RAIB

Rail Accident Investigation Branch

Rail Accident Report

Trackworker struck by train, Stevenage
7 December 2008

Department for Transport

Report 23/2009
August 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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This report is published by the Rail Accident Investigation Branch, Department for Transport.

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Contents

Preface

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.

Definitions

3 All mileages are measured from a zero datum at London King's Cross.

4 The up direction is towards London King's Cross and the down direction towards Edinburgh.

5 Throughout this report the member of staff who was injured is referred to as 'trackworker A'.

6 Appendices at the rear of this report contain the following glossaries:

- acronyms and abbreviations are explained in Appendix A; and
- technical terms (shown in *italics* the first time they appear in the report) are explained in Appendix B.

Summary of the report

Key facts about the accident

7 At about 17:35 hrs on 7 December 2008 a trackworker came into contact with a train passing a site at which track relaying was taking place at Stevenage in Hertfordshire.

8 The trackworker was taken to hospital for treatment of his injuries which were not life threatening.

9 The relaying was temporarily suspended for the *Safe Systems of Work* in place to be reviewed, leading to a delay in the re-opening to rail traffic of the line being repaired.

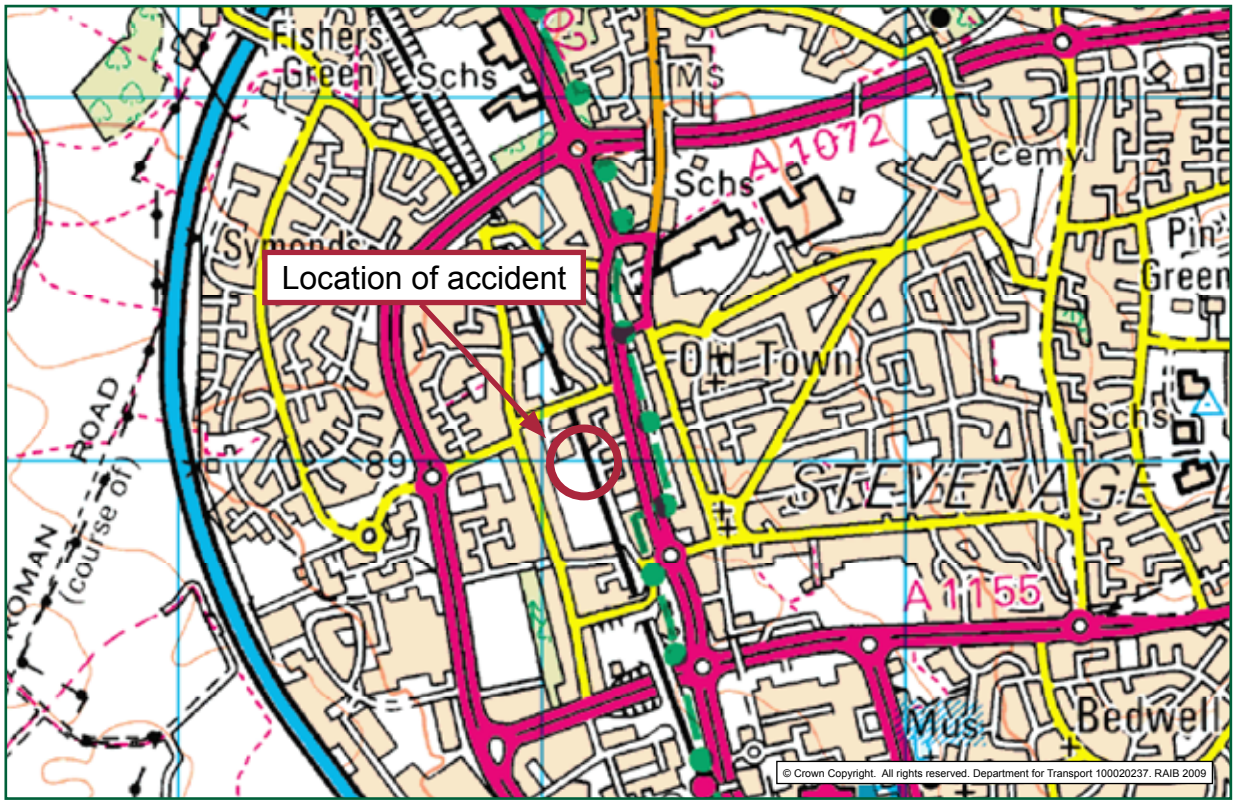

Figure 1: Extract from Ordnance Survey map showing location of accident

Immediate cause, causal and contributory factors, underlying causes

10 The immediate cause of the accident was trackworker A moving out of the *position of safety* to a point where he could come into contact with the train.

11 Causal factors were that:

- no fence or *Site Warden* was provided at the edge of the *Separated Green Zone* despite staff being required to work less than 3 metres from the up slow line;
- the planning process was insufficiently detailed to identify all the hazards and adequate Safe Systems of Work. No details of the operation of the *Trac Rail Transposers*, or the requirement for a Site Warden, were given on the *Task Briefing Sheet* or *COSS Record of Arrangements and Briefing Forms*;

- when the Trac Rail Transposers started working, the system of work established by the *Controller of Site Safety* (COSS) became unsuitable and was not adapted;
- staff involved in the accident had not received instruction in working in the proximity of Trac Rail Transposers;
- there was insufficient liaison between the Engineering Supervisor and the COSS whose team was working in the area to be occupied by the Trac Rail Transposer;
- trackworker A was unaware that the Trac Rail Transposers had stopped working for the passage of the train;
- the site lighting was obscured by the passing train so that trackworker A could not see the position of the rail being moved by the Trac Rail Transposers; and
- Jarvis did not request the provision of a Site Warden when requesting manpower from Infra Safety Services Labour.

