



Rail Accident Investigation Branch

Rail Accident Report



Class investigation into irregularities with protection arrangements during infrastructure engineering work

Report 14/2015
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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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Class investigation into irregularities with protection arrangements during infrastructure engineering work

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Summary

The Rail Accident Investigation Branch (RAIB) has investigated a number of accidents involving track workers on Network Rail's infrastructure and has identified track worker safety as an area of particular concern in recent annual reports¹.

The RAIB has also become concerned at the number of operating irregularities associated with the protection of those carrying out engineering work, particularly where protection was planned to block the line to traffic. This is because, in different circumstances, these irregularities could have led to harmful, and possibly fatal, outcomes.

The RAIB observed the regular occurrence of these operating irregularities in the daily incident reports produced by Network Rail's National Operations Centre. As a result, it decided to collect information over a two-year period (April 2011 to April 2013) to understand more. This report describes analysis that the RAIB has carried out based on this information, and its investigation of the safety issues that this identified.

The data analysis showed that most of the reported operating irregularities were potentially harmful and that their occurrence was neither infrequent nor reducing. A systematic review of these was then undertaken to identify the various safety issues that would need to be addressed to prevent them occurring and leading to harm.

The RAIB is aware that Network Rail is currently planning and implementing a major track safety initiative known as 'Planning and Delivering Safe Work' (PDSW). The investigation has sought to understand this and has established that Network Rail intends that PDSW will address a number of the safety issues identified.

However, the RAIB has observed that the initiative is currently only in the early stages of implementation and that the envisaged benefits have yet to be demonstrated. It has also observed that the initiative is intentionally focused on the roles of those working on site. This means that it will not have significant benefits in areas where risks may be created by people in a number of other roles that are important in safeguarding those carrying out work on the railway.

The RAIB has made two recommendations addressed to Network Rail. They are concerned with:

- monitoring and verifying the benefits obtained from the PDSW initiative; and
- developing an action plan to reduce the risks associated with railway roles that are outside the scope of the PDSW initiative.

¹ RAIB reports are available at www.gov.uk/raib.

Preface

- 1 This investigation has concentrated on engineering work carried out, or planned to be carried out, on railway infrastructure owned and managed by Network Rail. However, many of the issues identified may be of interest to other railway *infrastructure managers* in the UK.
- 2 The work has considered data from a relatively large number of events and has focused on safety trends and themes, rather than the causes of individual events. As a result, the RAIB has considered it proportionate to confine the supporting data analysis to information in Network Rail's daily incident reports, while acknowledging a degree of uncertainty in the findings and conclusions.
- 3 The purpose of an RAIB investigation is to improve railway safety by preventing future railway accidents or by mitigating their consequences. It is not the purpose of such an investigation to establish blame or liability. Accordingly, it is inappropriate that RAIB reports should be used to assign fault or blame, or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.
- 4 The RAIB's investigation (including its scope, methods, conclusions and recommendations) is independent of all other investigations, including those carried out by the safety authority, police or railway industry.
- 5 The report contains abbreviations and technical terms (shown in *italics* the first time they appear in the report). These are explained in appendices A and B.

Introduction

The investigation

- 6 In early 2011, the RAIB became concerned about repeated occurrences of events involving operating irregularities during infrastructure engineering work in the daily incident reports compiled by Network Rail's *National Operations Centre* (NOC), particularly where protection was planned to block the line to traffic. Although the outcome of the vast majority of these events was benign and the associated circumstances not meriting individual investigation, the RAIB was mindful of their regularity and the potential for more serious consequences.
- 7 The RAIB decided to analyse data from these reports in order to establish a more objective understanding of the significance of these events and the nature of any underlying reasons. The purpose of its investigation was to identify whether there were any recurrent safety concerns relating to protection arrangements that are used to safeguard those carrying out work on the railway.
- 8 The RAIB's *duty co-ordinators* review Network Rail's incident reports every day, and for two years, between April 2011 and April 2013, identified information on events of this type. The information was subsequently indexed and categorised by theme.
- 9 The RAIB reviewed the event information and concluded that events in a number of the categories were significant in nature, in that they could have led to harmful outcomes. It then looked at the rate of occurrence of these to determine whether, over the two-year period, this was reducing or not.
- 10 The investigation has also sought to identify likely unsafe acts² that could have led to harmful outcomes, and the likely safety issues³ associated with each. Because of the amount of data collected (over 700 events), a largely qualitative data analysis was carried out. This involved a systematic review of individual events taken from each of the significant event categories.
- 11 After identifying the full range of likely safety issues, the RAIB met with both Network Rail and RSSB⁴ to understand the nature and scope of any major track worker safety initiatives being implemented or planned. The RAIB has further consulted with Network Rail as to its understanding of the anticipated benefits of these initiatives and, in particular, how they relate to the safety issues identified.

² The term 'unsafe act' has been used to describe the action that could have led to a high consequence outcome. It is equivalent to the term 'immediate cause' that the RAIB uses when investigating accidents and incidents that did result in a harmful outcome (or near miss event).

³ The term 'safety issue' is used in the report to describe the condition, event or behaviour that was necessary for the unsafe act to occur. It is equivalent to the term 'causal factor' that the RAIB uses when investigating accidents and incidents that did result in a harmful outcome (or near miss situation).

⁴ A not-for-profit company owned and funded by major stakeholders in the railway industry, and which provides support and facilitation for a wide range of cross-industry activities. The company is registered as 'Rail Safety and Standards Board' but trades as 'RSSB'.

Protection arrangements for engineering work⁵

- 12 The Rule Book published by RSSB⁶, GE/RT8000, describes the safety arrangements that need to be in place when undertaking infrastructure engineering work on the railway.
- 13 Those working on the railway are considered to be either :
- ‘on or near the line’ – within three metres of a railway line, or on the line itself⁷; or
 - ‘lineside’ – outside the area called on or near the line, but within the railway boundary fence and visible to the drivers of approaching trains⁸.
- 14 Work can be carried out lineside so long as it does not affect or go within the area called on or near the line. If it does, a *controller of site safety* (COSS)⁹ needs to be present and give permission for the work to take place.
- 15 The COSS is responsible for setting up and managing the safe system of work. He may also be responsible for managing the work task. However, this is often the responsibility of a separate person, sometimes referred to as the team leader, or supervisor.
- 16 If the work is on or near the line and of a type that is considered not to affect the *safety of the line* (because, for instance, it won’t affect the condition of the track, or result in a vehicle or object fouling the line) trains may run normally. In this case the COSS may use one of four safe systems of work. The first two rely on workers being separated from lines that remain open to traffic:
1. ‘Fenced’ – a suitable barrier to separate the *work area* from the open line.
 2. ‘*Site warden warning*’ – one or more dedicated people (site wardens) appointed to warn those working if they stray outside the work area (safety area) towards the open line.

The second two safe systems of work allow workers to carry out work on open lines providing they are given sufficient warning to move clear of approaching trains:

3. ‘*Equipment warning*’ – special equipment arranged to give enough warning to allow all those working to reach a *position of safety* at least ten seconds before any train arrives.
4. ‘*Lookout warning*’ – one or more dedicated people (lookouts) located to give enough warning to allow those working to reach a position of safety at least ten seconds before any train arrives.

⁵ Paragraphs 12 to 30 consider work carried out by a group (two or more people). The arrangements for a person working alone are broadly similar. The main differences are the availability of an alternative competence, *individual working alone* (IWA), and that not all the safe systems of work can be used.

⁶ RSSB publications are available at www.rssb.co.uk.

⁷ Unless they are crossing the line at a level crossing; or they are on a station platform, and not carrying out engineering or technical work within 1.25 metres of the platform edge.

⁸ But not if they are on a station platform.

⁹ Network Rail is currently implementing a safety initiative known as ‘Planning and Delivering Safe Work’. This is introducing the new role of *safe work leader* who will also be able to give permission for work to be carried out in the area called on or near the line. This initiative and its likely benefits are considered in paragraphs 47 to 68.

