What is RSSB?

RSSB facilitates the resolution of difficult cross-industry issues and builds consensus.

RSSB delivers a unique mix of products and services to the industry – supplying knowledge, analysis, a substantial level of technical expertise and powerful information and risk management tools.

RSSB is a not-for-profit company owned by major industry stakeholders, working together to:

- Continuously improve the level of safety in the rail industry
- Drive out unnecessary cost
- Improve business performance

The company is limited by guarantee and is governed by its members, a board and an advisory committee. It is independent of any single railway company and of their commercial interests.
A key part of RSSB’s product range is the research and development (R&D) programme that it manages on behalf of the railway industry. The programme is funded by the Department for Transport (DfT) and aims to assist the industry and its stakeholders in achieving key objectives:

- Improving performance in terms of health and safety, reliability, and punctuality
- Increasing capacity and availability
- Reducing cost
- Integrating all of these to compete effectively with other transport modes (or complement them as appropriate) and deliver a sustainable future for the railway

The RSSB-managed rail industry research programme focuses on industry wide and strategic research that no individual company or sector of the industry can address on its own. The programme is also instrumental in supporting the development of a future vision that can be best delivered. In addition, RSSB manages the rail industry strategic research programme which has been specifically developed to support industry and its stakeholders in the delivery of ‘step changes’ in industry strategy in 10, 20 and 30 years time – as outlined in the Rail Technical Strategy.

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Operations and management research covers seven major topics, which are:

- Health
- Road-Rail Interface
- Operations
- Public behaviour
- Workforce development and competence
- Sustainable development
- Safety policy and risk management

This booklet focuses on the area of RSSB research covering operations:

- Informing you about research that has been done
- Showing you where to find the results of the research
- Encouraging you to find out more, including registering to receive the RSSB R&D e-newsletter

The R&D programme has generated substantial knowledge, information and resources – all specifically designed to support the rail industry’s day-to-day operations, at senior level and on the front line.

This booklet provides only a brief insight into projects – the best way to find out more information about each project is to go to the Research and Development section of the RSSB website – www.rssb.co.uk – where you can find more details, including links to the reports and outputs.
The scope of the railway ‘operations’ topic includes the collection of disciplines and activities associated with the safe preparation, dispatch, signalling and driving of trains. These activities are undertaken by members of the workforce in Network Rail, train operating companies (TOCs), freight operating companies (FOCs) and infrastructure contractors and because their duties directly control the safe movement of trains, such personnel are deemed to be safety critical. The rules, procedures and instructions used by the railway operational workforce have been developed and refined over many years and they include all necessary arrangements to deal with disruption, emergencies and unplanned incidents on the mainline rail system. In the railway operational community, such incidents are referred to as ‘abnormal and degraded mode working’.

The scope of the ‘operations’ research topic includes:

- General operations
- Abnormal and degraded working
- Safety critical communications
- Work inside and adjacent to engineering possessions
- Signals passed at danger (SPADs)

The topic also covers more strategic issues such as understanding operational practices that support the GB railway’s sustainable development plan, and emerging and future technologies.
The key driver for research under this topic is to provide cost-effective reductions in safety risk (and therefore business risk) for the railway industry and its funders, and/or reductions in the cost of operating the railway safely. Operational incidents in particular have a high public profile and are the subject of many inquiry recommendations.

The Operational safety topic research encompasses nine areas:

**Area 1: Safety critical communications – research into improving communications between operational staff, especially drivers and signallers, to reduce misunderstandings and accidents.**

Research in this area aims to improve understanding of the complex issues involved in railway communications practices, particularly in respect of drivers and signallers, and their effects on safety.

**Area 2: Train operations – signallers – research into the safety, competencies and performance of signallers.**

Research in this area would tend to be undertaken in-house by Network Rail, as a duty holder which takes virtually all responsibility for signalling on its infrastructure.
Operational Safety

Area 3: Train operations - drivers – research into driver competencies, managing the risk of signals passed at danger and improving driver work design, selection and performance.

SPADs – Much research has been carried out to improve the industry’s understanding of the underlying causal factors of SPADs and the methods of mitigating them.

Drivers - There are three sub-themes covering issues relating specifically to train drivers; they are driver design, driver performance and driver selection.

Driver design – research looks at the impact of the design and installation of systems on driver behaviour.

Driver performance – research investigates the important role that driver behaviour plays in identifying, mitigating and preventing errors.

Driver selection – research identifies the good practice used in different industries in Britain and internationally for staff selection, and evaluates whether these processes would be transferable for the selection of train drivers.

Area 4: Train operations – other on-train staff – research into safety and other issues which are managed by on-train staff, including guards, conductors and on-board service staff.

Research in this area develops an understanding of passenger behaviour in accidents and incidents, and how best to influence behaviour through effective on-train staff operations.
Area 5: Train operations – ground staff – research into reducing the hazards faced by ground staff including traincrew (when on the track), shunters and depot operational staff.

Research in this area has looked at the risk associated with maintenance depot operations; this includes collisions involving locomotives and other rolling stock, and accidents involving staff. It identified the required control measures and provides guidance to manage the risks effectively.

Research could also look at how the interface between train operators and the maintenance depot operators could be improved to maximise the efficiency of maintenance depot operations and improve the turnaround of locomotives and rolling stock.

Research in this area may seek to identify how depot operations could be improved to reduce energy consumption and emissions.

Area 6: Station design, performance and safety – research into improving the safety of those using railway stations and their wider journey experience.

Station design, performance and safety is covered in a separate guide called ‘Station Safety: A guide to RSSB’s Operations research in Station Safety’
Operational Safety

Area 7: Operations management - improving the safety and performance of operational activities on the railway and understanding human factors and work practices which contribute to them. An impact aspect of this area is risk management.

Research in this area helps the industry improve performance across all operations by disseminating information on tools, techniques and principles that are available within the rail industry or used by other industries.

Area 8: Operational management of infrastructure maintenance and renewals – examining the operational working practices which contribute to safe working by those engaged in infrastructure maintenance and renewals.

Research in this area helps improve the industry’s understanding of risks associated with track worker operations, and identifies the additional measures that could be put in place to mitigate the safety risk and improve efficiency.

Area 9: Research to support outputs from inquiries, government recommendations, policy initiatives and new legislation – responding to requests for research into operational safety and related matters following accidents or other initiatives

Research is required from time to time to ensure that recommendations relating to the management of relevant risks from investigations of recent major incidents, from Rail Accident Investigation Branch (RAIB) inquiries are satisfactorily addressed.
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### T011  Definition of abnormal and degraded working

**Description**
Gaining a greater understanding of what constitutes ‘abnormal’ and ‘degraded’ working and proposing definitions that are practical and acceptable throughout the railway industry.

**Abstract**
The expressions ‘normal’, ‘abnormal’, ‘degraded’ and ‘emergency’ are commonly used in connection with train working conditions, and are often the basis for implementing special operating regimes, but have not been authoritatively defined. This research, conducted for RSSB by Lloyd’s Register, investigates what constitutes each of these conditions, the associated safety issues and what needs to be done to help operators and planners mitigate that risk. It proposes new definitions of ‘abnormal’ and ‘degraded’ working, relating the type of working to the impact on train operations and to the associated safety risk (which is difficult to measure as the amount of time the railway operates under abnormal conditions is unknown). The definitions distinguish between the causes of abnormal working and the abnormal working itself. The concept of ‘integrity envelopes’, used in the offshore oil industry to cater for abnormal working, is considered for possible rail industry application.

**Published**
28 June 2004

**Current Position**
This research helped with the understanding of what constitutes ‘abnormal’ and ‘degraded’ working but it was not possible to obtain a consensus within the industry about possible application of the information gained.
T012 Risks involved in setting and maintaining speed restrictions

**Description**
Assessing the current standard for setting speed restrictions. Developing a risk based model to guide the setting of speed restrictions.

**Abstract**
This research examined the extent to which the setting of speed restrictions on the British national rail network is risk based. If set too high, speed restrictions increase derailment risk; if too low, they unduly limit line capacity. The research, conducted for RSSB by A D Little, reviewed relevant Group and Company standards and explored the way speed restrictions are applied in practice, including the role of professional judgement. It found that the setting of speed restrictions is not currently risk based. It proposed a risk-based approach, which would take account of both the frequency and the consequences of speed related incidents, whereby speed restrictions could be set at an appropriate level that assures safety without unnecessary impact on operational performance. It suggested that non-prescriptive guidance in standards, together with trained, competency-assessed field engineers, would enable more flexible setting of speed restrictions, allowing local factors to be taken into account.

**Published**
September 2004

**Current Position**
The research concluded that theoretically it is possible to produce profiles for how the risk of derailment varies with speed. However, practical use of these generic profiles is limited, as they do not take account of important local factors. An alternative approach is to provide a set of Group and Company standards underpinned by a prescriptive framework with the flexibility to allow engineers to make their own decisions based on local factors. Further information can also be found within the Workforce Development topic and, in particular, the following projects:

- T049 Managing the competence of transport maintenance staff
- T183 Competence assessment and verification standards
- T258 Development of competence assessment criteria for supervisors in safety critical roles
- T323 Technology to support practical decision making and competence assessment
# T013  Green zones: thinking strategically

## Description
Investigating cross-company co-operation processes to produce space in the timetable for regular infrastructure maintenance regimes.

## Abstract
The ‘Green zones: thinking strategically’ initiative addressed the level of track worker fatalities resulting from train strikes. It recognised that factors affecting track worker safety are often linked to cost effective planning and management of engineering work. A six-point strategy was developed to reduce track worker exposure to trains and to improve efficiency: automated inspection and mechanised maintenance; a low maintenance railway with good accessibility; timetables with sufficient engineering time; improved work/possession planning; simpler rules, standards and protection methods; and processes to start and finish possessions on time. Cross-industry teams conducted pilot exercises on three routes to develop methods of cooperating to deliver safer track work. This proved successful in harnessing local knowledge, tackling important issues such as renewals plans, generating and implementing new ideas quickly, maximising route benefits and fostering efficiency and safety. A report and a leaflet were published and made available across the industry.

## Published
July 2004

## Current Position
A green Zones information hierarchy diagram, with links to a number of documents such as, ‘A good practice guide to developing patrolling arrangements in locations with poor access’, ‘A guide to the design a reliable and low maintenance railway with good accessibility – infrastructure design principles as well as a project summary brochure is available to download. For further information, please visit: [www.rssb.co.uk/Research/Pages/ResearchandDevelopmentTool.aspx](http://www.rssb.co.uk/Research/Pages/ResearchandDevelopmentTool.aspx) and search for T013.

