Category A SPAD and TPWS activity report, Appendices

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The report may be downloaded from the RSSB website: [www.rssb.co.uk](http://www.rssb.co.uk).

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1 Appendix 1 – General information

1.1 The risk from cat A SPADs

The method of assessing trends in SPAD risk used here is designed to assess whether the changes are representative of any underlying change in risk, rather than just volatility in the data. Thus the metric is less vulnerable to the effects of one high-risk SPAD.

The selection of September 2006 as the benchmark date ensures that factors such as the instigation of TPWS and the removal of Mk 1 rolling stock, both of which had a positive effect on the level of SPAD risk, are not reflected in the changes in risk level, as they were completed prior to that date.

Focussing on the calculated risk after the input of these two changes portrays a more meaningful indication of trends in risk. It is based on the SPAD risk ranking tool (hence it reflects changes in both frequency and potential consequence) and provides a robust method for identifying changes in the underlying risk.

A number of factors are taken into account in the calculation of SPAD risk in respect of each individual SPAD. These include:

- The length of the overrun
- The distance to the most likely point of conflict
- The type of conflict (e.g., head-on, side-on/converging, rear-end, derailment, level crossing, etc.)
- The maximum speed of the SPAD train and of the conflict train
- The crashworthiness of both (if appropriate) trains
- The passenger loadings of both (if appropriate) trains

This results in the calculation of a score between 0 and 28, with 0 representing a SPAD with negligible risk, and 28 a SPAD with a significant potential to result in a multi-fatality accident. Those in the range 1-15 are classified as ‘not significant risk’, those between 16 and 19 ‘potentially significant’, and those 20 and above ‘potentially severe’.

These scores have a simple logarithmic relationship. The risk from a SPAD with a score of 20, for example, is not equivalent to the aggregate risk of two with scores of 10, but instead equates to two 19s. An increment of one is representative of a doubling of risk.

Thus the calculation of SPAD risk will be strongly influenced by a small number of those incidents towards the upper end of the range than it is by a larger number of low-scoring ones.
1.2 SPAD Risk

SPADs are ranked and analysed in terms of the potential risk they represent. Details of the methodology are presented in Appendix 4.

The measure of SPAD risk is calculated using the SPAD risk ranking tool (SRRT). This process fulfils the purpose of providing a consistent and objective measure of assessing changing trends in SPAD risk on a system-wide basis.

The SRRT provides each SPAD with a score between zero (no risk) and 28 (a very high risk). To assist with reporting, the SPAD risk ranking scores are grouped into three bands as follows:

- Risk rankings of 0 to 15 are classified as **no significant risk**.
- Risk rankings of 16 to 19 are classified as **potentially significant**.
- Risk rankings of 20 and above are classified as **potentially severe**.

For the purposes of most of the tables and graphs in this report, the significant and severe groups are reported together as 16+.

1.3 Data quality

RSSB works with the industry to ensure the quality of the information reported into SMIS is of the highest possible quality. One of the data quality initiatives involves providing a suite of topic-based indicators listing events that require action. Several of the indicators are related to SPAD and TPWS data.

The Railway Group Standard GE/RT8047 (*Reporting of Safety Related Information*)\(^1\) mandates the requirements for reporting safety related information by means of SMIS, so that reliable safety data is collected, analysed, and made available by RSSB for use by RSSB members in their management of risk.

The requirements of the Standard are additional to the statutory RIDDOR reporting requirements.

Guidance on the reporting of safety related information is provided in the RSSB document *Guidance on the definitions and analysis of safety related information*, which may be found at [www.rssb.co.uk/publications/guidance.asp](http://www.rssb.co.uk/publications/guidance.asp).

In addition to the data quality initiative, the Operations Focus Group (OFG) has requested that all Formal and Local Investigation reports pertaining to SPAD incidents be submitted to RSSB. This will serve to improve the quality of the data collected, and therefore the outputs to the industry (in reports such as this, for example).

\(^1\) See [www.rgsonline.co.uk](http://www.rgsonline.co.uk), Specifically
Appendix 2 - Industry developments

TPWS – industry strategy

TPWS was implemented in the UK as an interim measure to reduce the consequences of signals passed at danger (SPADs), pending implementation of full protection through systems that monitor driver performance continuously. In the Uff-Cullen report, it was envisaged that this higher level of protection would be delivered by the roll-out of the European Rail Traffic Management System (ERTMS\(^2\)) within ten years.\(^3\) In the intervening period it has become clear that the roll-out of ERTMS will take considerably longer, hence TPWS will be the primary means of mitigating SPAD risk for a period significantly beyond that originally envisaged.

