

Rail Accident Report



Fatal accident to Shunter, Dagenham Dock 17 July 2006

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

Fatal accident to shunter at Dagenham Dock

17 July 2006

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Introduction

- 1 The sole purpose of a Rail Accident Investigation Branch (RAIB) investigation is to prevent future accidents and incidents and improve railway safety.
- 2 The RAIB does not establish blame or liability, or carry out prosecutions.
- 3 Access was freely given by Freightliner Heavy Haul to its staff, data and records in connection with this investigation.
- 4 References to left and right are as seen facing eastward towards Tilbury.
- 5 Appendices at the back of this report contain two glossaries:
 - acronyms and abbreviations are explained in appendix A; and
 - technical terms (shown in *italics* the first time they appear in the report) are explained in appendix B.

Summary

Key facts about the accident

- 6 At 12:22 hrs on 17 July 2006, a 42-year-old shunter, employed by Freightliner Heavy Haul Limited (Freightliner), was crushed between a locomotive and a wagon during a shunting move at Dagenham Dock down yard. There were no immediate witnesses.

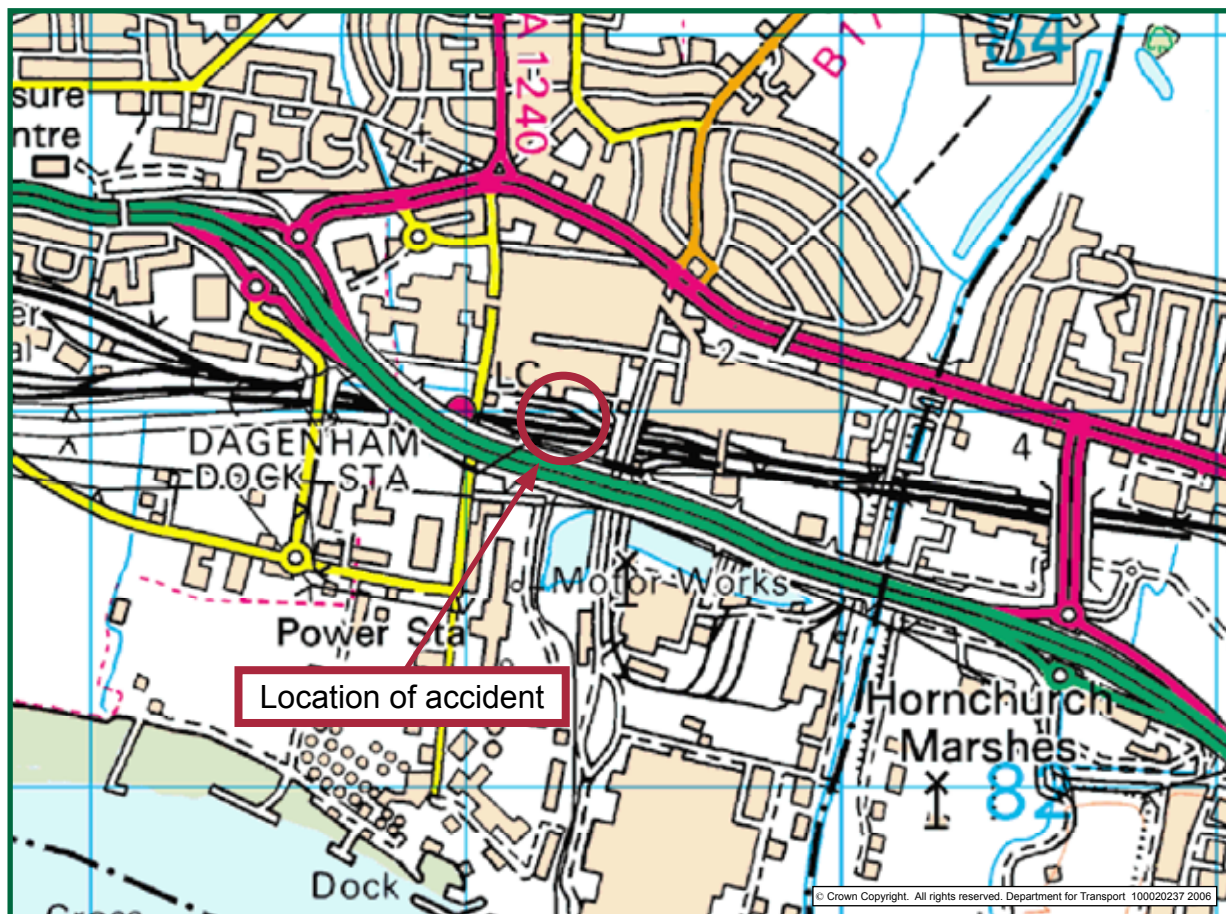


Figure 1: Extract from Ordnance Survey map showing location of Dagenham Dock down yard

Immediate cause, causal and contributory factors, underlying causes

- 7 The shunter sustained fatal injuries when he fell between the *buffers* of the locomotive and the wagon. He had been standing or walking close to the train alongside a siding, and as the train passed he collapsed, or tripped, and fell into the gap between the buffers.
- 8 Causal factors were:
- a. the shunter tripping or collapsing and falling towards the moving train; and
 - b. if the shunter tripped, the damaged condition of the trackside walkway on the north side of the siding, which presented a tripping hazard.

- 9 In addition, the following factors were considered to be contributory:
- a. The existence of trackside walkways within 1.25 metres of the track which did not provide a place of safety as specified during Personal Track Safety (PTS) training. This would put a user at risk from moving trains;
 - b. The shunter's lack of information about or experience of the specific hazards presented by the particular siding;
 - c. The proximity of a lamp-post to the track at the eastern end of siding 4. This post is in the walkway and had not been marked as having a *limited clearance*;
 - d. The relatively wide gap between the left-hand buffers of the locomotive and the wagon due to the curvature of the track at the eastern end of siding 4;
 - e. The container loading sequence, which resulted in the empty wagon's being in the middle of a *rake* when too few containers were delivered, and the need to remove it if the train was to be prevented from running with empty wagons;
 - f. The rapid charging of the brake system, which remained full of air after a previous movement. This may have led to the shunter's being taken unawares when the train started to move sooner than he expected if the shunter was not in a place of safety when the instruction to move was given; and
 - g. The driver being unaware of the shunter's position during the final eastward movement.

Severity of consequences

- 10 The accident resulted in the shunter's sustaining fatal injuries.

Recommendations

- 11 Recommendations can be found at paragraph 124. They relate to the following areas:
- a. The management of risks identified in the *local working instructions*;
 - b. Ensuring compliance with the *rule book*;
 - c. Methods of working; and
 - d. The establishment of safe walking routes between frequently used locations in railway yards.

The Accident

Summary of the accident

- 12 At 12:22 hrs on 17 July 2006, a 42-year-old shunter, employed by Freightliner Heavy Haul Limited (Freightliner), was crushed between a locomotive and a wagon during a shunting move at Dagenham Dock down yard. There were no immediate witnesses.
- 13 The accident occurred during a low-speed movement by locomotive 47 811, which was hauling a single unladen wagon, No. FRA 613035. The accident occurred during the last planned shunting movement of the day shift, while the wagon was being moved between two adjacent empty sidings under the supervision of the shunter, who had used his radio to give the driver authority to move.
- 14 The shunter was found beside the track, between the position where the locomotive and the wagon had been coupled together and a set of *hand-points* controlling access between the sidings. The shunter had sustained injuries consistent with his having been trapped between the buffers of the locomotive and the wagon.



Figure 2: Locomotive 47 811 and wagon FRA 613035 following the accident. The shunter was found adjacent to the lamp-post in the left hand edge

The parties involved

- 15 Dagenham Dock down yard is operated by Freightliner Heavy Haul under lease from Network Rail. Freightliner has been responsible for the site since 2000 and following the loss of car transporter traffic, has operated it as a waste transshipment facility since 2003. This involves the loading and assembly of a daily refuse train composed of sealed box containers carried on FRA flat wagons running from Dagenham to Calvert in Buckinghamshire. Freightliner loads the waste containers on to trains under contract to Shanks East London, which loads and delivers the containers to the yard.

Location

- 16 Dagenham Dock down yard lies east of Dagenham Dock station and the Chequers Lane level crossing on the north side of the London to Tilbury line. The site is immediately south of the Ford Motor Company's works, and was built for loading cars made there. Its five sidings have their *buffer stops* at the western end; they are generally straight except for the eastern end of sidings 4 and 5, which curve to the south. The sidings connect to a single line at the eastern end providing a common *headshunt*. Sidings 4 and 5 can each accommodate ten FRA wagons. Sidings 2, 3 and 4 are close together; sidings 1 and 5 are separated from the middle group by paved areas (Figure 3). The paved area between sidings 4 and 5 is used for forklift operations.
- 17 The concrete walkways alongside sidings 2, 4 and 5, close to the sleeper ends, were originally provided to enable staff loading cars on to wagons to step down on to a firm surface. They do not provide adequate clearance from the track when trains are moving. There are lamp-posts alongside several of the sidings, including the north side of siding 4. The easternmost lamp-post on siding 4 is only 0.97 metres from the outer edge of the nearest rail.

