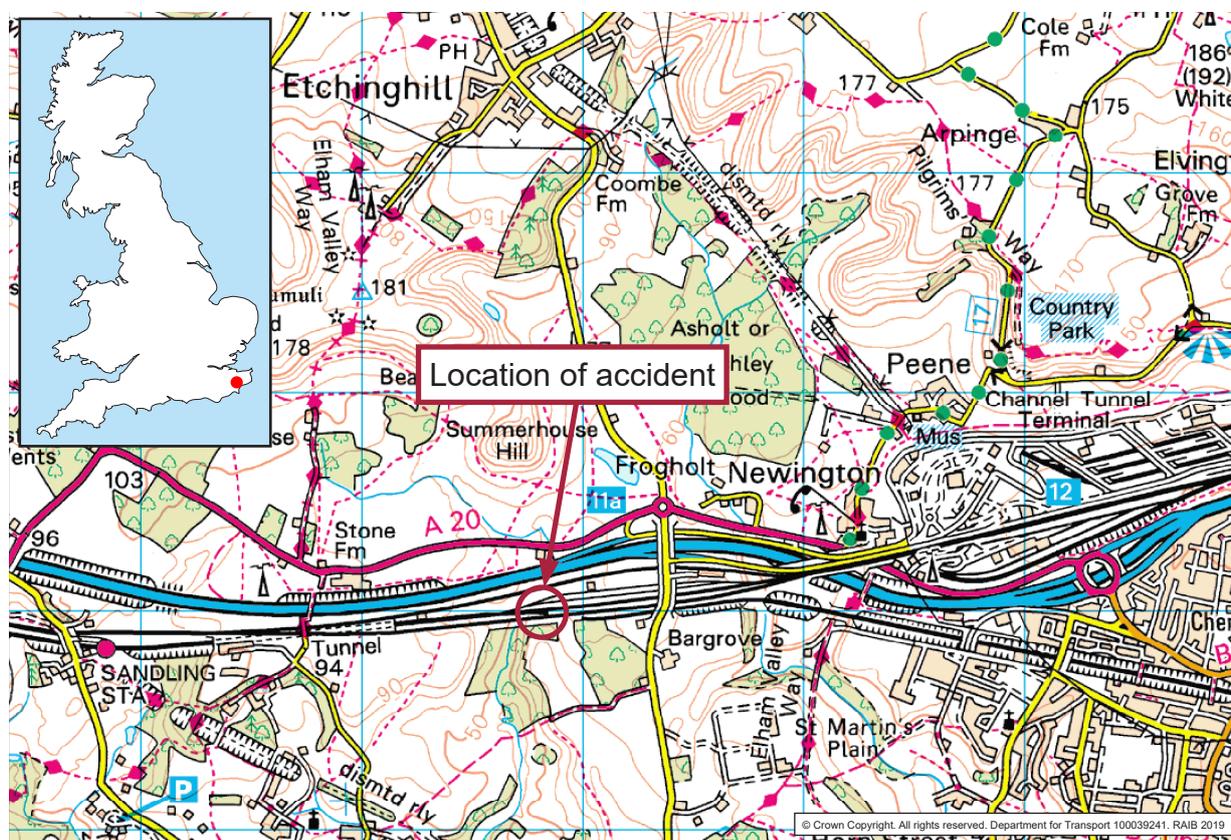


Figure 1: Extract from Ordnance Survey map showing location of accident

Context

Location

- 5 Dollands Moor freight yard is located between Sandling and Folkestone West, 3.5 km from the Channel Tunnel's UK portal (figure 1). The yard opened in 1988 in preparation for the opening of the Channel Tunnel in May 1994.
- 6 The main line between London (Charing Cross), Ashford and Folkestone passes along the south side of the yard.

- 7 The down High Speed 1 line from London (St Pancras) to the Channel Tunnel passes to the north of the yard and the up High Speed 1 line from the Channel Tunnel to London (St Pancras) passes to the south of the yard (figures 2 and 3).

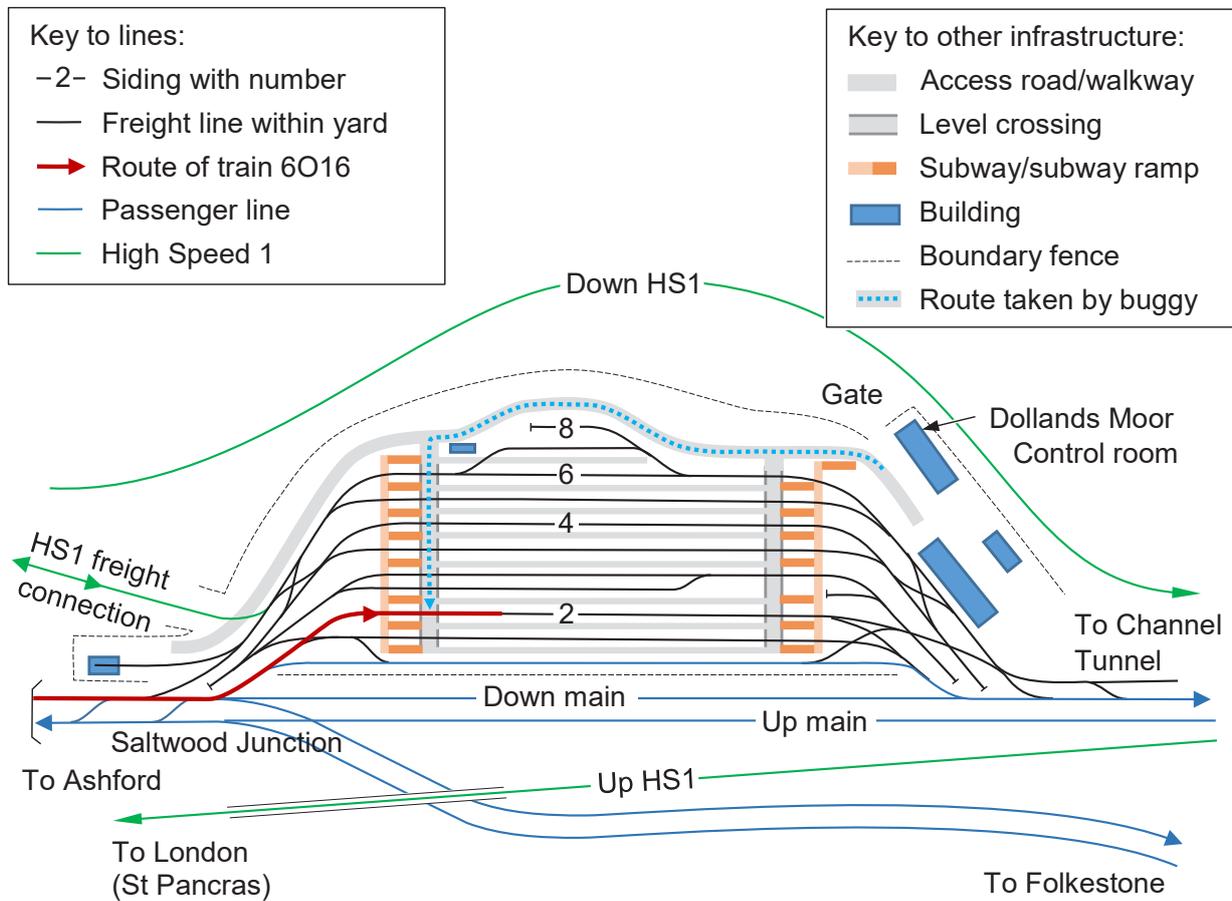


Figure 2: Dollands Moor yard (not to scale)