At the operational risk conference in July 2008, the ORR gave a presentation on *Managing and Reducing Operational Safety Risk*, which highlighted a concern regarding the lack of a clear strategy for the long-term future of TPWS.

In response, the RSSB Board considered the issues at its December 2008 meeting and directed the Vehicle/Train Control & Communications System Interface Committee (V/TC&C SIC) to develop a long-term strategy for TPWS. In turn, the V/TC&C SIC created a TPWS Strategy subgroup to aid with development, which is being achieved via close co-operation from Network Rail, the train operators, RSSB, the ROSCOs and the Rail Industry Association. It has been reviewed at senior industry level at each stage.

The strategy was approved by the RSSB Board at its meeting on 12 November 2009, and may be found at [http://www.rssb.co.uk/SAFETY/Pages/TPWSSTRATEGY.aspx](http://www.rssb.co.uk/SAFETY/Pages/TPWSSTRATEGY.aspx). There is also a TPWS strategy action plan at [www.Opsweb.co.uk](http://www.Opsweb.co.uk).

If you require information on the strategy, please contact: Colin Dennis, Director, Policy Research and Risk. Colin.dennis@rssb.co.uk.

\(^2\) For more information on ERTMS, see [www.ertms.com](http://www.ertms.com).

The definitions changed on 1 December 2012, with B, C and D no longer considered SPADs. A SPAD is a signal passed at danger (without authority). According to Railway Group Standard GO/RT3119, SPADs fall into one of four categories.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
</table>
| **A**    | **A1** When a SPAD has occurred and, according to available evidence, a stop aspect, indication or end of in-cab signalled movement authority was displayed or given correctly and in sufficient time for the train to be stopped safely at it.  
**A2** When a SPAD has occurred and, according to available evidence, the stop aspect, indication or end of in-cab signalled movement authority concerned was not displayed or given correctly, but was preceded by the correct aspects or indications.  
**A3** When a SPAD has occurred and, according to available evidence, verbal and/or visual permission to pass a signal at danger was given by a handsignaller or other authorised person without the authority of the signaller.  
**A4** When a SPAD has occurred and, according to available evidence, a stop aspect, indication or end of in-cab signalled movement authority was displayed or given correctly and in sufficient time for the train to be stopped safely at it, but the train driver was unable to stop his train owing to circumstances beyond his control (for example, poor rail head adhesion, train braking equipment failure or malfunction etc.). |
| **B**    | **B1** When a SPAD has occurred because a stop aspect, indication or end of in-cab signalled movement authority, that previously showed a proceed indication, was displayed because of infrastructure failure (for example, signalling or level crossing equipment has failed or malfunctioned).  
**B2** When a SPAD has occurred because a stop aspect, indication or end of in-cab signalled movement authority, that previously showed a proceed indication, was displayed because it was returned to danger or displayed in error. |
| **C**    | **C** When a SPAD has occurred because a stop aspect, indication or end of in-cab signalled movement authority was not displayed in sufficient time for the train to be stopped safely at the signal, indication or end of in-cab signalled movement authority as it had been returned to danger automatically or in an emergency in accordance with GE/RT8000 Rule Book. |
| **D**    | **D** When a SPAD has occurred because vehicles without any traction unit attached, or a train which is unattended, had run away past the signal at danger or without an in-cab movement authority. |

Any SPAD allocation is considered to be provisional, until the SPAD investigation process is finalised and the initial allocation is either confirmed or re-categorised. During the interim, the SPAD classification carries the suffix ‘(P)’ for ‘provisional’.  
**NB:** SPADs which occurred prior to the inception of version 2 of GO/RT3119 remain categorised according to version 1 of that Standard (i.e. A, B, C or D). The sub-categories (A1, A2, etc.) are only applicable after the issue of version 2.
On or affecting a running line (OOARL)

The criterion for a category A SPAD to be included in this report is that it occurred on NRMI. SPADs that have occurred in sidings and depots that are off running lines, but on NRMI, are therefore present. However, SPADs that have occurred within facilities operated by third parties are only included if the passing of the signal caused the train to enter or affect NRMI. This is a slightly wider definition than that used in Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR).

The RIDDOR requirement for reporting to the Office of Rail Regulation (ORR) is:

‘any case where a train, travelling on a running line or entering a running line from a siding, passes without authority a signal displaying a stop aspect unless the stop aspect was not displayed in sufficient time for the driver to stop safely at the signal’.

