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Key

Last quarter: Q2 2013/14
Last year: Q3 2012/13

Unless otherwise stated, stated values are for the end of Q3 2013/14, and comparisons are made between this and the last quarter.
Executive summary

Key statistics

<table>
<thead>
<tr>
<th>All SPADs annual moving total (AMT)</th>
<th>16+ SPADs AMT</th>
<th>SPAD risk relative to September 2006 benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>297</td>
<td>94</td>
<td>70%</td>
</tr>
<tr>
<td>Last quarter: 282</td>
<td>Last quarter: 84</td>
<td>Last quarter: 62%</td>
</tr>
<tr>
<td>Last year: 250</td>
<td>Last year: 81</td>
<td>Last year: 66%</td>
</tr>
</tbody>
</table>

Multi-SPAD signals (two or more SPADs in five years)

<table>
<thead>
<tr>
<th>20+ SPADs AMT</th>
<th>16 =</th>
</tr>
</thead>
<tbody>
<tr>
<td>124</td>
<td>16</td>
</tr>
<tr>
<td>Last quarter: 124</td>
<td>Last quarter: 16</td>
</tr>
<tr>
<td>Last year: 131</td>
<td>Last year: 17</td>
</tr>
</tbody>
</table>

Annual moving percentage of TPWS brake demands which were interventions

<table>
<thead>
<tr>
<th>58% ↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last quarter: 61%</td>
</tr>
<tr>
<td>Last year: 51%</td>
</tr>
</tbody>
</table>

Quarterly performance

SPAD numbers

<table>
<thead>
<tr>
<th>Q3 2012/13</th>
<th>Q4 2012/13</th>
<th>Q1 2013/14</th>
<th>Q2 2013/14</th>
<th>Q3 2013/14</th>
</tr>
</thead>
<tbody>
<tr>
<td>77</td>
<td>61</td>
<td>67</td>
<td>77</td>
<td>92</td>
</tr>
</tbody>
</table>

16+ and 20+ SPADs

<table>
<thead>
<tr>
<th>Q3 2012/13</th>
<th>Q4 2012/13</th>
<th>Q1 2013/14</th>
<th>Q2 2013/14</th>
<th>Q3 2013/14</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>12</td>
<td>1</td>
<td>2</td>
<td>7</td>
</tr>
</tbody>
</table>

SPAD risk relative to September 2006 benchmark

<table>
<thead>
<tr>
<th>Q4 2012/13</th>
<th>Q1 2013/14</th>
<th>Q2 2013/14</th>
<th>Q3 2013/14</th>
</tr>
</thead>
<tbody>
<tr>
<td>66%</td>
<td>60%</td>
<td>58%</td>
<td>63%</td>
</tr>
</tbody>
</table>

The 92 SPADs in Q3 13/14 was above the Q3 average of 81.0 for the previous three years. The annual moving total has seen an increase both compared to the last quarter and the same time last year.

Due to the small numbers involved, there is large variation in the number of 16+ and 20+ SPADs between quarters. Note that the 16+ category also includes 20+ SPADs.

The Q3 13/14 risk calculation included eight passenger train SPADs which passed the conflict point, which is the main reason for the increase from Q1, when this figure was seven.

SAS & SOY SPAD numbers

<table>
<thead>
<tr>
<th>Q3 2012/13</th>
<th>Q4 2012/13</th>
<th>Q1 2013/14</th>
<th>Q2 2013/14</th>
<th>Q3 2013/14</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>8</td>
<td>5</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

SOY SPADs have seen a decrease from their peak in 12/13, while SAS SPADs remain variable. Both are currently at historically low levels.

TPWS reset & continue

There was one post SPAD TPWS ‘reset & continue’ incident during the quarter, which occurred at Hitchin on 8 October 2013. The driver stated the signal was displaying a yellow aspect, and assumed the TPWS intervention was due to them being late to cancel AWS. The train passed the first potential conflict point.

Multi-SPAD signals

Of the 124 multi-SPAD signals, 85 (68%) have TPWS fitted. These signals carry a lower risk, as TPWS is designed to stop the train before it reaches the conflict point.