- 17 The line can be blocked and trains stopped from running normally while work is taking place. This safe system of work, known as ‘safeguarded’, should always be adopted when the work is considered to affect the safety of the line. It is also Network Rail’s preferred safe system for any work activity (as defined in Network Rail standard NR/L2/OHS/019 ‘Safety of people working on or near the line’). If it is not practical to implement the safeguarded safe system of work, Network Rail requires that consideration be given to the alternatives in the following order¹⁰:
- fenced;
 - site warden warning;
 - equipment warning; or
 - lookout warning.
- 18 Planned longer-term blockages of the line, where *engineering trains* and *on-track plant* can operate, are known as *possessions*.
- 19 The Rule Book also describes arrangements for working on *DC electrified lines* and *AC electrified lines* where there is a risk of electrocution. These include:
- the use of permits stating what electrical equipment is isolated (and earthed, where required) and on which, or near to which, it is safe for specified work to be carried out;
 - various safety precautions, such as when to consider that electrical equipment is live and restrictions on the type of work that can be carried out; and
 - communication with the *electrical control operator* (ECO).
- 20 The great majority of the irregularities identified from Network Rail’s daily incident reports were either associated with a running line under possession or with the blocking of a running line that was not under possession. The key aspects of the respective protection arrangements are outlined below.

Blockage of a running line outside a possession

- 21 A line blockage is achieved by placing the signal, or signals, protecting the affected section of line to *danger* (red). The COSS needs to arrange this by communicating with the signaller¹¹. This involves:
- the COSS and the signaller agreeing the specific arrangements, such as the lines to be blocked, the location of the work and the time needed to do it, and the protecting signals;
 - the COSS and signaller confirming and separately recording the agreed arrangements;
 - the signaller taking actions to ensure that the line to be blocked is clear (or that all trains have passed the work area), that points are in the correct position and that the protecting signals are at danger (this may involve confirming with other signallers that necessary arrangements are in place); and

¹⁰ Safeguarded, fenced and site warden safe systems of work have traditionally been referred to as ‘green zone’ working whereas protection involving warnings being given of approaching trains have been referred to as ‘red zone’ working. Red zone working is generally considered less safe, and in recent years Network Rail has been working to reduce the extent of this type of working. The RAIB reported on this in its investigation of the track worker incident near Roydon station, 16 July 2012 ([RAIB report 07/2013](#)).

¹¹ If two or more COSSs need the same line to be blocked a *protection controller* must be appointed to take overall control.

- the signaller granting the COSS an authority number so that work can start.
- 22 Additional protection is required if the work will affect the safety of the line. The signaller has to agree with the COSS which of the following is to be used, and will not issue an authority number until it is in place:
- the disconnection of signalling equipment by a signalling technician;
 - the COSS placing *detonator protection* or one or more *track circuit operating devices*;
 - the COSS having possession of the *token* for the line; or
 - the signaller applying *reminder appliances* in the signal box.
- 23 When the COSS has been given the authority number, he must also place a red flag (or red light) that is clearly visible to the driver of a train approaching the work area if a group is working, or if the work will affect the safety of the approaching train. This is to be done in both directions if the work area is on a single or bi-directional line, or if single line working is in operation.

Possession of a running line

- 24 A possession is a section of line (delimited by detonator protection) that is blocked for the normal operation of trains, and train movements in it are under the overall control of the *person in charge of the possession* (PICOP), rather than the signaller. Work can be carried out in a work area that is:
- within a *work site*, a designated section of the possession that an *engineering supervisor* (ES) is responsible for (*work site marker boards* are required to indicate the location of work sites¹² when engineering trains and on-track plant are within the possession); or
 - on a section of the possession where the PICOP remains in direct control.
- In either case, a COSS is responsible for setting up a safe system of work.
- 25 Except in an urgent situation, the possession of a running line is required to be planned in advance and published in railway notices. Network Rail operations control staff are responsible for notifying the signaller and the PICOP of any agreed changes.
- 26 The PICOP takes possession of the line through liaison with the signaller. This involves:
- the PICOP and the signaller confirming the published details, such as the line to be taken under possession, whether the possession is to be taken around any engineering trains, the protecting signals, the arrangements for any points and level crossings, the location of the detonator protection and the time the possession is to be taken;
 - the signaller confirming that all engineering trains, which need to be within the planned limits when the possession is taken, are at a stand at the signal as specified in the published railway notices;

¹² The work site marker boards should be placed on the track 100 metres beyond the ends of the work site.

- the signaller taking actions to ensure that points are in the correct position, and that the protecting signals and all *controlled signals* within the possession, or which lead to or across it, are at danger (this may involve confirming with other signallers that necessary arrangements are in place);
 - the PICOP recording and confirming the possession arrangements with the signaller;
 - the signaller granting the PICOP permission to place detonator protection¹³;
 - the PICOP recording that all detonator protection is in place, confirming this with the signaller; and
 - the signaller then granting the PICOP the possession.
- 27 Work sites within a possession are set up by the ES in liaison with the PICOP. This involves:
- the ES and the PICOP confirming the specific details, such as the line on which the work site is to be set up, the location of each work site marker board, whether the work site is to be taken around any engineering trains, and the arrangements for any level crossing within the work site;
 - the PICOP confirming that all engineering trains, which need to be within the work site limits when the work site is taken, are in the correct location and then authorising the ES to set up the work site and place the work site marker boards;
 - the ES telling the PICOP when he has placed the work site marker boards, the PICOP then dictating the detailed arrangements for the work site for the ES to record; and
 - the PICOP, after confirming that the ES has recorded the details correctly, granting the ES the work site.
- 28 The arrangements for each work area depend on whether or not it is within a work site. If it is within the work site, the COSS and the ES must agree the specific details for the ES to record and for the COSS to confirm. These include:
- the limits of the work area;
 - the nature of the work; and
 - the safe system of work that the COSS will use (safeguarded, fenced, site warden warning, equipment warning or lookout warning).
- 29 There are fewer safe system of work options available if the work area is outside the work site. With the agreement of the PICOP, the COSS can use a lookout warning based on trains operating at restricted speed. Alternatively the COSS is permitted to set up a warning arrangement that does not require the PICOP's authority, but this needs to be based on the possibility that trains could be travelling at maximum line speed.
- 30 Figure 1 shows the arrangements of a typical possession of a running line that incorporates work areas that are both within and outside a work site.

¹³ Detonator protection is not needed on a single line if the PICOP is in possession of the token for that line.

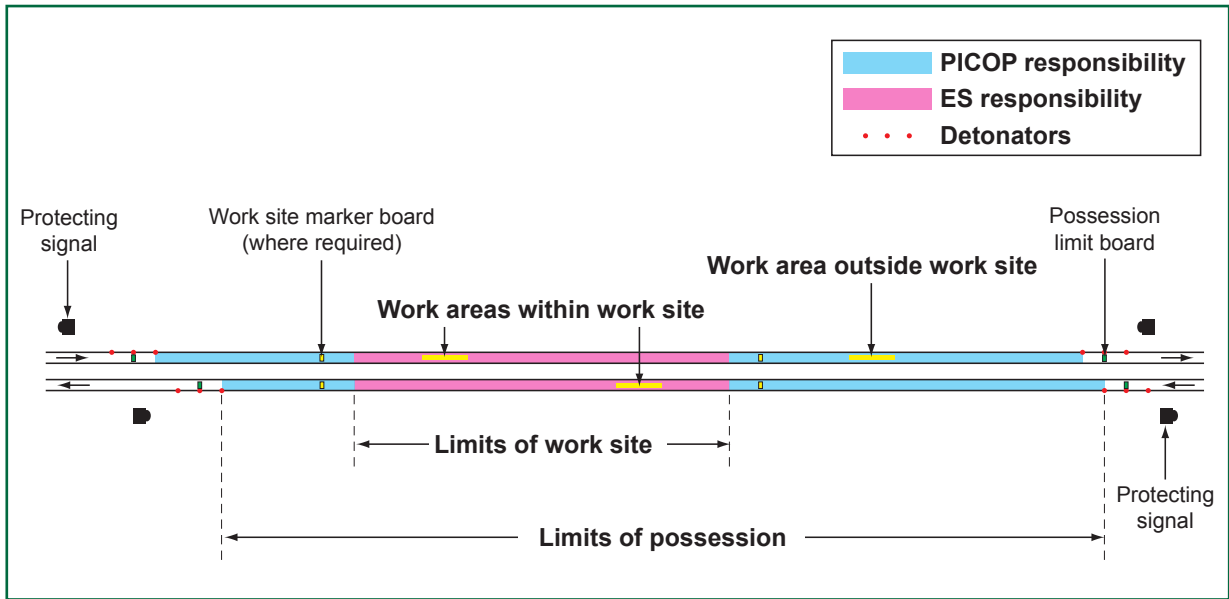


Figure 1: Typical possession arrangement showing the areas of PICOP and ES responsibility as defined in the Rule Book

Data analysis

31 The following sections further describe the data analysis aspects of the investigation that are outlined in paragraphs 7 to 10.