This RIDDOR-based subset of the full NRMI SPAD data is referred to in RSSB’s safety performance reports as ‘on or affecting running line’ (OOARL) SPADs. The OOARL and ORR reportable incidents can be fewer in number than those on NRMI.

SPAD risk ranking tool (SRRT)

The need both to understand SPADs better and to quantify the risk more effectively led, in 2001, to the development of a SPAD risk ranking methodology. This involves Network Rail and the railway undertaking involved in rating a SPAD against a number of criteria within five days of its occurrence.

The ratings are related to the likelihood of an accident and its potential consequences. Specifically, it has been designed to:

- Measure changes to the overall potential risk from SPADs.
- Identify those SPADs that are potentially significant and potentially severe.
- Inform the SPAD investigation process.

The risk ranking tool is made up of three elements:

- Part 1 - An initial collision potential assessment.
- Part 2 - An accident vulnerability ranking.
- Part 3 - The risk ranking score.

In general, this report uses the Part 3 score only. However, in Appendices 3 and 4 (last column), the complete three-part code is quoted. In the example, 'YD21', 'Y' comprises part 1, 'D' part 2, and '21' part 3. A detailed explanation of each element is given below.

Part 1: Initial collision potential assessment

The first character of the complete code will either be Y representing ‘yes’ or N meaning ‘no’. This character is registered in response to the question: following the Category A SPAD, could the train, before it reached another stop aspect, have come into conflict with another train on a cleared route joining or crossing the route ahead of the signal passed at danger?
Part 2: SPAD accident vulnerability ranking

The second character of the complete code provides weighting to the probability and severity of the incident and will be one of the following ten options:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Accident occurred.</td>
</tr>
<tr>
<td>B</td>
<td>SPAD train stopped on the first potential conflict point, with potential conflicting train stopped by actions of the driver and/or signallers prior to collision [Collision only prevented by recovery action].</td>
</tr>
<tr>
<td>C</td>
<td>SPAD train stopped on the first potential conflict point, with potential conflicting train stopped by automatic action of signalling system (ie signal flank protection) prior to collision.</td>
</tr>
<tr>
<td>D</td>
<td>SPAD or potential conflict train crossed the potential conflict zone without accident [Restricted time window for accident].</td>
</tr>
<tr>
<td>E</td>
<td>SPAD train stopped less than or equal to 50 metres in rear of the first potential conflict point by actions of signallers prior to accident [Potential for accident prevented by recovery action].</td>
</tr>
<tr>
<td>F</td>
<td>SPAD train stopped less than or equal to 50 metres in rear of the first potential conflict point by actions of the driver alone (with NO TPWS, ATP or a Trip cock system activation or intervention) [Escalation of SPAD required before accident could occur].</td>
</tr>
<tr>
<td>G</td>
<td>SPAD train stopped less than or equal to 50 metres in rear of the first potential conflict point with activation or intervention of TPWS, ATP or a tripcock system (with or without driver action to apply the brakes) [Escalation of SPAD required before accident could occur].</td>
</tr>
<tr>
<td>H</td>
<td>SPAD train stopped more than 50 metres in rear of the first potential conflict point by actions of signallers prior to accident [Potential for accident prevented by recovery action].</td>
</tr>
<tr>
<td>I</td>
<td>SPAD train stopped more than 50 metres in rear of the first potential conflict point by actions of the driver alone (with NO TPWS, ATP or a Trip cock system activation or intervention) [Significant escalation of SPAD required before accident could occur].</td>
</tr>
<tr>
<td>J</td>
<td>SPAD train stopped more than 50 metres in rear of the first potential conflict point with activation or intervention of TPWS, ATP or a trip-cock system (with or without driver action to apply the brakes) [Significant escalation of SPAD required before accident could occur].</td>
</tr>
<tr>
<td>K</td>
<td>SPAD where the design of the track layout and / or signalling controls prevents the possibility of a conflict in advance of the signal (eg at first signal of a double blocking), or in degraded working (eg T3 possessions or single line working) where all arrangements were in place for the safe passage of the train. [accident highly unlikely].</td>
</tr>
<tr>
<td>U</td>
<td>Unknown risk ranking result (generally relates to events from 2002 to 2004 that have not been ranked, plus a few current events for which results are still awaited).</td>
</tr>
</tbody>
</table>
Part 3: SPAD risk ranking score

The risk ranking system provides each SPAD with a score, which is between zero (no risk) and twenty-eight (a very high risk). To assist with reporting, the SPAD risk ranking scores will be grouped into severity bands as follows:

- Risk rankings of 0 to 15 are classified as **no significant risk**.
- Risk rankings of 16 to 19 are classified as **potentially significant**.
- Risk rankings of 20 and above are classified as **potentially severe**.