6% of SPADs in the last five years have been at signals which were Multi-SPAD at the time. 21% had at least one SPAD in the preceding five years.
## Context

### Most recent notable incidents resulting from SPADs

<table>
<thead>
<tr>
<th>Passenger train derailment</th>
<th>Passenger train collision</th>
<th>TPWS reset and continue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-passenger train derailment</td>
<td>Non-passenger train collision</td>
<td></td>
</tr>
<tr>
<td>30 Dec 2013 Goole</td>
<td>16 Oct 2003 Norton Bridge</td>
<td></td>
</tr>
</tbody>
</table>

### Last three SPADs resulting in fatalities

<table>
<thead>
<tr>
<th>Ladbroke Grove</th>
<th>Southall</th>
<th>Watford Junction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collision: 31 fatalities</td>
<td>Collision: 7 passenger fatalities</td>
<td>Collision: 1 passenger fatality</td>
</tr>
<tr>
<td>(29 passengers and 2 workforce)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Historic performance

<table>
<thead>
<tr>
<th>SPAD numbers (AMT)</th>
<th>SPAD risk relative to September 2006 benchmark</th>
<th>Seasonality (10-year average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>517</td>
<td>741%</td>
<td>Mar-02 J F M A M J J A S O N D</td>
</tr>
<tr>
<td>297</td>
<td>100%</td>
<td>Dec-13 70%</td>
</tr>
</tbody>
</table>

Since 2000 annual SPAD numbers have decreased by approximately 50%, with the long term trend continuing to show a decrease. Between March 2002 and September 2006 there was a significant reduction in SPAD risk following the installation of TPWS.

In the last 10 years, average monthly SPADs numbers have seen peaks in July and October/November.

### Contribution to total accidental system risk

SPAD risk contributes 10.0% of train accident risk, which is 0.6% of total accidental system risk. While this is a relatively small level of risk, SPADs are an important precursor due to their ability to cause a multi-fatality accident.
Risk

Modelled risk

Precursor indicator model (PIM)  

<table>
<thead>
<tr>
<th>Apr 2010</th>
<th>Dec 2013</th>
</tr>
</thead>
</table>
| [Graph showing PIM]  

The PIM measures the underlying risk from potentially higher risk train accidents (PHRTAs) by tracking changes in the occurrence of accident precursors. In April 2010, SPADs contributed 0.71 FWI/year (9.8% of the total risk), December 2013 shows SPADs contributing 0.82 FWI/year (9.3% of the total risk).

SPAD risk

<table>
<thead>
<tr>
<th>Sep-06</th>
<th>Dec-13</th>
</tr>
</thead>
</table>
| [Graph showing SPAD risk]  

The SPAD risk is modelled using the individual components of SPAD risk ranking scores, based on a rolling 12-month period. It indicates that, at the end of the quarter, the risk from SPADs is 70% of the 2006 benchmark level.

High risk SPADs

There were six SPADs with a risk ranking of 20+ during the quarter. The details are as follows:

- **SPAD risk ranking 22** – On 11 October a passenger train passed UR512 signal at danger on the Up Slow Line at Christian Street Jn (Anglia Route) by approximately 220 yards. The main reasons for the high risk ranking of this SPAD are that: (a) the train passed the potential conflict point, and (b) the consequences had a collision occurred, could have been relatively high due to the possibility of a rear-end collision involving two peak loaded passenger trains, where the potential collision speed is 20 mph.

- **SPAD risk ranking 23** – On 8 October a passenger train passed K698 signal at danger on the Up Slow Line at Hitchin (LNE Route) by approximately 2000 yards. The main reasons for the high risk ranking of this SPAD are that: (a) the train passed the potential conflict point, and (b) the consequences had a collision occurred, could have been relatively high due to the possibility of a rear-end or side-on collision involving two medium loaded passenger trains, where the potential collision speed is 37.5 mph.

- **SPAD risk ranking 23** – On 15 October a passenger train passed L329 signal at danger on the Down Line at Ilford (Anglia Route) by approximately 21 yards. The main reasons for the high risk ranking of this SPAD are that: (a) this is a plain line signal and so TPWS is not fitted, and (b) the consequences had a collision occurred, could have been relatively high due to the possibility of a rear-end collision involving two peak loaded passenger trains, where the potential collision speed is 40 mph.