As Network Rail has taken all maintenance contracts ‘in-house’, examples of safety information advice, resources and useful contacts are available on the Safety Central website. For further information, please visit: [www.safety.networkrail.co.uk](http://www.safety.networkrail.co.uk)
T014 Safety critical communications

Description
Defining the problem of poor safety critical communication between drivers and signallers, using data from site surveys. Categorising error types and identifying contributory factors. Guiding the development of remedial measures.

Abstract
Deficiencies in communication contribute to over 90% of rail incidents. This research aimed to improve safety critical communication between drivers and signallers, thereby reducing safety losses and improving operational and financial performance. Conducted for RSSB by AEA Technology Rail, it investigated examples of poor communications practice and used specific data drawn from seven signalling centres, six TOCs/FOCs, a driver training centre and a signaller training centre. The focus of the research was on the human rather than the technological elements of the communication process. The four main areas for improvement identified in the research were: training and competency of drivers and signallers; suitability and usability of communications technology; suitability and applicability of industry standards and protocols; and safety culture and organisational commitment. Although the research was based on a statistically small data sample, it provided an indication of the existing opinion range, and informs future safety critical communication research.

Published
April 2004

Current Position
Although the decision was taken not to continue with the T014 project as originally envisaged, the remit for this work was re-assessed and further work in this area was carried out for the following research projects:

- T185 Safety Critical roles: refresher training and re-assessment frequency
- T351 A strategy to develop future railway communications systems
- T365 Collecting and analysing railway safety critical communication error data
- T700 Developing options for further formalisation of voice communications within the rail industry. A training module is currently in development.
T021  Extended use of AWS

**Description**
Understanding the implications of extending AWS to new applications, such as warning drivers of speed restrictions or of their approach to multiple-SPAD signals. Human factors appraisal and risk assessment.

**Abstract**
The objectives of this project, on which RSSB collaborated with the HSE, were to provide an understanding of the implications of extending the use of the Automatic Warning Signal (AWS). New functions for AWS, for example, could be to forewarn drivers of approaching signals with a history of multiple SPADs or to indicate speed restrictions. The project, carried out by Nickleby HFE Ltd, examined the relationship between use extension and the risk of human failures that could lead to SPADs. It looked at the direction and nature of change in risk, specific circumstances where human reliability could be affected adversely and the factors influencing this. Recommendations were made concerning the relationship between AWS and TPWS; to review certain risk reduction strategies which had been identified; to review maintenance procedures relating to AWS magnets installed at temporary speed restrictions; to review the effectiveness of operating notices in maintaining effective route knowledge; and to publicise the study throughout the industry.

**Published**
January 2004

**Current Position**
RSSB’s Human Factors department has completed case studies on AWS signs. For further information, please visit:

[http://www.rssb.co.uk/expertise/HF/Pages/casestudies.aspx](http://www.rssb.co.uk/expertise/HF/Pages/casestudies.aspx).

Click the link ‘Check AWS’. It was recommended that if further signs were to be introduced, their number and positioning should be carefully considered, to avoid overloading the driver unnecessarily and reducing the impact of the signs. A “Check AWS strategy” could be included in driver training to help drivers recall signal aspects. Further work has been undertaken in T631 Research into whether ‘Check AWS’ signs have a beneficial impact on driver behaviour at stations.
Description
Reviewing the use and safety-critical effectiveness of Drivers Reminder Appliances (DRAs). Exploring the human factors, reliability and operational issues affecting their use. Proposing strategies to standardise DRA use.

Abstract
In contrast to the overall reducing trend in the incidence of SPADs, that relating to ‘starting against signal’ SPADs had remained broadly constant. This study reviewed the use of the driver-set and Automatic Warning System (AWS) -activated Driver’s Reminder Appliance (DRA) systems, which are designed to help prevent such SPADs. It evaluated their effectiveness, and developed strategies to standardise the use of the driver-set DRA. The findings suggested that the majority of drivers use the DRA as specified within the Rule Book, although a number of causes contributing to error and violation were identified. The study, undertaken by QinetiQ, explored the human factors, reliability problems, and operational issues that relate to the DRA. A number of strategies to standardise use of the DRA were proposed, including enhancements to communication, training, monitoring, and evaluation processes. Potential improvements in the design of the DRA and ideas for future generation systems were also identified.

Published
12 February 2004

Current Position
The work undertaken by this project was expanded further by research project T147 Mental workload assessment for train drivers.
Operational safety research – Projects published

**T024  Driver vigilance devices - systems review**

**Description**

This project identified various vigilance devices and technologies and evaluated their suitability for use in monitoring and maintaining train driver vigilance. Three devices were considered suitable within the constraints of UK railway operations but require further empirical evaluation before use.

**Abstract**

This project identified various vigilance devices and technologies and evaluated their suitability for use in monitoring and maintaining train driver vigilance. Out of thirteen devices identified in the information search, three were considered suitable for use by drivers and were within the constraints of British railway operations. One device, EDVTCS, was considered mature in terms of design development and actual use in overseas railways, and is the most suitable candidate for further evaluation and possible trials on the British railways. The areas and levels of assurance required for device implementation were identified. It was concluded that a monitoring device could possibly provide safety benefits, and that devices are available that reliably measure alertness. However, the prevalence of incidents related to drowsiness would have to be fully investigated and quantified before a full cost-benefit assessment could be performed.

**Published**

February 2004

**Current Position**

A number of resources exist to help drivers and their managers manage fatigue. For further information, please visit: [http://www.rssb.co.uk/expertise/human_factors/facts.asp](http://www.rssb.co.uk/expertise/human_factors/facts.asp) and scroll to Fatigue. ‘Feeling tired’ leaflets can be downloaded by clicking the links. There is also a good practice guide available to download, ‘Coping with Shift Work & Fatigue’: [A good practice guide for drivers](http://www.rssb.co.uk/expertise/human_factors/facts.asp). This guide to shift work and fatigue describes the important factors that affect sleep and performance at work and suggests ways that individuals can maximise alertness. [The 21st Century professional driver](http://www.rssb.co.uk/expertise/human_factors/facts.asp) is a DVD combining 31 minutes of video and animation with interactive exercises, addressing topics such as managing shift work and fatigue, getting support for personal problems and maintaining concentration while driving. To order a copy of the DVD, please visit: [www.opsweb.co.uk](http://www.opsweb.co.uk)
**Description**

Identifying, analysing and understanding the reasons for selecting red zone working and the barriers to green zone working. Making this knowledge available for decision-making by those developing strategies for track safety.

**Abstract**

The research, aimed at identifying, analysing and understanding the reasons for selecting red zone working and the barriers to green zone working, was conducted in two phases. In phase 1 the Midland Zone and a single infrastructure maintenance contractor were used on a sample basis to investigate the then current position. Phase 2 extended this study to a network-wide basis, allowing comparisons between zones, between their in-house staff and between contractors. A D Little also conducted reviews of international practice for track working, data management processes and the Rule Book. The principal conclusions of the research were that: increasing traffic demand raises maintenance requirements but decreases the time available to do it; the proportion of green zone working has steadily increased, but that done when all train movement has stopped has decreased; possessions are not making the best use of available time; violations of red zone working prohibitions may be related to poor presentation of information, and; support for going Green’, strong at the top of the management chain, weakens through succeeding levels.

**Published**

August 2004

**Current Position**

This report could be used to define the baseline of Red Zone working practices up to early 2003. This allows the industry to gauge improvements that have been introduced since 2003 in improving the safety or workers in Red Zone working. As Network Rail has taken all maintenance contracts ‘in-house’, examples of safety information advice, resources and useful contacts are available on the Safety Central website. For further information, please visit: [www.safety.networkrail.co.uk](http://www.safety.networkrail.co.uk)
T070 Common factors in SPADs

Description
Developing a comprehensive and definitive SPAD research library as a resource for SPAD investigation and as a research tool for SPAD reduction and mitigation.

Abstract
This research helped to improve industry understanding of the underlying causal factors of SPADs and methods of mitigating them. Human Engineering Ltd developed a SPAD research library in the form of a searchable database containing more than a thousand published articles covering aspects of human performance that could act as actors in SPADs. Users can read abstracts of the original articles and analyse their content, or perform data searches - by methodology (eg questionnaire, literature review), applicability (eg driver, signaller), organisational and workplace factors (eg safety culture, weather) or specific issue (eg fatigue, route knowledge). The articles’ main findings and recommendations have been analysed and classified. The ‘Common Factors Statements’ facility, providing grouped recommendations on specific issues, together with supporting and conflicting articles, is particularly powerful. The library allows stakeholders to find the latest position on particular areas of SPAD causation and prevention and should guide the direction of further research.

Published
September 2004

Current Position
A comprehensive and definitive SPAD research library containing all papers relating to the causal factors associated with SPADs has been developed. For further information, please visit: www.opsweb.co.uk. The library, ‘Common factors in SPADs’ can be found within ‘SPAD management tools’ on Opsweb.
T108  Mixed passenger and freight operations

Description
Improving the current understanding of risk associated with mixed passenger and freight traffic working. Developing measures to mitigate this risk.

Abstract
This research aimed to identify and where warranted by increased safety risk, seek mitigation of safety hazards associated with mixing passenger and freight traffic on the rail network. Conducted for RSSB by DNV, it identified the systems controlling the management of an integrated rail system, areas in which mixed rather than segregated operation may give rise to incremental risk, and mitigation measures to control this risk. It concluded that, based simply on safety losses recorded, mixed operation does not produce a larger safety risk. However, it suggested there is potential for higher risk arising from: the higher frequency of freight (rather than passenger) train derailments on passenger lines; the higher rate of freight/passenger (rather than passenger/passenger) train collisions (related to more frequent freight SPADs); and the more frequent use of non-Working Timetable planning systems for freight. It made detailed recommendations on cab radio availability, structures inspection, train preparation, derailment risk, SPAD rates, and train planning/timing.

