1. Purpose of paper

1.1 At the March 2014 board, a proposal to develop a forward strategy for the management of SPADs was endorsed. The strategy is required to address the emerging trend of increasing SPAD numbers, reflect the outputs of the Network Rail ‘deep dive’, coordinate the various existing strands of SPAD management activity, and consider future mitigation and controls.

1.2 This paper updates the board on progress with management activity to address SPAD risk whilst a suitable project manager to lead the development of the SPAD Risk Reduction Strategy has been recruited.

1.3 A key component of the strategy will be train protection systems, as their contribution to SPAD risk reduction is the greatest. An update on the related work of the Train Protection Strategy Group (formally the TPWS Strategy Group) over the last year is also provided, as the group move their focus beyond the ‘regulated’ fitment of TPWS, towards future train protection requirements. The relevant components of this will be incorporated in to the new strategy.

2. Progress to date

2.1 In order to develop the strategy, the identification and recruitment of a credible industry expert in SPAD management has been sought and this has taken some time. RSSB recently appointed Mike Carr (November 2014), who is well known throughout the industry, to the role of National Engagement Manager, and in this position he will coordinate the forward development of the strategy.

2.2 Management activity to address SPAD risk has continued across the industry though existing mechanisms, local tactical groups such as OPSRAM, and at national level through the System Safety Risk Group (SSRG) and its expert group the Train Operations Risk Group (TORG).

2.3 Following RSSB board endorsement of the proposal for a SPAD risk reduction strategy focused over the next two control periods, work has commenced. This has included awareness raising and a number of tactical improvement actions in advance of the strategy.
A summary of progress is contained below:

**Governance**

- A cross-industry ‘project initiation’ group has been established to develop the scope of the project; including the role of a project manager, short, medium, and long term proposals, and consider any quick wins.
- An outline governance structure has been developed comprising: Project Steering Group and dedicated workstreams for Operations, Human Factors, and Infrastructure & Engineering to manage their individual causal areas.
- The Project Steering Group will report to the Train Operations Risk Group (TORG) and will provide updates to RSSB board. This governance structure was approved by TORG on 15th December 2014.
- The chairman of TORG has written to all Network Rail Heads of Route HS&E Managers re identifying any local trends/actions via their OPRAMs (or equivalent meetings) which would support development of the strategy.
- Work has progressed with Network Rail to address the ‘deep dive’ (Risk of Train Collision – SPADs) actions – see Annex A.

**Supporting Activity**

- A dedicated human factors review is progressing and the draft output of workpackage one – ‘identifying the contribution of human factors to SPAD incidents’ has been delivered; this reviewed 257 individual SPAD incidents and mapped the causal/contributory human factors against the incident factor classification system (IFCS) of which 1651 factors were classified.
- Following European dialogue, the UIC have agreed to sponsor a European SPAD Task Force and GB rail is to be represented by Mike Carr.
- A research trawl has been undertaken to consider all relevant RSSB SPAD related projects - in total, 94 associated projects have been identified, and their content is being reviewed to validate their current status and applicability.
- A project is underway with Huddersfield University to develop a tool to identify red signal exposure. This may also assist with understanding performance and capacity constraints on the network by comparing the theoretical timetable against actual performance.
- Progress continues to be made in the use of SORAT to assess the SPAD risk for a signal layout at both design stage and in the steady state. The tool is used to assess SPAD risk for a scheme design and
allows consideration of mitigation options (such as the effectiveness of a TPWS design) to reduce SPAD risk.

- Network Rail’s Signalling Innovations Group is undertaking work as part of its Signalling National Innovations Portfolio (SNIP) programme to rationalise the tools and methodologies used to assess signal risk, and also align these tools and methodologies with the CSM for Risk Evaluation and Assessment.

- Progress is being made with developing signalling design and layout standards from first principles, and RSSB recently issued a number of related standards that define the physical characteristics of signals and the arrangements for indications. Work is also continuing on standards to address the relationship between signal spacing, human capability and train performance. This collection of standards should lead to the optimum design for conventional signalling and hence design out some of the SPAD risk.

- Work is in progress to review SPAD risk ranking (SRR) methodology, seeking to align this work with Network Rail’s review of risk definitions through looking at the various SRR components to see if they can be refined given the SPAD data we have collected over the last 10 years, along with the algorithms within SORAT. A review of the guidance in the SRR manual is also being undertaken in light of specific comments from Network Rail.