- **SPAD risk ranking 21** – On 20 November a freight train passed CR30 signal at danger on the Robeston Branch line at Herbrandston Junction by approximately 66 yards. The main reasons for the high risk ranking of this SPAD are that: (a) the SPADing train passed the first potential conflict point, and (b) there was the potential for a head-on or side-on collision with a lightly loaded passenger train.
• **SPAD risk ranking 22** – On 5 December a passenger train passed signal WH54 at danger on the Up Fast line at Radlett Jn by approximately 30 yards. The main reasons for the high risk ranking of this SPAD are that (a) the signal was protecting a bi-directional plain line with the potential for a head-on collision, and (b) the consequences had a collision occurred could have been relatively high due to the possibility of a head-on collision between two medium loaded passenger trains, where the potential collision speed is 75 mph.

• **SPAD risk ranking 20** – On 5 December a passenger train passed signal VC628 at danger on the Up Fast line at Balham by approximately 218 yards. The main reasons for the high risk ranking of this SPAD are that (a) this is a plain line signal and so TPWS is not fitted, and (b) the consequences had a collision occurred could have been relatively high due to the possibility of a rear-end or side-on collision involving two off peak passenger trains, where the potential collision speed is 30 mph.

There was also one non-passenger train derailment as the result of a SPAD – On 30 December a freight train passed signal G85 (GPL) at danger on the up line at Goole by approximately 20 yards and became derailed. The driver stated failing to observe the signal.

**SPAD risk in detail**

**SPADs by potential outcome**

<table>
<thead>
<tr>
<th>Potential Outcome</th>
<th>AMT of SPAD train reaching conflict point with potential for passenger collision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero risk</td>
<td></td>
</tr>
<tr>
<td>Passenger train collision</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

In the last 12 months, the majority (58%) of SPADs involved the potential for a passenger train collision. 27% had the potential for other outcomes, such as derailments or overrunning level crossings, and in 14% of cases there was no potential conflict before the next signal.

SPAD risk closely tracks the overrun probability for SPADs where there is the potential for a collision involving a passenger train, with the number of trains reaching the conflict point in such scenarios having a strong impact on the shape of the SPAD risk graph. In the last 12 months, eight trains reached the conflict point where there was the potential for a passenger train collision.

**SRM and SORAT**

The SRR methodology is designed to provide an immediate indication of changes in SPAD risk, which relies upon certain assumptions which prevent it being used as a tool to look at the risk of individual SPADs or certain categories of SPAD. Once SORAT has been more fully rolled out, it will allow a better understanding of the risk from SPADs at individual signals.

The SRM allows us to look at the risk from some of the main SPAD sub categories, in FWI per year:

<table>
<thead>
<tr>
<th>Category</th>
<th>FWI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junction</td>
<td>0.412</td>
</tr>
<tr>
<td>Plain line</td>
<td>0.237</td>
</tr>
<tr>
<td>Shunt</td>
<td>0.060</td>
</tr>
<tr>
<td>Other</td>
<td>0.112</td>
</tr>
</tbody>
</table>

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**Note:** The image and page number information are not relevant to the content provided.
Quarter in detail

Monthly SPAD numbers

The below two charts respectively show the number of SPADs and 16+ SPADs for each month during the quarter. The band shows an expected range for SPADs based on the past ten years.

All SPADs monthly variation

16+ SPADs monthly variation

SPAD numbers are relatively consistent throughout the year, with the SPAD numbers for each month of Q3 falling in the expected range based on previous years. There is a large variation in 16+ SPADs between months, due to their low numbers. In the last three years about 30% of SPADs have been risk ranked 16+.

SPADs by sub-category

SPADs numbers by sub category are shown below

A1 category SPADs

A2 category SPADs

A3 category SPADs

A4 category SPADs

A1 SPADs are attributable to driver error, A2 that the signal is imperfectly displayed or partly obscured, A3 that an incorrect authority had being given and A4 that the train experienced compromised braking performance. Full descriptions are given in Appendix 2.

Of those which have this field completed in SMIS, approximately 74.5% are A1, 17.3% are A2, 4.6% A3 and 3.6% A4. Incidents for which a sub-category has not been entered have been categorised as A1 SPADs.
TPWS at SPADs

**Percentage of SPADs with a TPWS brake demand**

<table>
<thead>
<tr>
<th></th>
<th>Q3 2012/13</th>
<th>Q4 2012/13</th>
<th>Q1 2013/14</th>
<th>Q2 2013/14</th>
<th>Q3 2013/14</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012/13</td>
<td>53%</td>
<td>67%</td>
<td>66%</td>
<td>51%</td>
<td>57%</td>
</tr>
<tr>
<td>2013/14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Recent quarters have seen an unusually high percentage of SPADs involve a TPWS brake demand. This is due to an increase in the number of SPADs at TPWS fitted signals, with the number at non-TPWS fitted signals staying relatively constant.