12 A contributory factor was that Jarvis did not indicate to Infra Safety Services Labour that the site would not be fully lit during the passage of a train on the up slow line, as it was intended to install the lighting between the up slow and up fast lines, and therefore Infra Safety Services Labour did not provide their staff with hat lamps.

Severity of consequences

13 Trackworker A sustained injury to several vertebrae and severe bruising to the back.

14 Suspension of the work at the accident site while trackworker A was removed to hospital led to the *possession* over-running by some three and a half hours.

Recommendations

15 Recommendations can be found in paragraph 128. They relate to the following areas:

- pre-planning and dissemination to Controllers of Site Safety of the Safe Systems of Work to be used;
- hazard identification and risk assessment in connection with the use of Trac Rail Transposers;
- communication with Controllers of Site Safety at work sites;
- conditions under which fences to protect staff at work sites may be erected;
- the provision of lighting; and
- the use of Trac Rail Transposers and similar equipment in close proximity to lines open to traffic.

The Accident

Summary of the accident

16 While standing between the up fast and up slow lines north of Stevenage station, a trackworker, employed on the renewal of the up fast line, came into contact with a slow moving train on the up slow line. He sustained severe bruising to his back and damage to vertebrae.

The organisations involved

17 The infrastructure manager is Network Rail and the work was being carried out by Jarvis Rail, one of its main contractors.

18 The trackworker's team was employed by Infra Safety Services Labour Ltd under contract to Jarvis Rail.

19 The Trac Rail Transposers used to position the new rails were supplied and operated by W&D McCulloch, also under contract to Jarvis Rail.

20 Network Rail, Jarvis Rail, National Express East Coast, Infra Safety Services Labour Ltd. and W&D McCulloch Rail freely co-operated with the investigation.

Location

21 The accident occurred on the East Coast Main Line from London to Edinburgh some 1000 yards north of Stevenage station, 28 miles from London.

22 This section of route runs approximately North to South and is laid with four lines. The fast lines are between the slow lines so that from West to East the lines are down slow, down fast, up fast and up slow (see Figure 2).

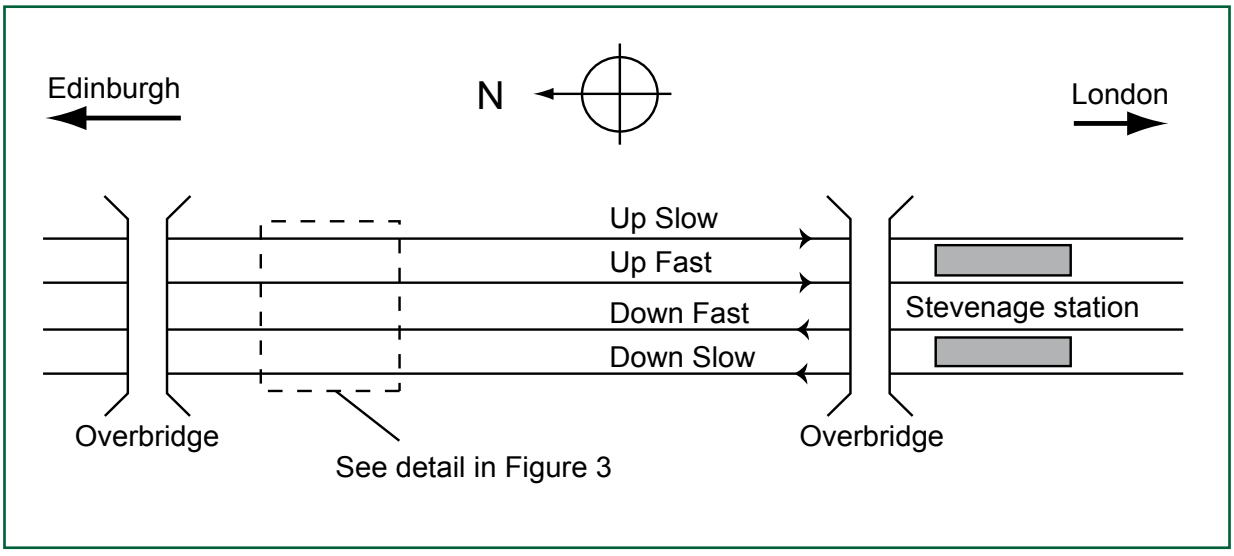

Figure 2: Diagram of the lines at the location of the accident

External circumstances

23 The weather was cold, clear and dry, and had no bearing on the accident.

24 The site is in a built-up area, but very little light reaches it from outside the railway boundary during the hours of darkness, necessitating the provision of temporary lighting at the work site.

Train

25 The train involved was 1A35, the 15:40 hrs Leeds to London King's Cross, operated by National Express East Coast.

The work site

26 As part of the planned maintenance of the East Coast Main Line, arrangements were made for a section of the up fast line north of Stevenage to be re-laid during the weekend of 6/7 December 2008.

27 To enable this work to take place the up and down fast lines between Knebworth and Hitchin were closed to traffic and included within a possession[1]. The up and down slow lines remained open to traffic and were on either side of the site of the work.

28 At the time of the accident the site of the work activities encompassed the fast lines for a distance of some 350 yards between the two road-over-rail bridges north of Stevenage station.

29 To enable work to continue during the hours of darkness, temporary lighting was provided. It was placed in the up *cess* outside the up slow line as there was not enough room between the up lines directly adjacent to the work site.

Applicable rules

30 The rules related to the protection of staff working on or near the line are defined in module T7 of the *Rule Book* (*Railway Group Standard* GE/RT8000).

31 These rules permit work to take place adjacent to a line that is open to traffic provided a fence is provided at the boundary of the work site (a *Fenced Green Zone*).