Data collection and event information

- 32 Network Rail records defined types of undesirable occurrences and operational incidents on the national network in the daily incident reports produced by its NOC, based on information received from operations control offices on each of its routes. The RAIB duty co-ordinators review these every day, and between April 2011 and April 2013, identified a total of 714 events involving operating irregularities during infrastructure engineering work (paragraph 8).
- 33 The data collection involved capturing and indexing Network Rail's descriptions of these events. In general, these concisely describe:
- the time and location of the event;
 - what happened during the event and the immediate action taken as a result;
 - the infrastructure involved (the names of lines, signals, points etc);
 - protection arrangements involved – for instance possession (including the lines affected and the reference number as published in the railway notices) or line blockage;
 - the trains involved (*train reporting number*, the booked departure time and location, and the destination);
 - the roles of the railway staff directly involved (for instance PICOP, ES, COSS, driver and signaller); and
 - the type of any on-track plant and equipment involved.

Appendix C includes the descriptions relating to four typical events that the RAIB identified.

- 34 Given that the investigation sought to understand areas of recurrent safety concern, and not a detailed understanding of the circumstances or factors associated with each individual event, the RAIB considered that it was reasonable to confine the subsequent data analysis solely to information in these descriptions.

Event categorisation

- 35 The investigation categorised the identified events into common safety themes, and found that the majority (617 events, around 86% of the total number identified) could be readily grouped according to the type of operating irregularity. The RAIB concluded that nine of these event categories related to irregularities of a significant nature in that the outcomes, while recorded as benign, could have been harmful, possibly resulting in fatality.

- 36 Around 71% (440 events) of the categorised events fell into one of the following nine (significant) event categories:
1. Protection equipment incorrectly placed
Events involving errors with the positioning of protection and other equipment, such as detonators, possession limit boards and work site marker boards, when setting up protection arrangements. Because of where the equipment was placed (for instance on the wrong line, at the wrong signal or on the wrong side of signals or points) there was a significant likelihood that the setting up was carried out on sections of open line. Some of the individuals undertaking this work were probably unaware of the risk of being struck by a train (144 events, 33% of all significant events).
 2. Protected area set up while the line is open to traffic
Events typically involving the granting of blockages on sections of lines where trains were still running, or allowing the placing of protection for possessions without first confirming that the line was clear. As a result, people on the line were at risk of being struck by a train and, depending on the nature of any work being carried out, trains may also have been at risk (39 events, 9% of all significant events).
 3. Working outside a protected area
Events in which work was being undertaken outside the area protected by the possession or blockage of a running line. As a result, people on the line were at risk of being struck by a train and, depending on the nature of any work being carried out, trains may also have been at risk (52 events, 12% of all significant events).
 4. Safety issues when a protected area is given up
Events involving the giving up of a possession or blockage of a section of running line that was not fit for the normal passage of trains. This was typically because at the time, or soon after, there were vehicles, equipment or people on the line, or because the track had been left in a poor condition. As a result, depending on the circumstances, both people on the line and trains may have been at risk (16 events, 4% of all significant events).
 5. Work incidents within a protected area
Events involving various problems with the work being carried out within a possession or blockage of a running line. These typically included train and on-track plant operating irregularities (for instance, unauthorised movements and collisions), derailments, infrastructure damage, incorrect operation of points, and obstructions on the line (for instance, work trolleys). As a result, people on the line and trains may both have been at risk (42 events, 9% of all significant events).
 6. Electrical protection irregularities
Events relating to the risk of staff receiving electric shocks, for instance when working on or near *conductor rails* and *overhead line equipment*. These mainly related to electrical isolation arrangement issues and working in the vicinity of live equipment. As a result, people in the vicinity of the railway may have been at risk (24 events, 5% of all significant events).

7. Trains incorrectly signalled into a protected area

Events involving the signalling of trains into or towards a section of line where an authorised possession or blockage had yet to be given up. Because of the likely presence of track workers, equipment and vehicles, and, depending on the nature of the work, the possibility of the track being in a poor condition, trains and people could both have been at significant risk (52 events, 12% of all significant events).

8. Work carried out without protection

Various situations where people had been working on the line without a suitable safe system of work. The RAIB observed that people on the line may have been at particular risk (59 events, 13% of all significant events).

9. Level crossing irregularities within a protected area

Various events relating to the irregular and unsafe working of level crossings within protected areas on running lines, mainly possessions. These typically related to local level crossing control arrangements and the passage of trains over level crossings when they were open to road traffic. As a result, road users and trains could both have been at significant risk (12 events, 3% of all significant events).

37 Figure 2 shows the proportion of events in each category.

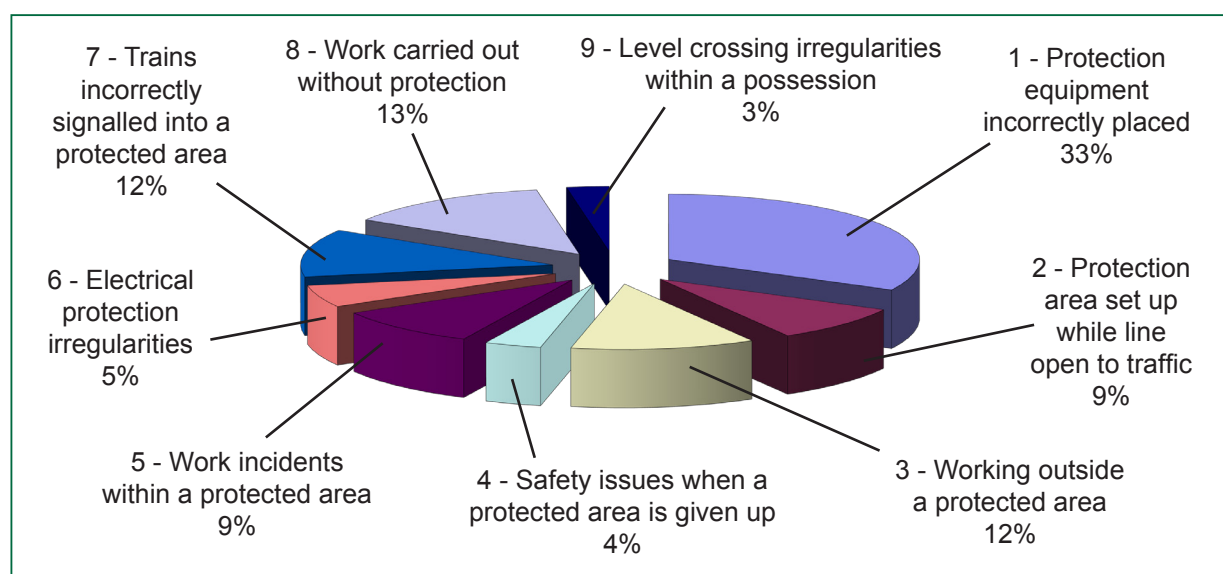


Figure 2: Proportion of events in categories 1 to 9

38 The remaining categorised events (177 events) divided into four other categories:

- trains prevented from running for technical reasons;
- procedural issues associated with infrastructure engineering work;
- *running through* points; and
- collisions with relatively lightweight protection equipment.

The RAIB observed that the risk associated with events in these categories was likely to be lower than for events in categories 1 to 9. The most credible worst-case outcomes for events in the four categories listed above being minor damage and the need for repair work. The RAIB excluded these four categories from the data analysis.

Safety trend

39 The RAIB found that, on average, the total number of category 1 to 9 events (ie those events of a significant nature) in each Network Rail four-week reporting period was not reducing (figure 3) and considered that it was important to try and identify the associated safety issues.