Infrastructure

- 8 The yard has six full length sidings which can accommodate trains up to 730 metres long, with concrete walkways between each siding (figure 4). The yard also incorporates a through loop for passenger trains and other sidings for locomotives and stored rail vehicles. The maximum permitted speed for trains entering the yard is 30 mph (48 km/h), reducing to 25 mph (40 km/h) within the yard.
- 9 The west (London) end of the yard is connected to the London (Charing Cross) to Folkestone main line at Saltwood Junction¹ giving access to all sidings. Sidings 3 to 6 also have a connection to High Speed 1 and this route is used by some freight trains travelling between Barking, Essex, and the Channel Tunnel. The east end of the yard provides a direct connection to the Channel Tunnel for all sidings.
- 10 All sidings are equipped with overhead line electrification equipment. Some sections of track at the west end of the yard, and the through passenger line, also have an electrified third rail.

¹ Saltwood Junction, 66 miles 38 chains from London (Charing Cross).

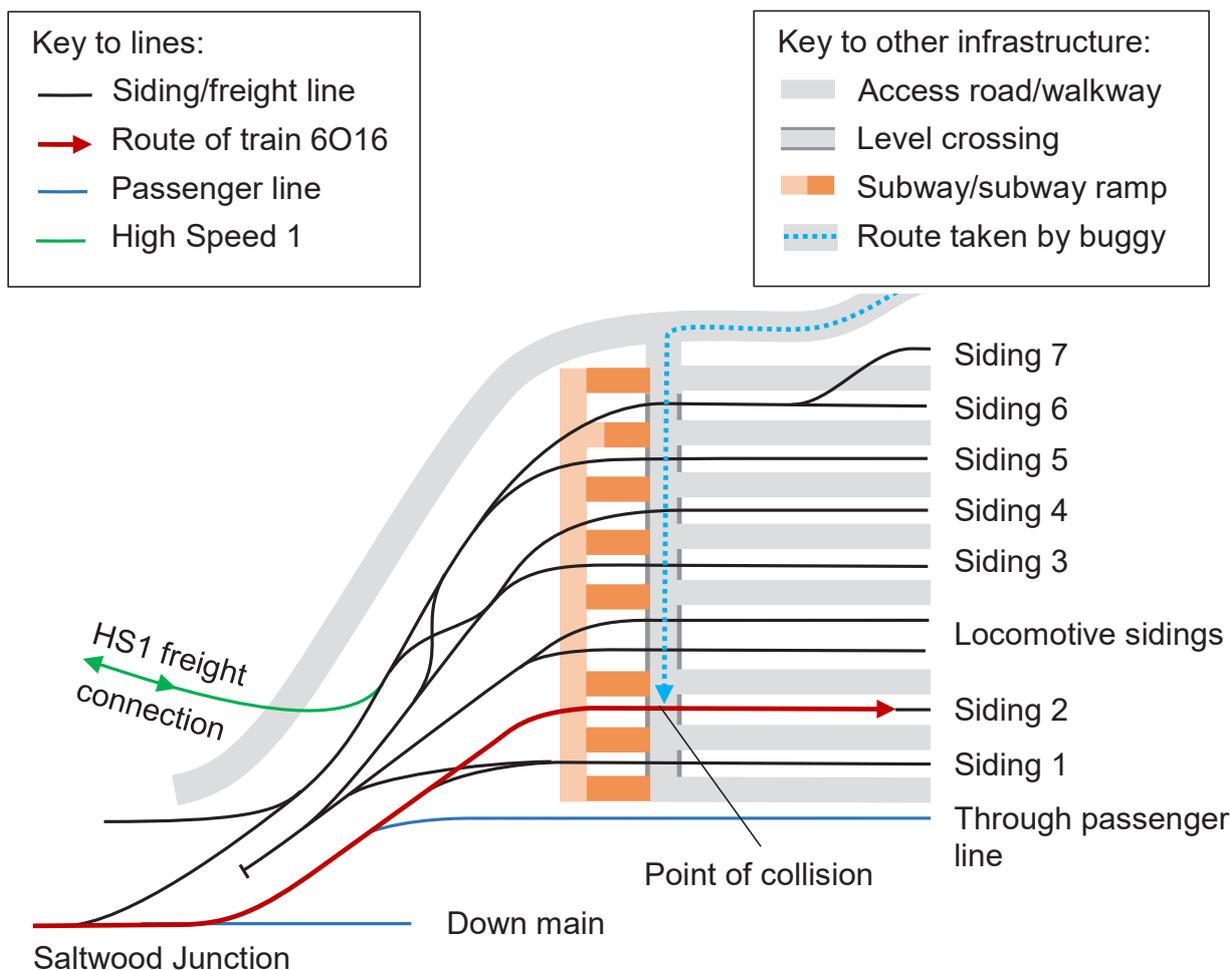


Figure 3: Dollands Moor yard west end (not to scale)



Figure 4: Dollands Moor freight yard looking south-east from the west end level crossing

- 11 Signals and points within the yard are controlled by a signaller located at workstation 5 at Ashford signalling centre² which is around 16 km from the yard.
- 12 The yard's main internal access road runs on the north side of the sidings. Subways are provided near each end of the yard, to allow staff to cross the sidings, accessed by covered ramps (figure 5). The subways were designed for use by pedestrians and small vehicles. A level crossing is also provided adjacent to each subway (figure 6).
- 13 The yard is lit by floodlights on overhead gantries. It is also equipped with CCTV, but the immediate location of the accident was not covered by a camera.
- 14 The yard's control room and mess rooms for shunters, engineering staff and drivers are located in buildings near the east (French) end of the yard.



Figure 5: View of a subway ramp and its canopy at the west end of the yard

Organisations involved

- 15 DB Cargo UK was the operator of the train, employer of the train driver and shunter, and operator of Dollands Moor yard. It was responsible for maintaining the track, roadways and level crossings within the site. DB Cargo (UK) Ltd is a wholly owned subsidiary of the German company Deutsche Bahn AG. Prior to June 2007, Dollands Moor yard was operated by English, Welsh and Scottish Railway (EWS). The company was renamed DB Schenker Rail UK until March 2016, when the name changed to DB Cargo UK. The Company will be referred to as DB Cargo in this report.
- 16 Network Rail employed the signaller and was responsible for the signalling and points operation in Dollands Moor yard.

² Ashford integrated electronic control centre (IECC).



Figure 6: View looking south across the west end level crossing with subway ramps on the right. The path of the buggy is shown. A train is visible on siding 2.

17 The above parties freely co-operated with the investigation.

Train involved

18 The train (reporting code 6O16³) was a regular Ditton Foundry Lane (Widnes) to Dollands Moor service. The train was formed of a class 66 locomotive, number 66230, and 12 wagons.