- The Train Protection Strategy Group has continued to implement the TPWS strategy developed in 2009 which has been extended to include all existing train protection systems and future industry requirements. An update to the RSSB board on progress with activities undertaken by the Train Protection Strategy Group is presented in Annex B. The development of ERTMS is being coordinated by the ERTMS Programme Board.

**Understanding**

- A causal ‘mind map’ has been developed to assist research mapping, and also to identify common causal modes.

- A mapping exercise is underway to categorise the research projects into themes to identify any shortfalls in causal learning.

- Abellio Group held a SPAD summit in Utrecht on 20th November, with representatives from UK, Netherlands and Germany, and RSSB were represented at the summit – a follow-up visit has been arranged with the Netherlands representative to seek further learning from their operation.

- Learning from train operators with a good SPAD record; XC Trains have itemised their good practice for consideration for wider industry adoption, including competence management systems, use of
simulators, risk ranking of driver depots, leadership and culture, TU engagement, and fair culture.

**Awareness**

- A presentation was provided to the October 2014 Operations Risk Conference, and an expert panel session held to seek industry feedback/input.
- A number of 1-2-1s have been held with key industry stakeholders seeking views on the structure of strategy.
- General awareness of the SPAD issue to front-line staff is being reinforced through various means including the ‘Red’ DVD series and the February 2015 edition (Red 41) will focus on the Greenford double SPAD incident.
- Queensland Rail have invited RSSB to be represented at their SPAD conference in Brisbane in early February 2015 as key note speaker with the theme of ‘Industry Partnering in SPAD Prevention’.

3. **Outline Strategy Framework**

3.1 The work to develop the strategy will be based broadly on the model used for the PTI Strategy, through three key workstreams, namely; operations, human factors, and infrastructure & engineering. Each workstream will create a matrix with short, medium and long term objectives set against mitigations identified during industry learning. In addition detailed data analysis will be completed in parallel to the qualitative work undertaken.

3.2 An outline structure for the strategy is proposed to include the following key themes, and some examples of their scope (not exhaustive):

- **Operations**
  - Driver operation
  - Guard/Conductor operations
  - Station operations
  - Signaller operations
  - ‘other’ staff operation (where they control movements of trains)
  - Operational publications - Rules, procedures & instructions
  - Timetabling
  - Route knowledge
  - Investigations
  - Risk ranking and supporting processes
  - Supervision & management
  - Leadership

- **Human factors**
  - Distraction/inattention
- Expectation
- Confusion
- Fitness
- Vigilance
- Mind-set
- Fatigue
- Memory overload

- Infrastructure & Engineering
  - Signalling systems
  - Train protection systems
  - Traction & rolling stock
  - Asset management & maintenance
  - Driving cab ergonomics
  - In-cab TPWS monitoring
  - Braking systems
  - Layout design
  - SORAT and supporting tools for layout risk assessments
  - Seasonal influences
  - Communications systems
  - Speed profiles
  - Inter-operability

3.3 Work to develop the outline strategy will commence in early 2015 under the governance arrangements set out above. The Project Steering will consider a ‘vision’ for SPAD management, the critical success factors, and specific targets for risk reduction over time, aligned to the various controls introduced.

4. Recommendations

4.1 The RSSB board is asked to:

- **NOTE** this update on progress with developing the SPAD Risk Reduction Strategy, incorporating the Train Protection Strategy Group update
- **DISCUSS** the board expectations in relation to the strategy wish to engage
- **ENDORSE** that the outline SPAD Risk Reduction Strategy is presented to the May 2015 RSSB board meeting.
ANNEX A

