



Rail Accident Investigation Branch

Rail Accident Report



**Track worker struck by a train on Grosvenor
Bridge, London Victoria
13 November 2007**

Department for
Transport

Report 19/2009
July 2009

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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Track worker struck by a train on Grosvenor Bridge, London Victoria, 13 November 2007

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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, liability or carry out prosecutions.
- 3 Throughout the report times and imperial distances are shown as follows:
 - hh:mm for hours and minutes;
 - hh:mm:ss for hours, minutes and seconds;
 - __ m __ ch for miles and chains (a chain is 22 yards or 20.12 m); and
 - distances are measured from the zero datum at Victoria station.
- 4 Appendices at the rear of this report contain the following glossaries:
 - acronyms and abbreviations are explained in Appendix A;
 - technical terms (shown in *italics* the first time they appear in the report) are explained in Appendix B;

Summary of the report

Key facts about the accident

- 5 At 14:00 hrs on 13 November 2007 a track worker engaged in a planned track inspection was struck by a passing train on Grosvenor Bridge south of London Victoria station. He suffered serious injuries.



Figure 1: Extract from OS map showing location of accident

Immediate cause, causal and contributory factors, underlying causes

- 6 The immediate cause of the accident was that the *Controller of Site Safety* (COSS) moved away from the line under lookout protection and toward an adjacent line on which a train was approaching.
- 7 The following factors are considered to be causal to the accident:
- the COSS walking behind the *lookout* and not informing the lookout that he was going near to the *Up Chatham Fast* line; and
 - the lack of response to the warning horn of the approaching train by the COSS and his apparent lack of awareness of the train's position.
- 8 The following factor may be causal to the accident:
- the driver of train 2A32 not registering the danger immediately before the accident and not sounding a further warning blast or repeated urgent warning blasts on the horn.

- 9 The following factors are considered to be contributory to the accident:
 - a. the length of time from the initial short blast on the horn until the train arrived at the site of the accident;
 - b. having an additional team member who by his presence changed the usual dynamics and reduced the ability of the COSS and lookout for walking close to each other; and
 - c. the need for the COSS to cross over towards the Up Chatham Fast line in order to look at the track hidden between the parapets of the Grosvenor Road Bridge.
- 10 The following factors may be contributory to the accident:
 - a. the lack of a complete briefing by the COSS to the trainee and lookout;
 - b. the lookout not challenging the COSS; and
 - c. the lack of head protection being worn by the COSS which may have increased the effects of being struck by the train.
- 11 The following factors are considered to be underlying causes of the accident:
 - a. the high level of administrative duties undertaken by the Track Section Manager that restricted his checks of the basic visual track inspection activities; and
 - b. the close working relationships, culture and banter within the work group which distracted them from following the safety rules whilst working on the track.
- 12 A possible underlying cause was the lack of a comprehensive and documented method of local supervision of track examination teams that included their inspection methods and attitudes.

Additional observations

- 13 Observations have been made about the following matters that were discovered during the investigation:
 - a. the lack of clear guidance in the Rule Book, COSS Handbook and subsidiary publications about the definition of an 'approaching train';
 - b. the lack of clear guidance in the Rule Book, COSS Handbook and subsidiary publications about the criteria for continuing to work on a line open to traffic when a train approaches on an adjacent line;
 - c. the lack of *limited clearance* signs on Grosvenor Road Bridge at the time of the accident;
 - d. the lack of automatic warning systems to warn of the approach of a train; and
 - e. deficiencies with the production and quality of the '*COSS pack*', inconsistencies in the *Sectional Appendix* and the need to recognise hazards from areas of limited clearance.

Severity of consequences

- 14 A member of Network Rail staff was seriously injured.
- 15 Network Rail imposed an *emergency isolation* of the *DC traction supply* to protect the injured track worker and then allow the ambulance service personnel onto the railway line. There was widespread disruption to Southeastern and Eurostar services in the Victoria to Brixton areas.

Recommendations

- 16 Recommendations can be found in paragraph 227. They relate to the following areas:
 - responsibility of individuals to ensure that they receive adequate safety briefings;
 - provision of automatic warning systems;
 - use of safety helmets during track inspection;
 - monitoring the effectiveness of processes for confirming 'on-the-job' safety performance;
 - the need to define an 'approaching train';
 - the need for clear instruction on safe systems of work when trains move on adjacent lines;
 - correction of deficiencies in documentation;
 - validation of new processes used to generate the COSS pack; and
 - rebriefing of appropriate staff about the limited clearance hazards such as exist on Grosvenor Bridge.

The Accident

Summary of the accident

- 17 A three man group, all employees of Network Rail, were conducting a planned basic visual track inspection from Battersea Pier Junction towards London Victoria station. At the time of the accident they were engaged in a track examination of the *Down* Chatham Fast line near Grosvenor Road Bridge.
- 18 At 14:00 hrs train *reporting number* 2A32, the 13:00 hrs Southeastern passenger train from Maidstone East to Victoria, struck a tool that one of the group was carrying and the force of the blow caused him serious injury.

The parties involved

Network Rail

- 19 Network Rail is the owner and infrastructure controller of Grosvenor Road Bridge and the railway that crosses it. Network Rail undertakes all routine maintenance of the track by its own staff.
- 20 The injured man was the COSS for the group. He was a leading trackman grade aged 47. He had been employed as a patroller at Victoria for 2 years, and had worked for Network Rail since 2005 and for other rail infrastructure maintenance companies / contractors for over 11 years prior to that. He is referred to in this report as 'the COSS'.
- 21 The COSS appointed one man as the *lookout* for the group. He was 25 years old, also of leading trackman grade and had been a patroller at Victoria for three years, having had seven years length of service with Network Rail and an infrastructure maintenance company. He is referred to in this report as 'the lookout'.
- 22 The third man in the group was a trainee trackman based at Victoria. He had eleven years experience as a trackman with British Rail and an infrastructure maintenance company, however these were prior to a six year career break; he had recently joined Network Rail. He is referred to here as 'the trainee'.

Southeastern

- 23 'Southeastern' is the operating name for London & South Eastern Railway Limited. It operated train 2A32 and employed the driver.
- 24 The driver of train 2A32 was based at Ashford depot and had been driving trains for 18 years. He regularly drove trains to Victoria and was deemed competent by Southeastern in *route knowledge* and *traction knowledge* for the class 375 *electric multiple units* (EMUs), the type of train that operated service 2A32 that day. He had 37 years service within the rail industry.

Fitness for duty

- 25 The three track workers (paragraphs 19 to 22) and the train driver were screened as routine for drugs and alcohol after the incident and all returned negative results.
- 26 There is no evidence to indicate that any of the staff were suffering from fatigue.

Location

27 Grosvenor Bridge carries the railway from Victoria station over the River Thames. It is located about three quarters of a mile (one kilometre) south of the station. Immediately to the north of the river bridge is a separate structure that carries the line across Grosvenor Road. It was adjacent to Grosvenor Road Bridge that the accident occurred. See Figure 1 for details.

Infrastructure

28 There are nine railway tracks on Grosvenor Road Bridge (Figure 2). From east to west the first four - referred to collectively as the Chatham lines - are known as:

- the Down Chatham Fast;
- the Up Chatham Fast;
- the Down Chatham Slow; and
- the Up Chatham Slow.

29 There are another five tracks to the west side of the bridge, known collectively as the Brighton Lines. These lines are not relevant to this accident.

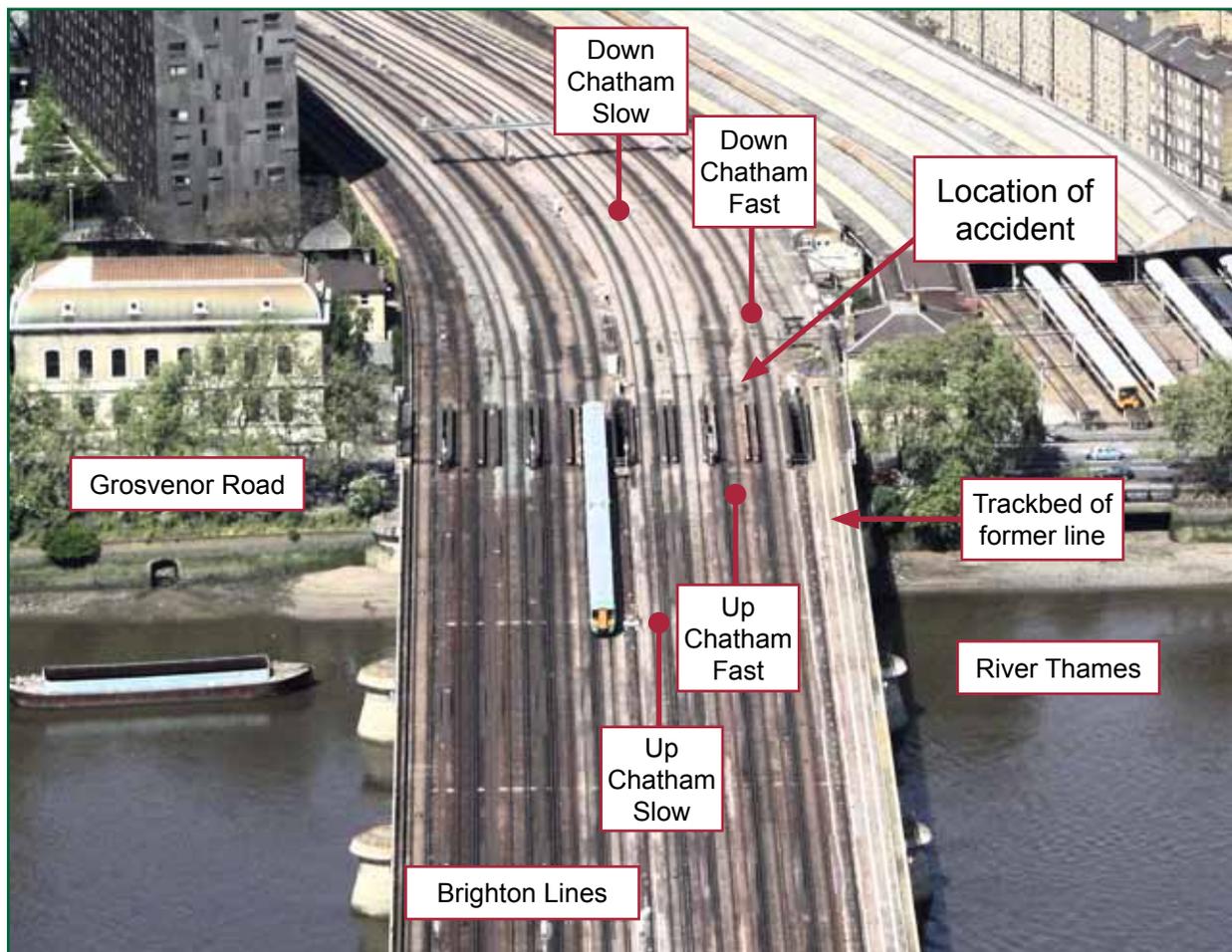


Figure 2: Aerial view, looking north towards Victoria station, of the railway lines crossing Grosvenor Road Bridge, showing the normal direction of rail traffic. © Metropolitan Police

- 30 Between the Down Chatham Fast line and the eastern bridge parapet there is an area that formerly had a track laid on it, this now forms a cess wide enough to stand in, which is well clear of trains.
- 31 On the river bridge the four Chatham tracks are separated by *six-foot* areas which are *ballasted*.
- 32 On the Grosvenor Road Bridge there are raised parapets to a height of 1100 mm between the four tracks. There are two of these parapets between each track separated by a narrow gap of 450 mm. The parapets are 23.850 m in length (Figure 3).