Buggies

- 19 Buggies to transport staff and equipment around the yard have been provided since the yard became operational. At the time of the accident, the yard was equipped with two Kubota RTV 500 petrol powered utility vehicles, each weighing 620 kg and with a top speed of 40 km/h. Each buggy can carry two members of staff. A rear cargo box allowed train tail lamps and coupling equipment to be transported (figures 7a and 7b).
- 20 Both buggies had been equipped with inspection lights on the left-hand side (figure 7a) to assist with train checking duties, controlled by a switch in the cab. The buggies are left-hand drive and the shunters had removed the left-hand doors to make it easier to get in and out of the vehicles.
- 21 The buggies were leased from a company which serviced the vehicles. DB Cargo was responsible for providing consumables such as fuel, tyres and batteries.

³ Each train operating on Network Rail infrastructure is allocated an alphanumeric reporting code.



Figures 7a and 7b: views of the undamaged Kubota RTV 500 buggy at Dollands Moor yard

Staff involved

- 22 The driver of the train had been based at Dollands Moor yard for over 20 years. He had passed his most recent competence test in December 2017 with good results.
- 23 The shunter⁴ who was injured in the accident joined DB Cargo in December 2017 and started at Dollands Moor yard in January 2018 after completing initial training. Before joining DB Cargo, he had more than five years' experience within the rail industry working for contractors employed by Network Rail. Although he had previously held several railway industry competencies (including Controller of Site Safety and Engineering Supervisor), DB Cargo required him to retake his Personal Track Safety (PTS) qualification in order to become his railway sponsor. He also undertook rolling stock technician and shunting training.
- 24 The shunter was trained by a colleague who acted as his mentor. The mentor was a shunter who had worked at Dollands Moor yard since 2014 and had the same qualifications and competencies as the shunter. He had a good safety record, and had also undertaken a mentoring course and was qualified to mentor other shunters. The shunter was the first person he had mentored.
- 25 An experienced shunter had trained the mentor as part of a group of new staff in 2014. By chance, he was the other shunter on duty on the morning of accident.
- 26 The yard operations supervisor⁵ was based in the Dollands Moor yard control room and communicated with the shunters by radio and the signaller by telephone.
- 27 The service delivery manager had line manager responsibility for the shunters working at Dollands Moor yard and had been in post for about six weeks before the accident. This post had been vacant from June 2017 until July 2018 during which time the role was covered by visiting managers.

⁴ The title Shunter was used until 2017 and is used in this report. In 2018, all shunters at Dollands Moor yard were renamed Operations Supervisors.

⁵ The role of yard operations supervisor had the title Yard Operative between 2012 and 2017. In 2018, this position was renamed International Operations Supervisor.

- 28 The safety assurance manager had been based at Dollands Moor yard for over 10 years. His job description stated that his responsibilities included:
- Local site specific training & management of mentors.
 - Management of employees through competence assessments to identify precursor events.
 - Managing the competence of individuals through competence assessments, compliance on site, and conducting local training.
- 29 The signaller was located at Network Rail's Ashford signalling centre.

External circumstances

- 30 The accident occurred during darkness. The weather conditions in the Folkestone area, as recorded⁶ at Cheriton, 2.5 km from Dollands Moor yard, were dry, with a temperature of 17°C and a light south-westerly wind.

⁶ Data from <https://www.wunderground.com>.

The sequence of events

Events preceding the accident

- 31 On the evening before the accident, the train driver booked on at Dollands Moor yard at 19:37 hrs, and then travelled as a passenger to Rugby where he relieved the driver of train 6O16 at 22:20 hrs.
- 32 At 20:30 hrs, the shunter began his shift at Dollands Moor yard. Another shunter and a yard operations supervisor were also on duty during this shift.
- 33 The shunters and yard operations supervisor had dealt with several trains before train 6O16 passed Herringe crossover⁷ at approximately 03:30 hrs. This crossover is located between Ashford and Westenhanger, about 4.75 miles (7.6 km) from Dollands Moor yard.
- 34 The yard operations supervisor observed train 6O16 on a panel showing the location of trains and contacted the shunters by radio, informing them that it would arrive on siding 2. This radio call was acknowledged in accordance with normal practice at Dollands Moor yard, but not repeated back by the shunters.
- 35 At 03:32 hrs, the yard operations supervisor called the Ashford signaller by telephone to request the train be signalled into siding 2. The signaller acknowledged the message and repeated back the siding number correctly.
- 36 At 03:35 hrs the shunter drove to the control room in a buggy. He had just finished dealing with a train which had recently arrived from France. He walked into the control room to collect the consist list (a list of the wagons in the train) and other documents for train 6O16. There was no further verbal confirmation of the siding number at this point and this information was not written on the consist list.
- 37 At 03:36 hrs, the shunter drove up the main access road in a buggy to the west end level crossing, a distance of about 830 metres (figure 8 and figure 9). The other shunter, as was normal practice, made his way to the opposite end of the yard and stopped on the concrete walkway on the north side of siding 2.



Figure 8: Google Earth image looking north, showing route of buggy from control room to siding 2.

⁷ Herringe cross-over, 61 miles 65 chains from London Charing Cross.

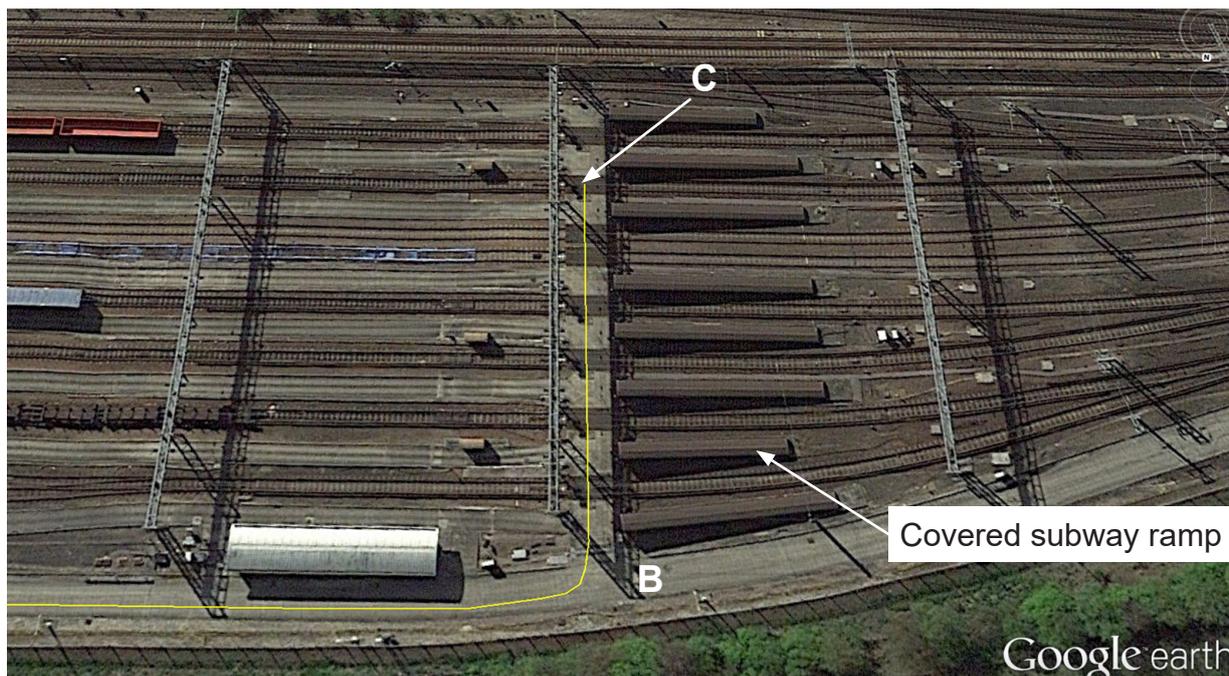


Figure 9: Google Earth image looking south, showing west end level crossing. Locations B (north end of crossing) and C (point of collision) are as marked on figure 8.