Published
May 2004

Current Position
This research was published but not pursued further.
## T145 Safety critical rule compliance

<table>
<thead>
<tr>
<th><strong>Description</strong></th>
<th>Investigating the causes of non-compliance with rules and procedures and deriving a list of the key influencing factors as a basis for developing tools to improve compliance.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Abstract</strong></td>
<td>The purpose of this project, conducted by Greenstreet Bermann on behalf of RSSB, was to develop a clear understanding of the factors that affect compliance with rules and procedures. There is evidence from inquiry reports and from studies performed within the railway and other industries that, although the majority of personnel are conscientious with respect to rules and procedures, incidents have occurred through failure to comply with them. The research described the factors affecting compliance, the prevalence of non-compliance in the industry and methods likely to succeed in improving compliance. It has delivered a toolkit of practical methods, procedures and guidance that the railway industry can readily use to improve compliance. It is anticipated that through the utilisation of the validated toolkit there will be a reduction in the incidence of non-compliant behaviours and therefore fewer incidents. The toolkit is being validated under project T506.</td>
</tr>
<tr>
<td><strong>Published</strong></td>
<td>July 2004</td>
</tr>
<tr>
<td><strong>Current Position</strong></td>
<td>See notes under T506 Safety critical rule compliance toolkit pilot</td>
</tr>
</tbody>
</table>
**Description**

Identifying opportunities for improving safety through facilitating effective team working, and producing practical guidance for management and staff for the development and control of team working.

**Abstract**

Effective team working is recognised as conferring significant benefits in terms of improved task performance and reduced error rates. Conversely, ineffective team working is known to contribute to poor performance and increased error rates. Team working becomes more complex where teams consist of members from different organisations spread across one or more geographical locations, and may have differing factors influencing their performance. The extent to which formal and informal team working exists within the railway has not been fully understood. This project, carried out by Gregory Harland, identifies opportunities for improving rail safety through facilitating effective team working within the rail industry. It identifies formal and informal team working within the rail industry, national and international best practice within the railway and other industries, and factors specific to the rail industry that could affect team working. The project produced practical guidance for management and staff for the development and control of team working, including robust metrics to enable the effectiveness of current (baseline) and future team working to be measured and monitored.

**Published**

November 2004

**Current Position**

A package of tools was produced and provides practical guidance for management and staff for the development and control of team working, including robust metrics to enable the effectiveness of current (baseline) and future team working to be measured and monitored. The Journey Guide sets how to use the tools and presentations that form part of the deliverables for use by the industry. For further information, please visit: [http://www.rssb.co.uk/expertise/human_factors/facts.asp](http://www.rssb.co.uk/expertise/human_factors/facts.asp) and scroll to Team Working.
### T147 Mental workload assessment for train drivers

**Description**
Defining a mental workload assessment tool for the rail industry, and developing and validating it for use by railway personnel.

**Abstract**
If a train driver’s workload is too high or too low this can be detrimental to performance and potentially to safety. The aim of the project is therefore to produce an approach for assessing Train Driver Mental Workload (MWL). The project has been a joint initiative between the Institute of Occupational Ergonomics and CCD Design and Ergonomics Ltd. The project began with a review of existing MWL measurement tools applied in other industries. A set of tools has been specifically developed for assessing the MWL of train drivers. The tools have then been tested with drivers in simulators, in the field and through workshops. Workshops with driver managers and human factors professionals have also been undertaken in order to assess the tools. The key output is a set of workload assessment tools which can be used for: comparing workload for different driving systems or routes, evaluating design changes and equipment upgrades, appraising staffing levels, establishing training requirements, and incident analysis.

**Published**
May 2005

**Current Position**
A set of workload assessment tools which can be used for: comparing workload for different driving systems or routes, evaluating design changes and equipment upgrades, appraising staffing levels, establishing training requirements, and incident analysis. To download a copy of the workload assessment tools, please visit: [http://www.rssb.co.uk/RESEARCH/Pages/ResearchandDevelopmentTool.aspx](http://www.rssb.co.uk/RESEARCH/Pages/ResearchandDevelopmentTool.aspx), and use ‘T147’ in the search field.
Investigating driver behaviour to understand the use, benefits and risks associated with protective devices aimed at preventing SPADs, and investigating the 'post-break phenomenon'.

Detailed investigation of driver behaviour has an important role to play in identifying and mitigating or preventing errors. The principal objective of this research was to understand how protective devices are used and the types of driver error they may mitigate or introduce. Protective devices include DSD, AWS, DRA, TPWS, ATP and ERTMS-related systems such as in-cab signalling. The study assessed the impact of device unavailability or unreliability on driver performance and risk. The research highlighted a number of potential human factors problems with the operation of protective devices. It suggests possible remedies and identifies lessons that can help to inform the design of new devices and systems. The study 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. However, although this particular study found little conclusive evidence to suggest that the postbreak phenomenon exists and has an impact on performance and error, subsequent review of the data by RSSB suggests that breaks of just a single day may in fact impact negatively on SPAD risk.

RSSB used the findings of this work to inform a number of human factors projects, including:

- Human factors good practice guide to managing alarms and alerts.
  To download a copy of the good practice guide, please visit: http://www.rssb.co.uk/pdf/research-toolkits/T326/index.html
### T148 Human factors associated with driver error and violation (cont.)

<table>
<thead>
<tr>
<th>Current Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Development and evaluation of TPWS improvements to combat reset and continue risk. See notes under T433 Development and evaluation of improvements to the TPWS to mitigate reset and continue risk. A whole life cost benefit and detailed functional specification is now being developed under research project T725 Justification of TPWS modifications identified in reset and continue research.</td>
</tr>
<tr>
<td>● Human factors associated with CCTV monitoring. A toolkit for the effective application of CCTV has been produced (T328 Human Factors of CCTV monitoring). To request a copy of the CCTV toolkit (CD-ROM), please email: <a href="mailto:enquirydesk@rssb.co.uk">enquirydesk@rssb.co.uk</a></td>
</tr>
<tr>
<td>● The 21st Century professional driver is a DVD and combines 31 minutes of video and animation with interactive exercises, addressing topics such as managing shift work and fatigue, getting support for personal problems and maintaining concentration while driving. To order a copy of the DVD, please visit: <a href="http://www.opsweb.co.uk">www.opsweb.co.uk</a></td>
</tr>
</tbody>
</table>
T149 Human factors study of railway worker information requirements

**Description**
Identifying the information railway personnel require in a range of operational scenarios, and understanding how this information is applied in order to make decisions and to perform tasks.

**Abstract**
Understanding what information railway personnel require and how this information is applied in order to make decisions and to perform tasks is a fundamental requirement in developing safe technology and operating systems. The form in which such information is presented to the workforce varies widely depending on the circumstances, including mechanical instrumentation, visual display units, written instructions, verbal communication, etc. This project, carried out by QinetiQ, identifies user information requirements in the full range of potential operational scenarios. Accurate knowledge of information requirements will provide the basis for more effective ‘user-centred’ design of future and (if appropriate) retrospective engineering and operations projects, and lead to safer and more effective working. The fundamental ‘core’ data, such as hierarchical task analyses and design standards guidance relating to rail industry staff tasks, will also be useful tools for other safety related projects, eg impact assessments resulting from equipment or procedural design, training needs analysis, change management, workload assessment, resource planning, etc.

**Published**
April 2004

**Current Position**
There is currently no information about further progress following the publication of this research.
T150  Driver route knowledge

Description
Understanding how route knowledge features in the driver’s tasks and how it can be best supported to avoid incidents related to route knowledge shortfalls.

Abstract
This research is a study of driver route knowledge - to understand its fundamental role in the effective performance of train driving, and to optimise the tools and techniques that drivers use to obtain and retain route knowledge. The study, conducted by Air Affairs, reviewed current training techniques and identified and highlighted best practice in the rail industry. It also assessed the impact of change through the introduction of new technology and the implications for route knowledge. The study provided recommendations for managing these changes.

Published
March 2006

Current Position
This research increased the understanding of driver route knowledge and identified potential improvements. This study also suggested reviewing and updating route knowledge and situation awareness training. Further research has been undertaken in project T718 Review of current GB driver training programmes and development of leading practice models for the industry and project T677 Generating a train driver awareness campaign - FOCUS. These projects can be found in the RSSB management research section on the RSSB website.
www.rssb.co.uk
## T152 Train driver visual strategies

<table>
<thead>
<tr>
<th><strong>Description</strong></th>
<th>Providing guidance to improve the visibility of trackside information by investigating driver visual strategies.</th>
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<tbody>
<tr>
<td><strong>Abstract</strong></td>
<td>Train drivers need to assimilate information from a variety of trackside sources, such as signals, warning boards and speed indicators, as well as from within the cab. The way in which the sources of information are physically arranged varies, reflecting layout constraints and the complexity and maintenance characteristics of the route. It is important for the safe operation of trains to understand how drivers assimilate this information. This was done using eye tracking technology to investigate the visual strategies adopted by drivers, including the durations, frequencies and sequences of their use of different elements of the visual scene. The data produced by the research is being used to provide guidance for improving the visibility of trackside information, to update signal positioning and visibility standards, to improve driver training on visual strategies and to inform our understanding of driver use of route knowledge. A particular benefit has been the opportunity to review the minimum signal reading times set out in railway group standard GK/RT0037 based on empirical data. This research project was carried out by TRL on behalf of RSSB.</td>
</tr>
<tr>
<td><strong>Published</strong></td>
<td>November 2005</td>
</tr>
<tr>
<td><strong>Current Position</strong></td>
<td>This research provided an insight into understanding train drivers' visual strategies. This study also suggested areas in which further investigation into train driver visual behaviour could be beneficial, such as complex gantry signals, concurrent driving behaviour, signage, SPAD mitigation measures and signal type. Further research has been undertaken in project <strong>T352 Providing human factors input to cab fitment of GSM-R</strong>.</td>
</tr>
</tbody>
</table>
T154  Review of research into back illuminated signals