32 Where is it not practicable to provide a fence, work should take place within a Separated Green Zone. The Separated Green Zone arrangements permit work to take place adjacent to a line that is open to traffic provided there is a distance of at least 3 metres between the boundary of the work site and the nearest rail of the line that is open to traffic. This minimum distance is reduced to 2 metres if a Site Warden is provided to monitor the movement of a group of staff and to warn them should they go too close to a line that is open to train movements.

[1] Also known as an engineering possession. Possession of lines is taken in accordance with rules laid down in module T3 of the Rule Book.

33 Only in the event that Separated Green Zone working cannot be achieved is it permitted for staff to work on or near a line that is open to traffic. This form of working is known as *Red Zone* working and is based in the principle that staff must immediately move to a position of safety when warned of the approach of a train.

The staff involved

34 The team, including trackworker A, was employed by Infra Safety Services Labour Ltd as trackworkers, comprising a qualified COSS and five other staff, one of whom was certified to act as a Site Warden but had not been tasked to act in that capacity. The staff frequently worked together and their previous duty had been at Kentish Town, finishing at 06:00 hrs on Friday 5 December. They had arrived at Stevenage at midday on Sunday 7 December.

35 On this occasion, their duties were to load sleepers from the engineering train onto the track relaying train, which moved to a position opposite to where the sleepers were to be laid, unload them, locate them on the *ballast* and attach the newly positioned rail to the rail already in place.

36 The person acting as COSS was also leading the team.

37 The COSS and the team were all subject to work instructions given by the Engineering Supervisor in charge of the work site.

Events preceding the accident

Work taking place

38 An additional possession was taken at 01.30 hrs on Sunday 7 December of the up and down slow lines at Stevenage to enable machinery to be brought onto the site south of Stevenage station across the up slow line. Once the machinery was in place, the possession of the slow lines was given up at 05.30 hrs to enable rail traffic to pass during the day.

39 After the rails and sleepers of the up fast line had been removed the new sleepers were brought in at the north end of the site from an engineering train standing on the up fast line. A relaying train on the down fast line lifted the sleepers from the engineering train and placed them in position on the ballast ready for the rails to be laid on them.

40 When the sleepers had been aligned accurately by a team of trackworkers the rails were moved onto them using the Trac Rail Transposers. A Trac Rail Transposer straddles the rail and lifts it a small distance sufficient to clear any obstacles close to the ground.

41 Once the rail was in position on the sleepers, *fishplates* temporarily clamped it to the adjacent rail already in place to provide the continuous surface on which trains run safely. A welded joint later replaced this temporary joint.

Protection of staff and train movements

42 The work activities near Stevenage on 7 December 2008 were being protected by means of the Separated Green Zone arrangements. No Site Warden had been appointed for the team of staff which included trackworker A. Without a Site Warden, the Rule Book requires the boundary of the Separated Green Zone to be 3 metres or more from the nearest line open to rail traffic.

43 A system to give an audible and visual warning on the approach of a train had been installed on the up slow line. This system, known as the *Automatic Train Warning System* (ATWS), was to warn the staff operating the rail vehicles to stop working and lower any loads to ensure the safe passage of trains on the open line. This procedure was designed to prevent the load swinging and coming into contact with the passing train.

44 Although the ATWS was not specifically provided to warn staff who had moved outside the Separated Green Zone to move to a position of safety clear of the up slow line, it was used for this purpose.

45 The staff planning the work applied a *Temporary Speed Restriction* of 20 mph to the up slow line adjacent to the work site as an additional precaution, because of its proximity to where staff were working.

Events during the accident

46 The COSS briefed his team that their work was to take place in a Separated Green Zone that the Engineering Supervisor had established on the fast lines.

47 However, the COSS had recognised that the work activities would require his team to work closer to the up slow line than was permitted by the rules. Consequently, he also briefed his team that when they heard the audible warning from the ATWS they should move into the *four foot* of the up fast line, the line that was being re-laid (this meant that the up slow line was treated as being a Red Zone adjacent to the Separated Green Zone).

48 By about 17:30 hrs the relaying train had moved to the south end of the site to enable two Trac Rail Transposers to move a section of rail into position on the side of the up fast line adjacent to the up slow line.

49 At this time the team members had become separated by their work activities. Some were at the engineering train shown in Figure 3, some by the relaying train and one member of the team, trackworker A, was standing close to the rail end to which the new rail was to be attached. Consequently he had to stand aside from the length of rail being positioned by the Trac Rail Transposers. This resulted in him standing, with a small group of other track workers, in the space between the up fast and up slow lines.

50 The ATWS activated to warn of the approach of a train on the up slow line and the Trac Rail Transposers stopped working as a precautionary measure during its passage.

51 The train driver maintained the train's speed at 20 mph in accordance with the Temporary Speed Restriction and sounded the train's horn intermittently while passing the site.