Figure 10: CCTV still image showing ramps and west end level crossing. Locations B and C are as marked on figure 8. The buggy is visible at location B, approaching the west end level crossing. The collision occurred just outside of the camera's field of view at location C.

38 At 03:38:21 hrs⁸, train passed signal AD755 after emerging from Saltwood tunnel. This signal is located on the main line and controls entry to the yard. At this point, the train was about 540 metres from the west end level crossing, travelling at 16 mph (26 km/h). The signal was displaying a single yellow aspect, and the driver slightly increased the locomotive's power. The train's speed gradually increased to 22 mph (35 km/h).

⁸ Times in this report are adjusted where necessary to match the locomotive's data recorder (OTDR) clock. CCTV clock times have therefore been adjusted by -00:14:48 hrs.

- 39 At 03:38:50 hrs, CCTV images show that the buggy turned from the access road onto the west end level crossing to cross the siding lines (figure 10). The buggy slowed down but did not stop before disappearing from view at 03:39:09 hrs as it approached siding 2. There is no further CCTV or other evidence relating to movements of the buggy until the train driver saw it stationary across siding 2 just before the collision which occurred 37 seconds later.
- 40 At 03:39:12 hrs, the train's headlights became visible on a west-facing depot CCTV camera. The train was about 300 metres from the level crossing and still on the main line at this time. A few seconds later it crossed Saltwood Junction at the entrance to the yard.

Events during the accident

- 41 As the train was approaching the level crossing, the driver saw the buggy obstructing the line ahead and, at 03:39:41 hrs, applied the brake when the train was about 50 metres from the level crossing. He did not sound the train's horn. Immediately before the collision, he saw a person in orange overalls sitting in the buggy, who appeared to be reading a document and then looked up at the last moment before attempting to dive out.
- 42 The train travelled about 102 metres beyond the crossing before stopping 16 seconds after the collision. The buggy was pushed along the track by the train; creating sparks which ignited petrol spilt from the buggy's fuel tank as the train slowed down. The train driver left the cab immediately and before a significant fire took hold (figure 11); he was uninjured.



Figure 11: Image of locomotive and damaged buggy following accident. Concrete walkways run between each siding and are used for the inspection of trains.

Events following the accident

- 43 The train driver phoned the yard operations supervisor who contacted the emergency services. The driver then ran back to care for the shunter who was lying beside the track about 20 metres from the level crossing. Staff from the office took a van towards the site, arriving about three minutes after the accident occurred. The shunter suffered life-changing injuries and was subsequently airlifted to hospital.
- 44 The shunter's radio was recovered from the site and found to be intact and in full working order. He was not carrying a mobile phone or any other electronic device.

Key facts and analysis

Background information

Function and operation of the yard

- 45 Dollands Moor yard was built to allow security and safety checks to be undertaken on all freight trains using the Channel Tunnel. While trains are stopped in the yard, the tail lamps marking the end of each train are changed between British and French (UIC⁹) types. The locomotive is also changed when necessary.
- 46 Dollands Moor yard differs from other DB Cargo yards in that the speed of arriving trains is relatively high, and points and signalling are controlled remotely by Network Rail staff at Ashford signalling centre. It is also the only DB Cargo yard where staff use buggies.

Interaction with the signaller

- 47 Signallers at Ashford signalling centre are required to obtain the permission of a yard operative before allowing any train to enter Dollands Moor yard. In addition, a signal box instruction¹⁰, which remained in force at the time of the accident, gave instructions to signallers relating to signal protection when vehicles or plant were to be taken over either the west end or east end level crossings. The instruction stated that a member of staff from Dollands Moor yard would request permission to cross from the signaller by telephone. The signaller was instructed to agree a suitable time with the caller and replace the relevant signals to red to prevent approaching train movements while the crossing was in use.

Shunters' duties

- 48 Two shunters were normally rostered to work on night shifts at Dollands Moor yard, together with a yard operations supervisor located in the Dollands Moor yard control room. A plan of train movements was produced at the start of each shift. During the shift, shunters carried a radio, and dealt with arriving trains bound for either France or the UK, returning to a mess room near the control room at the east end of the yard when there were no duties to undertake. During day shifts, when there were fewer freight train movements, one shunter was rostered to undertake all required duties.
- 49 Shunters were notified of an approaching train 10 to 15 minutes before its arrival by the yard operations supervisor. This notification, normally given by radio, included the train's reporting number (headcode) and the siding number which it would be arriving on.
- 50 The shunters arranged the duties between themselves so that, after receiving a radio notification, one shunter would visit the control room and collect the train's consist list, and other documentation relating to the train from the yard operations supervisor, before going to the siding. The other shunter would proceed directly to the opposite end of the same siding.

⁹ Union Internationale des Chemins de Fer.

¹⁰ Special instructions to the signaller at Ashford IECC workstation 5, updated December 2016.

- 51 DB Cargo has described the duties of the shunter at the rear of the train as follows:
- 'The shunter is to be positioned in a place of safety on the concrete walkway adjacent to the siding which the train is arriving on. The shunter will then conduct a roll-by examination¹¹ of the train as it passes. Once the train comes to a stand and is secured, the shunter will then change over the train tail lamps and proceed to examine the train along both sides from the concrete walkway.'*
- 52 The inspection of trains was assisted by the additional lights fitted to the left-hand side of each buggy (paragraph 20 and figure 7a). This meant that the right-hand side of a train travelling towards France, such as the train involved in the accident, could only be inspected by a buggy travelling from the west end level crossing towards the east end level crossing, and required a buggy travelling from the access road to cross the track used by the train before the inspection started.
- 53 The shunter at the front of the train would uncouple the locomotive if required and assist with the wagon inspection. When a replacement locomotive needed to be attached, the shunter at the front of the train would couple that locomotive and assist the driver to conduct a brake test by instructing his colleague by radio to operate a valve on the braking system at the rear of the train.

Identification of the immediate cause

- 54 **The buggy was in an unsafe position on the level crossing as the train approached.**
- 55 The unsafe position of the buggy and the approach of the train are apparent from the evidence included in the description of events during the accident (paragraph 41).

Identification of causal factors

- 56 The accident occurred due to a combination of the following causal factors:
- The buggy driver was not aware that he was in the path of the approaching train until it was too late to avoid injury (paragraph 57);
 - Custom and practice at Dollands Moor yard resulted in buggies using level crossings when not protected by signals, rather than the east end subway (paragraph 64);
 - The train driver could not see the buggy until it was too late to take action to avoid the accident, because DB Cargo did not ensure that the buggies were conspicuous when allowing them to operate near the railway (paragraph 78).

Each of these factors is now considered in turn.

¹¹ A visual examination of a moving train.