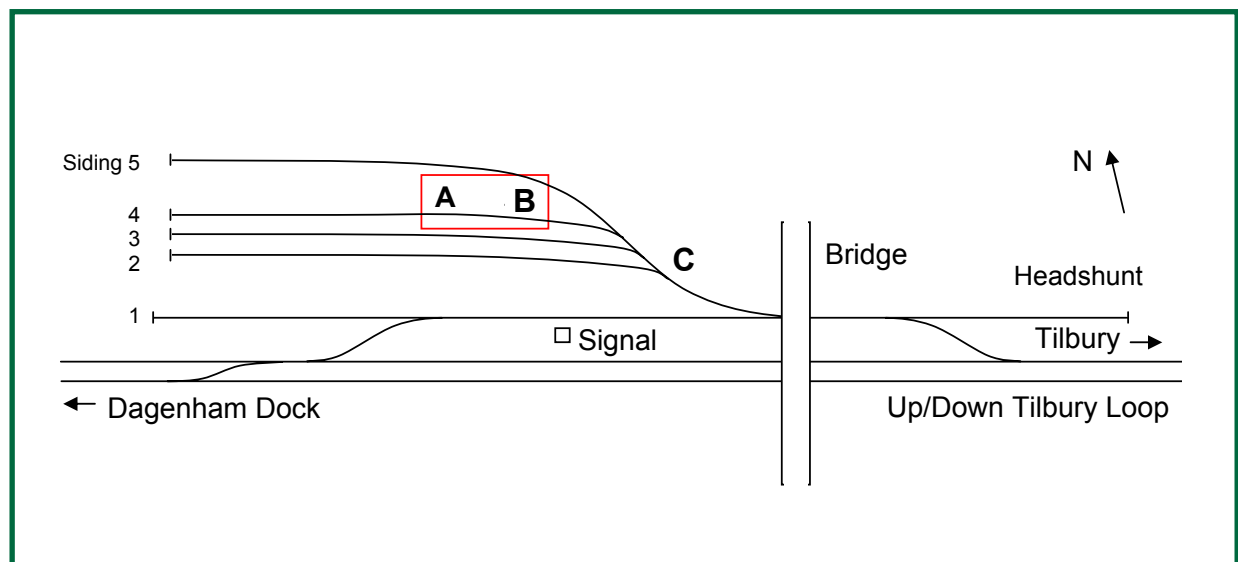


Figure 3: Schematic layout of Dagenham Dock down yard showing the area of accident. Reference is made to positions A, B and C throughout the remainder of this report

- 18 Apart from some ballasted areas around the sidings, the yard is predominantly paved. The condition of the paved surface is generally sound except for the concrete trackside walkways, which were badly broken in more than one place. If the shunter used the walkway between the assumed coupling position (position *A*) and the place where he would have operated the hand-points between sidings 4 and 5 (position *C*), this would have required him to cross two damaged parts of the walkway and pass the lamp-post close to the track (paragraph 17); this was neither marked as having a limited clearance or otherwise highlighted (for example by bright paint), but there is no evidence that this would have prevented the accident.
- 19 The speed limit within the sidings is 5 mph (8 km/h). There is no indication that this speed was exceeded at any time on the occasion of the accident.

External circumstances

- 20 The weather on 17 July was dry, clear and hot, with a maximum air temperature in excess of 30 degrees Celsius.

Train equipment

- 21 Shunting in the down yard is undertaken by locomotives of main-line classes. At the time of the accident a Class 47 locomotive, No. 47 811, was being used for this purpose (Figure 2).
- 22 The outgoing train was formed of loaded FRA flat wagons (Figure 2), to be hauled away from the yard by a Class 66 locomotive. This locomotive remained on siding 1 throughout and was not involved in the accident.
- 23 Outgoing trains consist of up to 22 loaded wagons. The vehicle involved in the accident was an empty 60-foot flatbed wagon, designed to carry three 20-foot *ISO* boxes, and was coupled to adjacent vehicles by *screw-link couplings* (Figure 5).

Yard operations

- 24 When shunting in the yard, locomotives are controlled by a shunter appointed to that duty, who uses a hand-held radio to communicate with the driver operating on a channel dedicated to shunting movements. The local working instructions govern the use of this radio system, and require a daily radio transmission check to be made at the beginning of each shift.

Events preceding the accident

- 25 The shunter had 16 years continuous experience in this role, having joined the rail industry in January 1988 and previously worked as a shunter for both British Rail and English Welsh and Scottish Railways Ltd (EWS).
- 26 The shunter had started work with Freightliner as a *mobile shunter* on 3 July 2006, two weeks before the accident, and by 17 July he had completed a 10-day period of practical supervision, under the guidance of an experienced colleague. He was due to be assessed in his knowledge of the applicable rules after shunting had ceased on the day of the accident, the first stage of his two year rolling competency assessment programme.

- 27 The shunter's site training had been undertaken entirely at Dagenham, although his duties as a mobile shunter would have required him to be trained and passed competent on other yards across south-east England once he was qualified.
- 28 The shunter had undertaken a competence assessment in *personal track safety* on 5 July, two days after starting with Freightliner. At the time of the accident, the record of this assessment had not been signed by his assessor, but the shunter held a personal track safety card issued by Sentinel in August 2005 that was valid for two years.
- 29 The shunter's daily shift pattern required him to work from 06:00 hrs to 16:00 hrs. Every day, the down yard receives a train of empty containers in the morning and dispatches a loaded train that afternoon. Because of the layout of the yard, the incoming train is split into three sections. Each section, consisting of up to eight wagons, is unloaded and then reloaded with the full containers which arrive at the site each morning by road. All unloading and loading of containers is undertaken in siding 5, using large forklift trucks.
- 30 Each section of the outgoing train is then assembled behind a main-line locomotive in siding 1 until a complete train is formed, the shunter also being responsible for recording the numbers of the wagons. This activity is normally complete by 12:30 hrs, ready for a booked daily departure time of 13:16 hrs. The outgoing train runs under the headcode 6M80.
- 31 During his second week, the shunter's practical supervisor and team leader (both Freightliner employees) observed him working and judged him to be competent. On Thursday 13 and Friday 14 July, the shunter successfully undertook the shunting duties associated with marshalling the outgoing train including use of the radio unaided, but under the practical supervisor's guidance. The shunter reportedly said that he felt confident to do the work at Dagenham, with the possible exception of the paperwork. During the period of practical supervision, rakes of empty wagons had been removed from siding 4, but there had been no requirement to put wagons into siding 4. As a consequence, there had been no discussion of any hazards associated with using this siding.
- 32 From 17 July, the team leader authorised the shunter to work within Dagenham yard, and during that morning, the shunter worked unsupervised for the first time. The activity had started at about 08:45 hrs and was progressing to schedule. The driver and shunter were able to take frequent breaks while each section of the train was unloaded and loaded in siding 5, and seating and messing facilities were provided in Freightliner's site office building.
- 33 The driver was experienced, but also relatively new to Freightliner (paragraph 70). A visiting manager took the time to observe the working relationship of the driver and shunter at various times during the morning of 17 July and reported that they worked well together.
- 34 While the third and final section of the train was being loaded, it was found that there were not enough containers to make up a complete train owing to late delivery by road. It is normal practice at Dagenham to detach any empty wagons and return them to siding 5 for loading in the afternoon. On this occasion, the empty wagon was No. FRA 613035. The container loading sequence led to its being in the middle of the third section of the train; removing it necessitated splitting the rake. Appendix D gives further information about the sequence of subsequent shunting moves.