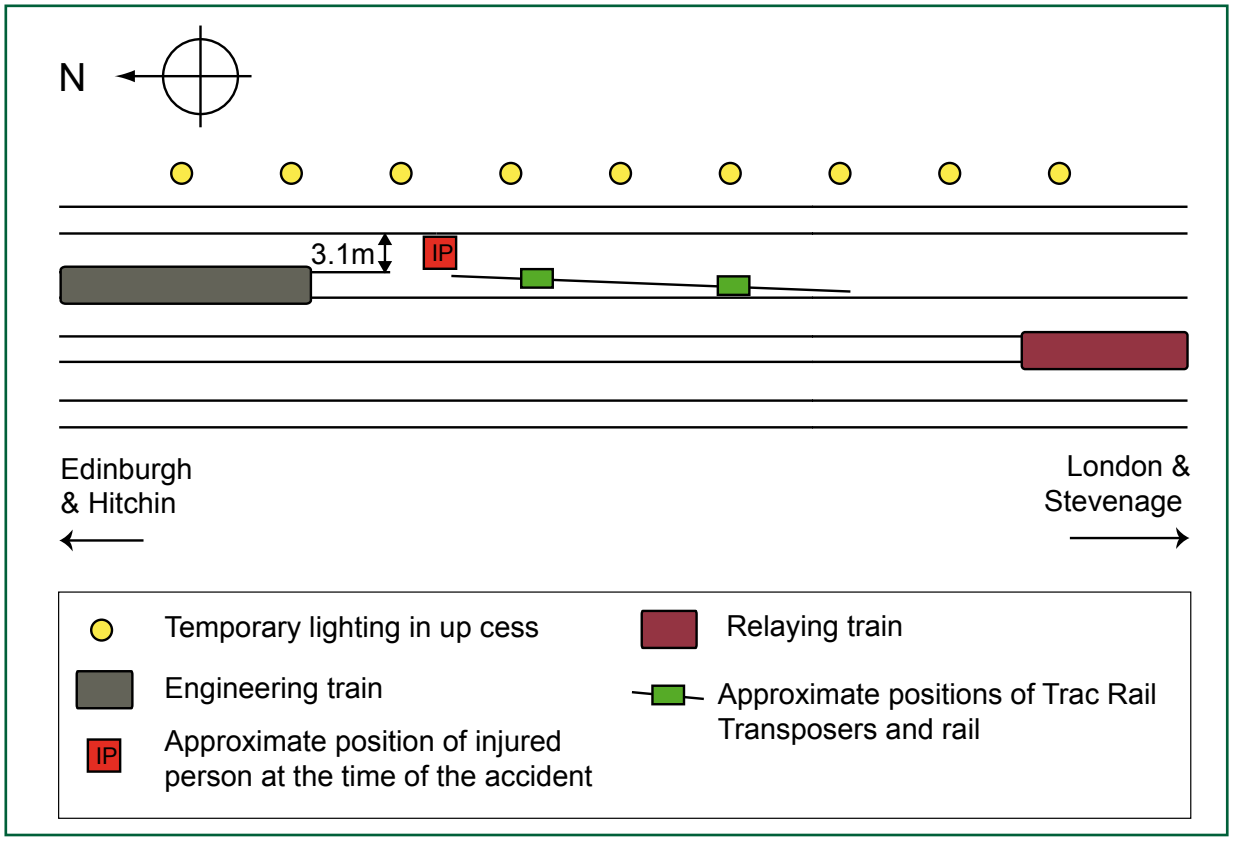

Figure 3: Diagrammatic representation of the site at the time of the accident

52 As the train passed, it obscured the temporary lighting placed in the up cess. The site adjacent to the train was now only lit by the limited light shining through the train windows.

53 Trackworker A could not move into his designated position of safety (see paragraph 47) as the Trac Rail Transposers were now working there, so he remained in the area between the up lines facing away from the passing train.

54 Trackworker A, who was not aware that the Trac Rail Transposers had temporarily stopped working, now became concerned that the rail being moved might swing unexpectedly and strike him. He felt that the position he was in was no longer safe as he was unable to see the exact location or movement of the rail being positioned. He has since stated that as soon as the train had passed he had intended to alert the COSS that the designated position of safety was no longer safe. As an immediate measure, he decided to establish how far back he could move towards the up slow line to get away from the Trac Rail Transposers.

55 He began to turn to his left to see how much space remained between him and the passing train when he came into contact with it and fell to the ground towards the up fast line. The other trackworkers standing near him were far enough from the train not to come into contact with it.

Consequences of the accident

56 The Engineering Supervisor in overall charge of the site arranged for the up slow line to be blocked to traffic and for the emergency services to be called.

57 Paramedics attended to trackworker A who was taken to hospital in Stevenage where severe bruising and damage to vertebrae were diagnosed.

58 The local Jarvis manager stopped all work within the site to review the systems of work in use to ensure that they were safe and in accordance with the Rule Book.

Events following the accident

59 A significant proportion of the train had already passed trackworker A when it struck him. The driver was not aware of the accident and continued his journey normally to Kings Cross.

60 Steps were taken to ensure that Site Wardens had been appointed to all the teams working at the site before work was allowed to be resumed.

61 The interruption to the work resulted in the possession being given up some three and a half hours later than planned, with some disruption to the train service on the morning of Monday 8 December.

The Investigation

Sources of evidence

62 These comprise:

- witness evidence;
- site visit;
- discussions with senior and local Jarvis management and the *Rail Safety and Standards Board*;
- documents retained in Jarvis's site file; and
- observation of Trac Rail Transposers in use.

Key Information

The site

General situation

63 Where the accident occurred the railway is straight. During normal running of the railway there is clear visibility of the approach of trains.

64 The distance between the adjacent rails of the up lines at this location is 3.1 metres.

Site lighting

65 Temporary lighting was installed to enable work to continue after dark. Originally this had been placed in the space between the up lines. It was not sufficiently stable there for the staff to be confident that the lights would not fall into the working area or onto the nearer rail of the up slow line.

66 During Sunday 7 December the lighting was moved from the space between the up lines to the cess on the up side.

67 In this position the temporary lighting provided adequate illumination of the work site, except when a train passed on the up slow line when the site was thrown into shadow and only lit by lamps mounted on machinery or carried by some staff.

Documentation

68 A primary source of information to staff at the work site was a Jarvis document known as the Task Briefing Sheet. This sheet explained the nature of the site, the work to be done and the overall protection arrangements in place. It detailed the general and specific hazards associated with the site, the emergency contact details of control offices and the local hospital, and the work to be done. It indicated the trains and mechanical plant to be used and the times of the start and finish of the possessions. While it described the possession, it did not specify to each COSS the Safe System of Work to be operated.

69 The Task Briefing Sheet did not contain any reference to a Site Warden.

Planning and provision of manpower

70 The Jarvis planners were certificated as competent in accordance with Network Rail Standard NR/L2/OHS/019 to plan the work and the necessary possession.