**TPWS interventions and activations**

TPWS brake demands are classified as being **interventions** or **activations**. These two terms are sometimes viewed as being mutually interchangeable, however, they do each have their own distinct meanings, which should be used when referring to TPWS brake demands associated with category A SPADs, as follows:

a) **TPWS Intervention**
   A TPWS intervention occurs when the TPWS applies the brakes in the absence of (or prior to) the driver doing so. For example:
   - A train starting against a TPWS-fitted signal at danger without authority will result in an **intervention** when the train passes the signal.
   - A driver taking no action to apply the brake on approaching a signal at danger and passing over the overspeed loops too quickly will also result in an **intervention**.

   In short the safety system 'intervenes' if the driver has not taken the appropriate action.

b) **TPWS Activation**
   This occurs when a driver has already applied the brakes before the TPWS operates. For example:
   - A driver might already be braking on the approach to a red signal, but still passes over the overspeed sensor too quickly, resulting in an **activation**.
   - If a train passes a TPWS-fitted signal at danger, despite having applied the brakes in an attempt to stop at it, then an **activation** results.

   In short, the safety system 'activates' to back up the driver's brake application.

**Multi-SPAD signals**

At any point in time, a signal is said to be a multi-SPAD signal if there have been two or more SPADs at the signal during the five years prior to that point.

**Multi-SPAD drivers**

At any point in time, a driver is said to be a multi-SPAD driver if he/she has had two or more SPADs since qualifying as a driver.
## Notes applicable to Appendices

<table>
<thead>
<tr>
<th>Duty holder</th>
<th>This is the name of the railway undertaking responsible for the train at the time of the SPAD. It should be noted that this company is not always the driver's employer.</th>
</tr>
</thead>
</table>
| Train class | 1 - express passenger  
2 - local passenger  
3 - parcels/select empty coaching stock ECS  
4 - express freight/freightliner  
5 - empty coaching stock (ECS),  
6, 7 or 8 - freight/engineering  
9 - Eurostar  
0 - light locomotive |
| Overlap column | A blank indicates the overlap is not known, a 0 indicates that the signal has no overlap, other figures are the distances in yards. |
| Total number of SPADs by driver | 0 - Provisionally driver not implicated in the SPAD. The number of SPADs by the driver is as reported by the train operator (mostly in information supplied directly to ORR. SPADs in previous employment may not be included. |
| Multi-tag column | T22 - One of the original multi-SPAD lists (‘Top 22’ in the 1998/1999 Year-end Safety Performance Report)  
IN - With more than two SPADs since 1 April 1994 and subject to Improvement Notice I/RJS/991007/1. Note: the Improvement Notice requirement is for the period 9 October 1994 to 8 October 1999, however, actual coverage is from 1 April 1994.  
M - The signal meets the criteria to be classified as ‘Multi-SPAD’ |
| Passenger line | This shows whether the signal passed is on a line on which passenger trains operate or does it control entry onto a line over which passenger trains run - Yes/No |
| TPWS operation | ACT - Activation (Driver braked before TPWS initiated a brake application)  
INT - Intervention (TPWS brake application before or without driver action)  
A/I - TPWS initiated a brake application, but not known if Act or Int  
NIL - No brake demand (non-fitment or short distance o/run)  
NTI - No brake demand (token issued: Loops suppressed)  
R&C - TPWS initiated a brake application, but TPWS reset by driver, then continued  
TSO - No brake demand (Train Stop Override operated)  
UNK - Not known whether TPWS applied brakes |
| Signal category | 2 - two aspect colour light  
3 - three aspect colour light  
4 - four aspect colour light  
D - disc  
F - fixed signal (old)  
FC - fixed colour light  
FD - fixed distant  
FS - fixed stop  
H - hand signal  
I - points indicator  
L - limit of shunt (old)  
LB - limit of shunt (board)  
LP - limit of shunt (position light)  
M - marker boards  
O - other  
P - position light  
S - semaphore  
SS - semaphore subsidiary  
T - stop board  
X - drivers crossing light |