- 35 The visiting manager observed that more than one attempt was made to uncouple the unloaded wagon from the vehicle behind it, and had a brief discussion with the shunter about how the curvature of some of the sidings at Dagenham made it very difficult to couple and uncouple vehicles in some places. On this occasion the shunter was able to get sufficient slack in the coupling only by repositioning the train on a straighter section of track. While this was done, the visiting manager observed the shunter standing clear of the train before giving instructions to the driver by radio.
- 36 The section of train with the empty wagon at the back was drawn eastwards over the hand-points between sidings 4 and 5 and *propelled* westwards into siding 4, where the crew brought it to a halt on a straight section of track. This may have been prompted by the earlier difficulty of uncoupling in siding 5. Although he had had no experience of uncoupling in this siding, this is not a siding-specific competence.
- 37 The shunter uncoupled the empty wagon and directed the driver to pull eastward with the remaining wagons, which were reattached to those that had been left in siding 5, and the whole rake was shunted to siding 1 to complete the outgoing train.
- 38 Finally, locomotive 47 811 returned to siding 4 to collect wagon FRA 613035 to move it to siding 5, ready for loading when the next delivery of loaded waste containers arrived by road. As the westward movement was made, the shunter walked beside the track, ahead of the locomotive and in contact with the driver by radio, counting down the distance to go which allowed the locomotive to reverse up to the wagon as a continuous movement. The driver made this move from the eastern cab nearer the headshunt end of the yard, which was the trailing cab for this movement. The shunter exchanged a few words with the visiting manager, who was once again passing the sidings, but their exchange did not interrupt the shunting movement. The visiting manager then saw the shunter standing beside the stationary locomotive and wagon, preparing to stoop between the buffers to couple the two vehicles together (position *A* in Figures 3 and 4).

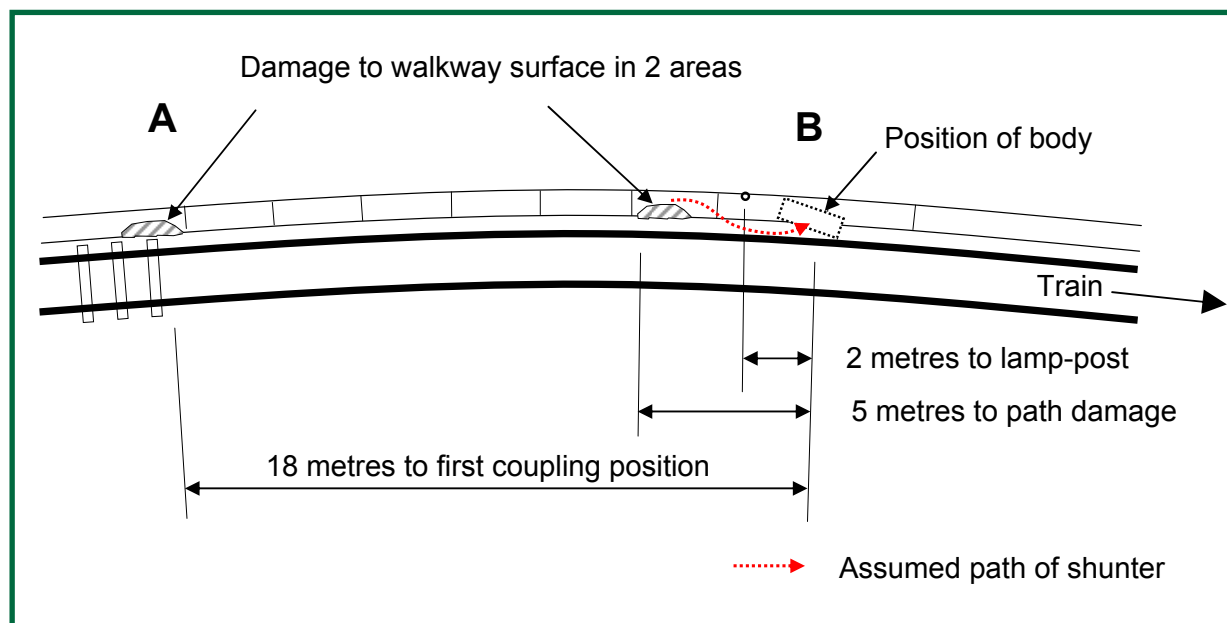


Figure 4: Dagenham Dock down yard siding 4. Position A (coupling position) and B are as indicated in Figure 3

Events during the accident

- 39 The coupling process required the link from the coupling of one vehicle to be dropped on to the hook of the other. Normal practice at the yard was to use the locomotive's coupling, but either can be used and it was the wagon's coupling that was used on this occasion. The brake hoses were connected and the air valves opened to provide a continuous train brake. The driver was not able to see the shunter during the coupling operation, as he remained in the east cab, but as the brake pipes were connected, he saw the needle of his brake pressure gauge twitch slightly. The last radio instruction he received was to pull forward (eastward) past the hand-points "once you get air". It is not known where the shunter was when he gave this instruction, but he was not in the practice of maintaining continuous radio contact with the driver during train movements and the driver was not relying on him to do so.
- 40 It can take between 15 seconds and 3 minutes for a long train of wagons to acquire sufficient brake pipe pressure to be able to move. For a single wagon that has recently been moved, and therefore still has air in its brake reservoir, this process can take as little as 3 seconds. If on the occasion of the accident the locomotive's *direct air brake* was used to control the previous movement, the *air brake pipe* will have remained pressurised throughout and the process will have been almost instantaneous. Although locomotive 47 811 was not equipped with a data recorder since it is not used outside the yard and is due for disposal by December 2007, it is likely that this was the method used since pressure is easily maintained by closing the air brake pipe cocks at the end of each wagon. The train was therefore in a position to move as soon as the instruction was given.
- 41 The driver moved the train eastward at a low speed, estimated from reconstructions as having been up to 4 mph (6 km/h). The locomotive stopped clear of the hand-points between sidings 4 and 5 (position *C* in Figure 3) to await the shunter's next radio instruction. This would have allowed the train to move back westwards into the siding 5 once the hand-points had been operated.
- 42 When the driver did not receive a further instruction, he attempted to contact the shunter by radio to determine the cause of the delay. He looked out of both sides of the cab but was unable to see anything, owing to the curve of the track and the height of the wagon. He left the cab to seek the shunter, and saw an orange high-visibility vest on the ground beside siding 4 (denoted position *B* in Figures 3 and 4) and realised that the shunter had collapsed.

Events after the accident

- 43 The driver ran to the shunter and used his own mobile phone to alert the Freightliner team leader in the site office. The team leader, who was the nominated first aider for the site, first telephoned for an ambulance and then drove the short distance to siding 4, where he administered first aid. Other Freightliner staff quickly arrived on the scene to offer assistance.
- 44 The emergency services, at first including the air ambulance service, attended promptly. At 12:57 hrs, a doctor formally pronounced the shunter dead at the scene, 35 minutes after the accident.

The Investigation

Sources of evidence

- 45 Evidence was obtained from the following sources:
- site reconstructions;
 - evidence gathered at the scene;
 - post-mortem examination and pathologist's report;
 - witness statements;
 - employment and personnel records from Freightliner and the shunter's former employer, EWS; and
 - local working instructions issued by Freightliner for Dagenham Dock.

Key facts

Reconstruction of events

- 46 The investigation process included a reconstruction, using locomotive 47 811 and wagon FRA 613035 on 19 July 2006, with assistance from Freightliner staff.
- 47 The wagon was positioned in siding 4 and the locomotive brought up to it from the east. It was found to be impossible to couple the vehicles close to the lamp-post (adjacent to position *B*, Figures 3 and 4) using the coupling from either vehicle, since the gap between them was too wide owing to the curvature of the track. The wagon was subsequently propelled westwards towards the buffer stops in stages until the vehicles were successfully coupled, but using the locomotive's screw-link coupling after attempts to use both. This was achieved on a straighter section of track approximately 18 metres west of position *B* and denoted position *A*. Position *A* was established as the easternmost possible coupling position for locomotive 47 811 and wagon FRA 613035. Even here, the locomotive's screw-link coupling had to be fully extended before it was possible to couple them.
- 48 The reconstructions showed that, with a fully slackened screw-link coupling, the opening between the buffers on the northern side (left-hand side of the vehicles in the direction of travel) reaches a maximum of 320 mm on the tightest point of the curve. This occurs close to position *B* where the shunter was found. To maintain a low speed while overcoming the rolling friction on the sharp curve, a driver has to apply and remove power several times. On these occasions the width of the gap between the buffers was seen to vary, two compressions occurring in quick succession whenever the locomotive exerted a pull on the wagon, or increased its pull.