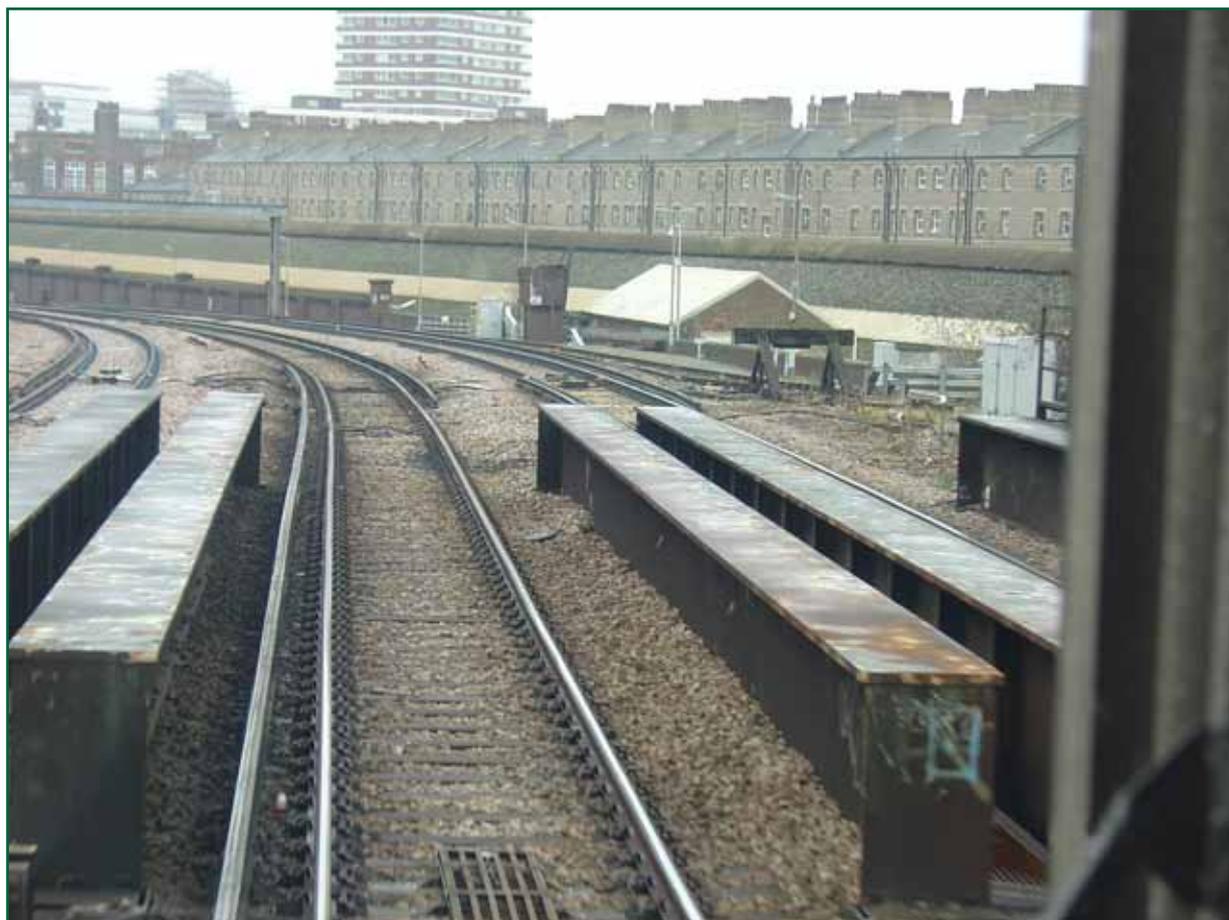


Figure 3: View from class 375 unit of the Up Chatham Fast line immediately before Grosvenor Bridge, looking towards Victoria Station¹

- 33 There were two features in the area of the bridge that would have made walking more difficult than at other locations. These were concrete *troughing* containing cables that had some broken or misaligned lids, and a redundant *rail greaser* between the Down Chatham Fast and Up Chatham Fast lines at the Victoria end of the Grosvenor Road Bridge. The location of the greaser is shown on Figure 4.
- 34 All the lines are electrified using the 750 volt third rail system, controlled from the Network Rail electrical control room at Lewisham.
- 35 The signalling system is *track circuit block* with *four-aspect colour light signals*, controlled by Victoria Area Signalling Centre, located at Clapham Junction.

¹ This photograph has been taken from the driver's eye position of a subsequent train and cannot be taken to be exactly representative of the view experienced by the driver immediately before the accident.

- 36 There were no faults on the electrification or signalling systems that contributed to the accident.

Inspection of the track

- 37 Regular inspection of the track is required to confirm that it is in a safe state for train movements. One of the methods used is for a basic visual inspection to be undertaken by patrol staff from Network Rail's maintenance organisation. For the purposes of managing inspection activities the track is split into sections, colloquially known as patrols. Victoria patrol 3, patrol 4A and patrol 5 are referenced in this report.

The train

- 38 The train involved was a 4-car class 375 electrical multiple unit 375830.
- 39 The driving cab of the unit is located at the front left-hand side.
- 40 The maximum permitted speed for trains on the Up Chatham Fast line at Grosvenor Bridge is 40 mph (64 km/h). Train 2A32 was travelling at approximately 25 mph (40 km/h).
- 41 There were no faults found on the train that could have contributed to the accident.

External circumstances

- 42 At the time of the accident the weather was dry and bright. Neither the weather nor visibility contributed to the accident.

Events preceding the accident

- 43 On Tuesday 13 November 2007 a group of two men from Victoria track examination team had been tasked with carrying out basic visual track inspections within their Track Section Manager's area. The purpose was to check the condition of the track, to identify maintenance that was required and to undertake minor adjustments and remedial work. The group consisted of the COSS (who was the patroller), and the lookout. The lookout's sole responsibility was to look for and provide a warning of approaching trains.
- 44 The two men booked on at 07:30 hrs, and first carried out patrols 5 (Victoria, Brighton side) and 5A ('Atlantic' lines, Battersea Park to Wandsworth Road). These passed without incident. After completing them, the men returned to their base at the old signal box at Victoria shortly before 12:00 hrs. There they took a planned break until approximately 13:00 hrs.

- 45 At around 13:00 hrs the two men began patrol 4A, which required them to walk out along the Up Chatham Slow line from Victoria (0 m 40 ch) to Battersea Pier Junction (0 m 72 ch), then along the Up Stewarts Lane line to 1 m 16 ch (Figure 4). There they would cross over and walk back to their starting point along the Down Stewarts Lane line and then onto the Down Chatham Fast line. See Figure 5 for a diagram of this patrol.

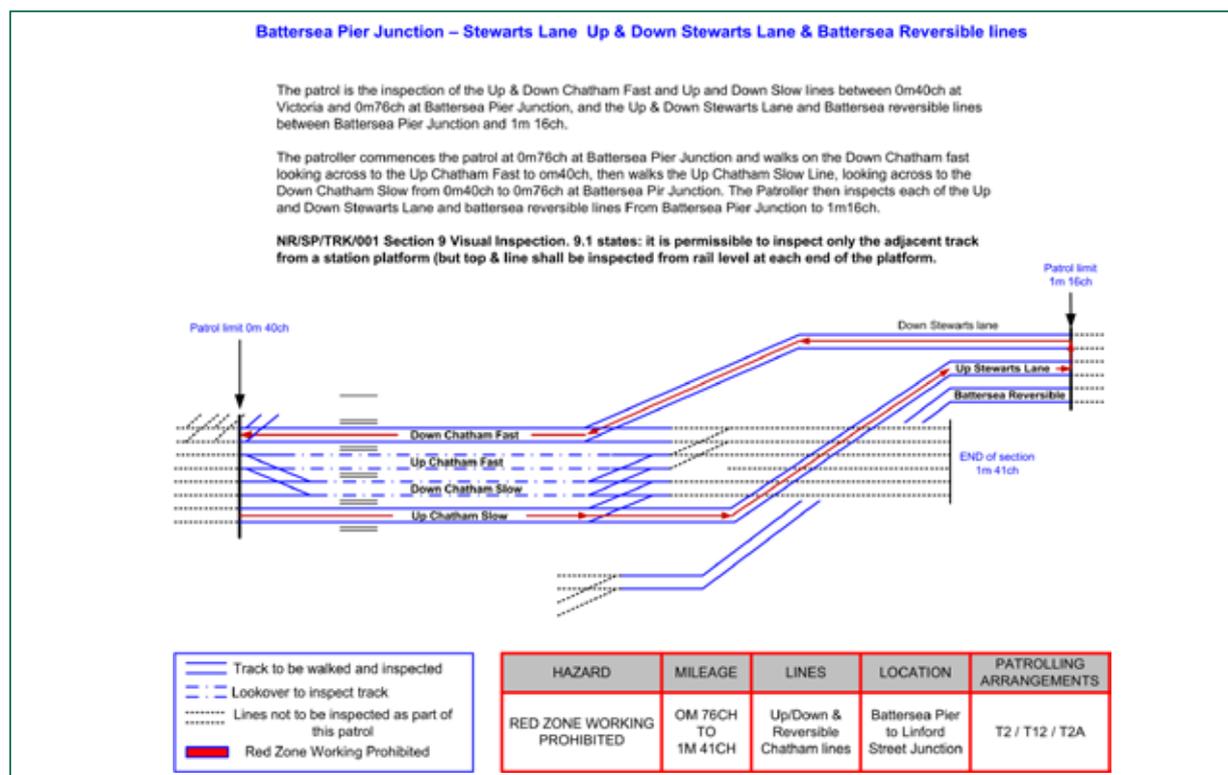


Figure 4: Route of Patrol 4A²

- 46 They were accompanied on patrol 4A by a trainee who was being *mentored* by the COSS. He was accompanying the team in order to gain experience of track examination.
- 47 Initially the group patrolled in the *four-foot*, which is the normal place for a patrol to walk; the outward leg was undertaken without incident. At the limit of patrol 4A the men crossed over to, and began walking back along, the Down Stewarts Lane line.
- 48 Upon reaching Battersea Pier Junction, the group found that it was uncomfortable to walk on the irregular surface of the ballast on the Down Chatham Fast, so the team split: the COSS walked in the six-foot between the Down and Up Chatham Fast lines, whilst the lookout and trainee walked in the cress of the Down Chatham Fast line. After a while they all moved back into the four-foot of the Down Chatham Fast line.

² It should be noted that Network Rail issued this diagram some time after the accident; it does however show the exact route of the patrol.

Events during the accident

- 49 Train 2A32, the 13:00 hrs Maidstone East to Victoria, passed Battersea Pier Junction at approximately 13:58 hrs. It was travelling on the Up Chatham Fast line. As it approached the south end of the River Thames bridge the driver observed three men walking adjacent to the Down Chatham Fast line and sounded the horn.
- 50 Upon hearing the warning the lookout and trainee both raised a hand and looked around. According to witness evidence, the COSS did not raise his hand, but carried on walking in the four-foot of the Down Chatham Fast line.
- 51 As the workgroup approached the south end of the road bridge the COSS stepped from the four-foot of the Down Chatham Fast line, across the six-foot and towards the four-foot of the Up Chatham Fast line. This is shown as location 'A' in Figure 5. He is reported to have exclaimed '*..... I nearly walked in front of that!*' – referring to the approaching train 2A32. At 13:59 hrs he then followed his colleagues across the Grosvenor Road Bridge, walking in the four-foot of the Down Chatham Fast line. (All times are estimated from the *on-train data recorder* (OTDR), full details are tabulated in Table 1 following paragraph 76)
- 52 Approximately 20 seconds later (14:00:20 hrs), as train 2A32 approached the north end of the River Thames bridge, the three men were part way across Grosvenor Road Bridge, walking in single file in the four-foot of the Down Chatham Fast line.
- 53 As the team passed clear of Grosvenor Road Bridge they observed in the distance some of their colleagues returning to the depot, having completed patrol 3. The team undertaking patrol 4A exchanged jocular comments on the fact that their colleagues appeared to have finished early.
- 54 Once off the bridge (at 14:00:25 hrs) the COSS walked diagonally into the six-foot between the Down Chatham Fast and Up Chatham Fast lines. He was carrying his track spanner over his right shoulder. The spanner was about 1 m (3ft 3³/₈ in) in length and weighed approximately 8kg (17¹/₂ lbs).
- 55 The other two team members continued walking along the Down Chatham Fast line. The trainee was in the four-foot. The lookout may have been in the four-foot or the cess at the time of the accident.
- 56 Six seconds later the COSS and his spanner were struck by train 2A32 which was travelling at just below 27 mph (43.2 km/h).
- 57 The train driver immediately stopped the train and made an emergency call to the signaller at Victoria Area Signalling Centre.
- 58 The lookout and trainee heard a "bang" and saw the train coming to a stand. Upon turning round, they saw their colleague lying in the six-foot between the Up Chatham Fast and Down Chatham Fast lines. He was lying on his back, parallel with the track, with his head towards the River Thames bridge and feet towards Victoria station. One of his boots was in contact with the *conductor rail* of the Up Chatham Fast line. The lookout and trainee pulled the COSS away from the conductor rail.