**Percentage of TPWS brake demands which are interventions**

<table>
<thead>
<tr>
<th></th>
<th>Q3 2012/13</th>
<th>Q4 2012/13</th>
<th>Q1 2013/14</th>
<th>Q2 2013/14</th>
<th>Q3 2013/14</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012/13</td>
<td>59%</td>
<td>66%</td>
<td>59%</td>
<td>62%</td>
<td>48%</td>
</tr>
<tr>
<td>2013/14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Over the past three years, 52% of the TPWS involvement in SPADs was interventions; this has recently seen a spike, with a greater proportion of TPWS brake demands at SPADs being interventions, although Q3 has been relatively lower.

**Reset and continue**

Since the installation of TPWS was completed in early 2004, there have been 29 ‘reset & continue’ incidents. None of these has resulted in either a collision or a derailment, although in one instance the SPAD train did damage some points by running through them.

**Last three reset and continue incidents**

- **Hitchin**
  - 8 Oct 2013

- **Arkleton East**
  - 8 Aug 2013

- **Shoeburyness**
  - 9 Jun 2013
TPWS approaching SPADs

**TPWS brake demands approaching signals at danger (with no SPAD)**

<table>
<thead>
<tr>
<th></th>
<th>Q3 2012/13</th>
<th>Q4 2012/13</th>
<th>Q1 2013/14</th>
<th>Q2 2013/14</th>
<th>Q3 2013/14</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012/13</td>
<td>247</td>
<td>287</td>
<td>303</td>
<td>320</td>
<td>237</td>
</tr>
</tbody>
</table>

There does not appear to be any correlation between the number of TPWS brake demands approaching signals at danger (which do not result in a SPAD) and the number of SPADs.

**Seasonality of TPWS brake demands approaching signals at danger (with no SPAD)**

One possible reason for this marked seasonal variation is that drivers alter their braking technique when approaching signals at danger according to the prevailing conditions, and that slowing down earlier reduces the numbers of overspeed trips approaching signals at danger.

TPWS at permanent and temporary speed restrictions (PSRs and TSRs)

**Brake demands at PSRs and TSRs**

<table>
<thead>
<tr>
<th></th>
<th>Q3 2012/13</th>
<th>Q4 2012/13</th>
<th>Q1 2013/14</th>
<th>Q2 2013/14</th>
<th>Q3 2013/14</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012/13</td>
<td>121</td>
<td>121</td>
<td>134</td>
<td>125</td>
<td>113</td>
</tr>
</tbody>
</table>

Prior to 2012, all TPWS brake demand data was collected from control logs, the data is now collected directly from SMIS resulting in a more complete data set.

**Seasonality of brake demands at PSRs and TSRs**

There is currently insufficient historical data on brake demands at TSRs and PSRs to draw any conclusions about their seasonality. There is currently no evidence to suggest a correlation with SPADs.

In all cases TPWS performance is based on the last two years of data.
Route performance

**Anglia**

<table>
<thead>
<tr>
<th>All SPADs AMT</th>
<th>16+ (incl. 20+) SPADs AMT</th>
<th>Train miles AMT (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>41 ↑</td>
<td>14 ↑</td>
<td>33 =</td>
</tr>
<tr>
<td>Last quarter: 37</td>
<td>Last quarter: 8</td>
<td>Last quarter: 33</td>
</tr>
<tr>
<td>Last year: 29</td>
<td>Last year: 14</td>
<td>Last year: 34</td>
</tr>
</tbody>
</table>

**Multi-SPAD signals**

<table>
<thead>
<tr>
<th>19 ↓</th>
<th>4 ↑</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last quarter: 21</td>
<td>Last quarter: 3</td>
</tr>
<tr>
<td>Last year: 20</td>
<td>Last year: 2</td>
</tr>
</tbody>
</table>