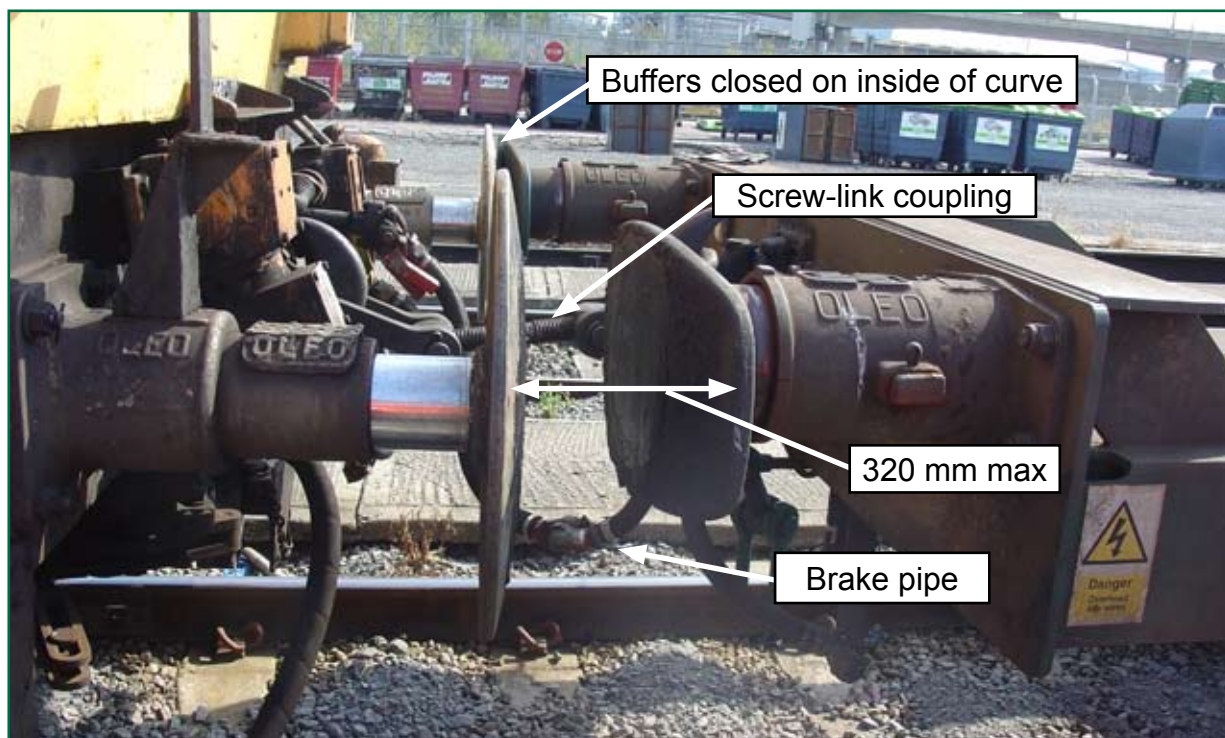


Figure 5: Class 47 locomotive and FRA wagon coupled on curve close to position B, viewed from north side

The scene of the accident

- 49 Measured eastwards from position A, no disturbance to the ballast was observed for the first 12 metres, either between the rails (in the *four foot*) or along the side of the track (in the *cess*). At 12 metres, there was a small area of disturbed ballast in the four-foot. Beyond this point approaching position B, the ballast in the north cess is overlaid with finer stone from the adjacent surfacing. This area showed signs of disturbance around the lamp-post in the area where the shunter was found.
- 50 DNA evidence was found on the ballast and rail at position B suggesting that the shunter fell forwards to the outside of the left-hand rail in the direction of travel.
- 51 The concrete walkway 5 metres west of position B was found to be damaged and sloping towards the track.
- 52 The surface of the lamp-post was examined from pathway level to a height of 2.2 metres. It bore no signs to suggest that the shunter had collided with the lamp-post.

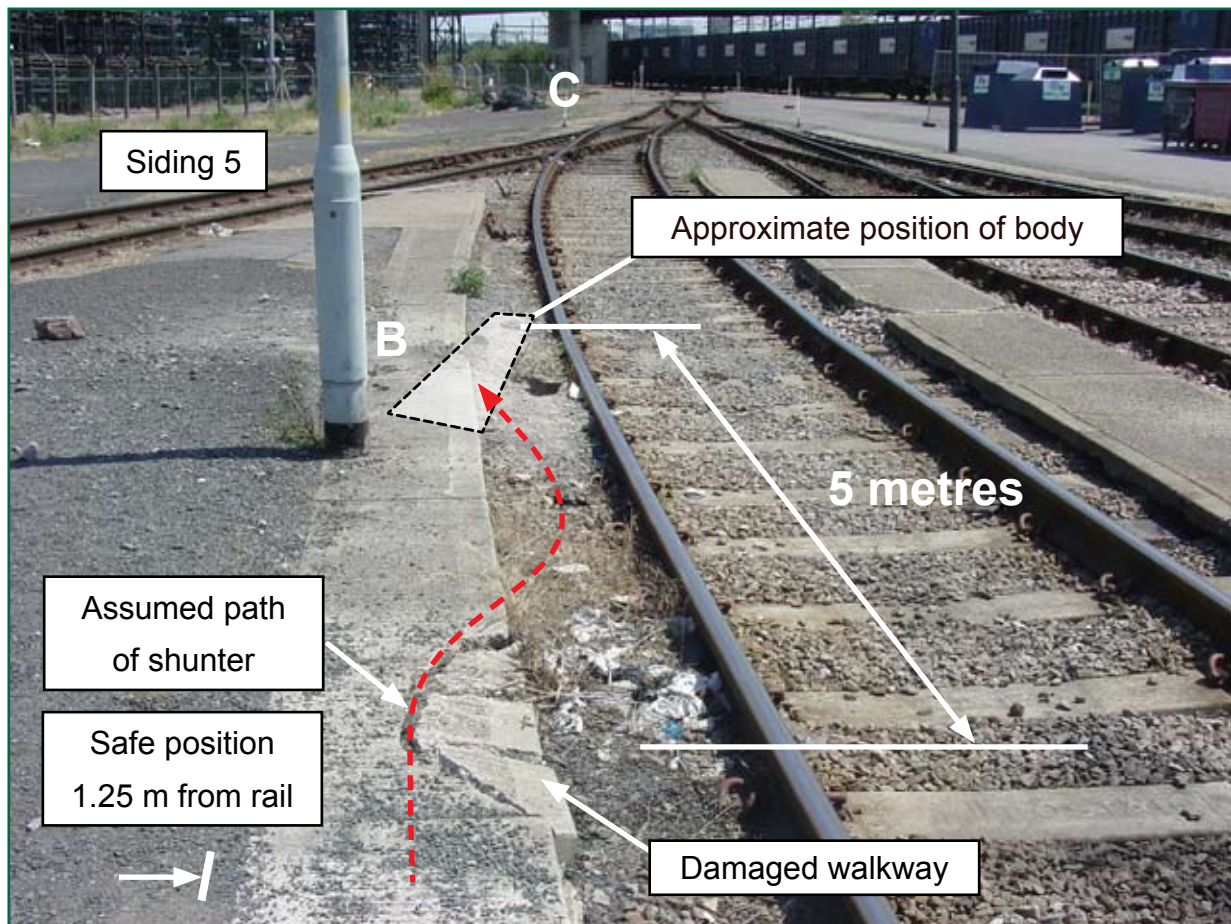


Figure 6: Accident scene showing damaged trackside walkway and lamp-post towards east end of siding 4

The shunter

- 53 The shunter was found lying clear of the track, 2 metres beyond the easternmost lamp-post of siding 4 at position B (Figures 3, 4 and 6). There was no indication of major trauma or amputation and no evidence that he had been dragged for more than a very short distance.
- 54 The pathologist subsequently reported that the shunter had suffered multiple injuries, particularly to the abdomen. The injuries were consistent with being crushed between two flat surfaces at chest height.

The high-visibility vest

- 55 The high-visibility vest that the shunter had been wearing at the time of the accident had come apart at the press-studs on the right side and shoulders, as vests of this type are designed to do if the wearer is caught by a moving train.
- 56 Grease marks were evident on both sides of the vest including vertical marks on the back of the vest, approximately 20 mm wide and 200 mm long. One of the marks, on the right shoulder, was slightly higher than the other, indicating that contact had probably been made on two occasions.
- 57 The marks from the vest were a hydrocarbon grease, commonly used to lubricate buffers.

The radios

- 58 After the accident, the radios that had been used by the shunter and the driver were tested before being removed from site, and found to be working satisfactorily. Both handsets had been returned to their charging unit so the status of the batteries at the time of the accident is unknown, however there is no evidence of either radio failing to work.
- 59 DNA samples on the mouthpiece of the shunter's radio were positively identified as his by analysis, indicating that the radio was close to his mouth at the time of the accident.

The locomotive

- 60 The RAIB examined locomotive 47 811 after the accident, and after the post-mortem examination made a further detailed examination of its western end. There was no evidence that a person had attempted to climb onto the locomotive. Potential DNA samples were recovered from the locomotive's buffer face, but subsequent analysis did not conclusively identify this as originating from the shunter or being attributable to the accident.
- 61 The buffer of the locomotive was measured at 560 mm diameter with its centre at a height of 1040 mm above sleeper level.