Update on Network Rail Deep Dive Actions

Management Response Actions Summary

<table>
<thead>
<tr>
<th>NR ID</th>
<th>Recommendation</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>Further mitigate the risk of SPADs where approach speeds are high, rolling stock is not fitted with 12%g braking capability, or where TPWS is not fully effective.</td>
<td>Closed</td>
</tr>
<tr>
<td>B2</td>
<td>Improve the understanding of human factors relating to SPADs.</td>
<td>Closed</td>
</tr>
<tr>
<td>B3</td>
<td>Reduce the number of TPWS interventions on the approach to signals at danger.</td>
<td>Closed</td>
</tr>
<tr>
<td>B4</td>
<td>Reduce Signalling WSFs (and SPADs) relating to railhead contamination due to leaf fall during Autumn and vegetation growth in Spring/Summer.</td>
<td>Closed</td>
</tr>
<tr>
<td>B5</td>
<td>Understand why the south east of the network tends to have higher levels of Signalling WSFs than other areas when normalised and introduce improvement measures.</td>
<td>Closed</td>
</tr>
<tr>
<td>C1</td>
<td>Develop improved Whole Life Cost Models and Decision Support Tools.</td>
<td>31/03/15</td>
</tr>
<tr>
<td>C2</td>
<td>Improve the competence of key staff.</td>
<td>31/03/15</td>
</tr>
<tr>
<td>C3</td>
<td>Minimise the risk of cyber attack.</td>
<td>31/01/15</td>
</tr>
<tr>
<td>D1</td>
<td>Address the key findings from the investigation into the Southampton WSF and subsequent follow-up review. Detailed actions in D2.</td>
<td>Closed</td>
</tr>
<tr>
<td>D2</td>
<td>Implement measures to address the findings from the Part D Design &amp; Deliverability Review.</td>
<td>30/04/15</td>
</tr>
</tbody>
</table>

Note. The recorded status of the Deep Dive actions are as shown in the Network Rail CMO system. These will be reviewed as part of the strategy.

Operational Review Management Actions

<table>
<thead>
<tr>
<th>NR ID</th>
<th>Action Taken</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td><strong>Fitment of further TPWS</strong> – the TPWS Steering Group considered system enhancements as part of the ‘Unregulated TPWS Fitment’ scope. Rather than provide ‘blanket’ guidance on additional signals to be fitted a signal specific approach was favoured. Signals outside of the original fitment criteria are being evaluated as a result.</td>
<td>Closed</td>
</tr>
<tr>
<td>B2</td>
<td><strong>Empty Coaching Stock and Light Locomotives Human Factors</strong> – a research proposal for RSSB to study why SPAD incidents appear to be disproportionally high in terms of the numbers of train movements for empty coaching stock and light locomotives has been accepted (Project 1058). This will be the first research project on SPAD issues undertaken by RSSB since 2006, and reflects the findings from the Network Rail Deep Dive. Following TORG endorsement - RSSB are no longer taking this study forward.</td>
<td>Closed</td>
</tr>
<tr>
<td>B3</td>
<td><strong>Reducing TPWS Interventions</strong> – the TPWS Steering Group is responsible for industry national strategy, at a local level work has focussed on providing TPWS Permanent Speed Restrictions (PSRs) to drivers (attempting to reduce the number of interventions). TPWS has been reviewed on a case-by-case basis with railway operators and a calculation used to provide the most effective scheme designs through the use of the TPWS Effectiveness Calculator and the Signal Overrun Risk Assessment Tool (SORAT).</td>
<td>Closed</td>
</tr>
<tr>
<td>B4</td>
<td><strong>Understanding higher levels of Signalling WSFs in the South East</strong> – an industry panel was convened to review Autumn 2013 performance. To supplement this activity, the panel request the assistance of John Curley to develop and take forward</td>
<td>Closed</td>
</tr>
</tbody>
</table>
the actions that stem from the review to date. Bi-lateral dialogue with the Routes and TOCs will fine-tune the recommendations for Autumn 2014 and develop considered actions for Autumn 2015.

B5 Reducing Signalling WSFs and SPADs due to railhead contamination – an industry panel was convened to review Autumn 2013 performance. In January 2014 the four elements of this action were raised for discussion. The outputs of this review have resulted in actions relating to: train planning of railhead treatment train, vegetation management plans, improved data capture and analysis and managing the operational risks (weather, leaf fall, low railhead adhesion, floods and snow, speed restrictions, weather and seasonal management and adverse weather arrangements).