71 They had given consideration to the provision of a fence between the lines when the work was being planned. Such provision was rejected because the distance between the up lines was less than that understood to be required by the Rule Book for a fence to remain in place while both lines were open to traffic at their respective speeds for normal operation. This perceived limitation on the erection of a fence therefore prevented it taking place during an earlier possession and would have necessitated its erection and removal during the main possession. This would have delayed the start of work and/or necessitated the engagement of additional staff for a short period to erect and remove the fence within the time allowed for the possession.

72 The planning staff in the local depot assessed the manpower needed in terms of skills, numbers of staff and the times at which they were required.

73 The planners submitted their assessment to Jarvis's headquarters which collated the requirements for a particular weekend and then completed and submitted Manpower Request Forms to the contractors who were to supply the staff.

74 The Manpower Request Form specified the skills required both in terms of technical capability and also in terms of *track safety competency*.

75 When the Jarvis staff in the Peterborough office developed the work plan, they assumed that the protection of the Infra Safety Services Labour team would use one of the Site Wardens which were to be provided to protect one of the other teams working at the site. The RAIB has no evidence that this planning assumption was recorded or notified to the Engineering Supervisor or COSS.

76 The local planners submitted a request for the provision of a COSS and five staff to unload and place sleepers, and to attach the rail to the section already in position, for 12 hours from 12:00 hrs on Sunday 7 December at Stevenage. Jarvis headquarters submitted this request to Infra Safety Services Labour without alteration.

The team

77 The team supplied by Infra Safety Services Labour comprised the COSS and five others. This was in accordance with the request for manpower provision made by Jarvis.

78 The individuals were well known to each other and had worked together frequently before that day. Their previous period of duty had ended at 06:00 hrs on Friday 5 December, some 54 hours before they reported for duty at Stevenage.

79 All held *Personal Track Safety* (PTS) certification.

80 In accordance with the procedures for achieving controlled safe access to a work site, the team presented their PTS cards at the *Site Access Cabin*, were registered as entering the site by the *Site Access Controller* and signed the *Site Access Register*. Signing the register is an acknowledgement that the signatory has received and understood the briefing given by the Site Access Controller. This briefing comprises basic instructions about the condition of the site and general safety arrangements. It is taken from a sheet completed towards the end of the planning process by the Jarvis staff at the local depot and provided by them to the Site Access Controller.

81 Trackworker A was initially thought to be more seriously injured than was the case, and consequently was not screened for the presence of drugs or alcohol.

82 The RAIB has no evidence of any medical or other factors likely to have influenced his behaviour. No witnesses reported observing any unusual behaviour.

The COSS

83 The COSS was directly in charge of the team but subject to instructions given by the Engineering Supervisor in charge of the work at the site. With the team, he had been instructed by Infra Safety Services Labour to report to Stevenage to assist with track relaying work.

84 The COSS obtained a copy of the Task Briefing Sheet and a COSS Record of Arrangements and Briefing Form (COSS Form) at the Site Access Cabin. On reaching the relaying site the Engineering Supervisor briefed the COSS on the work his team was to carry out. The Engineering Supervisor did not give the COSS any indication of the availability of Site Wardens or that one might be needed to provide protection from train movements on the up slow line, nor did the COSS request that a Site Warden be provided.

85 Neither the Task Briefing Sheet nor the COSS Form indicated any specific Safe System of Work to be used. The COSS Form had not been partially completed by the planners and therefore contained no information specific to the work site.

86 Using the information on the Task Briefing Sheet, the COSS filled in the COSS Form recording the Safe System of Work he set up as a 'Separated Green Zone'. The COSS did not tick the box on the COSS Form which would have indicated the use of a 'Red Zone with ATWS'.

Operation of the Trac Rail Transposers

87 Trac Rail Transposers are used to move rail which has already been placed on the ground within the site. Each travels on a pair of caterpillar tracks and straddles the rail to be moved. The rail is lifted only the minimum distance necessary for it to clear any obstacles.

88 One operator stands by each Trac Rail Transposer to control it. For the Trac Rail Transposer to operate, the controller has to hold a spring loaded control lever away from its neutral position. Should he release the lever, any movement, including raising or lowering the rail, will cease. Although Trac Rail Transposers often operate in pairs and in conjunction with each other, each is independently controlled by its own operator.

89 The rail being positioned can suddenly move laterally when it is lifted, particularly if it has been obstructed in its initial movement. Consequently, W&D McCulloch have imposed an 'exclusion zone' around each Trac Rail Transposer whenever it is moving rail, which can only be entered by the operator. This zone extends 5 metres in all horizontal directions and the Trac Rail Transposers carry a notice stating 'MAINTAIN 5M EXCLUSION ZONE'. The RAIB has found no evidence that staff other than those employed by W&D McCulloch are aware of the extent of the exclusion zone or that they have been briefed on its implications.

90 Although they are powered equipment, Trac Rail Transposers do not classify as rail vehicles because they run on their own caterpillar tracks rather than rails. They are not required by the Rule Book to stop working while a train passes a work site.

91 The Engineering Supervisor in charge of the work site instructed the Trac Rail Transposer operators directly to move the rail without reference to any of the other staff already working on the site.

Figure 4: A Trac Rail Transposer in use

92 There is evidence that, apart from the Trac Rail Transposer operators, none of the staff involved in the accident had received instruction on working in proximity to Trac Rail Transposers.

Analysis

Identification of the immediate cause[2]

93 The immediate cause of the accident was trackworker A moving out of the position of safety to a point where he could come into contact with the train.

Identification of causal[3] and contributory[4] factors

94 There were three principal factors leading to the accident:

1. the absence of a fence or Site Warden to prevent staff moving beyond the boundary of the Separated Green Zone;
2. trackworker A's concern about the possibility of being hit by the rail being moved by the Trac Rail Transposers, causing him to attempt to move further away from them, i.e. towards the up slow line; and
3. the blocking of trackworker A's position of safety by the Trac Rail Transposers.