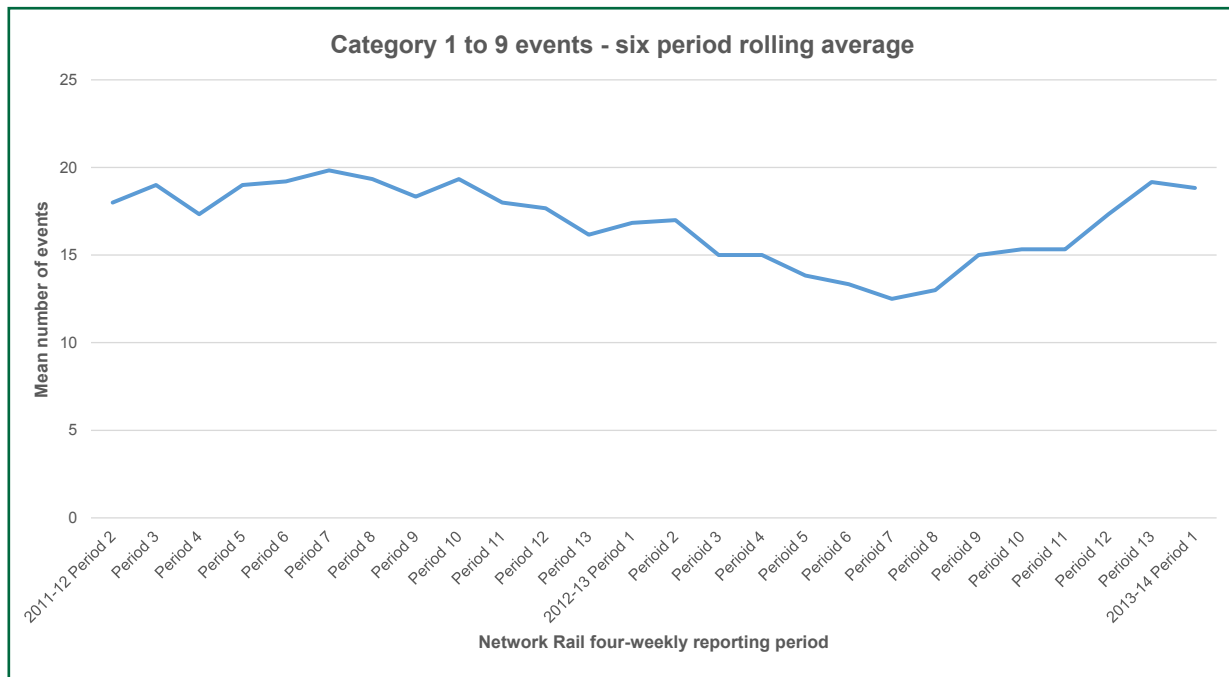


Figure 3: Category 1 to 9 events identified during the data collection period (note: averages for the first five reporting periods are calculated using reduced sample sizes)

Identification of likely safety issues

- 40 The RAIB selected a sample¹⁴ of events in each of the categories listed in paragraph 36 (these categories had been selected on the basis that the irregularity described could lead to a high consequence outcome). For each event selected, the RAIB carried out a systematic review of the information contained in the event description in order to identify evidence of the associated unsafe act and the most likely safety issue that had led to it.
- 41 Each unsafe act would have been prevented if the associated safety issue had not been present. Therefore, understanding likely safety issues is an important step to identifying areas for safety improvement and risk mitigation.
- 42 Table 1 lists the unsafe acts and likely safety issues that the review found evidence of.

¹⁴ The smallest sample represented 43% of the events in the category.

Event category	Unsafe acts	Likely safety issues
1. Protection equipment incorrectly placed	<p>Accessed an open line of own accord</p> <p>Authorised access to an open line</p>	<p>Incorrect understanding of planned protection limits</p> <p>Incorrect instruction given</p> <p>Did not follow correct instruction</p> <p>Did not follow correct planning information</p> <p>Incorrect planning information issued</p> <p>Lack of awareness of where to place protection relative to points</p> <p>Misunderstanding or communication error</p>
2. Protected area set up while the line is open to traffic	<p>Authorised access to an open line without checking it was clear with the signaller</p> <p>Signaller authorised access to an open line without checking it was clear</p> <p>Did not confirm line was safe</p>	<p>Violation or lapse</p> <p>Misunderstanding or communication error</p> <p>Incorrect planning information issued</p>
3. Working outside a protected area	<p>Accessed an open line of own accord</p> <p>Authorised access to an open line</p> <p>Requested access to an open line</p>	<p>Incorrect understanding of planned protection limits</p> <p>Violation or lapse</p> <p>Incorrect planning information issued</p> <p>Misunderstanding or communication error</p>
4. Safety issues when a protected area is given up	<p>Did not confirm that the line was safe</p> <p>Authorised access to an open line</p> <p>Accessed an open line of own accord</p>	<p>Violation or lapse</p> <p>Misunderstanding or communication error</p>
5. Work incidents within a protected area	<p>Authorised a non-permissible vehicle movement</p> <p>Made a non-permissible vehicle movement</p> <p>Unauthorised removal of protection</p> <p>Did not give warning about a vehicle movement</p>	<p>Violation or lapse</p> <p>Misunderstanding or communication error</p> <p>Incorrect understanding of planned protection limits</p>
6. Electrical protection irregularities	<p>Authorised access to an energised line</p> <p>Did not confirm isolation before applying protection</p> <p>Did not check isolation before confirming line as safe</p> <p>Did not protect an isolated section</p> <p>Working too close to energised equipment</p> <p>Energised wrong line</p>	<p>Violation or lapse</p> <p>Incorrect planning information issued</p> <p>Misunderstanding or communication error</p>
7. Trains incorrectly signalled into a protected area	<p>Authorised a non-permissible vehicle movement</p> <p>Authorised vehicle movement after agreeing a line blockage</p>	<p>Violation or lapse</p> <p>Misunderstanding or communication error</p> <p>Misunderstanding paperwork</p>
8. Work carried out without protection	<p>Authorised access to an open line</p> <p>Accessed an open line of own accord</p> <p>Did not protect track workers</p>	<p>Violation or lapse</p> <p>Misunderstanding or communication error</p> <p>Incorrect understanding of planned protection limits</p>
9. Level crossing irregularities within a protected area	<p>Authorised non-permissible vehicle movement</p> <p>Made non-permissible vehicle movement</p> <p>Did not communicate with signaller</p> <p>Did not communicate with level crossing attendant</p>	<p>Violation or lapse</p> <p>Misunderstanding or communication error</p> <p>Poor understanding of rules</p>

Table 1: Unsafe acts and likely safety issues identified for category 1 to 9 events (the unsafe acts and safety issues are ordered according to the number of times they were identified in each category, the first being the most common)

- 43 Appendix D includes a diagram showing the identified safety issues linked to their respective unsafe acts. These have also been mapped onto the key process phases associated with the safe management of infrastructure engineering work:
- pre-site activities – for instance work planning, staff training and competence arrangements;
 - setting up the protection arrangements on site;
 - carrying out the work on site; and
 - giving up the protection arrangements.

Industry track safety initiatives

- 44 The RAIB sought to understand any proposed changes to safety arrangements that were likely to affect the safety issues that the RAIB had identified.
- 45 The RAIB met with both RSSB and Network Rail in 2014. It presented findings from its data analysis and was advised that Network Rail had one significant initiative that it was in the process of developing and implementing: PDSW. RSSB told the RAIB that it was supporting Network Rail with this initiative (for instance, making necessary changes to the Rule Book concerning the new role of safe work leader (paragraphs 49 to 51)) but otherwise was not involved in any major track worker safety improvement initiatives.
- 46 The RAIB subsequently met with members of Network Rail's project team responsible for the PDSW initiative to understand the key changes Network Rail was proposing and the benefits that it anticipated¹⁵.

Key changes to protection arrangements due to the PDSW initiative

- 47 Network Rail explained that the PDSW initiative is specifically focused on the safety arrangements that those on site are responsible for. The fundamental areas for improvement were identified following a review of track worker safety it had commissioned from an external consultant. These included the need for a single person to be in charge of both safety and task, and for them to hold an authorised permit to work (PTW). Network Rail stated that its objective is for the initiative to reduce the number of track worker *fatalities and weighted injuries* by 25%.
- 48 In response to the above, Network Rail advised that it is planning and implementing four major changes to current protection arrangements:
- the new role of safe work leader (SWL);
 - a permit to work system;
 - a new digital map of the railway; and
 - a new universal work planning process.

¹⁵ As the PDSW initiative is currently only in the early stages of implementation (paragraph 64) it is possible that there may be subsequent detailed changes to the arrangements as described.

SWL role

- 49 Network Rail is introducing the new role of SWL to establish the principle of a single person being in charge of work carried out on the railway, including its safe delivery. It had identified particular concerns with existing arrangements whereby the person managing the task could be different from the COSS (paragraph 15). These included experience of situations where the appointed COSS did not feel they had the status to adequately enforce the safety arrangements they were responsible for, or influence the behaviour of the team. It had found this could especially be the case where a COSS had been hired from an external agency¹⁶.
- 50 Network Rail has defined three levels of competency for the SWL role:
- SWL level 1
The person responsible on site for the overall management of work within a work area that is outside a possession, or that is within a possession but outside a work site. In these situations the SWL will carry out the safety duties that the COSS was previously responsible for.
 - SWL level 2
The person responsible on site for the overall management of all the work being carried out in single or multiple simple work areas within a work site in a possession. The SWL is required to manage the interface risks between work areas, and for confirming that the task leaders responsible for each individual work area have considered their own risks and have controls in place. In these situations the SWL is also responsible for carrying out the Rule Book duties of an ES, including liaising with the PICOP in order to set up the work site.
 - SWL level 3
The person responsible on site for the overall management of work being carried out in a work site requiring significant strategic and risk management capability (typically a large infrastructure project). This could be due, for instance, to the complex nature of the work and its interactions, or that the work load is too great for one individual. In these situations, the SWL¹⁷ will appoint an ES to delegate the respective Rule Book duties to.
- 51 Network Rail is putting arrangements in place so that SWLs are trained and assessed as being competent to the appropriate level.