**Proportion of total SPADs**

---

**Kent**

<table>
<thead>
<tr>
<th>All SPADs AMT</th>
<th>16+ (incl. 20+) SPADs AMT</th>
<th>Train miles AMT (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 ↓</td>
<td>3 ↓</td>
<td>23 =</td>
</tr>
<tr>
<td>Last quarter: 23</td>
<td>Last quarter: 5</td>
<td>Last quarter: 23</td>
</tr>
<tr>
<td>Last year: 25</td>
<td>Last year: 9</td>
<td>Last year: 23</td>
</tr>
</tbody>
</table>

**Multi-SPAD signals**

<table>
<thead>
<tr>
<th>13 ↓</th>
<th>3 =</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last quarter: 14</td>
<td>Last quarter: 3</td>
</tr>
<tr>
<td>Last year: 13</td>
<td>Last year: 1</td>
</tr>
</tbody>
</table>

**Proportion of total SPADs**

---

**Data quality**

**Route performance**

**Lessons learned**
London North Eastern

All SPADs AMT

61 ↑
Last quarter: 55
Last year: 47

Multi-SPAD signals

19 =
Last quarter: 19
Last year: 22

Proportion of total SPADs

16+ (incl. 20+) SPADs AMT

24 ↑
Last quarter: 19
Last year: 17

Train miles AMT (millions)

80 =
Last quarter: 80
Last year: 81

SPADs per million train miles

0.76 ↑
Last quarter: 0.68
Last year: 0.59

SPADs per MTM from average

London North Western

All SPADs AMT

56 ↑
Last quarter: 50
Last year: 46

Multi-SPAD signals

26 ↓
Last quarter: 27
Last year: 29

Proportion of total SPADs

16+ (incl. 20+) SPADs AMT

17 ↓
Last quarter: 19
Last year: 12

Train miles AMT (millions)

82 =
Last quarter: 82
Last year: 84

SPADs per million train miles

0.68 ↑
Last quarter: 0.61
Last year: 0.55

SPADs per MTM from average
Scotland

All SPADs AMT

16 ↓
Last quarter: 20
Last year: 16

16+ (incl. 20+) SPADs AMT

7 =
Last quarter: 7
Last year: 4

Multi-SPAD signals

8 =
Last quarter: 8
Last year: 9

Proportion of total SPADs

Train miles AMT (millions)

36 =
Last quarter: 36
Last year: 36

SPADs per million train miles

0.44 ↓
Last quarter: 0.55
Last year: 0.45

SPADs per MTM from average

Sussex

All SPADs AMT

26 ↑
Last quarter: 22
Last year: 22

16+ (incl. 20+) SPADs AMT

9 =
Last quarter: 9
Last year: 4

Multi-SPAD signals

10 =
Last quarter: 10
Last year: 10

Proportion of total SPADs

Train miles AMT (millions)

22 =
Last quarter: 22
Last year: 22

SPADs per million train miles

1.17 ↑
Last quarter: 0.98
Last year: 0.99

SPADs per MTM from average
Wessex

All SPADs AMT

30 ↑
Last quarter: 29
Last year: 24

16+ (incl. 20+) SPADs AMT

8 ↓
Last quarter: 9
Last year: 9

Train miles AMT (millions)

31 =
Last quarter: 31
Last year: 31

Multi-SPAD signals

12 ↑
Last quarter: 9
Last year: 11

20+ SPADs AMT

2 ↑
Last quarter: 1
Last year: 2

SPADs per million train miles

0.97 ↑
Last quarter: 0.93
Last year: 0.76

Proportion of total SPADs

SPADs by quarter

Western

All SPADs AMT

30 ↑
Last quarter: 29
Last year: 28

16+ (incl. 20+) SPADs AMT

7 ↑
Last quarter: 4
Last year: 9

Train miles AMT (millions)

33 ↑
Last quarter: 32
Last year: 32

Multi-SPAD signals

16 ↑
Last quarter: 15
Last year: 16

20+ SPADs AMT

2 ↓
Last quarter: 3
Last year: 1

SPADs per million train miles

0.92 ↑
Last quarter: 0.89
Last year: 0.86

Proportion of total SPADs

SPADs by quarter

SPAD/TPWS Report, Q3-2013/14

Lessons learned

Data quality

Route performance

Context & Risk

Quarter in detail

Lessons learned
Wales

All SPADs AMT

15 ↓
Last quarter: 17
Last year: 13

16+ (incl. 20+) SPADs AMT

5 ↑
Last quarter: 4
Last year: 3

Multi-SPAD signals

2 =
Last quarter: 2
Last year: 2

20+ SPADs AMT

0 =
Last quarter: 0
Last year: 0

Train miles AMT (millions)

17 =
Last quarter: 17
Last year: 17

SPADs per million train miles

0.88 ↓
Last quarter: 1.00
Last year: 0.76

Proportion of total SPADs

SPADs by quarter

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Q3</th>
<th>Q4</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012/13</td>
<td>7</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Anglia</td>
<td>0.83</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data quality

Route performance

Lessons learned
Data quality

Reporting
We are confident there is no underreporting of SPADs, as SMIS has a direct link to CCIL, which we check to make sure all the SPAD events are entered.