Asset Review Management Actions

<table>
<thead>
<tr>
<th>NR ID</th>
<th>Action Taken</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Develop improved Whole Life Cost Models and Decision Support Tools – Whole life costs models have been developed and are now being used within the Routes to make project decisions. Tool validated using CPS projects. Further development of tools is now taking part of the ORBIS programme and both WLCM and decision support tools are subject to continuing development.</td>
<td>31/03/15</td>
</tr>
<tr>
<td>C2</td>
<td>Improve the competence of key staff –.competence of staff performing maintenance tasks on signalling assets is key to assuring safety and performance and adoption of an independent licensing scheme helps to demonstrate that competence over and above internal assessments. Licensing currently being progressed to ensure each team has one licensed individual and focus has been on team leaders. Extension to all technicians is now being progressed..</td>
<td>31/03/15</td>
</tr>
<tr>
<td>C3</td>
<td>Minimise the risk of cyber attack – Initial study into this area for signalling systems has revealed that the threat from external attack is relatively low due to the nature of our technology and the use of closed, private networks. Threats will increase with greater use of open networks and higher levels of technology such as ETCS and TM. These threats are now being considered as part of wider programmes.</td>
<td>31/01/15</td>
</tr>
</tbody>
</table>

Design & Deliverability Review Actions

<table>
<thead>
<tr>
<th>NR ID</th>
<th>Action Taken</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Address the key findings from the investigation into the Southampton WSF and subsequent follow-up review. Detailed actions in D2</td>
<td>Closed</td>
</tr>
<tr>
<td>D2.1 a</td>
<td>Signalling Notice Board issued to industry on 5 Jan 2013 to highlight key assurance standards for compliance and guidance, feedback sessions completed.</td>
<td>30/04/15</td>
</tr>
<tr>
<td>D2.1 b</td>
<td>Review and re-write of SSI8505 standard – review of standard and scope of re-write complete. Project combined with defensive data project by Asset Management Technical Services.</td>
<td>Closed</td>
</tr>
<tr>
<td>D2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.13</td>
<td><strong>Interlocking Data Development Plans (IDDPs)</strong> – implemented within the industry via Project Advice Note 0089. IDDPs in regular use, now business as usual.</td>
<td>Closed</td>
</tr>
<tr>
<td>D2.12</td>
<td><strong>Support &amp; Simulation Tools</strong> – suppliers briefed and aware of assurance requirements for tools. Suppliers engaged in advances required to use tools that can support the assurance process. TRE tool currently meets the requirements to mitigate previous incidents. Planning of trial of TRE tool on Swindon PSB re-lock (currently in flight).</td>
<td>Closed</td>
</tr>
<tr>
<td>D2.16</td>
<td><strong>Lessons Learnt &amp; Openness</strong> – suppliers engaged with share with pain to highlight pitfalls. Seven issued to date and briefed within the industry. Suppliers making improvements within their own organisations (e.g. Safe by Design).</td>
<td>Closed</td>
</tr>
<tr>
<td>D2.9, 2.10, 2.15</td>
<td><strong>Other Improvements</strong> – SSI control tables, test plans and configuration control – suppliers and Network Rail through four completed workshops formulated closure.</td>
<td>Closed</td>
</tr>
</tbody>
</table>
ANNEX B

RSSB Board update on the TPWS Strategy

The TPWS Strategy Group was established in 2009 and is tasked with monitoring progress with the TPWS Strategy that was approved by RSSB Board.

The group currently meets quarterly and is chaired by Phil Barrett from ATOC and the group has representation from across the industry.

The core of the activities undertaken by the group are set out in the TPWS Action Plan.

Key items of progress over the last year

Group remit

During the year a proposal was put forward by the V/T&C SIC to extend the remit of the TPWS SG to include other existing train protection systems. The TPWS Strategy Group endorsed the proposal and the VT&C SIC has approved a revised remit\(^1\) which covers this wider scope. The group is now titled the Train Protection Strategy Group (TPSG). The purpose of the TPSG Group is to:

a) Review the use of the TPWS system as information about the implementation of ERTMS becomes available.

b) Develop the industry Train Protection Strategy as the risk changes and the mitigations available to mitigate identified risks change.

c) Review the proposed migration of train protection systems to ERTMS, making recommendations as / if necessary.

d) Undertake research on behalf of V/TC&C SIC on train protection systems, as directed.

e) Comply with direction and guidance from the RSSB Board specifically considering:
   - Whether the existing train protection system continues to comply with the relevant regulations and advise the industry as appropriate to ensure continued compliance with the Railway Safety Regulations.
   - Whether the train protection systems remain fit for purpose in the long term given that, on the basis of the implementation plan for new train protection systems (ERTMS), the existing train protection systems may be in operation for some decades to come and well beyond their initial life expectancy.
   - Advice on whether the risk controlled by the current train protection systems remains SFAIRP and if it is it likely to remain so in the future, notwithstanding technical evolution.