PTW system

- 52 Network Rail is introducing a system that will mean it will not allow any work on or near the line, or which imports risk to the safe running of the operational railway, unless the person in charge (the SWL) is in possession of a PTW¹⁸.

¹⁶ The RAIB made a number of recommendations regarding the use of agency staff in track safety leadership roles in its investigation of the fatal accident at Saxilby, 4 December 2012 ([RAIB report 21/2013](#)). The RAIB has also found evidence of situations where staff employed by Network Rail have not enforced the safety arrangements they were responsible for. For instance, this was the case in the accident at Cheshunt Junction, 30 March 2010 ([RAIB report 06/2011](#)).

¹⁷ To be referred to as 'safe work manager' to avoid definition confusion in the Rule Book.

¹⁸ Network Rail staff will also require a PTW when working with electrical equipment or when they are within or on the railway boundary. A PTW will not be required for work directly related to facilities management (eg for work inside a station building) if it does not affect the safe operation of the railway. Staff that do not work for Network Rail or one of its designated contractors (eg employees of train operators) may not need a PTW in certain circumstances.

- 53 Network Rail has adopted a proprietary software system to generate, issue and manage the PTW in accordance with a prescribed process. This will involve:
- defining the nature, location and extent of the work, and the periods during which it can be done;
 - identification and assessment of the location-specific hazards and risks;
 - identification of the specific control measures to be implemented on site to mitigate the identified risks;
 - managing the competence and capability of those doing the work;
 - giving visibility (in real time) of the status of PTWs during their lifecycle; and
 - consideration and communication of any lessons learned.
- 54 The PTW itself is a detailed document that authorises specific people to carry out specific work at a specific time and location. Integral to the generation and issuing process is a structured risk assessment tool. This is used to identify and document (on the PTW) the site and work specific risks and related control measures.
- 55 Network Rail explained that the SWL would be issued with the authorised PTW before travelling to site (eg at a maintenance depot) and would make the PTW live using mobile communication on arrival (normally via a smartphone application). At this point the PTW would become visible on the computer system used in Network Rail operations control offices.
- 56 The SWL would then use the detailed information on the PTW to brief the site team on the work to be carried out and the measures to be followed to control the identified risks.

Digital railway maps

- 57 Implementation of the new PTW system has involved the development of a new set of maps of the railway detailing the geographical and related information needed to plan and set up protection arrangements on the railway, including:
- names of lines and permitted speeds;
 - location and name of signals and points;
 - location and name of designated access points; and
 - information on hazards and their location.
- 58 These maps, available in digital format, bring together information from a variety of established railway sources (including signalling diagrams, the *sectional appendix* and the *hazard directory*) into one reference.
- 59 The maps will also be used to illustrate the planned protection arrangements on the authorised PTW, such as the lines to be blocked, the location of protection limits and the signals involved.

Work planning process

- 60 A fundamental principle of the PDSW initiative is to ensure that the SWL has been involved with planning and reviewing the work arrangements from an early stage, and that a separate authority (usually a line manager) authorises them.
- 61 Network Rail explained that the PTW authorisation process used by the PTW system has been designed to assure this.

Assessment of the anticipated benefits of the PDSW initiative

- 62 The RAIB explained to Network Rail the likely safety issues identified in each of the significant event categories (paragraph 42 and table 1) and asked its opinion on whether the PDSW initiative would reduce their likelihood, and if so how and to what extent. Appendix E lists the benefits that Network Rail said that it intends for each safety issue in each event category.
- 63 In summary, the RAIB found that Network Rail intends that the PDSW initiative will be effective in:
- making better location information available to those on site, including the new digital maps, that will help avoid geographic misunderstandings (eg regarding planned protection limits, the lines that remain open and any signals involved);
 - making improved task information available to those on site (detailed on the authorised PTW) in order to help avoid misunderstandings with work instructions, emphasise the risks that are applicable and specify the measures to be followed to control these;
 - providing an improved work review and authorisation process (integral part of the software used to issue the PTW) that will help reduce planning information errors and clarify individual accountability and responsibility;
 - ensuring a prescribed process is followed when completing work (integral part of the PTW system) that will involve the SWL confirming that the line is in a safe condition before a protected area is given up; and
 - ensuring a single competent person is in overall charge of a work site or work area (SWL role) in order to help ensure compliance with rules and risk control measures, safe behaviour and minimisation of mistakes and misunderstandings.
- 64 The RAIB is aware that PDSW is currently only in the early stages of implementation and that Network Rail has yet to verify the benefits it envisages (Recommendation 1). However, if the benefits are proven, the initiative could have the potential to significantly reduce risk in five of the nine significant event categories:
1. Protection equipment incorrectly placed (33% of all significant events).
 3. Working outside a protected area (12% of all significant events).
 4. Safety issues when a protected area is given up (4% of all significant events).
 5. Work incidents within a protected area (9% of all significant events).
 8. Work carried out without protection (13% of all significant events).
- The RAIB observes that the main reason for this is that these categories closely relate to Network Rail's specific focus for the PDSW initiative: the safety arrangements that those on site are responsible for (paragraph 47). This leaves four event categories that will not be significantly affected by the PDSW initiative:
2. Protection area set up while line is open to traffic (9% of all significant events).
 6. Electrical protection irregularities (5% of all significant events).
 7. Trains incorrectly signalled into a protected area (12% of all significant events).
 9. Level crossing irregularities within a protected area (3% of all significant events).

- 65 The likely safety issues associated with these remaining four categories concern (at least partly) other railway roles, including the signaller, PICOP and ECO. The PDSW initiative does not plan to introduce any changes to these roles, or the work arrangements associated with them¹⁹.
- 66 The events in these four categories account for nearly 30% of the total number of significant events that the RAIB identified.
- 67 A review of information in appendix E shows that a number of important risks are likely to remain largely unaltered by the PDSW initiative. These include:
- track workers being incorrectly permitted to access a line open to traffic because of a mistake, misunderstanding or communication error made by a signaller or PICOP;
 - the exposure of staff to unprotected and live electrical traction supply equipment because of a mistake or misunderstanding involving the ECO or the planned isolation arrangements;
 - the signalling of a train into, or towards, a section of line where work is being carried out because of a mistake, misunderstanding or communication error made by a signaller or PICOP; and
 - the passage of trains over level crossings that are open to road traffic because of a mistake, misunderstanding or communication error involving operating arrangements that the signaller and PICOP should have confirmed.
- Since each of the above contains the potential for a harmful, and even catastrophic, outcome, the RAIB believes that it is important that actions are taken to reduce their likelihood (Recommendation 2).
- 68 The ORR (see appendix A for definition) has advised the RAIB that Network Rail has included a post-implementation review in its programme for PDSW that it intends to use to verify the benefits that the initiative has brought. Network Rail has furthermore advised that it is considering enhancements to PDSW for future development.

¹⁹ With the exception of certain related tasks (for instance the need for an authorised PTW so that protection equipment can be placed on the line when a PICOP is setting up a possession).

Conclusions

- 69 The RAIB found that most of the operating irregularities that it identified over the two-year data collection period were significant in nature (paragraph 35), and furthermore that their occurrence was frequent and not reducing (paragraph 39).
- 70 The investigation identified a variety of likely safety issues associated with these events. Examples include miscommunication, violations, lapses, and the incorrect understanding of protection limits. Figure 3 suggests that, on average, these issues were placing railway staff at risk between three and five times each week. In some cases, the public could also have been affected.
- 71 The RAIB has considered the need for additional work to further understand these safety issues and examine control measures that would mitigate the associated risks. However, it has recognised that Network Rail's implementation of a major track safety initiative (PDSW) will change current safety arrangements and potentially affect the type of irregularities that will occur in the future.
- 72 Because of the PDSW initiative, the RAIB has decided that such additional work would not be appropriate at this time. However, the RAIB has observed that:
- while recognising Network Rail's intention to include a post-implementation review in its programme for PDSW, this initiative has not been fully implemented and its benefits have yet to be verified (paragraph 64, **Recommendation 1**); and
 - the PDSW initiative does not plan to introduce changes to a number of important roles that are involved in the protection of those carrying out work on the railway, including the signaller, PICOP and ECO; therefore, it is likely that its implementation may not bring significant benefit in a number of important areas of risk (paragraph 67, **Recommendation 2**).