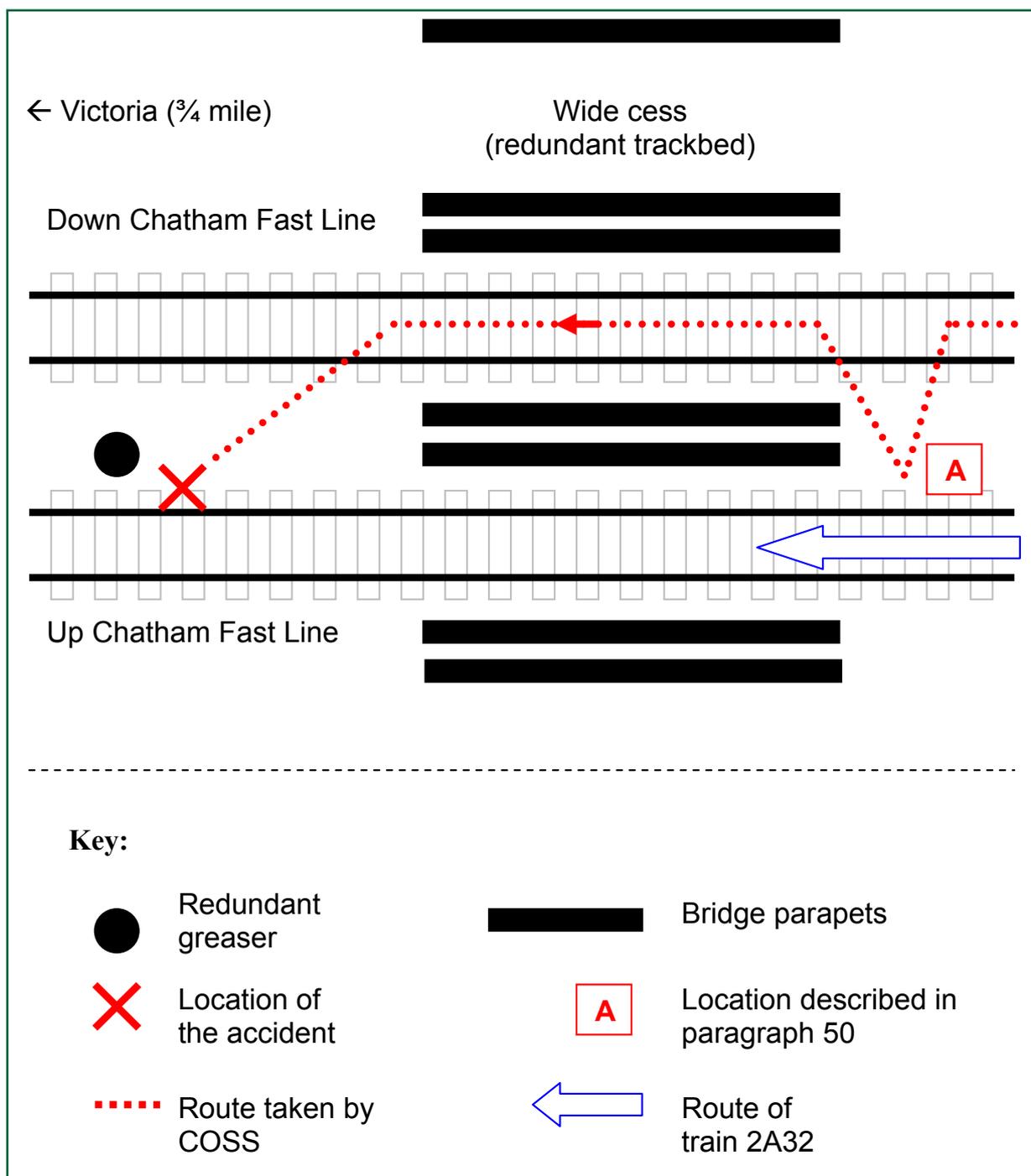


Figure 5: Route of COSS over Grosvenor Road Bridge

- 59 Aware that patrol 3 had taken a *T2A protection* of the Down Chatham Fast line, the lookout phoned the track chargeman who was the COSS of patrol 3 to tell him their COSS had been hit by a train. He requested that the protection be kept in place. The track chargeman advised that the protection had already been given up.
- 60 The track chargeman contacted the signaller at Victoria Area Signalling Centre and requested that the lines be *blocked* to traffic and that the traction current be isolated.

- 61 Upon receipt of the first of these emergency calls, the signaller arranged protection by returning signals to show a red aspect and by an emergency discharge of the traction current. He also summoned the emergency services.
- 62 The discharge of traction current had the effect of stranding several trains between stations for a significant time. Some of these trains were without power for auxiliary systems, including heating, ventilation and air conditioning. Southeastern and Eurostar staff made announcements to keep passengers informed and safe on board trains and to preclude the possibility that passengers might attempt to alight and thereby expose themselves to danger on the rail lines.

Consequences of the accident

- 63 The COSS suffered serious injuries including multiple fractures and brain damage.
- 64 Rail services in the Victoria and Brixton areas were badly disrupted as a result of the protective measures introduced following the accident.

Events following the accident

- 65 The track chameleon went to the site and helped the lookout and trainee look after the COSS until ambulance personnel arrived.
- 66 London Ambulance Service and the British Transport Police attended promptly. The injured man was stabilised and removed at 15:19 hrs to the Royal London Hospital.

The Investigation

Investigation process

67 The RAIB obtained evidence from the following:

- witness interviews;
- site photographs and measurements;
- on-train data recorder;
- train maintenance history;
- planning paperwork for basic visual track inspection;
- COSS paperwork;
- staff training and competency records; and
- joint Formal Inquiry report led by Network Rail with participation from Southeastern.

Key information

Background

Risk profile

- 68 Appendix D shows data on accidents relating to track workers and those involved in track inspection activities.
- 69 Thirty-one track workers have been killed in accidents over the last ten years, seventeen through being struck by a train. Track inspection workers form part of this group.
- 70 Track workers are subject to levels of risk well in excess of the average for all workers in the railway industry. Data contained within the Rail Safety & Standards Board's (RSSB) Annual Safety Performance Report for 2008 concludes that the risk of fatality per track worker per year is approximately double that for train crew.
- 71 The trend in track worker major injuries for the last five years shows the numbers reduced between 2004 to 2007, but in 2008 an increase was recorded.
- 72 The number of major injuries caused by track workers being hit by trains has not reduced, running at one or two per year, with a particularly poor year in 2004.
- 73 Unpublished data held by the RSSB shows that during the last ten years there have been twelve recorded instances of track inspection team members being struck by a train. Of these, five proved to be fatal, five (including the COSS at Victoria) had major injuries and two had minor injuries. These have occurred at a rate of one or two accidents every calendar year.

Performance of train 2A32

Driving of the train

- 74 The driver had booked on duty at Ashford (Kent) at 08:08 hrs on the 13 November 2007. He was reported as being well rested prior to starting work, having attended a company medical examination the previous day. The early part of his shift was undemanding, involving the cancellation of a driving duty to Canterbury West and then undertaking several shunting moves between the sidings and Ashford station. After travelling as a passenger to Maidstone East, his first main line driving was to work train 2A32 (the incident train) from Maidstone East at 13:00 hrs.
- 75 Witnesses stated that on the approach to the bridge over the river Thames the driver had blown the train's horn. This was verified by the on-train data recorder; the horn was sounded at 14:00:05 hrs for 0.2 seconds. It was not sounded again.

76 The on-train data recorder showed that the train had been *coasting* at 27 mph (43.2 km/h) when the horn was sounded. 22 seconds later at 14:00:27 hrs the driver applied the brake into 'step 3', but almost immediately released it again. Two and a half seconds later he reapplied the brake into 'step 3', and five seconds later, at 14:00:35 hrs, he applied the *emergency brake*. Once the emergency brake was applied it took the train a further six seconds to come to rest. The train stopped at 14:00:42 hrs, approximately 24 m beyond the point where the driver applied the emergency brake. Table 1 shows details of the train's approach.

Time	Location	Distance from accident site (metres)	Event	Speed of train	
				mph	km/h
13:00	Maidstone East station.		Train departs as 2A32 for Victoria.		
13:55	Herne Hill station.		Last stopping point.		
13:59:56	First visible point, near Battersea Pier junction.	- 389	Driver comes into sight of the patrollers. Train coasting.	27.0	43.2
14.00.05	22 m south of river bridge.	- 281	Driver sounds warning horn (0.2 sec). Train coasting.	26.8	42.9
14:00:07	South end of river bridge.	- 259	Train coasting.	26.6	42.6
14:00:27	Grosvenor Road Bridge (signal VS32).	- 29	Brake application (step 3).	25.3	40.5
14:00:27.½	¼ way across road bridge.	- 23	Brake released.	25.3	40.5
14:00:30	2 m after leaving road bridge.	- 4	Brake reapplied (step 3).	25.3	40.5
14:00:31	Accident site.	0	Braking.	24.8	39.7
14:00:35	49 m beyond the accident site.	+ 49	Emergency brake applied.	17.0	27.2
14:00:42	73 m beyond the accident site.	+ 73	Stopping point.	0	0

Table 1: Table of events for train 2A32 prior to and immediately after the accident. This has been developed from information contained in the on-train data recorder and from survey information of Grosvenor Road Bridge

Maintenance of the train

77 There were no train defects that affected the performance of unit 375830. The post-incident safety checks confirmed that the performance of the train's brakes and horn were operating correctly.

Vision from the driving cab

- 78 The class 375 type of electric multiple unit is capable of coupling to others of similar type. To allow through passage for passengers it has a corridor connection at the driving cab ends. The driving cab compartment is located to the left of the central gangway corridor connection which protrudes from the front of the cab. The driver has good vision of the line ahead; however the corridor connection only allows a restricted view of objects close to the right-hand side of the train. When driving on the main line this is not a limiting factor to a driver who is reliant on signals and observing that the line ahead is clear of obstructions. The corridor connection however does slightly restrict near visibility (Figure 6).
- 79 Between 12 m and 5 m from the accident site, the driver would have had restricted visibility of anyone close to the right-hand rail. From 5 m away the driver would have had no visibility at all of anyone in that location.

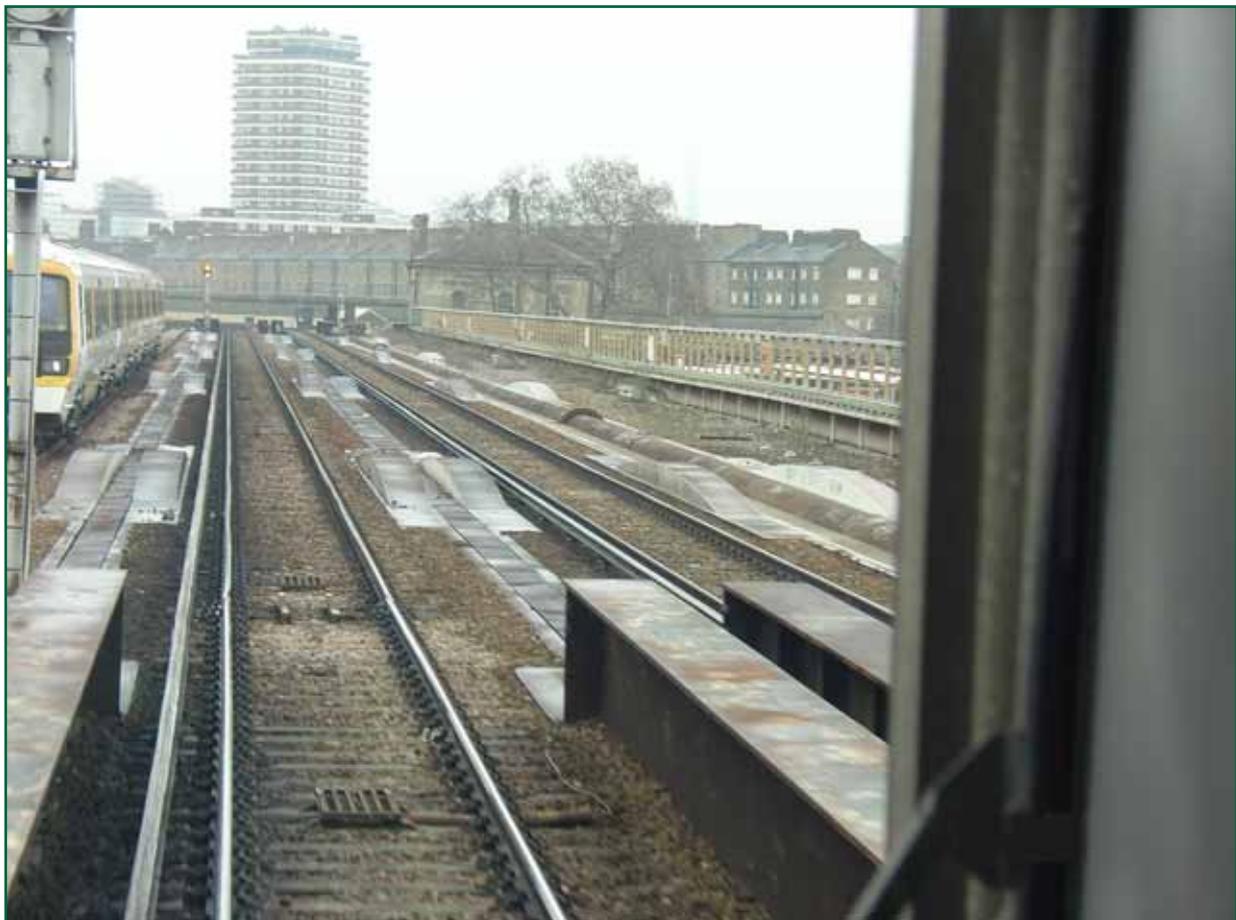


Figure 6: Drivers eye view from a class 375 train on the approach to Grosvenor Road Bridge which is beyond the signal displaying a double yellow aspect³

³ This photograph has been taken from the drivers eye position of a subsequent train and cannot be taken to be exactly representative of the view experienced by the driver immediately before the accident

Organisation and management of the basic visual track inspection

Purpose and frequency of the basic visual track inspection

- 80 Network Rail standard NR/SP/TRK/001 'Inspection and Maintenance of Permanent Way' (issue 2, October 2006) requires that each section of track has a routine visual, ultrasonic and geometry recording inspection at certain minimum frequencies.
- 81 This standard states that *'the track inspection regime is based on risk, both safety and commercial, deterioration rates, anticipated failure modes and identification of work needed so that it may be carried out in a planned way. Inspection frequencies and who they are carried out by are commensurate with the decisions required. Basic visual track inspections are visual inspections that identify any immediate or short term actions required.'*
- 82 Patrol 4A at Victoria was scheduled to take place every Tuesday. The day was rarely changed.
- 83 The organisation of, risk assessment for, and safety arrangements applied to the Victoria area track inspections were inherited by Network Rail from the previous infrastructure maintenance contractor in 2004.
- 84 After Network Rail decided to undertake its own maintenance, data collected by the infrastructure maintenance contractor was transferred into Network Rail's Safe System Of Work Planning System (SSOWPS). This included the arrangements made under *Risk Minimisation* (RIMINI) procedures. At the time of the accident the data had not been reviewed. There is now a project to address shortcomings in the SSOWPS (paragraph 223).