57 The buggy driver was not aware that he was in the path of the approaching train until it was too late to avoid injury.

- 58 It is unclear, partly because the shunter stated that he did not recall details of the accident, why the buggy stopped on the level crossing on siding 2. It is however likely that the shunter did so for one or more of the following reasons:
- a. He intended to do a roll-by examination before crossing the siding occupied by the train, and incorrectly believed he was stationary on a siding which would not be used by the train. The roll-by examination could be done from either side of the train so, at night and depending on whether they believed there was time to cross the siding before the train arrived, shunters either used the headlights of the buggy to illuminate the train before crossing the siding now occupied by the train, or crossed the siding before the train arrived and then used the lights on the left side of the buggy to illuminate the train. In both instances the buggy needed to have crossed the siding before the shunter could inspect the right-hand side of the stationary train (paragraph 52). If the shunter intended to do the roll-by examination before crossing the siding, it is possible that he was on the same track as the train due to mishearing or misremembering the siding number on which the train was arriving. This might have been the consequence of him following normal practice at Dollands Moor yard by not repeating back the radio message sent by the yard operations supervisor (paragraph 59).
 - b. He believed the train was not yet close to the crossing and was not looking for the approaching train. A reconstruction of the accident (paragraph 81) showed that it was fully visible when it was 80 metres from the level crossing and would have been conspicuous to the shunter if he was looking towards the train.
 - c. He chose this location to check his paperwork because it was a relatively well-lit part of the site. It is possible that he did this to find out the train length, which would help him establish the best position to stop on the walkway adjacent to the siding.
 - d. He was fatigued which, if true, was most likely a consequence of the time of day (paragraphs 60 to 62).
 - e. He misunderstood his position due to lack of signs and/or visual cues. The absence of such signs and cues is probably a consequence of them not being needed for the method of accessing the sidings documented in 2010 (paragraph 68).
 - f. He was distracted.

Communication

- 59 Repeating back radio messages reduces the risk of a misunderstanding and increases the likelihood of the recipient remembering the correct information. It is a requirement for many safety critical communications on railway infrastructure, including all operational communication by shunters and signallers¹². DB Cargo stated that it considered information about sidings to be used by arriving trains to be safety critical.

¹² PTS training course syllabus.

Fatigue

- 60 If fatigue played a part in any of the possible scenarios described above, the most likely cause is the natural circadian rhythm, which means humans are particularly likely to feel fatigued in the early hours of the morning.
- 61 The shunter's shift pattern required him to start at 20:30 hrs and finish at 06:30 hrs, which provided exactly the 14 hours minimum rest between shifts contained in Office of Rail and Road (ORR) guidance¹³. He commuted by car for one hour before and after each shift and so had the opportunity for 12 hours rest at home between shifts.
- 62 The shunter's rostered shifts did not conform to the ORR guidance that there should be two rest days between working early and late shifts. He had actually worked two early shifts followed immediately by two night shifts with the accident occurring on the second night shift. The greatest fatigue risk associated with this pattern would probably have been on the first night shift, so it is unlikely that the rostered work pattern influenced the accident.

Other possible explanations

- 63 There is no evidence to support any of the following explanations for the buggy remaining stationary on the level crossing, but they remain possible:
 - a. The RAIB considers that it is unlikely the shunter was sent to the wrong siding by the yard operations supervisor, since the other shunter, who received the same radio call, was positioned ready for the train to arrive in siding 2. This shunter was located at the east end of the siding when the accident occurred and did not witness it.
 - b. A defect with the buggy is unlikely to have been a factor as CCTV images indicate that the buggy's left-hand headlight was lit¹⁴ following the collision. The design of the buggy means that this can only happen when the engine is running (ie the lights go out when the engine stops). The headlight bulb on the right-hand side of the buggy (closest to the approaching train) was not working before the accident, but it is unlikely that this would have affected the shunter's assessment of his position on the crossing. It is also unlikely that the buggy had stopped on the crossing due to the engine cutting out. In the months before the accident, the shunters had encountered some problems when trying to start the buggies but there is no evidence of the engine cutting out.
 - c. A medical condition causing the shunter to black-out or become disorientated cannot be entirely discounted, though there is no evidence suggesting this. He had been passed for shunter duties after a pre-employment medical in November 2017, and colleagues report that his demeanour before the accident was normal.

¹³ 'Managing Rail Staff Fatigue', ORR, 2012.

¹⁴ This is consistent with post-accident testing which showed that the left-hand headlight bulb was capable of being illuminated and the right-hand headlight bulb was broken.

64 Custom and practice at Dollands Moor yard resulted in buggies using level crossings when not protected by signals, rather than the east end subway.Method of work

- 65 When Dollands Moor yard became fully operational following the opening of the Channel Tunnel in 1994, battery powered buggies were provided to transport staff and equipment. All staff were required to use the subways to access sidings whether on foot or in a vehicle. The parallel level crossings were chained off and any use required signal protection in accordance with a signal box instruction (paragraph 47).
- 66 These methods of working addressed the following potential safety issues relating to use of the level crossings:
- a. The relatively long crossing time required if a user needs to cross several tracks. The west end crossing spans eight tracks and has an overall length of 56 metres if crossing all tracks.
 - b. The difficulty of establishing which siding a train is approaching on until shortly before it arrives, particularly at the west end of the yard, due to the complex track layout.
 - c. The restricted opportunities for a crossing user to see some approaching trains due to the canopies covering the subway ramps.
- 67 By 2008, there were concerns that pedestrians using the subways were at risk of being struck by a buggy. The DB Cargo manager responsible for the yard undertook a risk assessment which concluded that it would be safer for pedestrians holding PTS certification to cross the tracks on the level crossings. The west end subway was also considered to be in poor condition and the manager devised a method of working that would allow this subway to be taken out of use.
- 68 This revised method of working was described in the yard's 2010 Safe System of Work (SSOW) document (paragraph 92). It required buggies to use the east end subway to access the appropriate siding. Buggies would then drive along the adjacent concrete walkway. Use of the level crossings by vehicles remained prohibited without the signaller's permission (ie without signal protection). However, although not stated in the document, staff were briefed that buggies were permitted to cross behind a stationary train to inspect its other side without contacting the signaller, as the presence of the train would keep the signal on the approach to the west end crossing showing a red aspect.
- 69 To facilitate use of the level crossing by pedestrians, the chains across the ends of the level crossings were removed. No signs were erected to show any restrictions on use of the level crossings by buggies.
- 70 In 2014, the battery powered buggies were replaced with petrol powered buggies. At about the same time, a group of five new shunters started at Dollands Moor yard, as part of a re-staffing programme to increase the yard's operational capability, bringing the number of shunters to six. The new shunters were trained by the experienced shunter who had been based mainly at Dollands Moor yard since the mid-1990s. The experienced shunter showed the new shunters that a petrol buggy could fit through the east end subway.

- 71 Use of the east end subway was problematic as it was often damp and, although the buggies had lights, the subway's internal lighting had failed (figure 12). It is not clear when these lights stopped working, but it pre-dated the arrival of the new group of shunters in 2014. There is no evidence that any maintenance reports were submitted requesting repair of the subway lighting between 2014 and 2018.



Figure 12: internal view of unlit east end subway in November 2018. The photograph was taken by torchlight.