Protecting staff from passing the limit of the Separated Green Zone

95 The absence of any form of guarding of the boundary of the Separated Green Zone between the up lines allowed trackworker A to stand too close to the up slow line. A probable loss of concentration and/or awareness caused him to believe he was further from the up slow line than he was.

Protection system applied

96 The Task Briefing Sheet indicates that the protection applied was 'T3 separated.' This is generally understood to indicate that a possession has been taken in accordance with section T3 of the Rule Book and that the work site within the possession is separated from lines open to traffic by at least 3 metres, or by 2 metres if a Site Warden is appointed, as specified in the Rule Book.

97 Witness evidence indicated that the COSS briefed that when hearing the ATWS indicating the approach of trains on the up slow line staff should move to the four foot of the up fast line. That in itself indicates that a form of Red Zone working was in place in respect of trains passing on the up slow line, though it was not indicated on the COSS Form.

98 The system of work established by the COSS was therefore a combination of Separated Green Zone and Red Zone working. Although not precluded by the Rule Book, this 'hybrid' method of working is not specifically defined.

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

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

[4] 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.

Permitted distance of the boundary of a Separated Green Zone from a line open to traffic

99 The Rule Book states that where there is no Site Warden or fence, the boundary of the Separated Green Zone must be not less than 3 metres from a line open to traffic. If a Site Warden is provided, the distance to the nearest open line can be reduced to 2 metres.

100 In this case the distance between the adjacent rails of the up fast and up slow lines was 3.1 metres. Therefore any work under Separated Green Zone conditions on the up fast line could not take place more than 10 cm from the outer edge of the rail adjacent to the up slow line, unless a Site Warden or fence were to be provided.

101 However, the work of placing the sleepers or of connecting new rail to that already in place required staff to work at a distance of less than 3 metres from the up slow line. Without a possession of the up slow line, or a fence between the up fast and slow lines, the COSS could have either appointed a Site Warden or applied Red Zone working. His choice of Red Zone working was influenced by the absence of a dedicated resource within his team to act as Site Warden, and the presence of ATWS providing a warning of approaching trains.

Absence of a fence

102 The provision of a fence had been considered and rejected during the planning of the work, as described in paragraph 71.

103 Nevertheless, the provision of a fence would have prevented trackworker A coming into contact with the passing train. The lack of a fence is considered causal to the accident.

104 Special arrangements agreed on the Western Territory of Network Rail have involved fences remaining in-situ when the distance between the rails is less than that mandated by the Rule Book. There may therefore be scope for installing fences at locations where it is currently considered that there is too little space for them to be left in place.

Lack of a Site Warden

105 Had a Site Warden been appointed, the edge of the Separated Green Zone could have been moved one metre nearer the up slow line, allowing work on the up fast line rail adjacent to the up slow to continue while a train passed.

106 A Site Warden would almost certainly have noticed if anyone moved outside the Separated Green Zone and instructed him to move back into it. That would have prevented the track worker standing where he would come into contact with a passing train. The absence of a Site Warden is therefore considered to be a causal factor.

107 Jarvis had not requested a Site Warden from Infra Safety Services Labour because it had been assumed that a Site Warden already on site would be made available to protect their staff. However, because staff had not been made aware of this planning assumption, it was not translated into the protection applied at the work site.

108 Consequently, the COSS perceived that he was not required to set up a Safe System of Work using a Site Warden. For this reason the absence of a request for Infra Safety Services Labour to provide a Site Warden and the inadequate information provided to staff are considered to be causal factors.

Information provided to the COSS

109 The provision of blank COSS Forms meant that the COSS was given no indication of the type of Safe System of Work to apply. The *COSS Handbook* (Section 4: 'Planning the safe system') states that a COSS will normally be issued with COSS Forms partially completed to the extent of containing the information given at the briefing by the Site Access Controller and including 'a pre-planned safe system.'

110 The Rule Book Module T7, Section 10.3 and Network Rail Standard NR/L2/OHS/019 state that in normal circumstances the Safe System of Work shall be provided to the COSS prior to the start of work. Only in exceptional circumstances shall the COSS be required to plan the safe system of work to be used.

111 The Task Briefing Sheet makes no mention of any Safe Systems of Work, so the COSS was required to develop his own. This was within the ability of a COSS, but it is possible that the absence of any mention of a Site Warden reinforced the perception in the COSS's thinking that one was unnecessary.

112 The planning process operated by Jarvis was insufficiently detailed to identify all the hazards and provide Safe Systems of Work. Had the task and the protection been correctly identified during the planning process and translated into suitable text on the COSS Form and/or the Task Briefing Sheet, it is likely that the COSS would have then been made aware of the need for a Site Warden. The absence of adequate planning for the task was a causal factor.

Trackworker A's concern about contact with the rail being moved

113 Trackworker A was aware that the rail was in the process of being moved into its final position on the up fast line. The darkness of the site as the train passed meant that he could not tell where the rail was or how it was moving. Had he been able to establish the situation of the rail, it is very likely that he would not have turned round and he would have been able to move away from the train. The obscuring of the lighting was a causal factor in the accident.

114 It was the practice of the operators of the Trac Rail Transposers to stop their working whenever a train passed the site. This is not an operational requirement as it is for some rail vehicles, but was done as 'good practice.' It ensured that the rail could not swing in precisely the manner which concerned trackworker A. However, trackworker A could not be aware that the Trac Rail Transposers had stopped working as their motors continued to run, albeit at idling speed[5]. If he had known that the Trac Rail Transposers had stopped working while the train passed, he would have been able to stand further from the up slow line. Trackworker A not knowing the Trac Rail Transposers had stopped work was a causal factor.