An update of the TPWS strategy, the inclusion of the strategy for other train protection systems and a revised action plan incorporating the wider scope of the TPSG are currently under development.

It should be noted that the TPSG will not duplicate or undertake the work of the ERTMS programme but will review the approach in respect of train protection strategy.

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\(^1\) The new remit can be made available to RSSB Board members on request
TPWS continues to be reliable and meet availability requirements

From the review of the latest infrastructure and on-train equipment data the group considers that TPWS is meeting its availability requirements specified in Railway Group Standard GE/RT8030 with no significant adverse trends or obsolescence issues being currently identified.

The group has completed a project reviewing what the long term availability requirements for TPWS should be. The main conclusions from the report are:

- The TPWS system comfortably meets the current 99.9% availability requirement:
  - The current level of train based equipment availability is around 99.99%
  - The current level of track based equipment availability is around 99.99%
  - The overall TPWS system availability is around 99.98%
- The safety benefit to be gained by increasing the availability from its current level is small and therefore the current requirement is sufficient.

The report also sets out new ways in which the availability of TPWS can be monitored by the industry to ensure that the 99.9% availability target set out in GE/RT8030 continues to be met.

The report is due for issue in January 2015.

TPWS fitments for emergency braking rates less than 12%g

Following RSSB Board approval of the recommendations made by the group relating to the optimisation of TPWS for trains with emergency braking rate <12%g in 2011, Network Rail now assesses all new schemes for trains with less than 12%g braking using their Signal Overrun Risk Assessment Tool (SORAT). Guidance on this process is now included within guidance note GE/GN8675 – Guidance on AWS and TPWS Interface requirements.

The group has continued to examine the methods for identifying the characteristics for the type of existing junction signals that may benefit from changes to the TPWS fitment where trains with <12%g are operating. However due to the inconsistencies in the data available this has not proved possible with any degree of certainty. Given the Network Rail systematically assess each junction signal using the SORAT tool the TPSG concluded that no further work to identify existing signal characteristics should continue.

One of the key pieces of information needed to be able to assess the risk at individual signals accurately is the number of red aspects approached at each signal. This has been an issue for the industry for a long time and RSSB is now working through its strategic partnership with Huddersfield University to produce a tool to calculate the number of red aspects approached at each signal using
data extracted from CCF. This project is progressing well and is now engaging further with Network Rail to integrate the data from a number of Network Rail systems to generate meaningful outputs.

Protecting against TPWS reset and continue risk

The ORR wrote to the train operating companies (TOCs) at the beginning of 2012 detailing what they expected operators to assess with respect to the DMI retro-fit for Standard Complaint TPWS. TPSG questioned the basis of ORR’s view hence made representations to that effect. The ORR has again written to some TOCs following the SPAD at Greenford. The Group believed that a revisit of the RSSB risk review of the cost benefit analysis updated in 2011 of the up rating of TPWS on board equipment based on recent incident data and the current Safety Risk Model values would be beneficial. This update is now in progress and is due for completion in February 2015.

Research work

Research projects T1014 Understanding the risk and benefits of providing TPWS permanent speed restriction set speed information to train drivers and T906 to integrate TPWS into the ERTMS DMI have now been completed and is published to the industry via SPARK. (www.sparkrail.org).

Consultation on the Railway Safety Regulations

In response to the consultation issued by the ORR on the 1999 Railway Safety Regulations TPSG coordinated a response to the ORR on the train protection specific issues. ORR’s comments on the consultation are awaited.

New workstreams being developed

- Reviewing and advising on proposals for using TPWS to replace ATP e.g. Chiltern and Heathrow Connect
- Monitoring the Roll out of ERTMS and how this will integrate with the present TP systems:
  - Maintaining awareness of the proposed ERTMS roll out and its effect on the present train protection systems
  - Considering the impact of the proposed Digital Railway Programme and the Rail Technical Strategy
- Considering the transitions between ERTMS, CBTC and the train protection systems to minimise risk so far as is reasonably practicable

Future of the group

The future of the group with the revised remit and the changes to the 1999 Railway safety regulations is likely to continue for the time being. This will be reviewed again by V/TC&C SIC in February 2015.