The wagon FRA 613035

- 62 Footprints, clearly visible in the dust on the deck of this wagon, were compared with the distinctive pattern on the boots worn by the shunter, and found to be dissimilar. Examination of the under-side of the wagon immediately after the accident presented no evidence that a person had fallen from or been trapped under it, except that the under-side of the suspension housings on the outer left-hand bogie frame was cleaner than the corresponding surface on the other side. There is no material or DNA evidence to connect the shunter with this level of cleanliness, and the area may have come into contact with another surface and been wiped clean.
- 63 The dry grease on the edges of the buffer face bore no evidence of anything that might have come into contact with it during the accident; deliberately pressing a garment against it also left little visible impression.
- 64 The wagon's buffer was measured at 335 mm x 610 mm, with its centre at a height of 1050 mm above sleeper level. The dimensions of the buffer correspond approximately with markings found on the rear of the shunter's high-visibility vest and the position of injuries received.

Other evidence

Operational and management issues

- 65 Freightliner's local working instructions for Dagenham Dock down yard, dated July 2005, include a risk assessment summary as Appendix 7. Item 2, 'Terminal Operations – General assessment', identifies uneven surfaces as a risk likely to lead to a slip, trip or fall, and gives it a high severity rating. The listed controls include regular maintenance and repair or isolation of the damaged area, these being the responsibility of the Operations Manager. A compliance audit undertaken in May 2005 by staff from the safety section of Freightliner's head office noted that areas of the yard were subsiding. This may have been a reference to walkway damage, but there is no evidence that any control measures were implemented, or that corrective action was taken.

- 66 The same appendix also contains a risk assessment specific to shunting. Item 4 lists ‘shunting – struck by moving rail vehicle’ as an event likely to result in a fatal outcome. Control measures include staff competence, the local working instructions themselves, lighting, and wearing personal protective equipment. Radio procedure is given as an additional control, and while general guidance for this subject is given, the local working instructions do not address radio procedures for controlling shunting movements. However, Rule Book module SS2, a mandatory requirement, directs how this is to be undertaken.
- 67 Module SS2 of the Rule Book, GE/RT8000 (June 2003), relates to shunting activities. The following sections of Module SS2 are of relevance to the accident at Dagenham:
- a. Section 4: Safeguards while shunting;
Sub section 4.2 (b) addresses the control of movements by radio. It states that the shunter must keep in constant communication with the driver throughout each movement by speaking continuously or by transmitting a continuous bleep signal. The driver is required to stop immediately if there is a break in transmission.
 - b. Section 5: Shunter’s personal safety;
Sub section 5.3 requires the shunter, when going between vehicles, to wait until the vehicles have stopped completely and to display a hand danger signal to the driver or instruct the driver not to move.
Sub section 5.4 requires the shunter, when dealing with the automatic brake, to connect the brake pipes after any other connections.
 - c. Section 6: Driving a traction unit from other than the leading cab;
Sub sections 6.1 and 6.2 permit a driver to drive a traction unit from a cab other than the leading cab when shunting a light locomotive, but not when proceeding on to vehicles, when a driver “must *always* drive from the leading cab”.
Sub section 6.5 concerns the control of such movements by a shunter and states that, when a traction unit is being driven from a cab other than the leading cab, the shunter must walk ahead of the leading cab or ride in that cab. If walking ahead, the shunter must signal to the driver by hand signal or radio.
- 68 Revised arrangements for assessment of the competence of ground staff had been implemented shortly before the accident, using Freightliner movements inspectors rather than local team leaders. These arrangements should have been in place at Dagenham at this time, particularly as the team leader’s competence to appraise certification had expired on 11 May 2006.
- 69 As the new arrangements had not been implemented at Dagenham, assessment of the shunter’s competence was undertaken by the team leader under the existing procedure. After successful completion of his period of practical supervision on the Friday before the accident, the team leader had deemed him competent to start work on his own. The formal rules assessment and completion of the first of five competence modules (Part 1 Rules and Regulations) was due to start on the afternoon of the accident. The five modules are normally completed over a period of two years, and are not a pre-requisite to being able to shunt unsupervised.

Staff issues

The driver

- 70 The driver had a total of 15 years experience and had worked for Freightliner for two months at the time of the accident. He had signed his certification to work trains within 'Dagenham Dock Down Sidings' on 15 May 2006 and this had been countersigned by the driver team leader on the same day. The driver was also certified competent to drive Class 47 locomotives, the signature on his Freightliner certificate being dated 24 May 2006. On 20 January 2001 he had signed a 'traction knowledge' card for this class of locomotive while with his previous employer.
- 71 The driver had had his first practical assessment with Freightliner on 24 May 2006, involving driving a Class 47 locomotive, shunting by radio, and coupling procedures. His knowledge of the locomotive type and driving skills were assessed as 'very good'.
- 72 Routine drugs and alcohol tests on the driver, carried out in accordance with normal industry practice, were negative.

The shunter

- 73 The shunter weighed 90 kg and was 1.81 metre tall, and was of stocky build. On the day of the accident, in addition to his normal clothing, he was wearing personal protective equipment, which consisted of safety boots and a high-visibility vest with press-stud fastenings.
- 74 He was described as having been in an outgoing mood on the day of the accident, with no obvious concerns. Although new to the company, he was liked and respected by his colleagues.
- 75 A prescription medication for hay fever and an anti-diarrhoea medication were found among the shunter's personal effects. There is no record that he had declared a requirement to take medication to his line manager, and there is evidence that he had not been suffering from either condition in the days prior to the accident. One known side effect of the hay fever medication can be drowsiness.
- 76 The post-mortem report records that the shunter had a 90 per cent constriction of his left anterior descending coronary artery, but this was not considered by the pathologist as being the cause of death. There is no evidence that he had been aware of this condition and had not consulted his doctor on this matter. He had no significant past medical history.
- 77 Drugs and alcohol test results were negative.
- 78 The shunter's previous employer, English, Welsh and Scottish Railway Ltd (EWS), had not provided Freightliner with his records at the time of his transfer, and Freightliner's administration services manager had not started to press EWS for them. Subsequent examination of these records revealed no issues regarding the shunter's competence or ability, and he was considered to be thorough and careful in what he did.

The practical supervisor

- 79 On 10 July 2006, during the two week period that the shunter was under supervision, the practical supervisor was held responsible for a collision between a loaded set of wagons propelled by a Class 66 locomotive and a buffer stop. The shunter was present, but not implicated in this incident. The practical supervisor had also been off work with stress for 6 weeks and had only returned to work one week prior to being asked to supervise the shunter, but this was for a matter unrelated to his work or working environment.

Previous occurrences of a similar character

- 80 During the ten years prior to the fatal accident at Dagenham, two shunters employed by EWS were crushed between rail vehicles and killed. The first of these accidents occurred at Willesden on 29 June 2000, when a shunter was crushed between a locomotive and a postal vehicle. The second occurred at Old Oak Common on 14 January 2005, when a shunter was trapped between carriages.
- 81 These accidents were investigated by Her Majesty's Railway Inspectorate. In response to the first, an improvement notice with seven control measures was served on EWS. The second attracted 12 recommendations, most of them concerning training and communications. Recommendations directly relevant to this incident involve the use of continuous radio communications the regular monitoring of communication and shunting activities.
- 82 Two days after the fatal accident at Dagenham, a shunter was crushed and killed at Bronwydd Arms on the Gwili Railway in South Wales. This accident has been subject to a separate RAIB investigation ref 22/2007.
- 83 Freightliner was not involved in any of these accidents, and there has been no similar incident at Dagenham while Freightliner has operated this yard.
- 84 The Rail Safety and Standards Board (RSSB) and its predecessors have not explored the issue of shunting accidents, since none of the above accidents occurred on Network Rail infrastructure.
- 85 Shunting injuries and fatalities are relatively rare, but the proportion of staff employed in shunting duties is very low in relation to the numbers employed as track workers and train crew. Normalised statistics reveal that the incidence of fatality is six times higher for shunting staff than it is for other railway track or operational staff.

Analysis

Physical and medical evidence

- 86 The evidence is consistent with the shunter's having fallen between the buffers a short distance before the easternmost lamp-post on siding 4, and then been quickly ejected. Disturbance of the ballast was concentrated on the north side of the track over a distance of less than 3 metres. There was no indication that he was dragged any further, and the disturbed ballast within the four foot, 6 metres in rear of his body, could not be attributed to the accident.

Identification of the immediate cause

- 87 The immediate cause of the accident was the shunter's becoming trapped between the buffers of the locomotive and the wagon as it moved eastwards at low speed.
- 88 In the absence of any direct witnesses of the event, a number of scenarios were examined in an attempt to establish how the shunter was crushed. They were compared with the medical and physical evidence to ascertain the most likely sequence of events.
- 89 Five possibilities were suggested by the evidence:
- A. after coupling the locomotive and wagon the shunter was trapped on the track between them when the train started to move;
 - B. he was riding on the wagon and fell;
 - C. he was riding on the steps of the locomotive and fell;
 - D. he was walking on the pathway and tripped or slipped towards the train; and
 - E. he was medically incapacitated and collapsed towards the train.