Recommendations

73 The RAIB makes the following recommendations²⁰ regarding the observations made in this investigation (paragraph 72):

- 1 *The intent of this recommendation is that Network Rail should implement its post-implementation review in such a way as to monitor and assess the impact of its planning and delivering safe work initiative.*

Network Rail should ensure that its post-implementation review of the planning and delivering safe work initiative includes the collection of information on events that are indicative of irregular working during infrastructure engineering work. It should then review this information to verify that the initiative has yielded the benefits intended and, if not, to identify and implement measures to remedy this.

- 2 *The intent of this recommendation is that Network Rail should reduce the risk of engineering protection irregularities associated with railway roles that are not currently being considered as part of the planning and delivering safe work initiative.*

Network Rail should develop an action plan to reduce the risk of irregular application of engineering protection arrangements by railway roles that are outside the scope of the current planning and delivering safe work initiative (for instance signallers, persons in charge of the possession and electrical control operators). As a minimum, consideration should be given to ways of reducing the likelihood of:

- protection being set up when lines are open to traffic;
- errors when arranging for work to be carried out on or near electrical traction supply equipment;
- the signalling of trains into protected areas; and
- irregularities involving the operation of level crossings within protected areas.

²⁰ 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 (also known as Office of Rail and Road) to enable it to carry out its duties under regulation 12(2) to:

- (a) ensure that recommendations are duly considered and where appropriate acted upon; and
- (b) report back to RAIB details of any implementation measures, or the reasons why no implementation measures are being taken.

Copies of both the regulations and the accompanying guidance notes (paragraphs 200 to 203) can be found on RAIB's website www.gov.uk/raib.

Appendices

Appendix A - Glossary of abbreviations and acronyms

COSS	Controller of site safety
ECO	Electrical control operator
ES	Engineering supervisor
IWA	Individual working alone
NOC	National Operations Centre
ORR	Until 1 April 2015 ORR was known as the 'Office of Rail Regulation'. It has used the name 'Office of Rail and Road' for operating purposes with effect from 1 April 2015. Legal force is expected to be given to this name from October 2015
PDSW	Planning and delivering safe work
PICOP	Person in charge of the possession
PTW	Permit to work
RSSB	Rail Safety and Standards Board
SWL	Safe work leader

Appendix B - Glossary of terms

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

AC electrified line	A line that is electrified by 25,000 volt AC overhead lines.
Conductor rails	A rail through which electricity is supplied to electrically powered trains.
Controlled signal	A signal which has to be made, by the signaller or automatic route setting system, to show a proceed aspect or indication during normal operations.
Controller of site safety	A person certified as competent to implement a safe system of work for a group of people on Network Rail controlled infrastructure.
Danger	A signal aspect or indication telling the driver that they must stop before the signal.
DC electrified line	A line which is electrified by 750 volt DC conductor rails.
Detonator protection	<p>Three detonators (small disc-shaped warning devices that explode when train wheels pass over) placed on the same rail 20 metres apart.</p> <p>When used to provide additional protection for a line blockage, the detonators are placed at the protecting signal (or clear of any points or through crossings beyond the signal).</p> <p>When used to delimit a possession, a possession limit board (a double-sided board with a red light and the word STOP on both sides) is placed at the centre detonator.</p>
Duty co-ordinator	Within RAIB, the person responsible for co-ordinating the RAIB response to accidents and incidents, and for determining how they relate to schedules in the Railways (Accident Investigation and Reporting) Regulations 2005.
Electrical control operator	The person having control over supply to, switching of and isolation of an electrification system in a geographical area.*
Engineering supervisor	The person nominated to manage the safe execution of works within an engineering work site. This includes arranging the marker boards, authorising movements of trains into and within the work site and managing access to the site by controllers of site safety.*
Engineering train	A train used in connection with engineering work on the railway, including self-propelled on-track machines that are permitted to travel in normal traffic.*
Fatalities and weighted injuries	Composite metric used to assess the safety trends on the railway, where one fatality is considered statistically equivalent to agreed numbers of lesser injuries, the weighting varying by the seriousness of the injury.

Hazard directory	A database maintained by Network Rail that contains details of the health, safety and environmental hazards known to exist on Network Rail-controlled infrastructure.*
Individual working alone	A person certified as competent to arrange a safe system of work for their own protection on Network Rail-controlled infrastructure.
Infrastructure manager	An organisation that is responsible for developing and maintaining railway infrastructure, and manages and uses that infrastructure or allows it to be used for operating railway vehicles.
Lookout	A person appointed by the controller of site safety, when working on lines open to traffic, who ensures that staff are warned of approaching trains so that they are in a position of safety for a minimum of ten seconds before the train arrives.
National Operations Centre	Based in Network Rail HQ in Milton Keynes, the National Operations Centre co-ordinates the supply of information to industry on significant events, compiles and maintains a daily national log of such events, reviews significant incidents for industry-wide transmission, and assists with maintaining an overview of train services, particularly during times of national disruption.
On-track plant	A specialist road-rail or other maintenance vehicle that is only permitted to operate on the railway within a possession.
Overhead line equipment	Wires and associated equipment, suspended over or adjacent to the railway for supplying electricity to electric trains.
Person in charge of the possession	An individual who is certificated as competent to take charge of arrangements associated with a possession.
Position of safety	A place where it is considered safe to be when a train passes. According to the Rule Book, a person is in a position of safety if they are at least 1.25 metres from the nearest open line if the maximum speed is up to 100 mph. If the speed is over 100 mph this distance increases to 2 metres.
Possession	A section of line (delimited by detonator protection) that is blocked for the normal running of trains to allow engineering work to be carried out. It is under the control of a PICOP.
Protection controller	A person appointed to take overall control of a shared line blockage when two or more COSSs need the line blocking at the same place and time.
Reminder appliance	A device used to remind a signaller that a particular lever, button or switch must not be operated.
Running through (points)	An incident where a train movement runs through a set of trailing points (points where two routes converge) that are not set in the correct position for the movement.

Safe work leader	A new competence that Network Rail is introducing. The safe work leader will have overall (task and safety) responsibility for work carried out in a work site or a work area outside a work site.
Safety of the line	The condition on the railway that needs to be satisfied for trains to be able to run safely, without, for instance, the risk of derailment or collision.
Sectional appendix	An operating publication produced by Network Rail that includes details of running lines, permitted speeds, and local instructions.
Site warden	A member of staff appointed to warn staff working near lines that are open to traffic in the event that they move outside their safe working area.
Token	A device (or permission code) carried by (or granted to) a driver as his authority to run over a single line.
Track circuit operating device	A device which can be placed on the top of each running rail to operate the track circuit and therefore provide signalling protection.
Train reporting number	A four-character alphanumeric code that is used to identify a train for operational purposes.
Work area	A specific place on the railway where engineering work is being carried out.
Work site	A section of line within a possession (sometimes indicated by work site marker boards) where work is carried out. It is under the control of an ES.
Work site marker board	A double-sided yellow board, with two vertical red-yellow flashing lights on one side and two yellow flashing lights on the other, used to indicate a work site in a possession.

Appendix C - Examples of typical event descriptions (anonymised)

Example 1: an irregularity involving the incorrect placement of work site marker boards (classified as a category 1 event)

(Route ID) At 2314 the driver of *train reporting number*, *train operating company code*, *departure time origin – destination*, reported having struck a worksite marker board on the *line name* at *mileage*, to the south of *location*. The driver was shaken and requested a Line Blockage to check the unit, thence going forward at 2332, with no damage reported. A Mobile Operations Manager attended to investigate. The board was found to have been placed in error in relation to the T3 possession per *possession item*, *location of possession limits*, *line names* all blocked 2240 – 0530, possession manager *organisation name*. The worksite was owned by *organisation name*, and the Engineering Supervisor (ES) stated that the worksite diagram pointed to the *line name A* rather than the *line name B*, this proving to be the case. The ES was relieved of duty for interview and ‘for cause’ screening.