- 72 By 2014, use of the east end subway was not being enforced and most shunters preferred to drive across the east and west end level crossings instead, a practice which DB Cargo managers permitted informally (paragraph 98).
- 73 Since shunters did not contact the signallers before using the level crossing, and given the difficulties of seeing whether a train was approaching the west end level crossing (paragraph 66c), it is likely that shunters were relying, at least in part, on radio messages to establish when trains were arriving. During the period from 2014 until the time of the accident, there were no recorded near misses between trains and buggies at Dollands Moor yard.
- 74 Although the condition of the west end subway was considered sufficiently poor to justify discontinuing its use in 2008 (paragraph 67), the RAIB found it was reasonably dry and most of its internal lighting was working in September 2018 (figure 13).



Figure 13: internal view of out of use west end subway with some working lighting, shown immediately after the accident in September 2018

Shunter's training

- 75 The shunter joined DB Cargo in December 2017 and undertook a three week shunting course at a company depot near Toton, Nottinghamshire. He arrived at Dollands Moor yard in January 2018, and began learning his duties at this yard through a mentoring process. There is no evidence that the shunter received a formal induction or training for using the buggies.
- 76 The shunter was assigned to the mentor and worked the same shifts as him for about three months. During this period he was not permitted to work independently. The shunter and mentor always used the level crossings to access the sidings. The mentor had always done this himself, and trained the shunter accordingly. The mentor was unaware of any prohibition on use of the level crossings by vehicles without protection by railway signals. Use of the level crossings by vehicles was not referred to by training material or safety documentation in place for Dollands Moor yard at the time of the accident (paragraph 91), and so the shunter and mentor had no formal guidance about how to cross the sidings.
- 77 In April 2018, the mentor informed the safety assurance manager that the shunter was ready for his final assessment. This assessment of his competency by the manager did not include a practical test, but the shunter answered questions and passed with high marks. The questions related only to shunting and train operation activities. They did not address travelling around the yard to reach trains and the safety assurance manager did not identify anything amiss with these arrangements. DB Cargo has informed the RAIB that unobtrusive monitoring *'was carried out on all shunters before they were signed off as competent'*, and *'part of this monitoring reviewed [the shunter's] safe use of the crossings'*.

78 The train driver could not see the buggy until it was too late to take action to avoid the accident because DB Cargo did not ensure that the buggies were conspicuous when allowing them to operate near the railway.

- 79 As the train approached the yard, it passed a signal displaying a single yellow aspect, permitting it to proceed as far as the signal at the east end (far end) of the yard. The driver was not required to drive on-sight: ie he was not required to drive so that he could stop within the distance he could see was clear of obstructions, but was required to look out for hazards on the line ahead. The train complied with the maximum permitted speed of 30 mph (48 km/h) reducing to 25 mph (40 km/h) while entering and moving through the yard. The train driver was familiar with normal operating practice at the yard and was expecting to see a buggy parked on the concrete walkway to the right of the siding awaiting the arrival of the train.
- 80 The train driver applied the brake when the train was about 50 metres (equivalent to about five seconds travelling time) from the level crossing. He saw the buggy but initially believed it was empty as no lights were visible. He did not sound the horn.
- 81 A reconstruction, requested and witnessed by the RAIB, showed that the curved approach to the sidings meant that the train driver did not get a view of the level crossing until the locomotive was about 100 metres from it. The reconstruction also showed that, although the buggy was partly illuminated by the yard's overhead lighting, the curved approach meant that the locomotive's headlights did not fully illuminate the buggy until the train was about 30 metres (equivalent to about three seconds travelling time) from the level crossing.
- 82 The buggy was not distinctly visible before it was illuminated by the train's headlights because its yellow bodywork meant it was a similar colour to pools of light reflected off the ground from the sodium floodlighting. This effect is illustrated by a photograph taken from the cab of a stationary locomotive during the reconstruction of the accident (figure 14). The reconstruction showed that the defective right-hand headlight had no significant effect on the conspicuity of the buggy viewed from an approaching train.

Buggy conspicuity

- 83 The petrol powered buggies, introduced in 2014, were equipped with front and rear driving lights which were designed to work only when the engine was running. They were not equipped with hazard lights, flashing beacons, reflective strips or other features to increase their conspicuity.
- 84 Network Rail document RT3170¹⁵ indicates that it is good practice for road vehicles to show hazard warning lights when on or near the line. DB Cargo has informed the RAIB that it requires vehicles in other yards (eg reach-stackers in container-handling depots) to have an orange flashing beacon. The Health and Safety Executive (HSE) publication 'A guide to workplace transport safety'¹⁶ states:

'Vehicles should also be clearly visible to pedestrians and other vehicles in the workplace so consider fitting, for example, additional lights, reflectors and flashing (or rotating) beacons'.

¹⁵ A Guide to Personal Track Safety.

¹⁶ HSG136, 2014 edition.

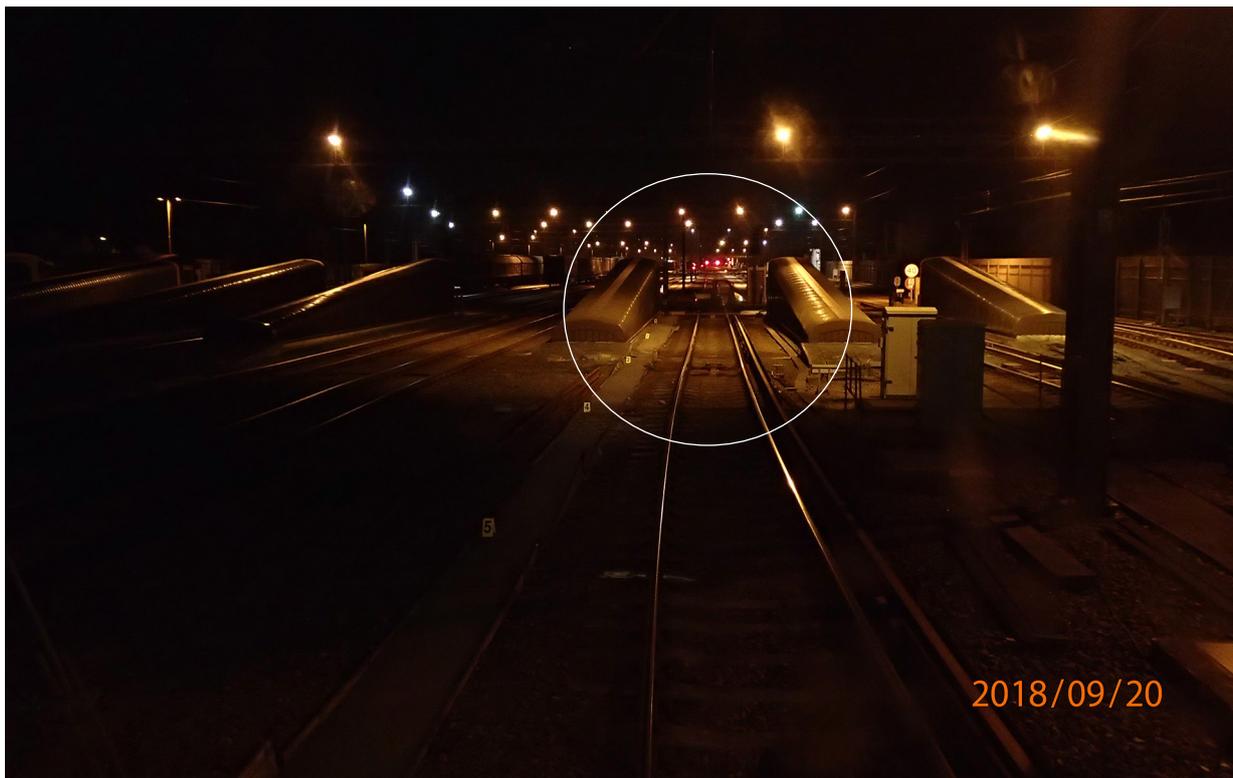


Figure 14: reconstructed view of a buggy on the level crossing showing a train driver's view 60 m from the crossing. Note that the right-hand headlight (ie on the side nearest the train) was unlit.