Examination of accident scenarios

Scenario A: Shunter was trapped between the locomotive and the wagon

- 90 The locomotive may have moved off more quickly than the shunter expected and trapped him, on the track, in the gap between it and the wagon if the brakes had charged more quickly than he expected (paragraph 40). Although there is survival space in this area, it is unlikely that anyone would remain there without attempting to escape. Possible means of escape include climbing on to the back of the locomotive or on to the wagon, dropping to the track to pass beneath the wagon, or darting through the widening gap between the left-hand buffers.
- 91 There was no physical evidence on either the locomotive or the wagon to suggest that the shunter attempted to climb on to either. The nature of his injuries suggests that he entered the gap between the buffers from the side of the track. Had he tried unsuccessfully to escape from between the vehicles, it is likely that he would have come into contact with the wheels of the wagon and suffered an amputation; there was no evidence of any injury of this type.

Scenario B: Shunter was riding on the wagon and fell

- 92 Initial reports from the scene by the emergency services suggested that the shunter had fallen from the wagon whilst ‘doing overhead point work’ (RAIB is unable to explain this phrase, which bears no resemblance to any evidence that it has seen, or indeed to normal railway technical phraseology). Although it would have been possible to ride on the wagon for the 80 metres from the coupling position to the hand-points, it would have taken some effort to climb on to it.
- 93 The local working instructions forbid anyone to ride on rail wagons; there is no record or physical evidence of the shunter having done so on this or any other occasion. The medical evidence does not support a fall from the wagon since the shunter sustained only minor head injuries.

Scenario C: Shunter was riding on the locomotive steps

- 94 Riding on the rear locomotive steps would have avoided the need to walk between the coupling position and the hand-points, but the lamp-post at the eastern end of siding 4 is so close to the track that anyone holding on to a vehicle would have had either to jump clear or to be knocked off the moving train.
- 95 There is no physical or medical evidence that the shunter came into contact with the lamp-post. He had not been known to ride on vehicles in this manner, and would have been aware that such an act was prohibited. He would also have been aware of the need to be in a position of safety before authorising a train movement.
- 96 The DNA samples on the shunter’s radio indicate that it must have been near his mouth as he was injured. This means that the radio must have been in the shunter’s hand at that stage. It is highly unlikely that he would be riding on a locomotive holding on with only one hand whilst using the radio with the other.

Scenario D: Shunter was walking on the pathway and slipped towards the train

- 97 There is a trackside walkway on both sides of siding 4. The one on the north side provides a walking route between the coupling position and the hand-points. Owing to the proximity of the track, anyone using it would need to walk outside the lamp-post at the eastern end of siding 4 if a train was near by. The compacted stone surface immediately north of the walkway provides a satisfactory alternative route.
- 98 The position of the injuries sustained by the shunter’s abdomen confirms that he was not standing at full height when he was crushed, and may have been off-balance. Yet his knees were not injured, which suggests that he was not dragged at a low level. There were no markings to suggest that he had grabbed at the buffers of the locomotive or the wagon.
- 99 The shunter was found immediately east of the lamp-post and had apparently passed between it and the train before falling or rolling on to an area of dusty ballast.
- 100 A damaged section of path, 3 metres west of the lamp-post, presents a tripping hazard (Figure 6).
- 101 There was no evidence of physical disturbance of the ballast, litter or dry grass in the ballast between the trackside walkway and the rails before a point 4 metres west of the lamp-post.

Scenario E: Shunter was medically incapacitated and collapsed

- 102 The shunter may have been medically incapacitated while standing or walking on the trackside walkway in the immediate vicinity of the lamp-post, fallen between the locomotive and the wagon, and then been thrown clear.
- 103 The post-mortem examination reported that the shunter had a narrowing of a coronary artery. There is no evidence that directly links this condition to the incident.
- 104 The air temperature was in excess of 30 degrees Celsius at the time of the accident. By this time the shunter had been working in the open, without a hat, for around fifty minutes, doing physically demanding work.

Evaluation of accident scenarios

- 105 The available evidence does not support scenarios A, B or C. There is evidence to support either of scenarios D and E, suggesting that the shunter was on the trackside walkway until he reached a point some 3 metres west of the lamp-post. It is most likely that he then fell between the buffers of the locomotive and the wagon, was crushed between the buffer faces, and was thrown clear to the side of the track immediately beyond the lamp-post.

Identification of causal and contributory factors

Layout and condition of the yard

- 106 In the case of scenario D, the damaged condition of the lineside walkway would be a causal factor although use of the walkway would not have put the shunter in a place of safety when adjacent to a moving train. The concrete walkway on the north side of siding 4 had been damaged in several places. The damage was of long standing, yet Freightliner's risk management processes had not identified it as a risk to staff. There is a reference to tripping hazards in the local working instructions, and the compliance audit of May 2005 identified a subsidence problem, but did not specifically mention the walkway damage in siding 4. That the defect had not been specifically identified, and that action had not been taken to repair or isolate the affected sections of the walkway, indicates that the risk management process is in need of review and reinforcement.
- 107 The proximity of the lineside walkway to the track is a contributory factor. Dagenham Dock down yard was built originally for loading cars on to car transporter wagons. Since staff would need to step down from stationary wagons once the cars were loaded, concrete walkways were provided on both sides of sidings 2, 3 and 4.
- 108 The walkway on the north side of siding 4 is 600 mm wide and positioned 600 mm from the track. Even the side furthest from the track is too close to it to constitute a place of safety in accordance with Network Rail's Track Safety Handbook, which specifies a minimum clearance of 1.25 metre between a person at the trackside and a train on the main-line network travelling at any speed between 0 and 100 mph (0 and 160 km/h) (Figure 6).
- 109 The shunter's lack of information about the specific hazards associated with the use of siding 4 is a possible contributory factor. Although in this instance it would have been possible to walk further away from the track, to the north of the walkway, the shunter had no practical experience of putting a wagon into siding 4, and there had been no discussion during his period of practical training about the specific risks associated with working on or about this siding. There is also evidence of a lack of clarity among Freightliner staff over who should have imparted information of this nature.

- 110 The position of the lamp-post at the eastern end of siding 4 may have been a contributory factor. This lamp-post is within one metre of the track, giving very limited clearance (Figure 6). Other lamp-posts in the yard are positioned behind the walkway rather than set into it. The risks associated with the position of this post are not mentioned in the local working instructions. The shunter had not been made aware of the risk, and although he would have been able to walk on the far side of this post, keeping it between himself and the train, the position of his body when found suggests that he did not do so.
- 111 The curved alignment of the track at the eastern end of siding 4 is a contributory factor. It leads to a widening of the gap between the buffers on the north side (Figure 5), which makes coupling and uncoupling vehicles difficult and presents an additional hazard to staff close to a train, in that the buffers are far enough apart at this point for a person to become trapped between the buffer faces. The gap between the buffers of the vehicles involved, at the time and place of the accident, was 320 mm, but was liable to change as the train moved.

Operation of the yard

- 112 Wagons are divided into short rakes for loading in siding 5. The loading activity requires one or more forklift trucks to tranship containers from lorries on to the rail wagons. There are no constraints on the loading sequence other than the need to maintain a safe clearance between machines.
- 113 The need to remove a wagon from the centre of the rake in siding 5 after loading is a contributory factor. It is normal practice at Dagenham to remove empty wagons and load them later, but the method of working on 17 July led to a single empty wagon remaining in siding 5 after loading, there being too few containers to complete a normal train. Removing it was difficult, owing to the curvature of the track at the eastern end of siding 5, and necessitated more shunting movements than would have been necessary to detach it from the end of the rake. The loading sequence adopted did not appear to take account of these factors, and resulted in its being positioned in the middle of the rake.

Method of working

- 114 As was established practice at Dagenham, the driver drove the locomotive from the cab at its eastern end (paragraph 38). This necessitated making westward (reverse) moves under the control of the shunter. For certain movements this is permissible, but it is expressly prohibited when reversing on to a wagon (paragraph 67c). However, on 17 July, the shunter controlled the movement by counting down the distance to go. There is no evidence that the driving position directly compromised the safety of this movement.
- 115 The speed of turnaround resulting from the driver being at the east end of the locomotive, contrary to the rule book, is a likely contributory factor. The driver's use of the eastern cab for the preceding westward (reverse) movement allowed him to stay in one cab and start the next movement without delay. This may have caught the shunter unawares, particularly since the brake system was pressurised as soon as the pipes had been connected. It also made it less likely that the driver would visually check the coupling procedure or ascertain the position of the shunter as he was at the far end of the locomotive.