<table>
<thead>
<tr>
<th>Description</th>
<th>Reviewing a report that suggested that an artificially illuminated white backboard would make signals more conspicuous to drivers than is the case with the conventional black backboard.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>Railway signals conventionally have a black shield or backboard to make them more conspicuous generally and to ensure that they are visible to drivers in all weather conditions. Visibility when the sun is low in the sky is an important consideration, and the backboard may also prevent interference from other light sources at various viewing aspects. An inventor, Mr. Lees, had proposed that if the signal backboard is white and is artificially illuminated the signal will be more conspicuous to drivers, thus providing an important means of reducing Signals Passed At Danger (SPADs). This research, conducted for RSSB by QinetiQ, reviewed available literature and preliminary experimental work to establish whether this supported the claims of the inventor. However, the research found that several factors (eg the need for use in poor visibility conditions or at complex scenes) made the concept unsuitable for use on the railway network.</td>
</tr>
<tr>
<td>Published</td>
<td>February 2004</td>
</tr>
<tr>
<td>Current Position</td>
<td>RSSB published the report and recommendations. It was decided that no further research is required at this time.</td>
</tr>
<tr>
<td><strong>T180  Safe working procedures toolkit</strong></td>
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<td>-----------------------------------------</td>
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<tr>
<td><strong>Description</strong></td>
<td></td>
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<tr>
<td>Developing a methodology to identify whether procedures for safe working are fit for purpose with respect to the balance between track worker safety and overall system safety.</td>
<td></td>
</tr>
<tr>
<td><strong>Abstract</strong></td>
<td></td>
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<tr>
<td>This research developed a methodology to identify whether procedures for safe working are fit for purpose with respect to the balance between track worker safety and overall system safety. It has sometimes been suggested that safety regimes for worker access to the track have become too conservative and have been introduced without due consideration of the tasks and timeframes which are needed to maintain the infrastructure to a safe condition. Interfleet Technology conducted the research, which included a discussion of the issues with a range of industry personnel. The research considered the effects of the progressive changes that have been made to track safety rules and the extent to which changes in track maintenance techniques can mitigate the adverse effects of more restricted access. The benefits of the research stem from an enhanced understanding of these issues and in particular how to assess the balance between the risk being mitigated, and the risk introduced by applying the proposed new controls.</td>
<td></td>
</tr>
<tr>
<td><strong>Published</strong></td>
<td></td>
</tr>
<tr>
<td>October 2004</td>
<td></td>
</tr>
<tr>
<td><strong>Current Position</strong></td>
<td></td>
</tr>
<tr>
<td>A safe working procedures toolkit was produced. To download a copy, please visit: <a href="http://www.rssb.co.uk/RESEARCH/Lists/DispForm.aspx?ID=218">http://www.rssb.co.uk/RESEARCH/Lists/DispForm.aspx?ID=218</a>. Further research has been undertaken; see T500 Assessing the fitness for purpose of single line working procedures.</td>
<td></td>
</tr>
</tbody>
</table>
T204 Evaluating the effectiveness of SPAD briefing methods

Description
Investigating current communication processes concerning SPAD issues - whether they reach target audiences and deliver appropriate messages. Improving briefing methods and producing a 'best practice handbook' as a reference for briefers.

Abstract
This research addressed the concern that the messages and media used in communicating key SPAD issues (including the outputs of the National SPAD Focus Group - NSFG) may not always be fully understood and therefore may not be entirely effective. Conducted by Risk Solutions for RSSB, the research investigated communications methods - to identify what the key messages are, to whom they should be communicated and whether existing methods were aimed at the right target audience. It benchmarked methods used in other industries to communicate similar messages and identified good practice. The research assessed current methods used on the railway to identify whether the intended audience was being addressed fully, whether the key messages were being communicated in the most appropriate way and how the industry measured against the benchmarks. Recommendations made, on improving communications methods, distribution and briefing methods and the use of media within railway industry organisations, have helped develop stakeholders’ training programmes.

Published
August 2004

Current Position
A safety communications good practice handbook was produced. To download a copy, please visit: http://www.rssb.co.uk/sitecollectiondocuments/pdf/reports/research/T204_handbook_final.pdf. Further information can also be found on Opsweb, please visit: www.opsweb.co.uk
T313  Analysis of driver survey material about signal sighting

Description  Analysing survey material concerning drivers’ perceptions of the hazards associated with signal sighting.

Abstract  This research, conducted for RSSB by Human Engineering, improves our understanding of drivers’ perception of signal sighting. The research examined data from a driver survey of 2003 regarding hazards associated with signal sighting. It completed and supplemented earlier analysis under the Minimum Reading Time assessment process. It examined the relationships between driver age and experience, their ratings of particular hazards, SPAD data and route complexity. One conclusion was that drivers perceive error inducing conditions as greater risks than signal complexity or cluttered approaches. Severity ratings emerging from the analysis could be used to assess the drivability of particular routes, to identify their suitability for driver training or to target improvements. There is evidence that driver perception of hazards changes with their experience level. The report recommended further investigation of: factors identified by the analysis; driver hazard ratings, leading to a route driveability rating; and how to support driver vigilance devices.

Published  August 2004

Current Position  The outcomes of this work were used in the development of further research undertaken in project T435 Development of SPAD risk management tools and underpins Network Rail’s route driveability tool.
**T328 Human factors of CCTV monitoring**

**Description**  
An investigation of human factors questions associated with the use of closed circuit television (CCTV) on the railway, and production of a toolkit for the effective application of CCTV.

**Abstract**  
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. However, there are a number of fundamental human factors questions associated with many CCTV monitoring tasks. This project identified how operator tasks should be defined to minimise fatigue and maximise effectiveness; selection and recruitment criteria appropriate for CCTV operators; how the operator’s mental model of the monitoring task can be supported by the CCTV system; appropriate image quality measures; issues of driver workload and CCTV with DOO; how many separate images/monitors an operator can perceive and interpret; and what the benefits and issues are surrounding distribution of real-time CCTV imagery to mobile devices (hand held or cab-based displays, etc). The resulting toolkit is provided to give guidance about how to design and apply effective CCTV technology and operations to particular work environments.

**Published**  
May 2007

**Current Position**  
A toolkit for the effective application of CCTV as produced. To request a copy of the CCTV toolkit (CD-ROM), please email: enquirydesk@rssb.co.uk
Psychometric testing - a review of the train driver selection process

Description
Reviewing and evaluating standards and procedures for the use of psychometric testing in recruitment for safety critical roles, and in post-incident testing, particularly for drivers.

Abstract
This research delivered a strategic overview of the use and benefit of psychometric testing within the train driver selection process. It investigated where and how psychometric testing is currently applied in the industry and reviewed the effectiveness of the current regime in selecting the best applicants to the role. Comparisons were made with experience in other industries in Great Britain and rail industries in Europe. The research also explored where and how tests can be most appropriately used in driver management. It identified further research requirements and made recommendations for the current selection process. An industry steering group has been set up to review and take forward the actions identified.

Published
February 2006

Current Position
ATOC Operations Council proposed the establishment of a ‘steering committee’ to look at how best to implement the recommendations made from the research. The group contains representatives from train and freight operating companies, ATOC, RSSB, Network Rail and other stakeholders who are working together to review and implement the recommendations proposed by this study. Further work has been undertaken on project T628 Driver Selection: Development phase.
### T341 Reducing accidents and collision damage in maintenance depots

**Description**
Analysing the precursors of accidents and collisions within maintenance depots, with particular reference to depot design and layout. Evaluating mitigation measures.

**Abstract**
This research investigated the causal factors influencing the incidence and severity of rail traffic accidents within maintenance depots, including all collisions involving locomotives and other rolling stock and accidents involving staff. In particular it considered the effect of depot design and layout, and what remedial measures could be taken in designing new depots or altering existing depot layouts or working methods. Only one factor was found to be statistically significant, namely the age of the depot with fewer accidents occurring in depots built within the last 20 years. The report has provided insights into the causes of depot accidents and indicated some methods for reducing the risks. This will help stakeholders across the rail industry to seek continuous improvements in the safety of those working at depots. The benefits of the research are expected to flow from reduced accidents, reduced expense from collision damage, and better availability of rolling stock.

**Published**
November 2005

**Current Position**
This research provided a list of potential mitigation processes for the most frequent failures for each high-loss hazardous event. The cost benefit for each mitigation process was derived in conjunction with depot staff. The three most practicable interventions were: Tool box talks, improved visual feedback for manual points and the use of a more structured protocol for verbal communication. The report has provided insights into the causes of depot accidents and suggests some methods for reducing the risks. This will help stakeholders across the rail industry to seek continuous improvements in the safety of those working at depots.
### T343 Managing driver managers

#### Description
This project has produced a collection of good practices that may, when implemented, deliver improvements in company and service performance, passenger and driver safety.

#### Abstract
This research project has produced a guidance document which has been developed through industry-wide consultation with train operating companies (TOCs), freight operating companies (FOCs) and other duty holders in the British railway industry. It has been developed to share information across the industry about issues that organisations have reported, the reasons they occur, and practices that have proved useful in dealing with them. Not all the guidance given in this document will suit every company but studying this guide will help organisations consider how they can improve the performance of front-line managers, highlight a number of key issues relating to driver managers, detail why these issues arise. It also provides examples of current good practices that consider underlying causes of shortfalls and options for addressing them. This guide does not focus on technical skills, an area which is already well supported and understood. Instead, the focus of this guide is on management skills and the process of supporting driver managers.

#### Published
February 2008

#### Current Position
A good practice guide was produced to help organisations consider how they can improve the performance of front line driver managers. It identifies a selection of key issues selected by industry and gives reasons for these issues arising as well as proposing options for addressing them. To ensure that the outcomes are widely adopted, the findings were presented to ATOC’s driver management group and were very well received. This guidance is a tool to be used and referred to as required. To download a copy of the good practice guide, please visit: [http://www.rssb.co.uk/sitecollectiondocuments/pdf/reports/research/T343_rpt_final.pdf](http://www.rssb.co.uk/sitecollectiondocuments/pdf/reports/research/T343_rpt_final.pdf)
T344 Assessing the effectiveness of an in-cab signal reminder device

**Description**
Assessing the practicability, and effectiveness in reducing ‘automatic cancellations’ by train drivers, of an in-cab reminder device displaying the aspect of the last signal passed.

**Abstract**
This research evaluated an in-cab bolt-on modification to the Automatic Warning System (AWS), designed by a South West Trains driver, to address the problem of drivers automatically cancelling the AWS without first checking the signal aspect. The device would provide a reminder of the aspect of the last signal passed, in the form of miniature lights mimicking the signal as well as a reminder for other applications of AWS magnets such as speed boards. The research evaluated the human factors effects of introducing the device to determine the potential net safety benefit of the proposed equipment. The research highlighted a number of benefits and disadvantages of the device but it was not possible to determine whether the balance of these was positive overall. In view of additional cost benefit considerations, regrettably it has therefore been decided not to proceed with trials of the equipment. However, aspects of its functionality, particularly the proposed suppression of bell signals when the driver reminder appliance is set because of a red signal, will be further assessed.

**Published**
November 2005

**Current Position**
It has been decided not to carry out any further development work on the in-cab signal reminder device (ICSRD) as such. However, RSSB has considered whether, in isolation, certain functional elements of the ICSRD may offer cost effective safety benefits.
### Description
Providing human factors input to the ergonomic positioning of GSM-R telephones in a variety of cabs.