- 85 Witness evidence indicates that the battery powered buggies used in the yard until 2014 were fitted with orange flashing beacons. Although DB Cargo requires vehicles operating near the track to be fitted with orange flashing beacons at other locations, this requirement appears to have been overlooked when the petrol powered buggies were introduced, despite them being regularly used in locations where it would be possible for there to be a conflict between buggy movements and movements of other road vehicles, rail vehicles and pedestrians.
- 86 Had the buggy been fitted with an orange flashing beacon, it is likely that the train driver would have seen it when the train was about 100 metres away. This would have allowed an earlier brake application, and given more opportunity for the train driver to have sounded the train horn in time for the shunter to jump clear or move the buggy.

Underlying factor

- 87 **DB Cargo's management of the use of buggies, subways and level crossings at Dollands Moor yard was inadequate.**

DB Cargo standards for safety management documents

- 88 DB Cargo, as employer of the staff involved, was required¹⁷ to undertake a risk assessment for each of its sites. It was also required to review this assessment when it was no longer valid or there had been a change in circumstances. DB Cargo's policy was for local managers to review their risk assessments annually and when significant organisational changes occurred.

¹⁷ Regulation 3, Management of Health and Safety at Work Regulations 1999.

89 The company's standard for risk assessment, published in 2013¹⁸, stated:

'In some cases generic risk assessments may be available. It is essential that these are supplemented with local information where necessary and take into account potential differences in supervision, training, geography, the local environment and any accident history.'

'Findings from the risk assessment should be used to develop a safe system of work... the risk management process requires a documented safe system of work, understood by all persons affected by the risks.'

90 The safe system of work document for each site was governed by a company standard published in 2009¹⁹ and updated in 2014²⁰. This gave staff responsible for developing and maintaining these documents guidance on legal responsibilities and what needed to be included. It stated:

'A safe system of work constitutes the bringing together of materials, people, plant and equipment; complying with all legal requirements, and industry standards. This of course includes the working activity in yards, terminals and engineering depots for which we have responsibility to work in a safe and effective manner.'

The safe system of work is a logical progression from the risk assessment findings and is designed as such to control the risks identified through the risk assessment process, to ensure a safe system of working for the activity.'

Under the heading 'When is a safe system of work required?' it stated:

'A safe system of work is needed when hazards cannot be physically eliminated and some element of risk remains.'

Under the heading 'What should be included in the Safe System of Work?' the list included:

- *Person in Charge.*
- *Site Conditions.*
- *Control of all movements ie rail and or vehicle movements.*
- *A summary of the significant hazards and controls identified through the risk assessment process.*

From 2014, a SSOW was also required to include:

- *A Map/Layout of site including authorised walking routes.*

[Safety documents for Dollands Moor yard](#)

91 From 1994 to 2007, freight trains using the Channel Tunnel and Dollands Moor yard were crewed by either French or British drivers under a bi-lateral agreement between the respective Governments. As a consequence, the yard's method of work document was written in both French and English and was about 50 pages long. When this agreement ended, operations continued using British drivers only. The SSOW document was simplified and the French sections removed.

¹⁸ Risk Assessment Standard, Issue 5 revision 2, published March 2013.

¹⁹ Safety Manual: Issue three, June 2009, Safe system of work.

²⁰ Safe system of work for depots, yards & sidings, December 2014.

- 92 The 2010 SSOW document²¹ included a detailed description of how shunters should access the sidings for train inspections using the east end subway (paragraph 68). It included a diagram of the yard showing roadways and pedestrian access routes via the subways. It stated that the level crossings (referred to as ‘Emergency road crossings’) were only to be used in an emergency or when specially authorised and with the permission of the signaller at Ashford signalling centre. This corresponded with the signal box instruction (paragraph 47).
- 93 In 2012, the Dollands Moor yard SSOW²² was substantially re-written in a response to an initiative from DB Cargo’s safety department aimed at streamlining SSOW documents across the company. Witness evidence suggests that local managers received an instruction that the method of work at Dollands Moor yard needed to be reduced to a workable document of about six pages. This resulted in information being taken out of the Dollands Moor SSOW document. The revised document made no reference to the use of subways, level crossings and buggies.
- 94 The 2013 version of the Dollands Moor yard risk assessment²³, the earliest such risk assessment DB Cargo was able to provide to the RAIB, was mainly focused on train working. It identified the need for dedicated walking routes and for staff to hold PTS competency, but contained no reference to use of subways, level crossings or buggies. This document, and others like it, was signed by the risk assessor and an authorising manager.
- 95 In 2014, the ‘working in the yard’ section of the risk assessment²⁴ identified that staff and contractors working in the yard were exposed to train, road vehicle and depot buggy movements. It did not identify that any action was required to mitigate these risks further. The 2014 SSOW document²⁵ made one reference to the new petrol powered buggies:
- ‘Two petrol driven buggies are provided for ease of carrying out duties within this location. These buggies are designed for carrying two personnel only and this instruction must be adhered to at all times. Only competent personnel are authorised to drive these vehicles.’*
- 96 By 2017, the risk assessment²⁶ included a section on powered buggies and identified the risk of personal injury resulting from being struck by buggies operating within the yard. In mitigation it stated:
- *Only trained & authorised personnel to operated (sic) powered buggies.*
 - *Daily checks and records completed with defects reported.*
 - *Maintenance regime conducted by supplying company.*
 - *Warning horn to be sounded when operating in the vicinity of other personnel.*
 - *Powered buggies only to be operated in authorised areas.*

²¹ ‘Method of Working for Dollands Moor’, authorised 11 June 2010.

²² ‘Method of working for Dollands Moor’, issued July 2012.

²³ Risk assessment DBS/Dollands Moor, issued July 2013.

²⁴ Risk assessment DBS/Dollands Moor, issued May 2014.

²⁵ ‘Method of work for Dollands Moor’, issued June 2014.

²⁶ Risk assessment. Task: train working. Ref ‘DBC/DMD/OPRA001, issued January 2017.