Example 2: an irregularity involving the incorrect taking of a line blockage (classified as a category 2 event)

(Route ID) At 0028 an act of irregular working was reported to have occurred during the protection arrangements for a line blockage on the *line name* at *location (line blockage reference)*, whereby the signaller at *signal box A*, having discussed and agreed the protection limits with both the Controller of Site Safety (COSS) and the affected adjacent signalbox, had inadvertently agreed the wrong protection limits with the signaller at *signal box B*, and when confirming that the line blockage had been granted the error was revealed. The line blockage was cancelled and retaken using the correct limits. The signaller *signal box A* was relieved of duty to undergo ‘for cause’ screening.

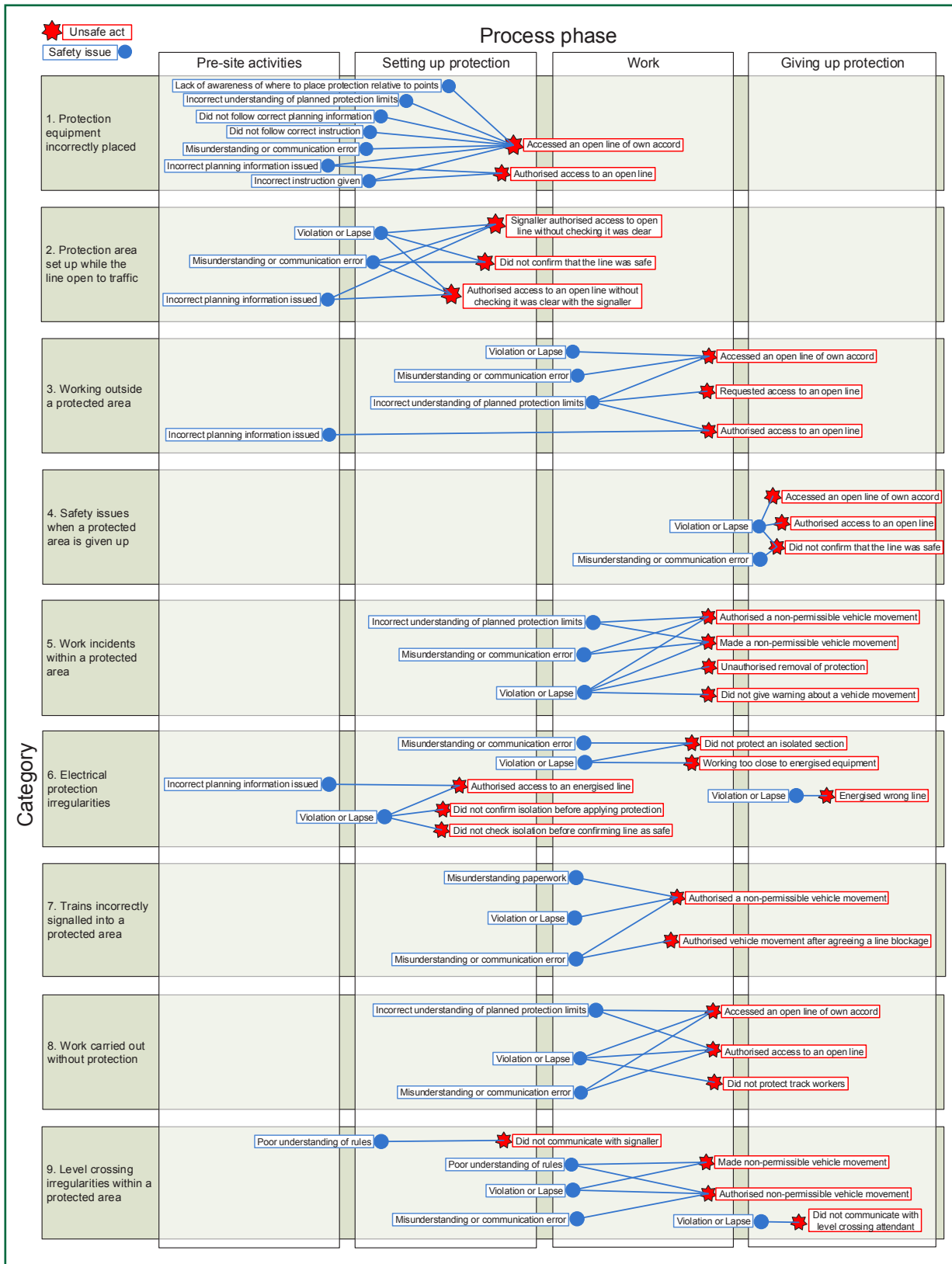
Example 3: an irregularity involving the incorrect re-charging of a DC conductor rail (classified as a category 6 event)

(Route ID) In relation to the possession per *possession item A*, *location A – location B*, *line names* blocked 0055 (Sun) – 0400 (Mon), Possession Manager Network Operations *route name*: at 0540 (Sun) the Electrical Controller at *location* inadvertently re-charged a section of traction current rail on the *line name* at 21m 55ch, in the vicinity of *junction name*, causing significant damage to an earthing strap in Worksite ‘A’. There were no injuries, and minor damage to the railhead. The Mobile Operations Manager attended. The ECRO investigation revealing that the person concerned, who should have been re-charging the traction current for *possession item B*, between *location C* and *location D*, had in error picked up the B2 form for *possession item A*. The person was relieved of duty for interview and screening.

Example 4: an irregularity involving the signalling of a train into a line blockage (classified as a category 7 event)

(Route ID) At 1044, having granted a blockage of the *line name* between *location A* and *location B (line blockage reference)*, the signaller at *signal box* signalled *train reporting number*, *train operating company code*, *departure time origin – destination* into the blocked section after misreading the paperwork. The error was realised immediately and the train brought to a stand by a CSR stop message. The COSS was contacted and reported that the group were just walking to site when the train passed them. The blockage was given up allowing *train reporting number* to proceed. The signaller was relieved of duty for interview and screening.

Appendix D - Safety issue linkage and mapping diagram



Appendix E - Anticipated benefits of the PDSW initiative

The tables below summarise the benefits that Network Rail intend from the changes introduced by the PDSW initiative with respect to each of the identified safety issues.

1. Protection equipment incorrectly placed

Safety Issue	Likely benefit of PDSW
Incorrect understanding of planned protection limits	<p>New digital maps available for briefing staff that place protection: reduced risk of location misunderstandings.</p> <p>The person placing the protection will need to be in possession of a PTW issued by PICOP. This will cover task-specific risk control measures (including location information from the digital map). The PICOP will be responsible for briefing the person placing protection, he will also then be responsible for making the PTW live.</p>
Incorrect instruction given	<p>New digital maps available for briefing staff that place protection: reduced risk of location misunderstandings.</p> <p>The person placing the protection will need to be in possession of a PTW issued by PICOP. This will cover task-specific risk control measures (including location information from the digital map). The PICOP will be responsible for briefing the person placing protection, he will also then be responsible for making the PTW live.</p>
Did not follow correct instruction	<p>New digital maps available for briefing staff that place protection: reduced risk of location misunderstandings.</p> <p>The person placing the protection will need to be in possession of a PTW issued by PICOP. This will cover task-specific risk control measures (including location information from the digital map). The PICOP will be responsible for briefing the person placing protection; he will also then be responsible for making the PTW live.</p>
Did not follow correct planning information	<p>New digital maps available for briefing staff that place protection: reduced risk of location misunderstandings.</p> <p>The person placing the protection will need to be in possession of a PTW issued by PICOP. This will cover task-specific risk control measures (including location information from the digital map). The PICOP will be responsible for briefing the person placing protection; he will also then be responsible for making the PTW live.</p>
Incorrect planning information issued	<p>New digital maps available for briefing staff that place protection: reduced risk of location misunderstandings.</p> <p>The person placing the protection will need to be in possession of a PTW issued by PICOP. This will cover task-specific risk control measures (including location information from the digital map). The PICOP will be responsible for briefing the person placing protection, he will also then be responsible for making the PTW live.</p> <p>New universal planning process: opportunity for improved rigour and accuracy checks.</p>
Lack of awareness of where to place protection relative to points	<p>Task-specific risks and control measures will be documented on the PTW. These will include the need to ensure a safe separation of two metres from a line that remains open to traffic.</p>
Misunderstanding or communication error	<p>New digital maps available for briefing staff that place protection: reduced risk of location misunderstandings.</p> <p>The person placing the protection will need to be in possession of a PTW issued by PICOP. This will cover task-specific risk control measures (including location information from the digital map). The PICOP will be responsible for briefing the person placing protection, he will also then be responsible for making PTW live.</p>