### Abstract
The Global System for Mobile Communications - Railway (GSM-R) voice radio system is likely to be introduced by duty holders for communications between the driver and the signaller. Prior to national implementation of GSM-R, an early deployment scheme is planned on four vehicle types on ScotRail’s North Clyde line. This research, being conducted for RSSB by Davis Associates, assesses the human factors issues associated with the cab fitment of the communication equipment, including the handset and speaker. This includes the positioning of the equipment in respect of the driver’s line of sight and reach. The research also defines a process to ensure that installations on other vehicles will also adequately take account of driver task and ergonomics requirements.

### Published
March 2005

### Current Position
The research has produced a guidance note which sets out a process for determining the optimum cab fitment location for the human-machine interface (HMI) of the GSM-R voice radio system. A survey and assessment process have developed to best locate the equipment so that it is, as far as possible, compliant with ergonomic principles. These principles are being applied to the Strathclyde trials. By correctly utilising ergonomic principles such as these, the driver is supported in his/her role and the risk of human error through poor equipment positioning is minimised.
### T365 Collecting and analysing railway safety critical communication error data

#### Description
Understanding the importance, cost and types of safety-critical communications failures involving front-line railway staff by capturing and analysing risk and error data from voice recordings and incident reports.

#### Abstract
Effective communication has a critical role in ensuring the safe operation of the railway. As many as 90% of accidents and incidents involve some sort of miscommunication. This research captured and analysed risk and error data about safety-critical verbal communication incidents involving front line railway staff. It analysed routine communications captured through voice recordings, to identify errors and provide the basis for future development of key performance indicators (KPIs). It also analysed incident reports and industry data, to identify the level and nature of safety critical communication errors contributing to risk and the costs of related accidents. The improved understanding of the importance, costs and types of communication failures was used to develop cost-effective strategies for minimising the associated safety risk. The future development of KPIs for communication performance will allow comparison between different companies in the railway industry. The data may also help in assessing the possible impacts of GSM-R on communications performance. As part of the project, a cost model was developed and RSSB is working with Network Rail and other industry parties to enhance this model to ensure its future use as a decision-making tool.

#### Published
June 2006

#### Current Position
Further work **T700 Developing options for further formalisation of voice communications within the rail industry**, was developed as part of the findings from T365. The research (T700) takes two parts, the first part having been published December 2008 and the second part (phase two development of training aids) is currently in progress.
### T368  Reducing SPADs - the role of rail staff other than drivers

<table>
<thead>
<tr>
<th><strong>Description</strong></th>
<th>Determining which rail staff, other than train drivers, have a role to play in reducing SPADs and identifying ways to help them.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Abstract</strong></td>
<td>The impact of specific key safety critical roles (ie driver and signaller) on SPADs has been, and continues to be, the focus of much effort. However, there are other safety critical and non-safety critical roles that also have an impact on SPADs. In order to improve understanding of the impact of these other roles, this research considered a broad range of potential SPAD causal factors. Building on the findings of the 'Common factors in SPADs’ project, the research determined which safety critical roles (excluding drivers) and non-safety critical roles have an impact on SPADs; which factors influence these impacts, and how to help to reduce the impacts.</td>
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<tr>
<td><strong>Published</strong></td>
<td>February 2007</td>
</tr>
<tr>
<td><strong>Current Position</strong></td>
<td>This research showed that many factors can have an influence on SPADs. In reviewing their SPAD management strategies, it is suggested that train operators and other duty holders should consider the full extent of the process and findings presented in the project report, and in particular the prioritised list of roles contained within the report. The industry was alerted to the report and its findings via Opsweb (<a href="http://www.opsweb.co.uk">www.opsweb.co.uk</a>), the website of the rail industry’s Operations Focus Group.</td>
</tr>
</tbody>
</table>
T433 Development and evaluation of improvements to the TPWS to mitigate reset and continue risk

Description
This research produced a prototype train protection and warning system (TPWS) control unit that in simulation tests increased the average number of correct brake demand diagnoses from 65% to 92%, and tested additional safety controls to prevent unauthorised resetting of the brakes.

Abstract
The TPWS reduces the number and consequence of signals passed at danger (SPADs) by providing the automatic warning system (AWS) together with overspeed sensor (OSS) and train stop (TS) facilities. There have been a small number of occasions on which, following an OSS or TS brake application, the train driver has reset the brakes and continued driving without first contacting the signaller for authority. This is in contravention of the TS and OSS operating rules. Previous research has shown that the audio-visual indicators given by TPWS may be confusing and cause ambiguity for drivers when diagnosing whether AWS, OSS or TS caused a break demand. This research, commissioned from Thales, produced a prototype TPWS control unit that changes the use and meaning of existing in-cab controls, and audio-visual indicators that increased the average number of correct brake demand diagnoses from 65% to 92%. Additional safety controls have also been tested to prevent unauthorised resetting of the brakes. Work is now in hand to consider whether the relative costs and benefits afforded by the prototype design merit further development work. A whole life cost benefit analysis and detailed functional specification is now being developed under research project T725 - Justification of TPWS modifications identified in reset and continue research - in support of the RSSB Board’s decision that further business case analysis is required.

Published July 2007

Current Position
A whole life cost benefit analysis and detailed functional specification is now being developed under research project T725 Justification of TPWS modifications identified in reset and continue research to support the RSSB Board’s decision that further business case analysis was required.
T435 Development of SPAD risk management tools

Description
This project has rationalised the various tools used in the SPAD risk management process, and now helps rail industry practitioners to decide which tool to use and where to use it.

Abstract
Over recent years several tools have been developed to support the SPAD risk management process. These include: SPAD Hazard Checklist, SPAD Risk Management Support Tool, SPAD Mitigations database and the Human Factors Signal Sighting Framework. However, there has, until now, been little guidance to indicate how, when and by whom these tools should be used. This research rationalises the tools and gives clear guidance regarding the correct tool to be used depending on the circumstances under review. It is not intended that the tools be lodged on the RSSB website, but instead the tools appear on SPADWEB (www.spadweb.co.uk), the industry website advising on SPAD avoidance.

Published
September 2006

Current Position
This research was designed to produce a single, integrated process, which showed what tools exist and at what stage of the risk management process they can be used. This not only improves the usability and usefulness of the tools, but also greatly reduces the workload of the user, and encourages a more consistent approach to SPAD management. These tools are available on Opsweb (www.opsweb.co.uk).
T443 Improving teamwork on the railway - stakeholder training

Description
Training industry stakeholders to use the toolset generated by the successfully completed project ‘T146 - Improving teamwork in the railway’. Demonstrating the ease of use and effectiveness of the tools.

Abstract
Following the successful completion of Project ‘T146 Improving teamwork in the railway’, RSSB intends to sponsor up to ten industry stakeholders in the use of the toolset generated by organisational psychologists Gregory Harland Ltd. For each participating stakeholder the sponsorship would cover nine days of consultancy to train users in how to apply the tools to their particular company and operating environment. It would also include the facilitation of three workshops to: benchmark current teamwork maturity; identify and implement improvement action plans; and record and measure the actual improvement achieved. This limited sponsorship programme will help

Published
March 2003

Current Position
In 2005, RSSB arranged for a trial survey, workshop and production of a report for interested organisations. RSSB’s offer was accepted by a major train operating company (TOC). The TOC saw the team improvement process as a useful extension to its safety culture assessment effort. The results of a teamwork survey of over 600 safety-critical staff were analysed at a workshop consisting of front-line staff, team managers and Health and Safety representatives. Considerable insight into the pattern of teamwork behaviour across the company was created at the workshop. Importantly, discussion of the results revealed the particular affordable interventions that the company could now make to improve its arrangements for teamwork, leading to further harmonisation. Following the implementation of selected options for action, and allowing for some time for the actions to have their effect, the company intend to re-survey their staff. This future survey can be analysed to help reveal the effectiveness of the teamwork interventions. In addition, a workshop discussion of these new survey results revealed the nature of any further interventions that would address any new problems arising in the interim.
### T500 Assessing the fitness for purpose of single line working procedures

**Description**  
Assessing the fitness for purpose of procedures and work instructions for single line working, and whether they may be influencing the ability of competent staff to perform to standard.

**Abstract**  
This research examined the fitness for purpose of Rule Book modules P1 and P2 regarding Single Line Working to establish whether they may be influencing the ability of competent staff to perform to standard. The principal conclusion is that the modules are fit for purpose, although there is potential to replace or supplement the narrative in P1 with a flow chart. Interfleet Technology surveyed industry stakeholders about what other factors may influence the reduced implementation of Single Line Working. Reasons given include the time taken to institute Single Line Working, the unacceptable delays it causes on heavily trafficked routes, including the effects of speed restrictions, the preference for diversions and blockades, and the reduced availability and competence of resources. The research provides useful insights into the relationship between commercial and operating imperatives, and these may help in assessing future proposals for more business-focused standards.

**Published**  
February 2005

**Current Position**  
This project followed on from a previous project T180 Safe working procedures toolkit, to identify whether procedures for safe working are fit for purpose. This was a small piece of follow-on work which concluded that existing procedures were basically fit for purpose. It does, however, suggest additional research to see whether the time taken to institute single line working could be reduced.
T501 Assessing the balance between track worker and overall system safety

**Description**
Assessing whether increased emphasis on personal track safety has had a detrimental effect on overall system safety, by making access to railway infrastructure for maintenance and inspection purposes more difficult.

**Abstract**
This research examined the proposition that the increased emphasis on personal track safety in recent years may have had a detrimental affect on system safety, by making access to railway infrastructure for maintenance and inspection purposes more difficult. Interfleet Technology, reviewed the requirements in standards, Network Rail's procedures for controlling access to the network, track worker safety statistics and developments in methods of undertaking track maintenance and inspection. The conclusions were that some rules (and the RIMINI risk minimisation process) may be too complicated, with changes to them often being too frequent and that only the introduction of mitigating measures had prevented the integrity of some assets deteriorating to dangerous levels. The research recommended that Network Rail and RSSB conduct a review of the relevant rules and standards to balance the promotion of personal track safety and the continued integrity of the infrastructure.

**Published**
February 2005

**Current Position**
The research recommends that Network Rail and RSSB conduct a review of the relevant rules and standards to balance the promotion of personal track safety and the continued integrity of the infrastructure. RSSB has discussed the recommendations with Network Rail as part of the process of defining future research.
Description

Validation of the Safety Critical Rule Compliance toolkit for the industry to use to improve compliance with rules and procedures.