Network Rail local management responsibilities

The Maintenance Delivery Unit Manager

- 85 Sussex Route comprises of about 800 miles (1280 km) of track and other assets on lines from London termini at Victoria and London Bridge through Surrey, East Sussex and West Sussex to the south coast. The Maintenance Delivery Unit Manager was responsible for the Croydon Delivery Unit which maintained the infrastructure of the Chatham lines into Victoria. The Maintenance Delivery Unit Manager was supported by specialist teams for both track and signalling.

The Track Maintenance Engineer

- 86 The Track Maintenance Engineer reported to the Maintenance Delivery Unit Manager and had overall responsibility for the maintenance of the track in the Croydon and Victoria areas.

The Track Section Manager

- 87 The Track Section Manager at Victoria reported to the Track Maintenance Engineer and was responsible for the maintenance of the track and structures in an area comprising 115 track miles between Victoria station and Selhurst (via different routes) and to Mitre Bridge junction near Willesden.
- 88 The Track Section Manager holds the responsibility defined in NR/SP/TRK/001 'Inspection and Maintenance of Permanent Way' of 'Supervisor' - the person responsible for ensuring that the track remained safe for operational use.

The track examination team

- 89 Four members of staff reported directly to the Track Section Manager; one of these was a track chargeman who supervised the activities of the patrollers in the track examination team. There were six members of the track examination team, comprising of leading trackman and trackman grades. The track chargeman also carried out basic visual track inspection - he was also the man who undertook patrol 3 on the day of the accident.
- 90 The track examination team members were all experienced members of staff. The trainee who was the third person on the patrol on 13 November 2007 had previous experience at Victoria.
- 91 The track chargeman allocated staff to each track inspection on a daily basis, issuing the COSS packs (paragraph 95) as required. Each member of the track examination team learned all of the 21 patrols in the Victoria area. The COSS had previously undertaken patrol 4A six times, three in each direction.

The works planner

- 92 The works planner was part of the Maintenance Delivery Unit Manager's organisation at Croydon and was responsible for planning scheduled work for all the track sections on the Sussex Route area. He was an experienced individual and had a department of thirteen staff. This nominally included a works scheduler for each of the track sections.

The works scheduler

- 93 Historically this department had been short staffed; consequently works schedulers regularly planned activities outside their normal familiar areas. They reportedly found it difficult to cope with the quantity of work. Prior to the accident the position of works scheduler allocated to the Victoria track section was unoccupied due to long term sickness. The patrol planning activities were covered on alternate weeks by two other works schedulers.
- 94 The works schedulers had two main responsibilities. These were planning maintenance work using a computer program called *ELLIPSE* (they had data entry clerks to help them do this), and determining safe systems of work which were recorded in SSOWPS. The details of the safe system of work were used to produce the COSS packs for the patrollers.
- 95 The COSS pack is a safety information method statement, and includes Form RT9909 which itemises the following:
- nature and location of work planned;
 - line names, direction of traffic, whether open to traffic or blocked and the *line speeds* applicable;
 - method of protection to be employed (safe system of work) when walking to and from the inspection locations, and when undertaking basic visual track inspection, i.e., whether *green zone* working, or *red zone* working;
 - known hazards associated with the access / egress and work areas;
 - actions to take in the event of an emergency; and
 - line blockage form, if appropriate.

- 96 The works scheduler allocated to the Croydon Track Section Manager's area produced the COSS packs for Victoria for the week of the accident. There is no evidence to suggest that he was deficient in any of the generic planning skills, save that the quantity of work severely limited his opportunity to visit patrol sites. He had four years railway experience and had been in this post for three years. Although some of the other works schedulers held COSS competency, he was qualified as a lookout. Although not a requirement, it was normal to have two persons passed competent as COSS and two as lookout to facilitate making site visits. At the time of the accident there was one of each.

The COSS' paperwork

- 97 There were several significant errors in the COSS pack (form RT 9909) for patrol 4A for 13 November 2007:

- The start mileage was correctly shown as 0 m 40 ch, but the end mileage was incorrectly shown as 0 m 76 ch, rather than 1 m 16 ch. However, the correct mileages were shown in the 'Nature of work' box.
- All lines involved were listed, and the maximum permissible speeds correctly shown. However, the Down Chatham Fast was shown to be blocked between signals VS23 / VS25 (Victoria station throat) and signal VS31. The block was actually taken by patrol 3 and was not in place for patrol 4A.
- The national *hazard directory* details shown at the rear of the form were only for the Chatham lines; there was no reference to the Brighton lines (this is a known problem in the SSOWPS). This was not relevant to the accident however.
- The safe system of work for walking on or near the line, and to or from the working area (i.e. for access and egress to the track undergoing inspection) was correctly shown as red zone. However, the safe system of work 'whilst carrying out work' was incorrectly shown as fenced or separated green zone.
- The form was completed by the COSS to show the method of warning as "Horn" and the *position of safety* as 'Cess'.
- The *sighting distance* has been calculated on the basis of a line speed of 60 mph (96 km/h) in both directions, a total *warning time* of 20 seconds giving a required *warning distance* of 550 metres (600 yards) (as defined by Module T7 sections 11 and 12 of the Rule Book). The calculation is correct for sections of open line, but does not take account of the Grosvenor Road Bridge parapets (see paragraph 120).

(It was noted that in the Sectional Appendix for the area (LOR SO110) there is an inconsistency in the permitted speeds in the vicinity of the accident site, 40 mph being shown on one page and 60 mph on the next. The calculation in the COSS sheets uses the higher of these figures and thus does not introduce an additional hazard. It had no bearing on the accident.

- The COSS has not circled a response for the question: 'Does sighting distance available equal or exceed warning distance needed?' This had no bearing on the accident as the sighting distance did exceed the warning distance.

Duties of the COSS

98 The role of the COSS is defined in the Rule Book Module T7 section 3; it is to set up the planned safe system of work for those within his work group. Further guidance is contained in the COSS Handbook issued by the RSSB. Before going on or near the line, the COSS Handbook required him to:

- receive the COSS information pack;
- check the competencies of those within the group;
- check that the lookout had the correct equipment with him;
- carry out a safety briefing, explaining the potential hazards, including:
 - the lines at the site and for each one the maximum permitted speed and direction of trains;
 - which line(s) had been blocked and which remain open; and
 - the best means of contacting the signaller, nearest A&E hospital, the emergency services and, if necessary, the electrical control operator;
- brief the lookout on where to position himself and what method of warning to use;
- define the nominated position(s) of safety;
- check understanding of all in the group;
- complete the RT9909 'Record of Site Safety Arrangements and Briefing Form' and obtain signatures from all in the group;
- sign the form himself; and
- advise the group when it is safe to move from the position of safety.

99 Although not stated in the COSS Handbook, there was a widespread understanding that a COSS was expected to report any errors or shortfalls in the planned safe system of work to a more senior manager. In this case, it would be the Track Section Manager from whom authority to change the working methods would need to be obtained.

100 A COSS is permitted to undertake work on the track. On this and most other visual track examinations the COSS was also a patroller.

101 A COSS must be deemed competent in the role and procedures to be used; the COSS involved in the accident had transferred from an infrastructure maintenance contractor in August 2005 where he had also undertaken COSS duties. He was last examined in the relevant rules by Network Rail's '*assessment-in-the-line*' process on 11 June 2007. He had passed all the necessary tests and was deemed competent to continue to undertake COSS duties.

Duties of the lookout

102 The lookout was required to:

- carry and use the safety equipment provided;
- receive and sign for the COSS's safety brief;
- maintain a look out for approaching trains;

- warn the group of the approaching train, acknowledge the train driver and move to the position of safety;
- check that the group had acknowledged his warning and had moved clear to the position of safety;
- make urgent warnings to the group if any did not acknowledge the warning and move to the position of safety; and
- report any infringements or inability to provide adequate warnings to the COSS.

103 The lookout had held *personal track safety*, COSS and lookout competencies for several years, and was last examined in the rules via Network Rail's assessment-in-the-line process on 25 May 2007. He too had passed all the necessary tests and was deemed competent in those roles.

Position of safety

104 Rule Book Module G2 'Personal safety when walking on or near the line, or when on the lineside' clause 6.6 'Action to take when a train approaches' requires that persons working on or near the line must 'move to a position of safety clear of any lines on which trains may approach'. Rule Book Module T6, clause 5.1c requires a person to 'immediately move to a position of safety until the COSS tells you it is safe to start work again.' The position of safety will be nominated beforehand by the COSS.

105 For a line speed of 100 mph (161 km/h) or less, Rule Book Module G2, clause 3.2 defines a position of safety as 1.25 metres (4 feet) 'between you (including anything you are wearing or carrying) and the nearest rail of any line on which a train can approach'.

The requirement to wear a safety helmet

106 The Network Rail Personal Track Safety Handbook, RT3170 clause 4.2 requires approved *personal protective equipment* to be worn on the track with a minimum of safety footwear, a safety helmet and high visibility clothing to be worn. Network Rail Company Standard NR/SP/OHS/021 'Personal Protective Equipment And Workwear' grants an exemption to staff from wearing a safety helmet during track inspection provided that they put one on whilst trains pass .

107 The COSS was probably carrying his safety helmet in his left hand immediately prior to the accident; however the helmet was not identified immediately after the accident.

Previous occurrences of a similar character

108 Since the RAIB commenced operation in October 2005 it has investigated 4 cases where track workers were aware of a train approaching and were subsequently struck. In none of these cases had the track worker moved to a position of safety, forgot the train and moved back into its path. In only one case at Leatherhead on 28 August 2007 was a patroller involved (RAIB report 19/2008 refers and may be found at www.raib.gov.uk).

Analysis

Identification of the immediate cause⁴

- 109 The immediate cause of the accident was that the COSS moved away from a line under lookout protection and towards an adjacent line on which a train was approaching.

Identification of causal⁵ and contributory factors⁶

Basic visual track inspection

- 110 Normally basic visual track inspection was undertaken by a COSS and a lookout. It was the custom for the COSS involved in this accident to walk just behind the lookout facing oncoming traffic in the four-foot of the track being examined. If the COSS needed to look at the adjacent line, the lookout would normally be immediately aware of his actions even if the COSS did not directly tell him what he intended to do; the lookout could then change his activity to watch out for trains coming from both directions.
- 111 On 13 November 2007 the trainee was also present. The addition of a third person changed the dynamics of the team, their distance apart and their awareness of each other's actions. For part of the patrol the lookout and trainee walked close to each other and the COSS trailed behind them. They walked in this formation as they crossed the river bridge. Although the lookout was not distracted from attention to track and trains ahead of the group, the presence of the trainee patroller close to the lookout made the lookout less directly aware of the actions of the COSS who was following some way behind; verbal communication from the COSS then became essential. Having an additional team member whose presence changed the usual dynamics between the COSS and lookout was a contributory factor in the accident.
- 112 The trainee was legitimately tasked by the COSS to examine the Down Chatham Fast line; he did this from the adjacent cess and then from the four-foot. This left the COSS free to concentrate on the adjacent Up Chatham Fast line, which he was required to observe. There is no evidence as to whether the COSS undertook an inspection of the Down Chatham Fast after the trainee, which he was required to do by NR/L3/TRK/002/A01 Track Maintenance Handbook. He should have done this from the four-foot of the Down Chatham Fast.
- 113 There is evidence that the COSS did not carry out a complete COSS briefing prior to going onto the line. The briefing form RT9909 contained some incorrect information and was only partially completed.

⁴ The condition, event or behaviour that directly resulted in the occurrence.

⁵ Any condition, event or behaviour that was necessary for the occurrence. Avoiding or eliminating any one of these factors would have prevented it happening.

⁶ Any condition, event or behaviour that affected or sustained the occurrence, or exacerbated the outcome. Eliminating one or more of these factors would not have prevented the occurrence but their presence made it more likely, or changed the outcome.

- 114 When a basic visual track inspection is carried out weekly by the same people it is likely that a high degree of familiarity will be achieved with the working practices. The lack of a complete briefing by the COSS due to familiarity with the work demonstrates an element of disregard for the correct procedures. The lack of a complete briefing by the COSS is a possible contributory factor in the accident.
- 115 It is not mandated in any of the rules, or in RT3170 'Personal Track Safety Handbook' that other members of the group should ensure that the COSS provides a complete briefing. As a qualified and experienced COSS himself, the lookout ought to have pointed out the lapses, however the strong personality of the COSS within the group, and the experience of the COSS and lookout working together over a period of time, reduced the likelihood of the lookout from doing so. Not challenging the COSS regarding the content of the brief was a possible contributory factor in the accident.

The planning of the basic visual track inspection

- 116 The irregularities in the planning process (paragraph 97) are an indication that the conditions relating to patrol 4A had not been correctly risk assessed. They are not contributory to the accident because even if the pre-planned paperwork had been perfect it is highly probable that the actions of the COSS, lookout and trainee on the day would not have changed. The fundamental error that appears to have been made by the COSS was to forget the approaching train; something that could have happened even if the paperwork was correct.