- 116 Visual or radio contact between the driver and shunter was not a requirement during the final eastward movement, but the lack of either is a possible contributory factor. It is not known where the shunter was at the time of his final radio transmission, but the driver was not aware of his position.
- 117 There is no evidence that existing arrangements for management surveillance had identified the non-compliances, or that action had been taken to correct them.

Conclusions

Immediate cause

- 118 The immediate cause of the accident was the shunter's becoming trapped between the buffers of the locomotive and the wagon as it moved eastward at low speed. He was close to the train immediately before the accident and not in a position of safety.

Causal and contributory factors

- 119 Causal factors were:

- a. The trip or collapse that led to the shunter's falling towards the moving train (paragraph 105, **Recommendation 6**); and
- b. If the shunter tripped, the damaged condition of the trackside walkway north of siding 4, which presented a tripping hazard (paragraph 106, **Recommendation 1**).

- 120 The following factors are considered to be contributory:

- a. The existence of trackside walkways within 1.25 metres of the track which did not provide a place of safety as specified during Personal Track Safety (PTS) training. This would put a user at risk from moving trains (paragraph 107, **Recommendation 3**);
- b. The shunter's lack of information about or experience of the specific hazards presented by siding 4 (paragraph 109, **Recommendation 5**);
- c. The proximity of a lamp-post to the track at the eastern end of siding 4. This post is in the walkway and had not been marked as having limited clearance (paragraph 110, **Recommendation 3**);
- d. The relatively wide gap between the left-hand buffers of the locomotive and the wagon due to the curvature of the track at the eastern end of siding 4 (paragraph 111, **Recommendation 2**);
- e. The container loading sequence, which resulted in the empty wagon's being positioned in the middle of the rake in siding 5 when too few containers were delivered, and the need to remove it if the train was to be prevented from running with empty wagons (paragraph 113, **Recommendation 2**);
- f. The train moving off quickly due to the rapid charging of the brake system, and the driver remaining at the eastern end of the locomotive. This may have led to the shunter's being taken unawares when the train started to move sooner than he expected if the shunter was not in a position of safety when the instruction to move was given (likely contributory factor only) (paragraph 115, **Recommendation 4**); and
- g. The driver being unaware of the shunter's position during the final eastward move (paragraph 116, **Recommendation 4**).

- 121 Possible contributory factors include drowsiness due to the effects of taking hay-fever medication (paragraph 75), the shunter's latent heart defect (paragraph 76), and the effects of working in the heat without a hat (paragraph 104).

Underlying causes

122 Underlying causes leading to the accident include:

- a. The layout of the yard, which necessitates trains being routinely divided and rejoined. Freightliner has not significantly developed or altered the yard since adopting it as a waste handling terminal (paragraphs 16, 17);
- b. The means of detecting non-compliance with the local working instructions were not effective. There is no clear evidence that risks were identified during safety inspections or that corrective action was taken. In particular, the Operations Manager or his delegated representative failed to respond to the compliance audit report of May 2005, which required the assessment and correction of subsidence in the yard (paragraph 65);
- c. The absence from the local working instructions of clear guidance on radio procedures for controlling shunting movements, when they had been identified as being a control measure (paragraph 66). This information is contained in the Rule Book section SS2 but is not specifically referenced; and
- d. The practice of using existing shunting staff to act as practical supervisors for experience new employees before the new employees are assessed by the local team leader. This could result in the perpetuation of unauthorised local practices (paragraph 26, **Recommendation 5**).

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

123 Freightliner has implemented a number of recommendations arising from its internal investigation of this accident. These measures include:

- a. The appointment of a new Group Compliance Manager to undertake a full review of compliance with the Rule Book during shunting. This person reports to the Director of Safety and has authority to take steps to correct faults immediately, when practicable;
- b. Mechanisms to ensure that recommendations made during compliance audits are tracked and reviewed at executive level;
- c. A review of local working instructions to address the risks of non-compliance;
- d. Training for managers to improve the standard of health and safety inspections. A compliance executive is reviewing the validity of these inspections, and a check sheet is being used to ensure that issues are satisfactorily closed out. The compliance executive is a newly created post and the appointee reports directly to the Managing Director of Freightliner;
- e. Training and competence assessment and certification are now being undertaken not by team leaders but by independent assessors reporting to the Professional Head of Operations (non train crew);
- f. Staff are being re-briefed on the importance of declaring any medication they are taking, and on the risks of certain types of medication being taken in combination;
- g. Improvements in the process of obtaining previous employment records; and
- h. Repair or removal of trackside walkways in response to an Improvement Notice served by the Office of Rail Regulation on 20 July 2006. This was to address the foreseeable risk of persons tripping or stumbling and being injured.

Recommendations

124 The following safety recommendations are made:¹

Recommendations to address causal and contributory factors

- 1 Freightliner should review the management of its infrastructure to ensure that risk factors identified in the local working instructions are recorded and assessed by trained personnel. The process should include follow-through checks to an agreed timescale to ensure that remedial action has been taken, and should provide a mechanism to elevate the issue to senior managers if compliance is not achieved. The local working arrangements should be changed where necessary (paragraph 119b).
- 2 Freightliner should review the method of working at Dagenham and similar facilities to ensure that wagons are loaded from the points end wherever possible. Wagons could then easily be detached if there were not enough containers for a full train, and the number of shunting movements reduced. The local working arrangements should be changed where necessary (paragraph 120e).
- 3 Freightliner should designate safe walking routes between frequently used parts of its yards. This includes marking or signing any hazards, and should include an instruction not to use walkways with substandard clearances where moving trains are present (paragraph 120a).
- 4 Freightliner should review its methods for checking and enforcing compliance with the Rule Book during shunting activities, in particular those relating to the proximity of staff to moving trains, the control of locomotives and the use of correct radio procedure (paragraphs 120f, 120g);
- 5 Freightliner should review and enhance the training given to new staff and ensure that it is overseen by independent assessors (paragraph 122d).
- 6 Freightliner should re-brief staff on the importance of being in a position of safety before giving instructions for a driver to move a locomotive or train (paragraph 118).

Recommendation to address other matters observed during the investigation

- 7 Freightliner should re-brief staff on wearing headgear that provides protection from impact and excessive exposure to the sun (paragraph 121).

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

Appendices

Glossary of abbreviations and acronyms

Appendix A

| | |
|-----|---|
| FRA | Flat bogie wagon used to carry removable containers |
| ISO | International Standards Organisation |

Glossary of terms

Appendix B

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

| | |
|--------------------------------------|---|
| Air brake pipe | Describes a Rail Vehicle equipped with an Automatic Brake, where the brakes are operated by air pressure.* |
| Buffer | An impact absorbing device fitted to Rail Vehicles to accommodate changes in alignment between adjacent Vehicles and to prevent them from colliding heavily during braking.* |
| Buffers (Buffer stops) | A device used to stop the progress of Rail Vehicles at the end of Sidings and other dead lines.* |
| Cess | The part of the Track Bed outside the Ballast Shoulder.* |
| Direct air brake | Air Brake operating on locomotive only.* |
| Four foot | The area between the two Running Rails of a Standard Gauge Railway.* |
| Hand-points | Points (Switches) operated by means of a Hand Lever fitted on or adjacent to the Switch Toe Timbers.* |
| Headshunt | A short length of Track provided to allow Shunting movements to take place in Sidings without those movements fouling the Running Line.* |
| International Standards Organisation | The body which, inter alia, specifies the size of containers used by Freightliner. |
| Limited clearance | Description of an area alongside the railway where it is unsafe to be whilst trains are running, due to a lack of space to stand safely between a train and a lineside feature. |
| Local working instructions | Instructions issued by Freightliner Heavy Haul for the operation of 'Dagenham Dock'. |
| Mobile shunter | An employee who discharges the duty of shunter at a number of locations, travelling between them as his workload requires. |
| Personal track safety | The minimum training required before being allowed On or Near the Line. The course introduces basic concepts of safety and emergency action.* |
| Propelled | The act of pushing a Train from the rear using a Locomotive.* |
| Rake | Train of coupled wagons. |
| Rule Book | A rule book issued by Network Rail and used by sections of the railway industry. |
| Screw-link coupling | An adjustable device used to connect Rail Vehicles together for haulage purposes.* |

Key Standards current at the time

Appendix C

Railway Group Standard GE/RT8000 Rule Book, Section SS2 (Issue 1 June 2003).

Freightliner Company Standards.