Abstract

The purpose of this project, conducted by Greenstreet Bermann on behalf of RSSB, was to validate the Safety Critical Rule Compliance toolkit (developed in project T145 - safety critical rule compliance), which the industry can use to improve compliance with rules and procedures. The research was designed to develop a clear understanding of the factors that affect compliance with rules and procedures. There is evidence from inquiry reports and from studies performed within the railway and other industries that, although the majority of personnel are conscientious with respect to rules and procedures, incidents have occurred through failure to comply with them. The research described the factors affecting compliance, the prevalence of non-compliance in the industry and methods likely to succeed in improving compliance. It produced a toolkit of practical methods, procedures and guidance that the railway industry can readily use to improve compliance. It is anticipated that through the utilisation of the validated toolkit there will be a reduction in the incidence of non-compliant behaviours and therefore fewer incidents. Click on ‘Report’ to download the toolkit and view the download instructions.

Published

November 2005

Current Position

To download the toolkit, please visit: http://www.rssb.co.uk/SiteCollectionDocuments/pdf/research_misc/T506/Toolkit.zip. The toolkit contains guidance (select the PowerPoint training pack in the ‘introduction’ section of the toolkit), which describes the purpose of the toolkit and how it can be used. It is structured in a form that allows it to be used as a training aid.
## T507  Review of the continued use of detonators

### Description
This project assessed the need for the continued use of detonators (or fog signals) for operational protection and whether there are alternative protection methods that would provide the same or better protection levels.

### Abstract
Since Victorian times, detonators or fog signals have been used as a means of warning in order to protect the railway and those working on it from harm. This research was designed to establish whether their use remains essential or whether other technical solutions are feasible. The research examined why, where and under what circumstances detonators are used on the railway in Britain, elsewhere in Europe and Australia, and in other industries. Given recent advances in technology it is perhaps surprising to find the absence of a viable alternative to the replacement of detonators, but the research found this to be the case. Several potential alternatives to the use of detonators were examined but it was found that these would not provide adequate protection in all circumstances. Whilst the research supports the continued use of detonators, it has to be recognised that there are hazards, to some extent mitigated by new arrangements for storage which are being implemented. The main output of the research is therefore focused on ways of reducing the incidence of the irregular use and placement of detonators. Examples of this include ensuring that those involved in the process have the requisite level of local knowledge and where this cannot be adequately provided, sufficient emphasis on correct placement is included as part of the planning and briefing processes.

### Published
June 2006

### Current Position
Given that it was found not to be practical to abolish detonators, the main output of this research has been the recommendations in Appendix 1 which propose ways of reducing the incidence of their irregular use. Examples of this include ensuring that those involved in the process have the requisite level of local knowledge and where this cannot be adequately provided, sufficient emphasis on correct placement is included as part of the planning and briefing processes. In 2009 Network Rail began trials of possessions without detonators.
### Description
Investigating the causes of an increase in SPADs relating to empty coaching stock trains and light locomotives. Proposing mitigations to counter the emerging trend.

### Abstract
This research, conducted for RSSB by Halcrow, working in conjunction with Human Engineering Limited, investigated the reasons for the increase in the numbers of empty coaching stock and light locomotive SPADs since summer 2003. A detailed review was carried out of 120 formal investigations into these kinds of SPADs (occurring between January 2002 and June 2004) to find if the increase could be attributed to a change in the factors underlying the propensity of drivers to pass signals at danger and to suggest appropriate mitigation measures. Discussions were held with Train Operating Companies, Network Rail and other sources to help identify underlying causes of the increase and differences in approach between territories. The research found no consistent causes for the worsening trend, but noted that half the recorded SPADs involved shunting, a quarter involved changing ends, and that concentration lapses and driver expectation issues were commonly recorded as underlying causes. A range of support measures was proposed to assist drivers, relating to shunting, concentration, driver training and route knowledge.

### Published
November 2005

### Current Position
No evidence was found to support any one consistent cause of what would have been a temporary increase in SPAD rates. Several factors featured in a relatively high proportion of incidents, such as drivers changing ends. The findings were reported to the NSFG and a steering group of NSFG members agreed that a small digest, ‘the research brief’ should be circulated by the Research and Development programme to all appropriate duty holders. To view a copy of the brief, please visit: [http://www.rssb.co.uk/SiteCollectionDocuments/pdf/reports/research/T508_rb_final.pdf](http://www.rssb.co.uk/SiteCollectionDocuments/pdf/reports/research/T508_rb_final.pdf)
### T534 Review of handsignalling operations, communications, and job aids

#### Description
This research investigated how handsignalling is used at present and the extent to which it could be replaced by other operating methods. It examined how handsignalling risk could be reduced, the Communications Protocol, and the use of scripted communications.

#### Abstract
Handsignalling has been used on the railways in Britain since their inception as a means of controlling the movement of people or goods. The use of handsignalling has featured in a number of incidents, either as a cause or as a causal factor, in some cases involving signals passed at danger (SPADs). This research was requested by National SPAD Focus Group in response to the industry’s general concern about hand signalling operations, and the specific concerns of Operational Safety Managers about SPADs where handsignalling had been cited as a cause.

#### Published
June 2007

#### Current Position
Possible next steps could include the development of job aids in the form of key cards to aid communications, and further user trials before full implementation. RSSB is addressing rule changes where applicable. There is considerable support for some of these changes as a result of the work being undertaken by the rulebook simplification workgroup. Possible development of equipment such as new warning boards and an indicator that would sit in the four-foot to signify the end of temporary block working sections. Further consideration should be given to the development of a restricted vocabulary for high risk communications. These issues were considered by RSSB in the project T758 Research into service recovery from extensive signalling failures.
T535 Assessing the impact of increased numbers of CCTV images on driver only operation of trains

Description
Assessing the impact on the safe and effective completion of passenger monitoring and door-closing of train drivers being presented with increased numbers of CCTV views while operating in driver only operation (DOO) mode.

Abstract
At the present time, CCTV monitors for use with trains working in driver only operated mode can only cope with trains up to eight cars in length. This is because current standards are based on a maximum of two monitors per cab, split into four ‘views’ each. Proposals exist to increase the number of CCTV views displayed in the driving cab to monitor long trains (more than 8 cars) when they are at a station stop, ready for departure. However, there are concerns about the potential effects on driver performance, in particular on drivers’ ability to detect potential incidents such as people trapped in the train doors, and on station dwell times. The purpose of this research was to assess the impact on the safe and effective completion of passenger monitoring and door-closing of the driver being presented with increased numbers of CCTV views while operating in DOO mode. The results, which suggest that ten and twelve car trains can be operated safely with CCTV screens split into six views, will be used in considering whether to change Railway Group Standard GE/RT 8060 to permit six images per cab-based monitor. There are also recommendations on the likely impact on station dwell times.

Published
November 2005

Current Position
Further work to develop guidance focussing on the human factors elements of CCTV, which can be applied practically by those involved in specifying and procuring CCTV systems was undertaken in project T328 Human factors of CCTV monitoring.
### T541 Human factors CD ROM version 5

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<tr>
<td><strong>Description</strong></td>
<td>Disseminating current knowledge about human factors in the railway industry, by publishing a catalogue in the form of a CD ROM. Creating the fifth version of the CD ROM.</td>
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<tr>
<td><strong>Abstract</strong></td>
<td>RSSB has previously issued four versions of a Human Factors Research Catalogue, in CD ROM format. This project will create version five. The catalogue disseminates current knowledge about human factors in the railway industry. Previous versions have been used widely by railway industry organisations from front line staff to directors. The catalogue helps the industry to learn about the human factors tools, techniques and principles available and helps to ensure that research effort is not duplicated. The catalogue also provides a means of disseminating the research reports produced from the RSSB research programme, as well as continuing to raise awareness of human factors work and the associated benefits within the railway industry.</td>
</tr>
<tr>
<td><strong>Published</strong></td>
<td>February 2006</td>
</tr>
<tr>
<td><strong>Current Position</strong></td>
<td>This CD ROM has been superseded by T800 RSSB human factors library. This was developed under research project T800. You can access the library at: <a href="http://www.rssbhumanfactorslibrary.co.uk/Login.aspx">http://www.rssbhumanfactorslibrary.co.uk/Login.aspx</a>. You will need to create an account and log in to view the library.</td>
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T605 Management of on-train crowding

Description
Evaluating techniques, including modelling and contingency planning, for managing crowded trains as a result of service disruption, local events or sheer weight of rush hour traffic.

Abstract
Crowded trains are a feature of busy suburban networks and many long-distance services. Two previous projects have looked at (T307) ‘Health and safety effects of crowding’ and (T161) ‘Crowd management at stations’. The Railway Industry Advisory Committee asked the Rail Safety and Standards Board to consider the management of on-train crowding by closing out the principal issues raised in the report on ‘Health and safety effects of crowding’. The issues ranged from how crowding is defined by the industry, to developing a consistent approach across the railway network and to better understand the controls that might be put in place by station and train operators. The research gauged the effectiveness of such measures and examined incident recording of crowding related events, in particular their codification, to improve data. Analysis of public behaviour patterns by observation and interviews were also be an important feature of this research. Principal client group was Operations Focus Group. However, the work was originally sponsored by the Rail Industry Advisory Committee.

Published
March 2009

Current Position
The reports and the good practice guide have been widely circulated throughout the industry and presented at a number of events such as the recent Station Safety Seminar in May 2009.
### Description

Development of updated standard selection criteria for train drivers and development of a suite of valid and reliable assessment methods to cover these criteria.

### Abstract

A review of the current arrangements for train driver selection, with particular focus on the psychometric tests and interview used in the selection process, was carried out in 2004/05 (T340 Psychometric testing - a review of the train driver selection process). The T340 study found a number of areas where the current arrangements could be improved, and proposed ways of taking this forward. An industry-wide steering group was formed in 2006 to review these recommendations, and identify where and how the current selection arrangements could be revised and improved. As such, this research (T628) was initiated to take forward the steering group’s strategy. It has proposed updated selection criteria for train drivers, to reflect the demands of modern train driving and to align more closely with the conventional traffic operation and management Technical Specification of Interoperability (TSI 2006/920/EC). A new suite of assessment methods has been identified which assesses all of the proposed selection criteria and addresses weaknesses in the current assessment methods that were identified in T340. The selection criteria and methods cover the cognitive, psychomotor and behavioural abilities and characteristics required for safe train driving. A trial of 284 train drivers was undertaken to evaluate off-the-shelf tests that were identified to assess the cognitive selection criteria. A new bespoke situational judgement test and multimodal interview were developed for the assessment of the proposed behavioural selection criteria. A bespoke test of written communication skills was also developed. The next steps will be undertaken in project T948 Driver selection: Implementation phase.
**Abstract, cont.**

This will validate the behavioural criteria assessment methods and three further cognitive/psychomotor tests. Tests which meet the acceptance criteria will be put together in a customised suite of tests ready for implementation in the GB rail industry. It is expected that the changes will be included in an updated version of Railway Industry Standard RIS-3751-TOM Train Driver Selection.