The location

- 117 The inspection required that the COSS examine the Down Chatham Fast line and observe the Up Chatham Fast line for anything that looked abnormal. On open line this was a straightforward task, but at the Grosvenor Road Bridge there are raised parapets in the six-foot that obscure full vision from one track to another.
- 118 Network Rail company standard NR/SP/OHS/069 requires limited clearance signs to be erected 'at obstructions where there is no position of safety (continuous or discrete) for 2 m or more and where the criteria for the provision of 'No Refuges' or 'Prohibition' signs do not apply'. There are no limited clearance warning signs on the parapets for Grosvenor Road Bridge. The lack of warning signs was not causal or contributory to the accident.
- 119 The parapets are less than 24 m long (paragraph 32). The time needed to get to a position of safety should be factored into the warning time provided to anyone crossing the bridge. This was not done in the calculation of the warning times on the COSS form.
- 120 At a nominal walking speed of 1 m/s (approximately 2¼ mph) there is insufficient time for a staff member to be warned of an approaching train and to reach a position of safety compliant with Rule Book module G2 (paragraph 104) from the middle of the bridge. This is neither noted as a hazard, nor as 'red zone prohibited' in the National Hazard Directory. The time to reach a position of safety is neither causal nor contributory because all the members of the track examination team were clear of the parapets when the accident occurred.

- 121 Because the parapets restricted the view of the track the COSS was forced to cross over towards the Up Chatham Fast line. There the COSS was able to look through the bridge parapets at the track on the road bridge. The parapets restricting the view of the Up Chatham Fast line are a contributory factor in the accident.
- 122 Another track worker, not connected with the accident, did admit to walking through the parapets on the Up Chatham Fast line, with his back to traffic on occasion, contrary to the safe system of work.
- 123 Witnesses stated that when walking towards Victoria at Grosvenor Bridge, it was not possible to determine from which line a train warning horn came without turning to face the train. The RAIB accompanied patrol 4A subsequent to the accident and confirmed this.

The COSS

- 124 The COSS has suffered a complete memory loss of the accident.
- 125 Why the COSS did not move away from the Up Chatham Fast line until the train had passed is unclear. Evidence suggests it was the practice to only move clear of the line on which a train was approaching and not to the identified position of safety; however, this does not explain why the COSS strayed towards the adjacent line.
- 126 The fact that the COSS strayed for a second time towards the Up Chatham Fast line when a train was approaching suggests a repeat of the earlier inattention. Distraction by some external event, or focus on the job-in-hand are possibilities to explain why the COSS forgot about the train, however there is no specific evidence.
- 127 The train driver on 2A32 had blown a short blast on the horn of 0.2 seconds duration; the lookout and trainee acknowledged it and stayed clear. The driver was of the opinion that the COSS had not acknowledged the warning. The COSS's lack of awareness about the approaching train was a causal factor in the accident.
- 128 Normally the COSS would walk close to the lookout. With the COSS walking some way behind the lookout who was at times in the cess and the four-foot, the immediacy of the lookout knowing that the COSS was going to check the adjacent line was removed. The COSS should have advised the lookout whenever he (the COSS) intended to go near or on to the Up Chatham Fast line. The lookout would then have been able to start looking in both directions to protect him. This did not happen. The COSS' lack of advice to the lookout about his intended actions was a causal factor in the accident.
- 129 There were no concerns about the health of the COSS prior to the accident, this having been confirmed by periodic Network Rail medical assessments that are a necessary part of retaining PTS and COSS competency. Several persons who knew him well confirmed his apparent good state of health; and no adverse comments were made with regards to his hearing, eyesight or sense of balance.

The lookout

- 130 The lookout acknowledged the warning horn from train 2A32 in the correct manner by raising one hand above his head.

- 131 Because he had been instructed to look out for trains approaching on the Down Chatham Fast Line, the lookout was not required to observe what the group were doing after the warning from train 2A32. Nevertheless, if the COSS had been warned a second time from any source about the approaching train, it is probable that the accident would not have occurred.
- 132 There is conflicting evidence as to whether the lookout was in the four-foot of the Down Chatham Fast line or in the adjacent cess at the exact time of the accident; however, this has no bearing on the accident.
- 133 The reported jocularity (paragraph 53) suggests that the attention of the group was not fully on the job at that precise moment. The COSS' comments may have given the lookout a false sense of security that the COSS was near him and was clear of the approaching train; however, this has no bearing on the accident.

The trainee patroller

- 134 The trainee acknowledged the warning horn from train 2A32 in the correct manner, and continued his walk along the four-foot of the Down Chatham Fast line with the lookout ahead of him.

The driver of 2A32

- 135 Following the initial short blast on the horn the train driver gave no further warnings in the 26 seconds before the accident, despite having seen the COSS not raise his hand to acknowledge. In addition the driver did not notice when the COSS moved towards the Up Chatham Fast line on the first occasion and did not use the horn to provide a warning at that time (paragraph 140).
- 136 As the train approached the workgroup and the COSS started to move back towards the Up Chatham Fast line after having reached the end of the road bridge parapet, the train driver did not blow the horn. It is possible that a second warning at any point might have been sufficient to remind the COSS of the presence of the train. The length of time between the first and only blast of the horn and the accident is a contributory factor in the accident.
- 137 The driver was aware of the potential danger to the COSS as he moved closer to the line on which the train was approaching because four seconds before the accident (at 14:00:27 hrs) he moved the brake into 'step 3'. The driver did not believe it was necessary to blow the horn again, had he done so, it is again possible that the accident could have been averted.
- 138 The driver may have been unsure of the intentions of the COSS as he released the initial brake application within half of a second, but reapplied it in 'step 3' again two and a half seconds later. After the accident had occurred he applied the emergency brake.
- 139 The driver believed that drivers were discouraged from excessive horn blowing because of the effect on the wider community. RAIB has examined the training and briefing processes for Southeastern's drivers and found no evidence of such guidance being given to drivers when approaching workers on or near the line.

- 140 There is no restriction on use of the horn for safety reasons; in the Rule Book module TW1 'Preparation and movement of trains' clause 10.2 'Using the warning horn' the driver is required to initially;
- use the high and low tones on the loud setting to give a warning to anyone on or near a running line;
- and then
- give a series of short, urgent danger warnings to anyone who is on or near the line who does not:
 - a. acknowledge the warning by raising one arm above the head, or
 - b. appear to move clear out of the way of the train.

It is evident that the driver did not give the urgent danger warnings as required by the rules, when the COSS strayed a second time towards the Up Chatham Fast line. Not blowing the horn a second time (paragraph 136) or giving urgent danger warnings is a probable causal factor in the accident.

- 141 The driver stated that as two of the three in the group had acknowledged his initial warning he thought that they all knew that the train was coming. The RAIB considers that from a distance of over 200 m it would be difficult to judge how close the members of a group were together and whether they could have communicated about the approaching train.
- 142 The RAIB has taken evidence from a number of drivers and driver managers (from Southeastern and other companies) with respect to track workers. The common understanding is that the driver does not know what activity any workers on or near the line are undertaking. Drivers will blow the warning horn upon seeing anyone on or near the track, regardless of activity.
- 143 There is no clear consensus on what is the optimum time for blowing the horn to ensure track worker awareness, as the situation differs in each locality. Drivers use their judgement for this.
- 144 Drivers are not required to have knowledge of the type of work being carried out by track workers; it is the duty of the lookout to provide the initial warning and to ensure that they have all moved to a position of safety. Drivers are thus satisfied that the workers are in a position of safety if they have all acknowledged the train's warning horn and are clear of the line on which the train is approaching. In some cases, workers may be on an adjacent line under green zone protection, such as occurs for patrol 3 at Victoria, which employs T2 protection.

The speed of train 2A32

- 145 The train took a relatively long time (26 seconds) to reach the work group from the time that the driver sounded the horn (Table 4). It is possible that the COSS might have registered that the train was there, but had been lulled into a false sense of security knowing he had some time in hand. During this time something on the Up Chatham Fast line which he was examining may have distracted him from the approaching train.

146 This scenario is unlikely for two reasons:

- a. the COSS made an initial move towards the Up Chatham Fast line and then remarked that he had forgotten about the train (paragraph 51); he must then have recognised its presence; and
- b. nothing untoward or unusual was found on the Up Chatham Fast line when the Maintenance Delivery Unit Manager visited the site after the accident.

Use of personal protective equipment

147 The COSS was not wearing his safety helmet, but was probably carrying it in his hand (paragraph 107). He should have put it on his head for the passage of train 2A32, but as he had apparently forgotten about the train, he was not wearing it. It is possible that the train initially struck the spanner that the COSS was carrying over his shoulder. The lack of head protection may have affected the severity of injuries sustained by the COSS and is a possible contributory factor in the accident.

Identification of underlying causes⁷

148 There were several issues in the planning and management of track protection that have a bearing on the event.

Familiarisation and culture of the track examination team

Training

149 The COSS had transferred from the night production team into the Track Section Engineer's team in April 2007, seven months prior to the accident. Once he had passed his basic visual track inspection course he was required to be mentored. Records show that this was done on four occasions by three people; an Assistant Track Section Manager, the track chargeman and the lookout, all of whom had COSS certification.

150 The normal method for someone to learn was to accompany planned track inspections and be mentored by an experienced and competent person. Although it was claimed that this had been done, no documentary or corroborative evidence exists on which duties the COSS was mentored. It is thus not possible to establish beyond doubt that he had been shown how to undertake patrol 4A correctly. The mentoring form included a space for the work location, but this had been left blank. Prior to the accident, patrollers did not complete a log book; this requirement has now been introduced.

Supervision

151 The Track Section Manager or his assistant is required by Network Rail company standard NR/RP/TRK/001 'Inspection and Maintenance of Permanent Way' to inspect the track every two months. He had an eight-week programme that he or an Assistant Track Section Manager undertook, so that the entire track in his section was inspected. These 'supervisor visual track inspections' were usually in lieu of the regular inspections planned for the same week; there was no requirement that they should confirm the correct application of safe systems of work by the patrol teams.

⁷ Any factors associated with the overall management systems, organisational arrangements or the regulatory structure.

- 152 The Track Section Manager, along with the other managers up to Maintenance Delivery Unit Manager level in South East Territory, was also required to undertake periodic track inspections with teams under a local arrangement known as 'Boots on ballast'. These were to monitor how the patrollers or workgroups carried out their work and applied the safe systems of work. There were no formal national or local processes for how they were to be carried out. These inspections, along with the 'supervisor visual track inspections usually took place on Wednesdays. In the Sussex Route, area managers maintained their own records.
- 153 Witness evidence indicates that the Track Section Manager had a high workload with regular weekly meetings at Croydon on Tuesdays, the normal day for patrol 4A. In practice he was only able to get out on the track on Wednesdays, or on Sundays if he worked the additional day as overtime. Even so, his track walks were often only carried out monthly. He would alter the day of each patrol if required. Sometimes the track chargeman accompanied him on the walks. The high administrative workload of the Track Section Manager is an underlying factor in the accident.
- 154 The Track Section Manager did not have any records as to when he had last accompanied patrol 4A, although he did consider that it must have been within the eight weeks prior to the accident. There was no record whether or not the COSS who was injured had been present, or indeed who acted as COSS that day.
- 155 Witness evidence showed that the two Assistant Track Section Managers also had a heavy workload with other statutory inspections and regular activities, so they rarely went out with patrol staff. The track chargeman, who reported to the Assistant Track Section Managers, regularly accompanied patrols and this gave him the chance to observe how they were being carried out. These concentrated on the technical aspects of the work; it was very rare for any concern to be logged about the safety of the activities being undertaken.
- 156 Neither NR/RP/TRK/001 'Inspection and Maintenance of Permanent Way' nor NR/L3/TRK/002 'Track Maintenance Handbook' directly specify how basic visual track inspection should be undertaken; that is detailed on a worksheet NR/L3/TRK/002/A01 'Track Patrol (foot and mechanised)' and NR/L3/TRK/002/A02 'Track inspection – supervisor'. Both these are directly referenced from NR/L3/TRK/002. The local methods of applying the requirements of the worksheets are left to local managers to define and enforce. The RAIB considers that the lack of a more comprehensive and documented method of local supervision of the staff within the track examination team is a possible underlying cause in the accident. Network Rail has now introduced a company standard and a Manager's Notebook that manages this activity (paragraphs 222 and 225).

Culture

- 157 Witness evidence shows that there was a culture of banter between members of the track examination teams which would normally occur throughout the briefing and patrol, although on the day of the accident the presence of the trainee significantly reduced the banter between the COSS and lookout during the patrol.

- 158 The Track Section Manager believed that the COSS' humour and banter was good for team morale in certain circumstances, for example when working on the line. He did not consider that this banter would be excessive. There is no evidence that the Track Section Manager attempted to modify this aspect of the COSS' approach to work; but his occasional presence with the team might have led to increased focus on their inspection duties and safety.
- 159 There are no records available of how the COSS performed on his mentored or supervised track inspections, or of any corrective action required, or any close out of actions. The competency arrangements were managed by Network Rail's assessment-in-the-line process which checks only for technical competence.
- 160 It is likely that when a manager or supervisor accompanied a basic visual track inspection, that the attitude and behaviour were different to that on other occasions. The day that an RAIB inspector accompanied patrol 4A there was a high degree of diligence and adherence to the standards, and behaviour was exemplary.
- 161 In 2005 the RAIB investigated a track worker fatality at Trafford Park (RAIB report 16/2006). Included was recommendation 8 that Network Rail must 'maintain the prescribed standard of performance required of the COSS' and that a review should consider 'the development of a new robust monitoring process to ensure that an individual's on-the-job performance routinely achieves the prescribed level'. Network Rail concluded that the existing competence standards were adequate to control a person's performance and that no further action was required.
- 162 Recommendation 9 stated that Network Rail were to 'consider further work and the expansion of the current programme of research into understanding the causes of rule violation, in direct contravention to the training people have received'. Network Rail concluded that sufficient work was already underway as demonstrated by a commissioned study from Leeds University Business School entitled 'We are Trackmen'; Network Rail also had access to many other behavioural papers and supporting data. These were used in a human factors behavioural study and a specific safety initiative entitled 'SAF7'.
- 163 It is probable that the underlying close working relationships, culture and banter by the team undertaking patrol 4A led to the violation of certain rules and may have contributed to lapses of attention or situational awareness within the group. The RAIB considers this to be an underlying factor in the accident and has made a recommendation that is similar to one included in the Trafford Park report.