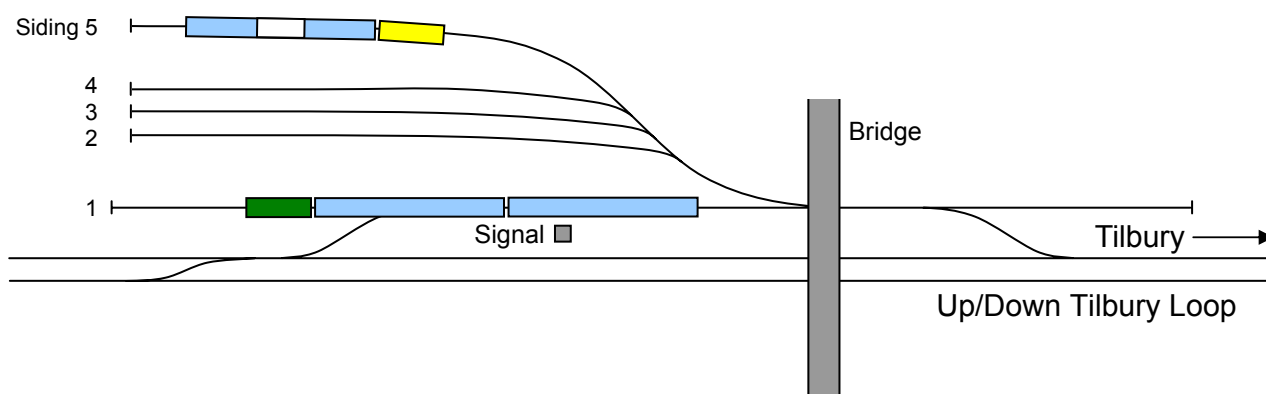
Freightliner local working instructions for Dagenham Dock (July 2005).

Track Safety Handbook.

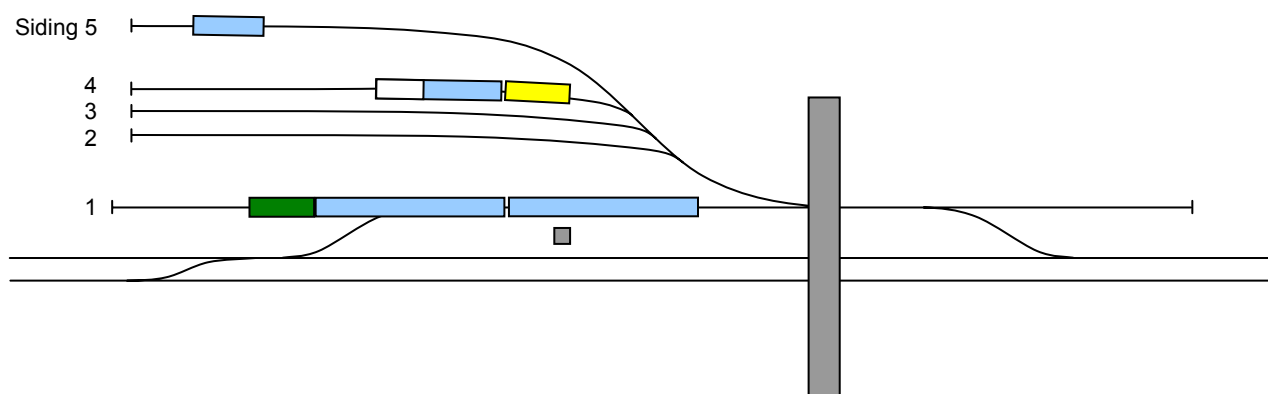
Key:

- Class 47 shunting locomotive
- Class 66 train locomotive
- Loaded FRA freightliner wagon
- Unloaded FRA freightliner wagon

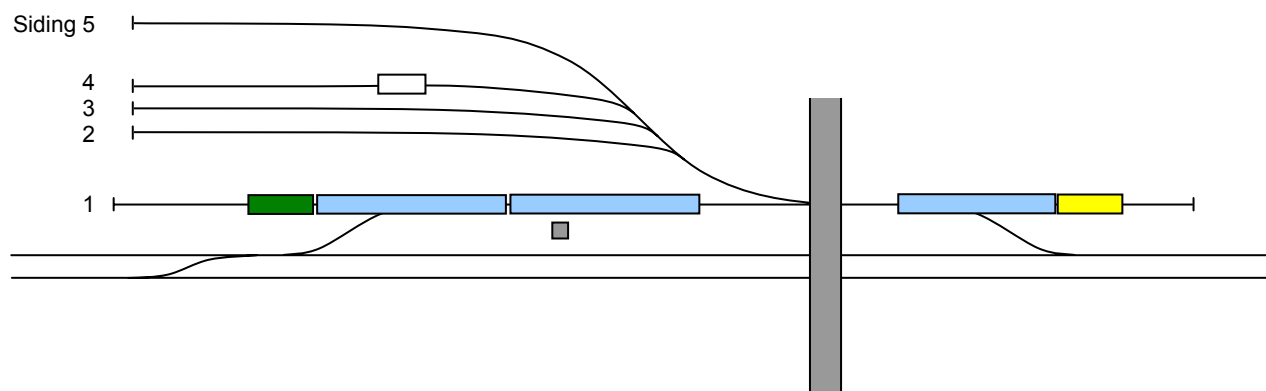
1. Waste container train loaded in sections in siding 5.
Rear section of train contains empty wagon due to late arrival of lorry.



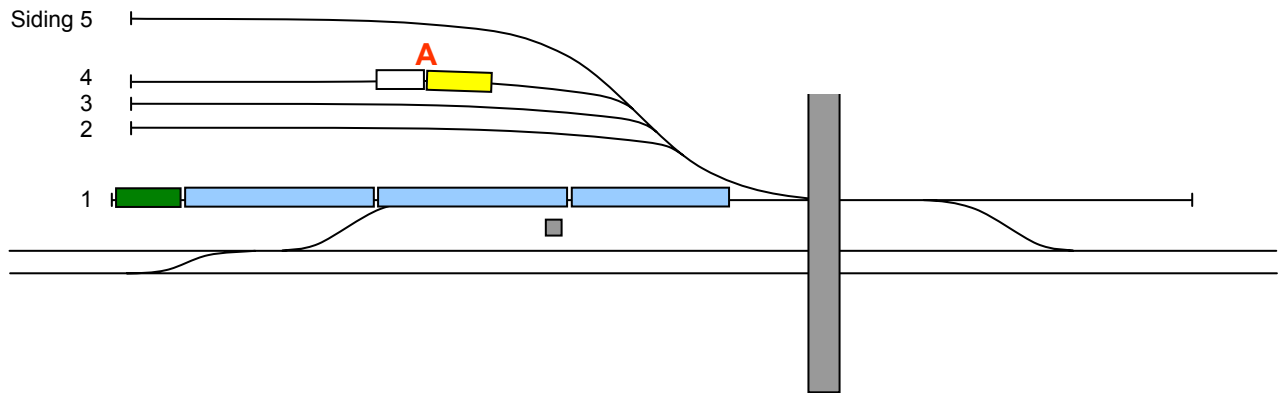
2. Unloaded wagon dropped off in siding 4.



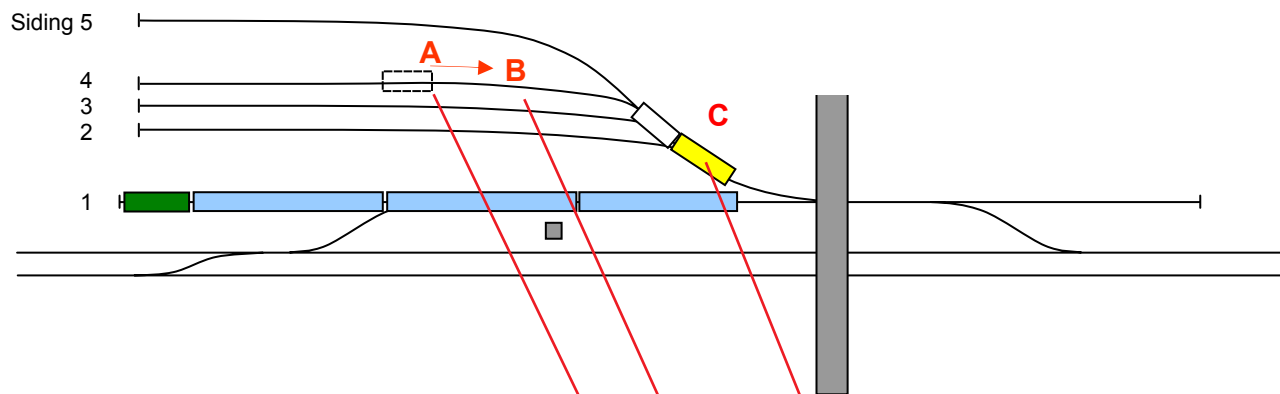
3. Rear section of train moved to siding 1 to complete outgoing train



4. Class 47 locomotive returns to empty wagon on siding 4 to position it in number 5 siding in preparation for loading.
Shunter observed next to stationary train at position **A**.



5. Class 47 locomotive moves eastwards to position **C** to clear points.
Shunter is found at position **B**.



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Department for Transport.

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