**Published**

July 2010

**Current Position**

This project has made steps towards the development of an updated driver selection process. **T948 Driver selection: Implementation phase** will take this development process through to implementation.
### T631  Research into whether ‘Check AWS’ signs have a beneficial impact on driver behaviour at stations

#### Description
To evaluate whether the ‘Check AWS’ signs used by Arriva Trains Wales have a beneficial impact on driver behaviour at stations where a start-away SPAD risk exists.

#### Abstract
Arriva Trains Wales have introduced ‘Check AWS’ signs at a number of stations with a high start on yellow signal passed at danger (SOYSPAD) risk. The automatic warning system (AWS) is in widespread use throughout the national rail network. The signs were implemented to encourage drivers to check the AWS sunflower in the cab to remind them of the previous signal aspect. Eye movement data was obtained from drivers to establish whether they looked at the AWS sunflower when Check AWS signs were present. The frequency of checking the AWS sunflower appeared to increase where Check AWS signs were present. Interviews with drivers suggested that the signs were a positive addition to reducing SOYSPADs at stations. If Check AWS signs are to be used further, their number and position should be carefully considered. The Check AWS strategy for recalling signal aspects could be used in driver training. The long-term effect of the signs is unknown. The project also provided Rail Safety and Standards Board (RSSB) staff with training on the use of the eye tracking equipment. This was so that RSSB human factors specialists could, themselves, collect the necessary data without having to rely on external consultancies. This had the added advantage of further developing the skills within the RSSB human factors team who undertook much of this research, with the support of TRL.

#### Published
June 2007

#### Current Position
If more Check AWS signs are to be introduced, their number and position should be carefully considered to avoid visual clutter and redundancy due to poor positioning. The Check AWS strategy for recalling previous signal aspects could be used in training programmes for drivers. A follow up study in six months time could help to establish the long-term impact of the signs.
### Description
To enhance human factors understanding of multi-SPAD signals and the effects of line identifiers on driver visual behaviour.

### Abstract
The main aims of this project are to increase GNER’s understanding of the multi-SPAD signal (D301), to identify any viable solutions, to increase the industry’s understanding of driver cognitive strategies and how these interact with driver visual behaviour, and to enhance the industry’s understanding of start-away SPADs and train driver workload departing from stations. The scope of this piece of work is to address the multi-SPAD signal problem identified by GNER and the impact of line identifiers at signal gantries.

### Published
May 2007

### Current Position
The conclusion is that the banner repeater is the most effective mitigation strategy to reduce the number of SOYSPADs at D301. While it is acknowledged that this is a costly intervention it is the only strategy that addresses the root cause of the SOYSPAD, providing signalling information ahead of the reduced sighting distance of the signal, and permitting the driver to recover from errors arising from expectations.
# T682 Developing the incident cost model

**Description**
Developing a railway industry incident cost model based upon previous research into safety critical communication errors but applicable to a wider range of railway events such as collisions and derailments.

**Abstract**
As part of a wider study, a base level incident cost model was developed, which provided a framework for deriving the costs, to the rail industry in Great Britain, of an incident where the prime or contributory cause is a voice communications failure. The model defined the key cost contributors of an incident on the railways, and could be used to capture the actual cost element build-up following an incident (where actual data was available). Where actual cost data was not available (the majority of cases) the model provided some indicative typical cost data derived from industry sources. This research was published as T365, ‘Capturing error data for safety critical communications’. Industry stakeholders then indicated that further work on the cost model to increase its accuracy would be desirable, to provide a tool that could be used to ascertain quickly the true cost of a developing incident, broadening the scope beyond communications related incidents and/or be used as part of an incident prevention business case. This project, which was originally supported by the former Safety Critical Communications Focus Group, has achieved that goal of creating a model which can be used for most types of incident, such as (but not limited to) collisions, derailments or signals passed at danger.

**Published**
November 2007

**Current Position**
A cost model and user guide was developed and shown at the 2007 Risk Management Forum organised by RSSB and was been extremely well received. RSSB are developing a strategy to address the ongoing need to keep the model updated.
### Description
This project identified the benefits associated with changes to the formalisation of front line staff safety critical communications.

### Abstract
The Rule Book currently requires formalisation of safety critical communication by front line staff. Examples of current communications formalisation include the use of standard words and phrases, use of the phonetic alphabet, repeating back messages and the concept of lead responsibility. Formalisation and simplification can provide benefits, primarily through reductions in communication ambiguity and reduced errors in safety critical communications. This project investigated the benefits associated with the formalisation and logical simplification of railway communications. It suggests a number of possible improvements, including changes to the Rule Book. Proposals for change, which are subject to a formal industry process, are currently under consideration by Network Rail.

### Published
December 2008

### Current Position
A communication good practice guide will be produced and made available to all front line staff, although the material will be primarily aimed at trainers in safety critical communication. It is intended to produce training modules as a cohesive training package and host these on Opsweb (www.opsweb.co.uk). It is envisaged that the modules will be stand alone training packages that can be downloaded as required. We hope to have available video and audio clips to re-enforce the training message where appropriate together with posters to advertise the presence of these modules.
## T725 Justification of TPWS modifications identified in reset and continue research

### Description
A full cost benefit analysis and detailed functional specification will be developed under this project, to support the industry’s decision about which TPWS modifications to take forward from research project T433.

### Abstract
RSSB research project T433, which developed and evaluated train protection and warning system (TPWS) improvements to mitigate the risk of 'reset and continue', has been closed and a research brief published. There are still a number of outstanding issues to be addressed in order for the industry - represented by RSSB’s Board in this case - to be able to say that it has closed out all recommendations arising from the work that has been undertaken. This project aims to support the industry’s decision about which TPWS modifications should now be taken forward. This will involve the development of a detailed functional specification, and a full cost benefit analysis. Each document will support the other, and will aim toward justifying and implementing the optimum solution for the industry, taking whole life cost and risk into account.

### Published
August 2009

### Current Position
The research was received favourably by a cross-discipline rail industry working group. The design preferences delivered by the trials along with cost-benefit analysis has assisted the industry to progress with TPWS modifications for the future. The industry has taken positive steps in this area and has recommended that the ‘3-indicator’ panel should be introduced to all new trains and the ‘2-indicator’ panel should be assessed by each train operator to determine if the modification is reasonably practicable for their particular fleets of trains. The next steps are to modify the Railway Group Standard relating to TPWS to include a new mandatory requirement to fit the ‘3-indicator’ panel to new trains and develop a non-mandatory Railway Industry Standard specifying the requirements for the ‘2-indicator’ panel for existing trains.
This project aimed to improve the methods of recovery from major signalling failures to clear trapped trains and assessed the costs and benefits of applying the principles of ‘driving on sight’ in such

This project aimed to support the industry in improving the way it manages the recovery from extensive failures of signalling equipment during periods when degraded methods of working have to be implemented. The specific objectives of the project were to identify how to clear an affected part of the network of trapped trains in a systematic way, and assessed the costs and benefits of applying the principles of ‘driving on sight’ for trapped trains. This would allow multiple signals to be passed at danger when the line ahead may be occupied by introducing a streamlined form of temporary block working once trapped trains have been cleared, to restore the separation of trains and permit movements through the failed area. The benefits anticipated from any change in practice are in reducing the time needed to clear the affected area of trapped trains; reducing the time needed to start systematic train movements through the failed area, and improving the efficiency of temporary block working over the affected line(s) until normal operation can be resumed. Any potential ‘quick wins’ should be identified for early implementation. The work was sponsored by the Traffic Operations and Management Standards Committee and the principal client group was the Operations Focus Group.

Published March 2009

This research was designed to inform Traffic and Operations Management Standards Committee (TOM SC) discussions and decisions on rules for degraded working procedures during signalling failures. Some changes to the rules were implemented (eg permissive working at stations) but, as the research showed that there isn’t a clear case for moving away from the Temporary Block Working procedure because of the trade-off between safety and performance, industry has decided not to alter this arrangement.
### T800 Human factors library

<table>
<thead>
<tr>
<th>Description</th>
<th>This project has updated version 5 of the Human Factors CD.</th>
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<tbody>
<tr>
<td>Abstract</td>
<td>RSSB has updated the fifth edition of the human factors research catalogue, following the success of earlier versions. The updated version is in a new web-based format and includes a range of research literature, focused on key issues for the rail industry. The library includes rail specific research from the railways of Britain and international railways, research from safety critical industries such as the aviation, nuclear, and chemical sectors, and from the road vehicle driver context. While a considerable volume of human factors research has been undertaken within the rail industry in Great Britain, it is important to recognise that many of the issues covered are common to other industries, and therefore insight can be gained from the research that has been done in other areas, and abroad. This human factors library now includes literature reviews of over 1,200 documents. It is a useful source of information for those involved in human factors research, and benefits the rail industry by increasing understanding of human factors issues and demonstrating where such knowledge can be usefully applied to improve safety performance. In turn this should help reduce risk, improve business performance and, ultimately, customer satisfaction. The RSSB human factors library can be found at <a href="http://www.humanfactorslibrary.co.uk">www.humanfactorslibrary.co.uk</a>.</td>
</tr>
<tr>
<td>Published</td>
<td>September 2009</td>
</tr>
<tr>
<td>Current Position</td>
<td>The RSSB human factors library can be found at <a href="http://www.rssbhumanfactorslibrary.co.uk">www.rssbhumanfactorslibrary.co.uk</a>.</td>
</tr>
</tbody>
</table>
This guide is an accessible source of human factors information, developed to offer practical advice for designers, suppliers, managers, supervisors, trainers and health and safety staff who work within the railway industry.

Human factors are all about the ‘people’ issues which need to be considered to assure the lifelong safety and effectiveness of a system or organisation. This guide considers the main human factors problems affecting the performance of railway staff in relation to five key areas: design, training, conditions, staffing, and culture. The main purpose of the guide is to answer the question ‘what practical advice can a human factors approach offer to railway staff without requiring them to be experts in the subject?’ The guide is written in a frequently asked questions (FAQ) format, addressing questions that are relevant to railway staff and their managers, and that human factors research has had some success in answering. The guide will also be of interest to front-line staff when making an input to decisions which affect their working lives. The guide is available in searchable pdf format on the Rail Safety and Standards Board (RSSB) website. A hard copy is also available on request from RSSB.