Response of others

- 164 Immediately the accident happened, the lookout telephoned the track chameleon to tell him about the accident and to ask him to keep the 'T2' protection in place (paragraph 59). This is not what rail personnel are taught to do as part of their personal track safety training. They are required to call the controlling signaller to arrange for the line to be blocked and traction current discharged. The track chameleon did these tasks as soon as he had spoken to the lookout. However there was no delay to the protection being applied because the driver of train 2A32 had made an immediate emergency call to the signaller.

- 165 The lookout and trainee assisted their colleague by pulling him clear of the conductor rail and making him as comfortable as they could.
- 166 Network Rail, British Transport Police and London Ambulance Service staff reacted quickly and reached the scene without delay; however, the injured party's next of kin was not informed until nearly four hours after the accident due to the COSS' contact details not being readily available.

Other factors for consideration

Moving to the position of safety

- 167 The COSS had identified the cess on the redundant trackbed as the position of safety. The Down Chatham Fast line was not identified as a position of safety.
- 168 In some instances a separated green zone can be established around the four-foot of a line. This is pre-planned and will involve the use of a 'T2' or 'T12' protection which will prohibit the passage of trains over the line. This was not utilised for patrol 4A at Victoria because of the deleterious effect this would cause to the train service and the low level of risk that was perceived for this activity.
- 169 Members of the track inspection teams stated that, if a train was approaching on another line, it was their practice not to move clear of a track they were working on when there was no train approaching along that specific line.
- 170 The Rule Book requires that all staff working on the track should acknowledge a warning from the lookout about an approaching train, and then move to the nominated position of safety (paragraph 104). In practice, lookouts sometimes do not sound a warning when they sight a train that they understand to be incapable of reaching track workers; the track workers are thus able to continue working. This was the case at Grosvenor Bridge; for example, when trains were seen on the Brighton lines; the members of the track examination team continued their duties on the Down Chatham Fast line.
- 171 There is no clarity in the Rule Book, or in the COSS Handbook, as to the definition of an 'approaching train', and when a lookout might or might not sound a warning. Safety posters published by Sentinel in 2003 and distributed to Network Rail premises up until about 2007 are still displayed in some locations; they give the following instruction '*On or near the line when a train approaches? Move to a position of safety, clear of all lines*'; No definition of an 'approaching train' was given on the poster (see Figure 7).
- 172 Prior to this accident the RAIB has reported on several instances of track workers on the main line network not moving clear of all lines. In each case the workers remained at, or only retired to, the minimum distance from a train which was thought not to pose a risk. RAIB publications on accidents at Tinsley Green (report 43/2007) and Ruscombe (report 04/2008) relate to locations where facing points permitted a train to move from one track to an adjacent one. The RAIB publication on the accident at Leatherhead (report 19/2008) relates to a location at a junction. Recommendations 1 and 4 in the report on the fatality at Ruscombe and recommendation 3 of the near miss at Tinsley Green addressed the issue of approaching trains in the vicinity of facing points.

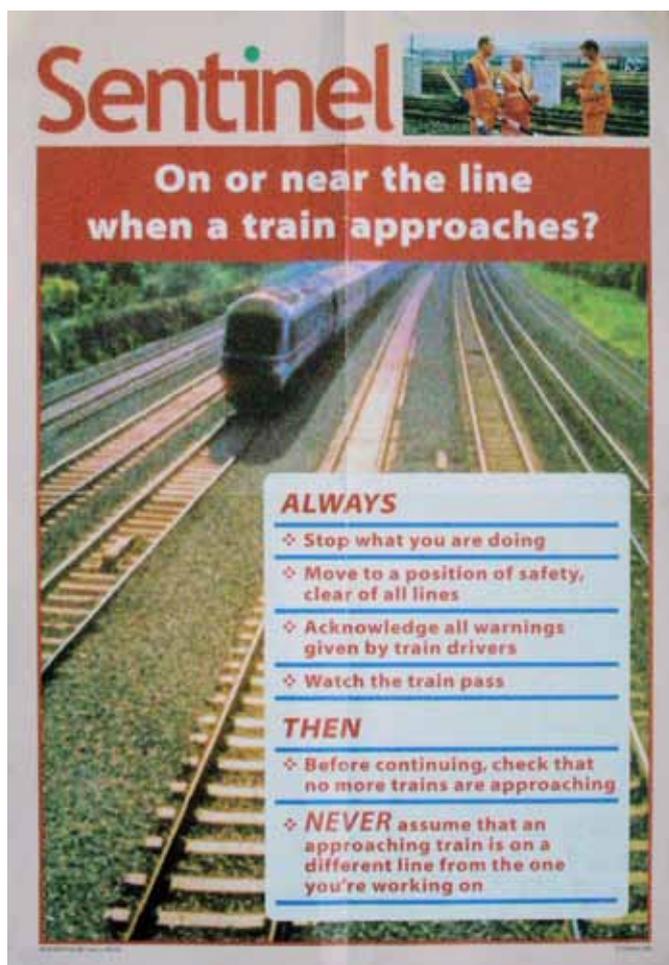


Figure 7: Sentinel safety poster displayed in many Network Rail premises

- 173 When a train is sighted and the lookout does not sound a warning, staff will not move to a position of safety clear of all lines. This situation can have pitfalls, for example;
- where the topography results in a train blocking the lookout's sighting distance to other trains that could pose a danger to the staff on the line where they were working;
 - where a passing train could block the route between the site of work and the position of safety;
 - where points would permit the train to cross from another line directly towards the site of work; and
 - as happened at Grosvenor Bridge, staff can inadvertently 'stray' into an adjacent open line.
- 174 Literal application of the rules described in paragraph 104 and 105, such that track workers moved to the position of safety whenever a train approached, irrespective of what track it was on, would result in an increase in the time, and hence resources, necessary to carry out many types of work in complex areas such as exist on the approach to Victoria Station. Network Rail contends that unacceptable inefficiencies in the amount of useful work possible in Red Zones would result from such a restriction.

- 175 Such literal application could lead to continuation of the present practices, undocumented in official publications, of staff remaining on the track where they perceived a train was not on the line they occupied.
- 176 No evidence has been found in published documentation or COSS training material of any criteria to guide a COSS as to how to set up a safe system of work on multi-track lines when staff are not to move clear of all tracks.
- 177 Such criteria would require that consideration is taken of;
- the practical capabilities of lookouts;
 - the possibility of human error and its consequences;
 - the ability to identify the track a particular train is using;
 - multiple train movements;
 - the need for a precise knowledge of the track layout between the sighting distance and the site of the work;
 - nature of the work being undertaken; and
 - the continued ability of the lookout to observe that staff who stayed on the track did not move to a position where they became at risk of being struck when a train drew near on an adjacent line.

Detailed prior planning of the safe system of work will be required in order that a COSS will be provided with an effective level of assistance. The application of these requirements is likely to become more difficult for a site of work that moves, as is the case for track examination.

Red zone or green zone working

- 178 According to Rule Book clause 3.1 of module T7, the COSS is deemed to be responsible for ensuring that the appropriate arrangements have been made to ensure the safety of those going on or near the line. For routine, repetitive work such as basic visual track inspection this is pre-planned with the COSS pack having been prepared by the works planning department at the Maintenance Delivery Unit Manager's office.
- 179 Because red zone working is not as safe as green zone working, when the basic patrols were first established, they were examined to see what the most appropriate protection system should be. As the rules have changed over the years the method of patrolling has been amended to take account of the new requirements and risk. Blocking the line for some patrols on the approach to Victoria and Waterloo are examples of changed methods of protection.

180 At the time of the accident the list of protection options available is summarised in table 2 (source: RS502 COSS Handbook). When work is planned, the planner or COSS must select the best available safe system of work; the list below shows the order of priority:

Priority	Safe system of work	
First	Safeguarded green zone	created by blocking all the lines at your site
Second	Fenced green zone	created by putting up a fence between your site and the nearest open line.
Third	Separated green zone	created by making sure there is a space between your site and the nearest open line (A Site Warden is sometimes provided to give a warning if anyone strays outside the permitted work site toward a line still open to traffic).
Fourth	Red Zone with warning given by ATWS	an Automatic Track Warning System warns the group of approaching trains
Fifth	Red Zone with warning given by TOWS	a Train Operated Warning System warns the group of approaching trains
Sixth	Red Zone with warning given by LOWS	a Lookout Operated Warning System warns the group of approaching trains
Seventh	Red Zone with Pee Wee	lookouts using Pee Wee warn the group of approaching trains
Eighth	Red Zone with lookout	one or more unassisted lookouts warn the group of approaching trains

Table 2: Safe systems of work for track working (listed in order of priority)

- 181 This hierarchy means that activities under a red zone safe system of work, with warnings given by one or more lookouts, should only be undertaken when all other methods are not available.
- 182 The distance between the tracks over Grosvenor Road Bridge are such that a separated green zone could be set up on one track without affecting traffic on the adjacent lines. Other parts of patrol 4A may not permit this. This arrangement would nevertheless significantly reduce train path capacity for the Chatham lines whenever basic visual track inspection was being carried out.
- 183 Even if the Down Chatham Fast line had been closed to traffic under green zone protection it is not certain that this would have prevented this particular accident. The COSS would still have been able to stray out of the separated green zone towards a line open to traffic. A site warden would however have been present to give a warning if the work group comprised three or more people, as was the case in this accident.

- 184 The planning was done on the premise that basic visual track inspections should be completed in daylight (a requirement in NR/SP/TRK/001, unless non-daylight basic visual track inspections have been approved by the Territory Engineer (Track)). Network Rail managers consider that to only use green zone safe systems of work would reduce the line's capacity (number of train paths) to an unacceptable level.
- 185 Green zones were therefore used only where it was impossible to create a red zone safe system of work, either because of geographical features on the line, or when identified as 'red zone prohibited' in the Hazard Directory. This is the reverse of the priority list shown in Table 2.
- 186 Rule Book module T7 'Safe systems of work when walking or working on or near the line, clause 3.1 'Making sure the safe system of work is suitable', requires the planner / COSS to obtain information about the site, including the track layout, the normal direction from which trains approach on each line, and other local features which might affect the safety of the work. Information that was thought to be appropriate was input into the SSOWPS by the works scheduler.
- 187 Patrol 4A was risk assessed as practical for red zone working. The adjacent patrol 3 required the creation of a green zone because the area between Victoria station and the boundary with patrol 4A was 'red zone prohibited' in the Hazard Directory.
- 188 Network Rail uses a number of automated warning systems, however these are mostly more appropriate to the protection of a static site of work rather than for patrolling duties. One manually operated radio system, the Lookout Operated Warning System, is suitable for protection of patrolling, but is more useful in areas where sighting of trains by a single lookout is impossible to achieve. It provides a local electronically generated warning to each worker when activated by the lookout. Where protection would be required from trains approaching in two directions, as is the case in the multi-track area over Grosvenor Bridge, then two lookouts would be required. Moving the area covered by the Lookout Operated Warning System does not add to the complexity of the activity. Additionally all the warning systems take some time to set up and test, leading to additional maintenance inefficiencies. No easy to use automatic system providing a continuous warning of an approaching train, with a minimal efficiency burden and appropriate for patrolling activities is currently available. Had such a system been available the continuous warning may have alerted the COSS to the approaching train and thus have prevented the accident.

[Previous research by the Rail Safety and Standards Board](#)

- 189 As a result of the lack of compliance with the Rule Book, or of an alternative local approach to ensure the safety of track workers, the RAIB has investigated what studies have previously been undertaken by the rail industry into reducing the risk profile for this group of workers.

Report: 'Green Zones: Thinking Strategically'

190 In 2003 the RSSB published a report called 'Green Zones: Thinking Strategically'. This study examined how collaborative working and good planning could improve safety and efficiency of engineering work on the railways. At that time private sector infrastructure maintenance contractors undertook the majority of Network Rail's routine maintenance; very little was done 'in house'. An abstract from the report is reproduced below:

'The 'Green Zones: Thinking Strategically' initiative addressed the level of track worker fatalities resulting from train strikes. It recognised that factors affecting track worker safety are often linked to cost effective planning and management of engineering work. A six-point strategy was developed to reduce track worker exposure to trains and to improve efficiency:

- automated inspection and mechanised maintenance;*
- a low maintenance railway with good accessibility;*
- timetables with sufficient engineering time;*
- improved work/possession planning;*
- simpler rules, standards and protection methods; and*
- processes to start and finish possessions on time.'*

191 Cross-industry teams conducted pilot exercises on three routes to develop methods of cooperating to deliver safer track work. This proved successful in harnessing local knowledge, tackling important issues such as renewals plans, generating and implementing new ideas quickly, maximising route benefits and fostering efficiency and safety. A report and a leaflet were published and made available across the industry.