[5] It would not be reasonable to expect the injured person to have noted the change in the sound of their motors. To have been aware of the change would have required trackworker A to have been very familiar with the sound of them when working and when idling. The noise of the passing train would have also tended to mask any change in the sound of the Trac Rail Transposers' motors.

115 The site lighting was originally placed between the up lines, but was moved to the cess during the day of Sunday 7 December because the Engineering Supervisor considered it to be unstable. In its original position it would have lit up the area where the Trac Rail Transposers were in use and trackworker A would have noted that they were not working. He would have seen that it was safe for him to walk forward away from the passing train. Had the lighting been secured in a stable manner, it would not have been moved. During the investigation, the RAIB became aware of the availability of equipment which enables temporary lighting to be secured to a fence had one been installed (see paragraph 104).

116 Infra Safety Services Labour had not been advised that the site would be anything other than fully lit. They have stated that had they been so advised, they would have provided their staff with additional equipment such as hand lamps or hat lamps. If trackworker A had been in possession of a lamp, he may have been able to establish the exact location and movement of the rail and that the Trac Rail Transposers had stopped moving it. He may then have realised that he could move safely towards the work site away from the train. The non-provision of a portable lamp was a contributory factor.

The operation of the Trac Rail Transposers and their occupation of the position of safety

117 The Task Briefing Sheet identified the Trac Rail Transposers as equipment which would be used on the site, but gave no indication of the hazards arising from their use, nor of any precautions required. Therefore it gave the COSS no guidance on the effect of their use and he did not take it into account when setting up the Safe System of Work. The planners not taking account of the precautions required if Trac Rail Transposers are in use when developing the task was a causal factor.

118 The system of work set up by the COSS did not allow for the position of safety to be occupied by the Trac Rail Transposers, rendering it unsuitable when they started working.

119 The COSS stated the he did not actively seek information on when or where the Trac Rail Transposers would be working and he was neither advised that they were to start work, nor of the effect of their doing so. Consequently, the system of work was not adapted to take account of their operation. This may have been partly caused by the COSS being with the relaying train when the Trac Rail Transposers began work, but it indicates a lack of liaison between staff on the site. The lack of liaison between staff was a causal factor.

120 When Trac Rail Transposers are in use an exclusion zone of five metres should be set up around them, as indicated by a notice carried on each Trac Rail Transposer (see paragraph 89). It is usual for the Trac Rail Transposer operators to ensure that staff do not move into an unsafe position in relation to the rail being moved.

121 When a Trac Rail Transposer was placing rail on the up fast line, the exclusion zone of five metres would have extended to include at least one rail of the up slow line. As a matter of custom and practice rather than by instruction, as would apply to some on-track machinery, the Trac Rail Transposers lowered the rail to the ground when the ATWS was activated, but because their motors were still running, the exclusion zone remained in place.

122 If the system of work had been adapted to take account of the operation of the Trac Rail Transposers, or the exclusion zone had been enforced, staff would have been prohibited from standing between the up lines while the Trac Rail Transposers were working and the accident would not have occurred. Not adapting the system of work was causal.

Conclusions

Immediate cause

123 The immediate cause of the accident was trackworker A moving out of the position of safety to a point where he could come in contact with the train (paragraph 93).

Causal factors

124 Causal factors were that:

a. No fence or Site Warden was provided at the edge of the Separated Green Zone despite staff being required to work less than 3 metres from the up slow line (paragraphs 103 and 106, Recommendations 1 and 4, action taken paragraph 127).

b. The planning process was insufficiently detailed to identify all the hazards and adequate Safe Systems of Work. No details of the operation of the Trac Rail Transposers, or the requirement for a Site Warden, were given on the Task Briefing Sheet or COSS Forms (paragraphs 108, 112 and 117, Recommendations 1 and 2).

c. When the Trac Rail Transposers started working the system of work established by the COSS became unsuitable and was not adapted (paragraph 122, Recommendations 1, 2 and 3).

d. Staff involved in the accident had not received instruction in working in the proximity of Trac Rail Transposers (paragraph 117, Recommendation 2).

e. There was insufficient liaison between the Engineering Supervisor and the COSS whose team was working in the area to be occupied by the Trac Rail Transposer (paragraph 119, Recommendation 3).

f. Trackworker A was unaware that the Trac Rail Transposers had stopped working for the passage of the train (paragraph 114, Recommendation 2).

g. The site lighting was obscured by the passing train so that trackworker A could not see the position of the rail being moved by the Trac Rail Transposers (paragraph 113, Recommendation 5).

h. Jarvis did not request the provision of a Site Warden when requesting manpower from Infra Safety Services Labour (paragraph 108, Recommendation 1).

Contributory factor

125 A contributory factor was that Jarvis did not indicate to Infra Safety Services Labour that the site would not be fully lit during the passage of a train on the up slow line and therefore Infra Safety Services Labour did not provide their staff with hat lamps (paragraph 116, Recommendation 5).

Additional observation[6]

126 Equipment is available for use at railway work sites, which enables temporary lighting to be attached to fencing provided for staff protection (paragraph 115).

[6] 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

127 Jarvis Rail have arranged for the wider use of fences at work sites adjacent to lines open to traffic. Jarvis Rail's HSQE Manager now has to authorise the use of ATWS without a fence.

Recommendations

128 The following safety recommendations are made:[7]

Recommendations to address causal and contributory factors

1 Jarvis Rail should enhance its management systems so that the systems of work intended to be implemented by Controllers of Site Safety within work sites are pre-planned by a competent person. The method of protection should be clearly indicated on the Task Briefing Sheets and on COSS Forms (paragraphs 124a, 124b, 124c and 124h).