SPADs with a completed investigation

The SPAD investigation is important, as it is the final stage of the process, after which SMIS is updated to reflect any additional information or corrections which have come to light.

It is also often used to help establish cause, where this is otherwise not clear, which is used in the safety risk model and furthering our understanding of SPAD risk.

It is expected that more recent SPADs may not have a completed investigation, while older SPADs should have a completed investigation that has been added to SMIS.

TOCs and Network Rail are being asked to ensure old SPADs with completed investigations are up to date in SMIS.

Days taken to enter SPAD events into SMIS

Over the last five years, the vast majority (98%) of SPADs have been entered into SMIS within five days of the event occurring.

The majority of those which have been entered into SMIS after five days have been events which were not originally thought to have been a SPAD.
Lessons learned

SPADs – an international perspective

Greg Morse, Operational Feedback Specialist

On 30 January 2013, a freight train passed two signals at danger between Dulwich Hill and Hurlstone Park in Sydney. Just prior to the incident, two members of a litter pickup team had been working on the track. Once alerted to the train’s approach they moved to a safe place behind the platform at Hurlstone Park station. There were no reported injuries.

The Australian Transportation Safety Bureau’s investigation found that the more senior co-driver had inadvertently fallen asleep in the cab. The trainee driver, in a reduced state of alertness, missed the first signal at caution and the next signal at stop. He applied the brakes once the train passed the final stop signal after realising that it applied to his train.

The Bureau determined that fatigue management, and in particular an over-reliance on the use of bio-mathematical model scores used to roster train crew, was one area where the operator – Pacific National – needed to improve.

As a result, the company started a review of its SPAD risk management processes and training requirements for driver-trainers. It also updated its Fatigue Management Standard and is considering the appropriate use of bio-mathematical tools as part of its fatigue risk management review process.

In Britain, fatigue has been something of a ‘hidden danger’. There is a link to SPADs – indeed the 2006 SPAD and (low-speed) derailment at Brentingby (caused by the driver ‘microsleeping’ in his cab) was investigated by RAIB. However, it was the rollback incident at Shap in 2010 that led to a move to lift the veil on the subject.

In brief, this incident occurred when a freight heading uphill between Tebay and Shap Summit slowed to a stop and started to roll back. It reached 51 mph and travelled for 2.2 miles before the driver applied the brakes.

Shap caused no injuries or damage, though the consequences could clearly have been worse: a signaller had re-routed the train into Tebay sidings, but if the driver had not braked when he did, it would have run into the yard at a speed that may have led to derailment, damage and obstruction of the adjacent line.

RAIB reported that ‘the driver was not sufficiently alert at the time of the incident because he was probably fatigued, his journey was monotonous, he was in a dark and comfortable environment and he had little in his field of view to attract his attention’. It added that the Shap driver was working the first of a series of night shifts, and ‘had been exposed to a work pattern that was likely to induce high levels of fatigue’, a pattern which suffered from an insufficient recovery time between progressively earlier shift start times in the previous run of consecutive nights, a long diagrammed turn and so on.
As Shap, Brentingby and the Australian incident show, people who are tired are more likely to make a mistake. Yet as the relevant fields in SMIS are not mandatory, fatigue seldom shows up as a cause or contributory factor in research and analysis.

An improvement came with Network Rail’s ‘10 incident factor’ approach to incident classification, which includes the recording of whether fatigue was a factor. Similarly, RSSB has sought to provide further information to members on the causes of accidents and incidents through proposals for Incident and Human Factors causal classification.

More recently, RSSB and Network Rail have worked together to combine these proposals into a single cohesive module within SMIS.

This ‘Incident Factor Classification System’ (IFCS) module completed in November 2012, after which RSSB and Network Rail staff began recording the causal classifications for all RAIB reports and Formal Investigations from January 2011.