192 The first of these six strategies advocated automated inspection. The recommendations published in Green Zones: Thinking Strategically were aimed at increasing the speed with which the benefits of mechanised inspection and maintenance could be realised. These were as follows:

- 'Network Rail should publish their strategy and timetable for mechanisation and thereby encourage investment in plant and training.*
- Network Rail should consider the ability of engineering contractors to provide mechanised plant when letting renewals contracts.*
- Network Rail should recognise that train operators are willing to install inspection equipment on their trains and develop a programme for doing so and for utilising the data which this provides.*
- Network Rail and engineering contractors should work with the unions to develop workforce support for mechanisation by selling the safety benefits, by demonstrating that staff will be re-deployed onto more skilled activities and by stating that there will not be a reduction in demand for skilled and experienced track workers.*
- RSSB and Network Rail should make the Rules and Standards changes required to allow for mechanised inspection.'*

193 The RSSB did recognise that there were practical issues to be addressed, and included the following text alongside these recommendations:

'Mechanisation of inspection and plain line maintenance would be technically consistent, faster, cheaper and safer than current manual methods. In addition to improving track quality and reliability, the introduction of mechanised inspection and maintenance plant would produce significant cost savings, reduce the possession time required for these activities and reduce the exposure of track workers to moving trains and other hazards. However, mechanisation will require significant investment in on-track machinery and staff training, and engineering companies are reluctant to make this investment without a commitment from Network Rail to use it regularly. Additionally, the workforce may be concerned that mechanisation could result in job losses and are therefore suspicious of the emerging technology.'

194 Subsequent to the publication of the Green Zones: Thinking Strategically report Network Rail has taken most maintenance activities 'in-house', so the reluctance of engineering companies should no longer be a factor against the implementation of the Green Zones: Thinking Strategically initiative. Network Rail could now usefully revisit the Green Zones: Thinking Strategically report with the objective of reducing the amount of red zone track inspection through the use of inspection trains.

[Report: 'Assessing the balance between track worker safety and overall system safety'](#)

195 In 2004 the RSSB published a further document entitled 'Assessing the balance between track worker safety and overall system safety'.

196 The purpose of this research was to determine whether there was validity in the proposition, *'that the increased emphasis in personal track safety in recent years may have had a detrimental effect on system safety, by making access to railway infrastructure for maintenance and inspection purposes more difficult'*.

197 In the report there is discussion which identifies the benefit of cyclical maintenance and inspection activities being considered in conjunction with train plans which could optimise green zone working. Red zone working would only be needed at locations where the risks were minimal, but not to do so would jeopardise the integrity of the infrastructure.

198 There is confirmation of the progress made in automation and the benefits attained. It does temper the progress with awareness of limitations and of new risks introduced:

- the need for separate follow up visits once track defects are identified;
- the need to concentrate on primary routes;
- the need to retain visual inspection for older infrastructure such as jointed track and wooden sleepers; and
- the limitations on human attention capability for analysing copious volumes of recorded data.

199 The findings (with respect to basic visual track inspection) are that 'the objective must be one of continuous progress in exploiting the benefits of automated inspection and mechanised maintenance opportunities'.

Network Rail's actions

- 200 Network Rail produced the new specification NR/SP/TRK/001 in August 2005. This permitted up to 75% of basic visual inspections of *plain line* to be done using inspection vehicles, an option which had not been available in the previous specification RT/CE/S/103 'Track Inspection requirements'. In practice this option is of very limited use, since the speed of the inspection vehicle is limited to 10 mph (16 km/h) and it is required to be able to stop readily to enable minor defects to be attended to. Such a regime, in daylight, would be disruptive to traffic on any but the most lightly used lines.
- 201 Network Rail operates the New Measurement Train over much of the rail network; a separate train is used over the d.c. third rail network as exists at Grosvenor Road Bridge. Both operate at speeds that can easily be accommodated by the timetable. Although their main purpose is to measure and record *track geometry*, they are also equipped with forward and downward cameras capable of recording images of track. Whilst the measurement trains are far better than visual inspection for detecting and recording faults in plain line track geometry, considerable development is required to enable the camera systems and their record analysis tools to be used to replace some existing inspection activities.
- 202 The Ultrasonic Rail Flaw Detecting Train used by Network Rail, together with an updated strategy for rail maintenance and replacement, has improved the identification of broken rails, and has resulted in a significant reduction in the number of broken rails occurring. Its operation is more effective at identifying broken rails than simple visual methods.
- 203 The residual workload for a basic visual track inspection is mainly checking the condition of rail fastenings and joints. On sections of plain line track laid with *bullhead rails*, the basic visual track inspection will also carry out the routine maintenance task of knocking *keys* back into *chairs*. Jointed *flatbottom* and bullhead track also needs occasional attention to the bolts joining adjacent sections of rail. Track comprising *continuously welded rail (CWR)*, does not require such attention and inspection is the team's only task. Some basic visual track inspections (but not those in the Victoria area) are specifically tasked with observing other features such as the condition of earthworks, embankment or cutting sides, and reporting any falls of rock or earth. The track covered by patrol 4A was formed of CWR so the inspection team had little need to undertake any remedial activities.
- 204 New technology to record the condition of fastenings (the Cybernetix system of non-contact optical sensors) is being evaluated by Network Rail. This will address some of the limitations of existing equipment (paragraph 201), however further software development is required on the recognition and flagging of defects before inspection teams could be replaced.
- 205 Given the perceived inefficiencies that occur if track workers retire to the cess whenever a train approaches and the significant disruption to train path availability from blocking the line, then other means to ensure the safety of track workers need to be found. If suitable methods of ensuring track worker safety while trains are running are impractical then automated inspection should be considered as an alternative.

Conclusions

Immediate cause

206 The immediate cause of the accident was that the COSS moved away from the line under lookout protection and toward an adjacent line on which a train was approaching.

Causal factors

207 Causal factors were:

- a. the COSS walking behind the lookout and not informing the lookout that he was going near to the Up Chatham Fast line (paragraph 128, No recommendation); and
- b. the lack of response to the warning horn of the approaching train by the COSS and his apparent lack of awareness of the train's position (paragraph 127, no recommendation).

208 The following factor was probably causal;

- a. the driver of train 2A32 not registering the danger immediately before the accident and not sounding a further warning blast or repeated urgent warning blasts on the horn (paragraphs 137 to 140, no recommendation).

Contributory factors

209 The following factors were considered to be contributory:

- a. the length of time from the initial short blast on the horn until the train arrived at the site of the accident (paragraph 136, no recommendation);
- b. having an additional team member who by his presence changed the usual dynamics and reduced the ability of the COSS and lookout for walking close to each other (paragraph 111, no recommendation); and
- c. the need for the COSS to cross over towards the Up Chatham Fast line in order to look at the track hidden between the parapets of the Grosvenor Road Bridge (paragraph 121, no recommendation).

210 The following factors were considered to be possibly contributory:

- a. the lack of a complete briefing by the COSS to the trainee and lookout (paragraphs 113 and 114, no recommendation);
- b. the lookout not challenging the COSS, probably due to the strong personality of the COSS within the group (paragraph 115, **Recommendation 1**); and
- c. the lack of head protection being worn by the COSS which may have reduced the effects of being struck by the train (paragraph 147, **Recommendation 3**).

Underlying causes

211 The underlying causes were:

- a. the high level of administrative duties undertaken by the Track Section Manager that restricted his checks of the basic visual track inspection activities (paragraph 153, no recommendation); and
- b. the close working relationships, culture and banter within the work group distracted them from following the safety rules whilst working on the track (paragraph 163, **Recommendation 4**).

212 A possible underlying cause was the lack of a comprehensive and documented method of local supervision of track examination teams that included their inspection methods and attitudes (paragraph 156, **Recommendation 4**).

Additional observations⁸

213 There is a lack of clear guidance in the Rule Book, COSS Handbook and subsidiary publications about the definition of an 'approaching train' (paragraphs 171 to 177), and hence the criteria for setting up a Safe System of Work (**Recommendations 5 and 6**).

214 The lack of limited clearance signs on Grosvenor Road Bridge is not compliant with Network Rail company standard NR/SP/OHS/069 'Lineside facilities for Personal Safety'. This was not causal or contributory to the accident (paragraph 118, no recommendation).

215 There were several deficiencies with the production and quality of the 'COSS pack' with regard to the systems used for planning and preparation of work, the related inconsistencies in the Sectional Appendix and the need to recognise hazards from areas of limited clearance. None of these were causal or contributory to the accident (paragraph 116, **Recommendations 7, 8 and 9**).

216 The lack of an automatic warning system to provide a continuous warning of the approach of a train (paragraph 188, **Recommendation 2**); and

217 The lack of mechanised inspection techniques is the primary reason why basic visual track inspection needs to be undertaken under red zone with lookout protection. When mechanised inspection techniques become available the exposure to hazards from moving trains will be able to be significantly reduced (paragraph 205, no additional recommendation in this report, but see paragraph 228 for details of a previous recommendation) .

⁸ An element discovered as part of the investigation that did not have a direct or indirect effect on the outcome of the accident but does deserve scrutiny.

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

- 218 Network Rail instigated an internal investigation into the accident in accordance with Railway Group Standard GO/RT3473. The investigation was led by Network Rail, with participation from Southeastern. The internal report was published on 31 March 2008.
- 219 A Network Rail company wide Safety Bulletin was provided shortly following the accident. Subsequently the details from the investigation were published in an internal publication "Front Line Focus" in October 2008. Learning points were included in the briefing pack that accompanied the publication.
- 220 NR/SP/TRK/001 'Inspection and Maintenance of Permanent Way' Appendix A has been rewritten.
- 221 Network Rail has instigated a long-term 'Technology Review' to investigate alternative ways of carrying out track inspection to reduce the need for carrying out patrolling duties. The current inspection trains are being used to trial equipment that uses video capture or direct optical recognition of faults.
- 222 Network Rail has published a new procedure NR/L3/TRK/1015 'Management of Track Patrolling Activity' which came into effect on 1 December 2008.
- 223 Network Rail is currently conducting a thorough review of the RIMINI process. Phase 1 of the project has been completed; it reviewed the known issues of the process and the way in which it was administered. Phase 2 will address a redesign of the process, the roles and responsibilities, and the information systems and paperwork that support it. The planned completion is June 2009.
- 224 Network Rail has removed the redundant rail greaser from the vicinity of Grosvenor Road Bridge.
- 225 In January 2008, Network Rail introduced a trial of a 'Manager's Notebook'; it has now been introduced as a formal process for all infrastructure managers. It is designed to record site visit findings and to share these constructively with the staff involved.
- 226 Network Rail has affixed limited clearance warning signs to the parapets of Grosvenor Road Bridge.

Recommendations

227 The following safety recommendations are made:⁹

Recommendations to address causal, contributory and underlying factors

The following recommendation was made by the RAIB as a result of the investigation into track worker injury at Leatherhead on 29 August 2007 (Recommendation 5, RAIB report 19/2008¹⁰).

*'Network Rail should review the implementation of mechanised inspection techniques for plain line with the objective of ending or reducing the practice of foot patrolling under traffic.'*¹¹

This recommendation addresses the factor identified in paragraph 216. It is therefore not remade so as to avoid duplication.

- 1 The Network Rail should propose a change to the Rule Book, in accordance with the Group Standards code, so that all members of a work group have the responsibility to ensure that they receive a full briefing prior to signing the COSS form (paragraph 210b).
- 2 In order to reduce the risk to track workers, Network Rail should review their programme for provision of automatic warning systems for red zone track inspections and if practicable should implement a programme to accelerate the introduction of appropriate systems for multi track areas (paragraph 216).
- 3 Network Rail should review the derogation that safety helmets need not be worn at all times during basic visual track inspection (paragraph 210c).

continued

⁹ 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 Regulation (ORR) to enable them to carry out their 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 can be found on RAIB's web site at www.raib.gov.uk.

¹⁰ RAIB reports are available at the RAIB web site, www.raib.gov.uk

¹¹ This recommendation is associated with a recommendation from the RAIB's investigation into the derailment at Grayrigg on 23 February 2007 (recommendation 19, RAIB report 20/2008, the text of which is not duplicated here).

- 4 In order to verify their effectiveness, Network Rail should monitor recently introduced processes that will show whether an individual's on-the-job performance routinely achieves the prescribed level with regard to safety. If necessary these processes should be enhanced (paragraphs 222 and 225).

Recommendations to address other matters observed during the investigation

- 5 In order to reduce the risk to track inspection staff, Network Rail should propose a change to the Rule Book and the COSS Handbook, in accordance with the Group Standards code, that amends the procedures for red zone working with lookout protection in a multi-track area to:
- Clearly define an approaching train.
 - Clarify the criteria for setting up a safe system of work, including the circumstances that require pre-planning. Consideration should include:
 - a) the practical capabilities of lookouts;
 - b) the possibilities for human error and its consequences;
 - c) the ability to identify the track a particular train is using;
 - d) the likelihood of multiple train movements;
 - e) the complexity of track layout;
 - f) the nature of the work being undertaken; and
 - g) the size and disposition of the work group for continued observation by the lookout
 (paragraphs 213).¹²
- 6 In advance of any change to the Rule Book and COSS Handbook under Recommendation 5 and to provide clear and unambiguous safety instructions and/or guidance, Network Rail should either eliminate the current practices used in relation to staff not moving to a position of safety but remaining in a location where they do not believe they are in danger from a train moving towards their site of work, or should introduce formally risk assessed alternatives for setting up a safe system of work in a multi-track area. The risk assessment should consider the topics listed in Recommendation 5.
- 7 Network Rail should validate the process and systems used to provide safety information for the COSS pack to show that its output is correct and complete (paragraph 215).

continued

¹² These recommendations are associated with the recommendations from the RAIB's investigations into a near miss of a track worker at Tinsley Green Junction on 17 March 2007 (Recommendations 2 and 3, RAIB report 43/2007), and into a track worker fatality at Ruscombe Junction on 29 April 2007 (Recommendation 1, RAIB report 4/2008). Those recommendations only concerned an 'approaching train' in conjunction with facing points.