2 Jarvis Rail should enhance its risk assessments to include Trac Rail Transposers and the inclusion of any risk mitigation measures in documented working arrangements (this should include an assessment of the exclusion zone around the machines and its enforcement). Jarvis Rail should subsequently brief all relevant staff (and in particular Engineering Supervisors and Controllers of Site Safety) on the hazards identified and the nature of the exclusion zone (paragraphs 124b, 124c, 124d and 124f).

3 Jarvis Rail should enhance its management systems to deliver clear communications at all work sites so that all Controllers of Site Safety are made aware of work to take place at that site, when it will occur and the implications for their system of work (paragraphs 124c and 124e).

4 Network Rail should review the conditions permitting the installation of fences next to tracks open to traffic at normal line speed in order to facilitate their greater provision adjacent to work sites (paragraph 124a).

5 Jarvis Rail, in consultation with Network Rail, should investigate the provision of lighting which can be installed with sufficient stability adjacent to lines open to traffic (paragraphs 124g and 125).

continued

[7] 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 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 (paragraphs 167 to 171) can be found on RAIB's web site at www.raib.gov.uk.

Recommendation to address other matters observed during the investigation

6 Network Rail, in consultation with the users of Trac Rail Transposers, should review the conditions of their operation, when they work in close proximity to lines that are open to traffic, with particular reference to the effect of the exclusion zone on the safe passage of trains (paragraph 121).

Appendices

Appendix A - Glossary of abbreviations and acronyms

ATWS	Automatic Train Warning System
COSS	Controller of Site Safety
COSS Form	COSS Record of Arrangements and Briefing Form
PTS	Personal Track Safety

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

Automatic Train Warning System	A lineside warning system that can be installed at a site of work to: ● detect an approaching train; and ● alert personnel who are on or near the line. It may be installed temporarily for the period of work or it may be installed permanently at a location.
Ballast	The stone material on which the sleepers are laid.
Cess	The place immediately adjacent to the ballast between the edge of the ballast and the fence at the limit of railway property.
Controller of Site Safety (COSS)	A person holding a safety critical qualification demonstrating the holder's competency to arrange a Safe System of Work.*
COSS Handbook	A book written by the Rail Safety and Standards Board and issued to each COSS acting as a reference document to assist him in carrying out his duties.
COSS Record of Arrangements and Briefing Form (COSS Form)	A form completed by the COSS indicating the location of the work site, the work to be done, the specific hazards of the work site, the arrangements in place to mitigate their effect and the Safe System of Work applied. It is signed by each member of the team whose safety is the responsibility of that COSS.
Fenced Green Zone	A method of Green Zone protection in which the staff are working separated from adjacent lines open to trains in traffic by a fence.
Fishplate	Specially cast or forged steel plates used in pairs to join two rails.*
Four foot	The area between the rails of a railway line. On Network Rail lines distance between the rails is 1435 mm.
Green Zone	A method of staff protection under which a section of line is blocked to the movement of trains in traffic, although engineering trains may move within the zone at a speed no faster than walking pace.
Personal Track Safety certification	A national system for ensuring that all staff who work on or about the railway line are trained and satisfactorily tested in the safety procedures to be followed to achieve their safety.
Position of safety	A person is in a position of safety if there is at least a predetermined distance between him (including anything he is wearing or carrying) and the nearest rail of any line on which a train can approach. This distance is 1.25 metres if the speed of the approaching train is 100 mph or less.

Possession	The closure of a specific section of line to railway traffic, usually to allow engineering work to take place on the infrastructure in accordance with module T3 of the Rule Book.
Rail Safety and Standards Board	The independent company within the railway industry whose primary objective is to facilitate the industry's work to achieve continuous improvement in the health and safety performance of the railways in Great Britain, and thus to facilitate the reduction of risk to passengers, employees and the affected public, including the management of standards and regulations.
Railway Group Standard	A document mandating the technical or operating standards required of a particular system, process or procedure to ensure that it interfaces correctly with other systems, processes or procedures.*
Red Zone	A method of staff protection under which staff work on or close to a line open to traffic, with adequate warning being given of approaching trains together with a position of safety for staff to occupy as the train passes.
Rule Book (Railway Group Standard GE/RT8000)	A document describing the duties and responsibilities of staff and the regulations in force to ensure the safe operation of the railway.
Safe System of Work	A method of working which enables staff to work safely.
Separated Green Zone	A method of *Green Zone* protection in which the staff are working separated from adjacent lines open to trains in traffic by a distance of 3 metres. If a Site Warden is appointed, the distance may be reduced to 2 metres.
Site Access Cabin	A cabin at the site entrance occupied by the Site Access Controller.
Site Access Controller	A person who records the entry and exit of everyone who enters and leaves a work site, responsible for checking the validity of their PTS card and briefing them on the overall safety arrangements and general hazards of the site. He is not responsible for specifying Safe Systems of Work.
Site Access Register	A record maintained by the Site Access Controller of, and signed by, all those who enter and leave the site. Signing the register is an acknowledgement that the Site Access Controller's briefing has been given and understood.
Site Warden	A qualified person whose exclusive duty at a work site is to ensure that staff do cross not the line that marks the limit of a Separated Green Zone and to warn them should they do so.
Task Briefing Sheet	A Jarvis document developed during the planning of work and provided at the work site summarising the work to be done, protection arrangements and hazards appropriate to the work and the site.

Temporary Speed Restriction	A speed restriction imposed on trains passing over a specific section of track, which is less than the normally permitted speed, applied for a limited period because of track condition or other temporary, local constraint.
Trac Rail Transposer	A machine used to move single rails within a work site. It is powered and travels on its own pair of 'caterpillar' tracks. The rails are carried near to the ground and directly below the vehicle between the caterpillar tracks.
Track safety competency	The certificated competency achieved by an individual in respect of their ability to work on or near the line or to exercise certain duties in respect of the development or application of safety procedures.

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

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