By March 2014, the IFCS will hold a sufficient sample of incidents for analysis. This will enable RSSB to identify fatigue issues more effectively than has been possible hitherto. The analysis will feature in a Special Topic Report, which is intended for publication in September 2014.

More information on fatigue – and how to fight it – may be found in RSSB’s leaflet *Fatigue and Shiftwork* and on www.opsweb.co.uk.

The ORR has updated *Managing Fatigue in Safety Critical Work* (January 2012), which emphasises a broader proportionate approach to fatigue risk management through the integration of a Fatigue Risk Management System within a company’s SMS (rather than simply focussing on the use of the Fatigue & Risk Index). It also emphasises the development of a culture that encourages open reporting and treatment of fatigue related issues. The updated guidance warns against the limitations of mathematical models.

RSSB’s Human Factors function also runs a *Human Factors Awareness for Incident Investigators* course, which raises awareness of the human factors issues that can contribute to the likelihood of accidents and incidents.
## Relevant research and development

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<td>Driver vigilance devices – This project identified various vigilance devices and technologies and evaluated their suitability for use in monitoring and maintaining train driver vigilance.</td>
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<td>Human factors study of fatigue and shift work – This project investigated and sought to reduce the risk introduced by fatigue to passenger train drivers. Its aims were to optimise, cost-effectively, changes to current shift work planning and practice, to reduce safety risk, particularly from SPADs, and to improve human performance and productivity.</td>
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<td>Common factors in SPADs – This research helped to improve industry understanding of the underlying causal factors of SPADs (including fatigue).</td>
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<td>Human factors associated with driver error and violation – The main objective of this research was to understand how protective devices are used and the types of driver error they may mitigate or introduce. The study assessed the impact of device unavailability or unreliability on driver performance and risk, and highlighted a number of potential human factors problems with the operation of protective devices. It also investigated the so-called ‘post-break phenomenon’ whereby it was believed that drivers are more prone to error on the first day of work after a day off.</td>
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<td>Human factors of CCTV monitors – The rail industry uses CCTV in a wide range of applications, including level crossing control tasks, driver-only operation (DOO), crowd management and security at stations, and in-train security monitoring. This project identified how operator tasks should be defined to minimise fatigue and maximise effectiveness.</td>
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Appendices

Report scope
The information in this report covers SPADs which occurred on Network Rail managed infrastructure (NRMI) during the first quarter of 2013/14, comparing it with previous quarters and years.

Note: Following the recent reissue of Railway Group Standard GO/RT3119, the term ‘SPAD’ now refers to those events which were previously labelled as a ‘category A SPAD’.

Definitions
Various definitions can be found in appendix 1 and 2 can be found as a separate file on the website, alongside this report.

Details of all SPADs on the network
Details of all SPADs that have occurred on the network since 1998 can be found on the SPAD and TPWS page of Opsweb, http://opsweb.co.uk/spad-and-tpws-reports-data. This file is updated every month to include the latest available data.

It is possible to filter on the risk ranking column to identify potentially significant (risk ranked 16+) and potentially severe (risk ranked 20+) SPADs.

Multi-SPADs
A multi-SPAD signal is defined as one which has had two or more SPADs in the preceding five years. A current list of multi-SPAD signals may be found on the SPAD and TPWS page of Opsweb, http://opsweb.co.uk/spad-and-tpws-reports-data. This is updated every Monday.

It is possible to filter on the events in current 5 years column on the Multi-SPADed list tab to identify signals that have had three or more SPADs in the period. It is also possible to see any signals which were cited in the two post-Ladbroke Grove Improvement Notices, by filtering for T22 and IN in the multi-tag column.

SPADs per million train miles
SPAD rates per million train miles by company can be found on the SPAD and TPWS page of Opsweb, http://opsweb.co.uk/spad-and-tpws-reports-data in the OPSRAM data for Network Rail Routes file. This file is updated every month to include the latest available data.

Previous reports
This section details items which can be found in previous reports, but haven’t been included in this one as they either aren’t updated quarterly or are only included at times of interest.

2012/13 Q4 - SPADs per 100 drivers
             - SPAD rate by driver age and experience
## SPAD numbers

### Table 1. All SPADs: monthly totals

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20  SPAD/TPWS Report, Q3-2013/14