- 8 Network Rail should identify and correct the apparent inconsistencies within the Sectional Appendix relating to maximum permitted train speeds on the approaches to Victoria station (paragraph 215).
- 9 In order to ensure that staff allow an appropriate time to reach a position of safety, Network Rail should arrange to rebrief appropriate staff working on the railway so that they are reminded of the risks posed by areas of limited clearance such as the raised bridge parapets on the lines over the Grosvenor Road Bridge (paragraph 215).

Appendices

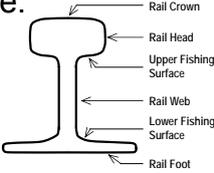
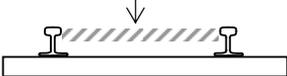
Appendix A - Glossary of abbreviations and acronyms

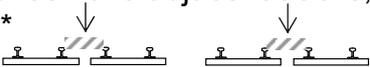
ch	Chain (imperial unit of measurement equating to 1/80 of a mile) (20.12 m)
COSS	Controller of Site Safety
CWR	Continuously Welded Rail
ELLIPSE	Former computer system for works management, now called MIMS
MIMS	Minicom Information Management System
ORR	Office of Rail Regulation
PTS	Personal Track Safety
RAIB	Rail Accident Investigation Branch
RIMINI	<u>Risk Minimisation</u>
RSSB	Rail Safety and Standards Board
SSOWPS	Safe System of Work Planning System

Appendix B - Glossary of terms

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

Assessment-in-the-line	Process for ensuring competence for Network Rail staff
Ballast	Crushed stone, nominally 48 mm in size and of a prescribed angularity, used to support sleepers, timbers or bearers both vertically and laterally
Blocked	Preventing trains from moving by placing or maintaining signals at danger
Bullhead rail	The former standard Rail Section in Britain.*
Cess	The part of the track bed outside the ballast shoulder that is deliberately maintained lower to aid drainage, provide a path and a Position of Safety.*
Chairs	A cast or fabricated support for bullhead rail.*
Coasting	Removing power from a traction unit and allowing the train to continue under its own momentum.*
Conductor rail	An additional Rail used to convey and enable collection of electrical Traction Current at Track Level. Conductor Rail systems carry voltages of the order of 750 Volts.
	
Continuously welded rail	On Network Rail, a rail of length greater than 36.576m (120'), produced by welding together standard rails or track constructed from such rails.*
Controller of Site (COSS)	A Safety Critical qualification demonstrating the holder's Safety competency to arrange a Safe System of Work, i.e. protecting staff working on the Line from approaching Trains.*
COSS pack	A pre-prepared information pack supplied to a COSS containing all the documents that the COSS should require.
DC traction supply	The direct current (DC) power supply to the conductor rails.
Down	In a direction away from London.*
Electric multiple unit	A multiple unit train whose motive power is electricity supplied externally from overhead line equipment (OLE) or conductor rails.*
Emergency brake	The (abnormal) full application of all available braking effort. The target value for this for a Heavy Rail vehicle is 1.176 m/s ² . A more normal occurrence is Service Braking.*
Emergency isolation	An Isolation of the traction current system without prior planning, typically in response to an accident.*

Flatbottom (rail)	A rail rection having a flat based rail foot or flange.*	
Four-aspect colour light signal	A signal which conveys movement authorities to train drivers by means of coloured lights; green (proceed), double yellow (preliminary caution), single yellow (caution) and red (stop).	
Four-foot	The area between the two running rails of a standard gauge railway.*	
Green zone	A safe place of work, free from trains, but on or near the line. Such an area can be created by: <ul style="list-style-type: none"> ● safeguarding, that is stopping all train movements by taking some form of possession; ● fencing the area off with blue netting or black and yellow tape ● separating the area from the running line by 2 m (6' 6"); and appointing a site warden to ensure all staff stay within the safe area. <p>The opposite is a red zone.*</p>	
Hazard directory	A database maintained by Network Rail which contains details of the health, safety and environmental hazards known to exist on Network Rail controlled infrastructure.*	
Keys	A shaped wedge of spring steel, oak or teak that secures a bullhead rail in a chair.*	
Limited clearance	An area where there is insufficient space to stand safely during the passage of trains on the adjacent line. These areas are normally marked by a red and white chequered sign.*	
Line speed	The maximum speed at which trains may run when not subject to any other restriction *	
Lookout	A competent person whose duties are to watch for and to give an appropriate warning of approaching trains by means of whistle, horn or warning siren.*	
Mentoring	The process of giving a newly qualified trainee practical experience under supervision.	
On-train data recorder	A data recorder fitted to traction units collecting information about the performance of the train including speed, throttle and brake control positions, activations of horn, DSD and AWS cancel button, etc.*	
Plain line	Track without switches and crossings.	
Personal Track Safety (competence)	The minimum level of competence for workers to go on to the track.	

Position of safety	A place far enough from the track to allow a person to safely avoid being struck by passing trains. On Network Rail infrastructure this is 1.2 m (4 feet) at speeds up to and including 100 mph.*
Personal protective equipment	Safety equipment issued by a company to employees for their use in a hazardous environment.
Protection	Methods of ensuring the safety of staff working on or near the line by preventing trains from running.
Rail greaser	A device for delivering a measured quantity of lubricant (generally grease) onto the running edge of a running rail in order to reduce the friction between the rail and wheel flange on curved track.*
Red zone	An area not protected from train movements that is on or near the line and is too close to lines open to traffic to be a green zone. Red zone working can only be used if there is no realistic alternative and is banned in some situations.*
Reporting number	A four character alpha-numeric identifier for a particular train service, irrespective of the vehicle numbers that form the train.
Route knowledge	Before any driver can drive a train along a particular route, they must first learn the locations of junctions, stations, signals, permissible speeds, etc. This is route knowledge.*
Sectional Appendix	A Network Rail publication that contains essential information about the line.
Sighting distance	The distance from the site of work at which trains must be seen in order to give adequate warning time to those on site when working on an open line
Six-foot	The colloquial term for the space between two adjacent tracks, irrespective of the distance involved * 
Step 3 (brake application)	<p>The different positions on the driver's brake controller representing progressively greater brake demands, e.g. brake step 1 is typically equivalent to a retardation rate of 0.3 m/s², brake step 2 to a retardation rate of 0.6 m/s² and brake Step 3 to a retardation rate of 0.9 m/s².*</p> <p>Step 3 is usually reserved for urgent braking requirements.</p> <p>There is also an emergency brake step which applies all available braking effort.</p>
T2 protection	A temporary stoppage of rail traffic as allowed for in Module T2 of the Rule Book.
Track circuit block	A signalling system where the line beyond is proved clear to the end of the overlap beyond the next signal using track circuits.*
Track geometry	The horizontal and vertical alignment of the track.*

Traction knowledge	The requisite level of understanding a driver must have to be authorised to operate a specific type of traction unit.
Troughing	U-section trough units with lids used to protect and manage lineside cables.*
Up	In a direction towards London.*
Warning distance	The minimum distance at which it is necessary to give a warning which gives everyone in the workgroup time to reach a position of safety at least ten seconds before the train arrives.*
Warning time	The amount of time a particular group working on an open line require to stop work, make the site safe and move to a position of safety when warned of the approach of a train.*

Appendix C - Key standards

GE/RT8000	Rule Book
NR/L3/TRK/1015 (issue 1)	Management of Track Patrolling Activity
NR/L3/TRK003	Track Maintenance Handbook
NR/SP/TRK/001 (issue 2, October 2006)	Inspection and Maintenance of Permanent Way
NR/SP/OHS/021	Personal Protective Equipment and Workwear
NR/SP/OHS/069	Lineside Facilities for Personnel Safety (formerly RT/CE/S/069)
RS502	COSS Handbook
RT3170 Issue 6	Personal Track Safety Handbook.
RT/CE/S/103	Track Inspection Requirements
Green Zones: Thinking Strategically	Green Zone: Thinking Strategically, a report by the RSSB. This can be downloaded from: www.rssb.co.uk/pdf/reports/research/ Green%20Zones%20-%20Thinking%20 Strategically.pdf

Appendix D - Track worker accident statistics

Year	Track worker fatalities	Type of accident (excludes road accidents)
2008	2	Struck by platform (x1) Fall from height (x1)
2007	2	Struck by train (x2)
2006	0	
2005	3	Struck by train (x3)
2004	8	Struck by road-rail vehicle (x2) Struck by runaway trolley following deliberate tampering with braking system (x4) Fell down tunnel shaft (x1) As consequence of collision (x1)
2003	3	Struck by plant (x1) Electric shock (x2)
2002	2	Crushed by load (x1) Electric shock (x1)
2001	4	Struck by train (x4)
2000	2	Struck by train (x2)
1999	2	Struck by train (x2)
1998	5	Struck by train (x3) Off-track (x1) Electric shock (x1)

Table 3: Number of track worker fatalities on Network Rail infrastructure

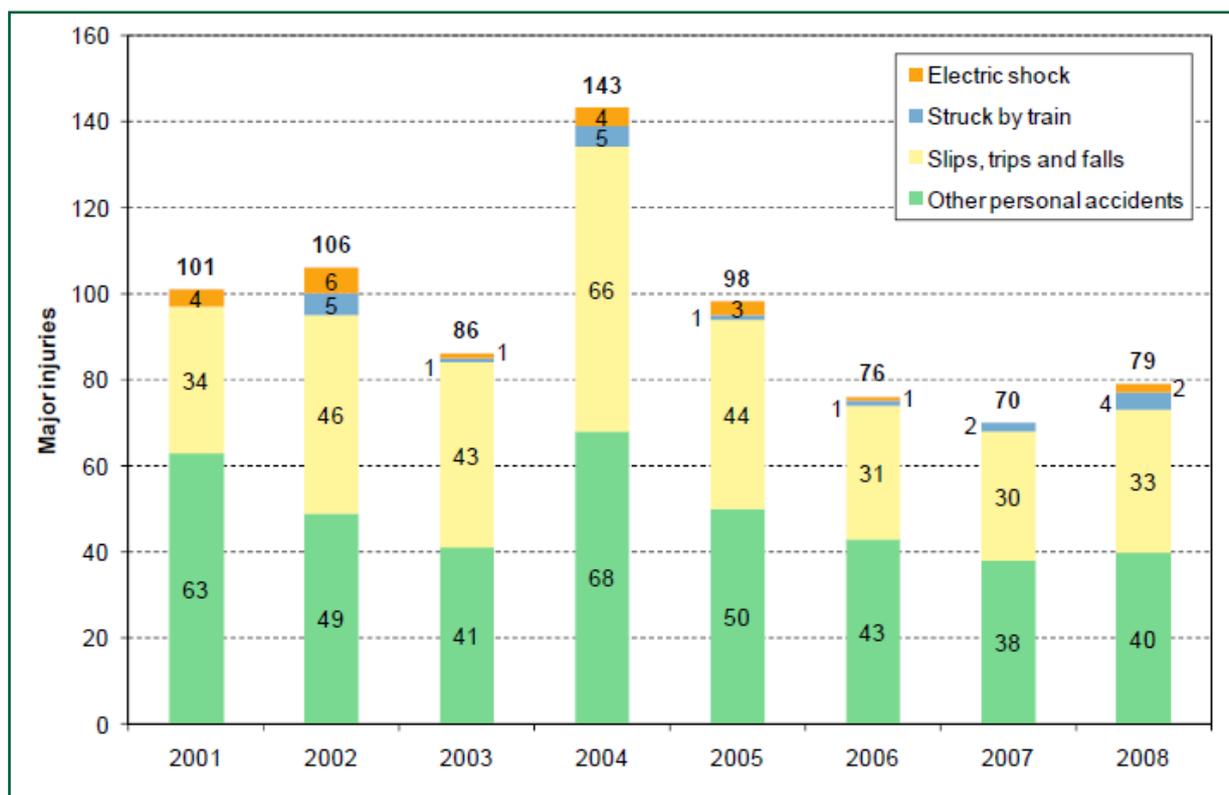


Table 4: Track worker major injury rates for the last five years (extract from RSSB Annual Safety Performance Report 2008)

Year	Track inspection team members struck by trains	Consequences of the accident
2008	0	
2007	2	2 x major injury
2006	1	1 x major injury
2005	2	2 x fatal injury
2004	1	1 x major injury
2003	1	1 x minor injury
2002	1	1 x minor injury
2001	1	1 x fatal injury
2000	1	1 x fatal injury
1999	2	1 x fatal, 1 x major injury

Table 5: Track inspection accident rates for the last ten years (extract from data supplied to the RAIB by the RSSB)

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