- 97 Subsequent updates and reviews of the SSOW and risk assessments did not result in any further significant amendments relevant to the buggies. Therefore, at the time of the accident, neither the SSOW document nor the risk assessment:
- defined the authorised areas where powered buggies could be operated;
 - made reference to use of level crossings or subways; or
 - identified the risk to buggy users from moving trains.
- 98 DB Cargo stated that local managers permitted use of buggies on the level crossings ‘on the expectation that the crossings would be used in line with PTS rules, ie operatives should cross only when there is a clear line of sight and only if a position of safety is available at the other side’. The RAIB notes that PTS (personal track safety) rules do not cover using vehicles on level crossings or permit use of vehicles elsewhere on railway lines unless authorised by an appropriate company procedure; DB Cargo has provided no evidence of a relevant procedure.
- 99 Although the risk assessment and SSOW documents were updated annually, DB Cargo’s ‘Management of Change’ process required a more detailed review of the risk assessment and SSOW document when significant changes occurred. This triggered a safety compliance check in 2018, when the contracts delivery manager role was introduced, but although this identified a lack of training for staff using the buggies, it did not result in any significant changes relating to their use.
- 100 In addition to the risk assessments and SSOW, DB Cargo also issued documents relating to the company’s competency assessment process. These focused on operational tasks relating to trains rather than accessing the trains. Assessments of the shunter were done in accordance with the processes, so did not consider how buggies and other vehicles were used in the yard (paragraph 77).

Safety tours and audits

- 101 The safety assurance manager responsible for, and based at, Dollands Moor undertook safety tours at the yard several times a year. The last tour before the accident, undertaken in April 2018 using DB Cargo’s safety tour standard²⁷ made some observations, including:
- *All PPE supplied and being used correctly on site.*
 - *All staff following the local SSOW.*
 - *Accommodation buildings in good order with all facilities working.*
 - *Daily checks completed by staff using vehicles.*
- 102 The safety tour reports did not identify that buggies were using the level crossings instead of the east end subway, or record that the lighting in the east end subway was not working (paragraph 71). The safety assurance manager stated that he believed that the east end subway was in regular use, but was aware that buggies were sometimes driven across the east end level crossing. He considered that with the training staff received, and the available sighting, this was safe. He stated he was not aware of shunters driving up the internal access road and across the west end level crossing.

²⁷ DB Cargo safety tour standard DBS/RHS/0035 issue 1 April 2015.

- 103 The arrangements in place for monitoring the safety of the site repeatedly overlooked the issue of using buggies on the level crossings without signal protection, probably because the practice had become normalised and safety documents were silent on this matter (paragraph 93). Furthermore, the mentoring process, in the absence of documented systems (paragraph 76) served to perpetuate this potentially unsafe practice.
- 104 In July 2018, a DB Cargo auditor visited Dollands Moor yard to conduct an audit of the operations system. The resulting report²⁸ identified several non-conformances. The following extracts of this report are directly relevant to this investigation:

This risk assessment covers a number of yard activities and is generally good.

Major Non Conformity: No record of training for ground staff in the use of powered buggies.

Comment: These [buggies] must not be used until training is complete.

SSOW needs updating and re-issue at it is signed off by previous manager but generally good.

Comment: Remove from SSOW 'staff working at night' as this no longer takes place.

Minor Non Conformity: No evidence that SSOW have been briefed to staff.

- 105 The audit concentrated on engineering staff, and the report made few references to shunting activities. It also made no reference to the use of subways or level crossings or the lack of information on what areas were authorised for use by powered buggies (paragraph 97), and recommended removing night working from the SSOW stating '*this no longer takes place.*'
- 106 DB Cargo had not implemented the recommended action to not use the buggies until training was complete (paragraph 104). However, it has informed the RAIB that the status of the buggies was being reviewed at the time of the accident.
- 107 The length of time for which buggies used level crossings without this activity being formally documented or risk assessed, and the extent to which shunters lacked guidance on the correct use of these vehicles, indicates a possible shortcoming in the corporate (head office) oversight of safety management arrangements for shunting activities at the yard. This is also suggested by witness evidence that there had been little supervision and checking of shunters' working practices. The need for effective corporate supervision was particularly important when the service delivery manager role, the role intended to provide line management for the shunters, was vacant. This role was filled about six weeks before the accident after a period of over 12 months when it was vacant (paragraph 27). DB Cargo stated that unobtrusive monitoring of staff at its yards by safety assurance managers from other areas had previously been considered, but not implemented.

²⁸ Dollands Moor Safety Compliance Check, 4 July 2018, ref. CT/040718/0001.

Summary of conclusions

Immediate cause

108 The immediate cause of the accident was that the buggy was in an unsafe position on the level crossing as the train approached (paragraph 54).

Causal factors

109 The causal factors were:

- The buggy driver was not aware that he was in the path of the approaching train until it was too late to avoid injury (paragraph 57);
- Custom and practice at Dollands Moor yard resulted in buggies using level crossings when not protected by signals, rather than the east end subway, with one likely consequence being that radios were being used to inform safety critical decisions (paragraph 64, **Recommendation 1**);
- The train driver could not see the buggy until it was too late to take action to avoid the accident because DB Cargo did not ensure that the buggies were conspicuous when allowing them to operate near the railway (paragraph 78, **Recommendation 1**).

Underlying factor

110 DB Cargo's management of the use of buggies, subways and level crossings at Dollands Moor yard was inadequate (paragraph 87, **Recommendations 1 and 2**).

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

111 DB Cargo has stated that it has undertaken the following actions:

- Withdrawn the remaining buggy at Dollands Moor yard from use pending a review of operational arrangements at the yard. Shunters currently have to walk or use a road vehicle to access the west end of the yard. They then walk across the level crossing.
- Commenced a national project to look at providing digital radios which will allow radio calls to be recorded.
- Implemented a centralised document management and storage system so that safety documents are readily available.
- Instructed all sites to review signal box instructions where these exist.

Recommendations

112 The following recommendations are made²⁹:

- 1 *The intent of this recommendation is to address gaps identified in the local safety management system.*

DB Cargo should improve safety management arrangements at Dollands Moor yard including, as a minimum:

- ensuring that movement of people and vehicles to and from trains are covered by appropriately documented safe systems of work supported by appropriate risk assessments (paragraph 110);
- ensuring that vehicles used on and/or near the operational railway are conspicuous to train drivers (eg by fitting orange flashing beacons, attaching reflective material and/or selection of appropriately coloured vehicles) (paragraph 109);
- consider reinstating one or both subways, and making provision for their future maintenance, if required for vehicular use (paragraph 109); and
- establishing adequate arrangements for devising, documenting, checking and supervising safe systems of work (paragraph 110).

- 2 *The intent of this recommendation is to ensure the identification and correction of any shortcomings in safety related documentation, safety audits and safety inspections. Implementation could include utilising appropriate competent staff from one location to check work undertaken at another location.*

DB Cargo should review and, if necessary improve, corporate oversight and verification of safety arrangements and safety supervision at DB Cargo locations across the UK (paragraph 110).

²⁹ 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.

Appendices

Appendix A - Sources of evidence

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

- information provided by witnesses;
- staff and personnel records;
- CCTV evidence from fixed cameras at Dollands Moor yard;
- on train data recorder;
- DB Cargo documents, standards and procedures;
- buggy maintenance records;
- site reconstruction and measurements; and
- forensic testing of headlight bulbs from the buggy involved in the accident.

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

© Crown copyright 2019

Any enquiries about this publication should be sent to:

RAIB	Email: enquiries@raib.gov.uk
The Wharf	Telephone: 01332 253300
Stores Road	Website: www.gov.uk/raib
Derby UK	
DE21 4BA	