2. Protection area set up while line is open to traffic

Safety Issue	Likely benefit of PDSW
Violation or lapse	<p>Signallers: No effect, as there will be no change to the signaller's role.</p> <p>PICOP and signaller: No effect, as there will be no change to the arrangements concerning the PICOP and signaller relationship.</p> <p>PICOP and staff site: The person placing the protection will need to be in possession of a PTW issued by the PICOP. The PTW will cover task-specific risk control measures reducing the risk of communication misunderstandings when the PICOP briefs him.</p>
Misunderstanding or communication error	<p>Signallers: No effect, as there will be no change to the signaller's role.</p> <p>PICOP and signaller: No effect, as there will be no change to the arrangements between PICOP and signaller.</p> <p>PICOP and staff site: The person placing the protection will need to be in possession of a PTW issued by the PICOP. The PTW will cover task-specific risk control measures reducing the risk of communication misunderstandings when the PICOP briefs him.</p>
Incorrect planning information issued	<p>New digital maps available for briefing staff that place protection: reduced risk of location misunderstandings.</p> <p>The person placing the protection will need to be in possession of a PTW issued by PICOP. This will cover task-specific risk control measures (including location information from the digital map). The PICOP will be responsible for briefing the person placing protection, he will also then be responsible for making PTW live.</p> <p>New universal planning process: opportunity for improved rigour and accuracy checks.</p>

3. Working outside a protected area

Safety Issue	Likely benefit of PDSW
Incorrect understanding of planned protection limits	<p>New digital maps available for briefing staff that place protection: reduced risk of location misunderstandings.</p>
Violation or lapse	<p>New digital maps used for briefing work site staff: opportunity to check/confirm understanding of protection limits at pre-work brief.</p> <p>The person responsible for each work area needs to be in possession of a PTW. This will cover task-specific risk control measures and therefore act as a reminder to those on site of their individual responsibilities.</p> <p>Otherwise, the risk of human error remains the same.</p>
Incorrect planning information issued	<p>New digital maps available for briefing staff that on protection limits: reduced risk of location misunderstandings.</p> <p>New universal planning process: opportunity for improved rigour and accuracy checks.</p>
Misunderstanding or communication error	<p>New digital maps available for briefing staff that place protection: reduced risk of location misunderstandings.</p>

4. Safety issues when a protected area is given up

Safety Issue	Likely benefit of PDSW
Violation or lapse	<p>New prescribed site handback process incorporated within the PTW system will act as a reminder to individuals of their responsibilities to check and confirm that the line is clear and safe.</p> <p>The person in charge of each work area will need to be in possession of a PTW. This will cover relevant task-specific risk control measures; for instance, the need for a track geometry supervisor to confirm there are no geometry faults before allowing trains to run (although reliance will remain on the track geometry supervisor's surveying/inspection skills and competence in making this assessment).</p> <p>Otherwise, the risk of human error remains the same.</p>
Misunderstanding or communication error	<p>New prescribed site handback process incorporated within the PTW system will act as a reminder to individuals of their responsibilities to check and confirm that the line is clear and safe.</p> <p>SWL will have overall responsibility for task and safety: reduced potential communication misunderstandings and clarity of responsibility for confirming the line is clear and safe before handing back to the PICOP.</p> <p>SWL will hold PTWs applicable to all individual sites of work within a work site: SWL is therefore able and responsible for managing and resolving interface issues, and any likely misunderstandings and work conflicts.</p>

5. Work issues within a protected area

Safety Issue	Likely benefit of PDSW
Violation or lapse	<p>SWL will be the single person in charge of both task and safety: clearer role cascade, with responsibility for resolving interface issues between sites of work.</p> <p>SWLs will need to demonstrate a higher level of competence, with training and assessments in place to suit: the intention is to ensure professionalism of staff and improve responsibility ownership. For instance, SWLs in charge of more complex sites (SWL3) will require an IOSH qualification.</p> <p>SWLs will be able to allocate some of their responsibilities to staff that directly report to them, for instance, for the management of engineering train and plant movements. This is particularly relevant to complex sites as it will help reduce the burden of work on individuals. Although this not a significant change to the current ES arrangements, it will mean that task as well as safety (Rule Book) duties can be clearly delegated.</p>
Misunderstanding or communication error	<p>New digital maps available for briefing staff that on protection limits: reduced risk of location misunderstandings.</p> <p>SWL will have overall responsibility for task and safety: reduced communication misunderstandings and clarity of responsibility.</p> <p>SWL will hold PTWs applicable to all individual sites of work within a work site: SWL is therefore able and responsible for managing and resolving interface issues, and any likely misunderstandings and work conflicts.</p>
Incorrect understanding of planned protection limits	<p>New digital maps available for briefing staff that on protection limits: reduced risk of location misunderstandings.</p>

6. Electrical protection irregularities

Safety Issue	Likely benefit of PDSW
Violation or lapse	<p>PDSW is intending to introduce more rigour to the planning (of electrical isolations) in order to reduce errors on site: the PTW detailing the task, risks and control measures for the electrical isolation team on site, and reminding them of their safety responsibilities.</p> <p>However, the specifics of the isolation arrangements will remain reliant on the local knowledge and competence of the staff involved (both the ECO and the team on site). The risk of human error, therefore, remains the same.</p>
Incorrect planning information issued	<p>No change is proposed to the ECO's responsibilities for isolation arrangements, therefore no significant effect.</p> <p>The new digital maps are being extended to include details from Designated Earthing Point plans; this may bring small benefits on AC electrified lines.</p> <p>There is no proposal to include isolation information on the digital maps relating to DC electrified lines.</p>
Misunderstanding or communication error	<p>No change is proposed to the ECO's responsibilities for isolation arrangements, therefore no significant effect.</p> <p>However, PDSW is intending to introduce more rigour into the planning process to reduce errors on site and the new digital maps are being extended to include details from Designated Earthing Point plans, which may bring small benefits on AC electrified lines.</p> <p>There is no proposal to include isolation information on the digital maps relating to DC electrified lines.</p>

7. Trains incorrectly signalled into a protected area

Safety Issue	Likely benefit of PDSW
Violation or lapse	No change to PICOP and signaller roles, arrangements and relationship, therefore no significant effect.
Misunderstanding or communication error	No change to PICOP and signaller roles, arrangements and relationship, therefore no significant effect.
Misunderstanding paperwork	<p>No change to PICOP and signaller roles, arrangements and relationship, therefore no significant effect.</p> <p>Note: a long term goal of PDSW is to reduce late changes to planned work. This may reduce the risk of the signaller having out-of-date information in the future.</p>

8. Work carried out without protection

Safety Issue	Likely benefit of PDSW
Violation or lapse	Network Rail operations control will have oversight of all staff authorised to be on the railway. As staff will need a PTW to be able to work, this will help ensure more robust monitoring and an improved safety culture.
Misunderstanding or communication error	New digital maps available for briefing staff on site: reduced risk of location misunderstandings.

Incorrect understanding of planned protection limits	New digital maps available for briefing staff on site: reduced risk of location misunderstandings.
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9. Level crossing irregularities within a protected area

Safety Issue	Likely benefit of PDSW
Violation or lapse	<p>SWL will be the single person in charge of both task and safety: clearer role cascade, which will include responsibility for train and plant movements.</p> <p>Agents allocated to level crossing duties will be issued with a task-specific PTW, which will help remind them of their safety responsibilities. However, the specific level crossing arrangements will remain reliant on the knowledge and competence of the staff involved. The risk of human error, therefore, remains the same.</p> <p>No change to driver, machine operator or PICOP roles and arrangements. Therefore, PDSW will have no effect otherwise. This is particularly the case in PICOP controlled areas within a possession.</p>
Misunderstanding or communication error	<p>SWL will be the single person in charge of both task and safety: clearer role and responsibility cascade.</p> <p>SWLs will be able to allocate some of their responsibilities to staff that directly report to them, for instance, for the management of engineering train and plant movements. Although this not a significant change to the current ES arrangements, it will mean that task as well as safety (Rule Book) duties can be clearly delegated.</p> <p>No change to driver, machine operator or PICOP roles and arrangements. Therefore, PDSW will have no effect otherwise. This is particularly the case in PICOP controlled areas within a possession.</p>
Poor understanding of rules	<p>New digital maps available for briefing staff on the protection arrangements in place: reduced risk of location misunderstandings.</p> <p>No change to driver, machine operator or PICOP roles and arrangements. Therefore, PDSW will have no effect otherwise. This is particularly the case in PICOP controlled areas within a possession.</p>

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