This handbook is now widely available to the industry. It complements the forthcoming Human Factors research library due to be launched shortly. For further information see project T800 Human factors library.
### T826 Developing safety signage for children on board trains

<table>
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<tr>
<th><strong>Description</strong></th>
<th>Developing signs to communicate safety messages to children about how to use facilities on board trains safely.</th>
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<tr>
<td><strong>Abstract</strong></td>
<td>Whilst much research has been undertaken with regard to communicating emergency safety messages effectively (following Lord Cullen’s Recommendations), other non-emergency safety signs may not be as effective in delivering clear messages, particularly to children. The aim of this research supported by the industry’s Operations Focus Group (OFG), was to investigate how well children between five and ten years of age comprehend non-emergency safety signs currently placed on board rolling stock in Great Britain. The research methodology included a review of good practice in developing safety signs from an ergonomic perspective and investigated techniques for communicating safety messages to children via human factors discussion groups with approximately 210 children between five and ten years of age. Additionally, an analysis of national safety incident data from the rail industry’s Safety Management Information System was conducted to establish the main accident precursors. The project resulted in the development of a number of posters and safety labels that can be displayed on passenger trains in Great Britain (GB).</td>
</tr>
<tr>
<td><strong>Published</strong></td>
<td>December 2009</td>
</tr>
<tr>
<td><strong>Current Position</strong></td>
<td>The project deliverables include a number of posters and safety labels that can be displayed on trains. To obtain print quality copies of the posters and / or labels please send a request by e-mail to: <a href="mailto:enquirydesk@rssb.co.uk">enquirydesk@rssb.co.uk</a></td>
</tr>
</tbody>
</table>
**BE SAFE on the train!**

- **BE SAFE! Hold the bar!** Handrails can stop children falling.
- **BE SAFE! Sit nicely!** Children can fall off the chairs.
- **BE SAFE! Stand back!** Children can hurt their fingers in doors.

**Hold on tight!**

- **BE SAFE! Hold the bar!** Handrails can stop children falling.

**Sit! don’t climb!**

- **BE SAFE! Sit nicely!** Children can fall off the chairs.

**Stand away from the door!**

- **BE SAFE! Stand back!** Children can hurt their fingers in doors.
Operational safety research – projects in progress

T595 Causes, risk and mitigation of station stopping incidents

**Description**
Investigation of the industry’s risk management arrangements in relation to ‘station stopping incidents’, in order to identify good practice and issues to be addressed.

**Abstract**
When trains do not stop correctly at stations, problems occur in respect of safety, passenger journeys and company business. The industry is well aware of the issue at autumn peak time when overruns associated with low adhesion occur. However this project has identified that human error accounts for 69% of overruns, with the remainder caused by low adhesion. In 2006 human error caused over 350 incidents. Station stopping incidents include ‘station overruns’, ‘failures to call’ and ‘stop-shorts’ as these are highly similar in cause and consequence. This RSSB-led project examines the causes, including human factors; safety risks, including the relationship between station stopping incidents and signals passed at danger (SPADs); and the impact on business, including delay minutes and resources required to investigate and implement recommendations. The project also includes an evaluation of management practices, the development of techniques for monitoring incident occurrence and the creation of tools to enable companies to better learn from and prevent station stopping incidents from occurring.

The anticipated successful outcomes of this research will include reductions in the number of station stopping incidents and delay minutes arising, improved customer satisfaction, and lower industry costs.

The research was proposed by the Association of Train Operating Companies and the principal client group is Operations Focus Group.

**Published**
Due for publication October 2010

**Current Position**
In progress
### Description
Investigating how route knowledge affects various routes when running in degraded conditions

### Abstract
Emergencies can occur on a route which may necessitate a route change via a diversion. At present rules prevent drivers from attempting to drive such a route unless they can demonstrate some knowledge of the intended route (route knowledge). This is normally gained by the individual driving the diversionary route a specified number of times a year. It is recognised, however, that the infrastructure has some ‘bypass’ routes (eg York and Crewe) which are relatively easy to drive but may not be able to be used because of the current rules. This research will investigate the current rules and seek to determine whether a shift to a more risk assessment based decision taking would be more appropriate. To do that, several challenges must be faced, including a test of current route retention, investigating the effects of route conducting by persons other than drivers (such as supervisors or station staff) and formalising and risk assessing those drivers who have route knowledge versus those who do not.

### Published
Due for publication October 2010

### Current Position
In progress
### T839  Eco-driving: understanding the approaches, benefits and risks

#### Description
Understanding the approaches, benefits and risks that eco-driving presents to different train operators in Great Britain.

#### Abstract
In response to both economic and environmental pressures (and potentially also specific franchise commitments), TOCs are keen to identify and exploit the opportunities presented by the adoption of energy-efficient driving techniques (eco-driving). ATOC and RSSB co-hosted an industry seminar on the subject on 1 December 2009 and one of the ‘next steps’ agreed at this was that RSSB should produce a good practice guide on eco-driving, drawing on existing TOC experience. While the focus of the guide would be on how to achieve maximum energy savings, through a combination of operational techniques and driver education / incentivisation, it will also need to highlight any potential safety implications and how these can best be managed. The aim of this research project is therefore to inform the content of the guide by undertaking initial analysis to determine both the high-level safety risk implications of eco-driving and also the core energy/cost savings that could potentially be achieved. This research needs to take place prior to establishing ‘good practice’. As such this research project, supported by Operations Focus Group as lead sponsors, will undertake a high-level risk assessment to identify safety risks associated with eco-driving; validate the energy savings claimed by a sample of those TOCs already employing eco-driving (noting that benefits from energy saving may be partially offset by increased costs elsewhere); and producing case studies of existing eco-driving applications.

#### Published
Due for publication January 2011

#### Current Position
In progress
### Description
Development of three TPWS audible alerts to mitigate issues around ‘reset and continue’.

### Abstract
Reset and continue is an issue that the rail industry is working hard to address. A reset and continue event is where a driver has a category A SPAD, and then for one reason or another, the driver clears the brake demand and continues, potentially into conflict with another train. This piece of work will deliver the audible alerts, in the form of speech messages, for a modified TPWS system which mitigates against reset and continue. These audible alerts will be delivered as part of the revised Group Standard for GE/RT8030 (Requirements for the Train Protection and Warning System). The benefit of this work is that it will help the industry to deliver a solution that improves the driver machine interface (DMI) including modifications to address reset and continue. The new TPWS DMI indicates to the driver when a brake application has occurred due to: a signal passed at danger (SPAD); an overspeed; or an Automatic Warning System (AWS) caution warning that has not been acknowledged in time by the driver. This work will develop standardised audible alerts for the TPWS DMI taking account of human factor requirements. The principal client group is Operations Focus Group.

### Published
Due for publication September 2010

### Current Position
In progress
**T904 Development of a train driver education programme on mobile phone risk**

**Description**
An investigation of driver attitudes and behaviours regarding mobile phone use, and development of a train driver education programme.

**Abstract**
The use of mobile phones while train driving has the potential to impair driver performance and increase the likelihood of accidents and operational incidents. This research aims to produce an analysis of train driver attitudes and behaviours regarding mobile phone use; and to develop an effective, fit–for-purpose train driver education programme, designed to reduce the incidence of inappropriate mobile phone use. Understanding patterns of mobile phone use and driver attitudes towards their use will help to produce effectively targeted education materials. These can be used in industry campaigns to augment existing strategies related to mobile phone use. This research will provide industry with a means to reduce the risk related to accidents and incidents caused by mobile phone distraction; and build a good foundation for the extension of the campaign to other safety critical roles. This project is sponsored by Operations Focus Group.

**Published**
Due for publication October 2010

**Current Position**
In progress
This research will summarise existing information, tools and processes which relate to musculo-skeletal disorders in train drivers.

Carpal Tunnel Syndrome (CTS) is a condition causing pain and numbness in the hand and wrist and weakness in the grip. In December 2009 three train drivers from Arriva Trains Wales collectively pursued a legal claim against the company for compensation. The claimants alleged that the CTS condition was work-related and resulted from repetitive work, awkward wrist postures, and operating the brake and power controls in cramped conditions. The judge ruled in favour of the claimants, awarding £22,000 to be shared between them. This case highlights the potential for improvements in the way that musculo-skeletal disorder (MSD) risks associated with train driving are managed. The rail industry considers that better understanding and mitigation of the risk posed to drivers by MSD should result in a reduction of MSD related absenteeism. This research will summarise the existing information, tools, and processes which relate to MSDs in train drivers. If existing information is insufficient, further work will be undertaken to establish the current state of play for MSDs in train drivers. If required, a rail specific suite of tools will be developed to assist train operators in assessing MSD risk, reducing MSD risk, dealing with existing MSDs, and monitoring and reviewing control measures. The research was proposed by the Association of Train Operating Companies and is being carried out on behalf of the industry’s Operations Focus Group.

Due for publication November 2010

In progress
T948  Driver selection: Implementation phase

Description
Implementation of an integrated and validated standardised driver assessment process with safety and business benefits for the rail industry.

Abstract
A previous project, T628 Train driver selection: Development phase has developed / identified a full suite of psychometric tests for use during the standardised train driver assessment. Some of these tests were validated as part of T628. In order to recommend the full suite for implementation in RIS-3751-TOM ‘Train Driver Selection’ there is a need to show evidence of the validity of the remaining tests and to prepare all tests for implementation as an integrated assessment package. This new project, supported by OFG, will deliver: a report detailing the method and findings of the validation trial of two vigilance tests (WAF-V and VIGIL), a two hand coordination test (2HAND), and a written communication test; a report detailing the method and findings of a validation trial of the new Situational Judgement Exercise (SJE) and multimodal interview (MMI); a summary report detailing a justified recommendation for a set of tests / assessment methods to recommend in RIS-3751-TOM, that adequately covers all of the new selection criteria and meets assessment centre implementation requirements; and final presentations of the project findings and recommendations to the project steering group, the ATOC Operations Forum, TOM Standards Committee, Operations Focus Group, and the CER psychologists sub-group, as required. The methodology for this work will include several phases. Validation trials, which will involve data collection with a mixture of approximately 100 train driver candidates, trainees and qualified drivers to assess the validity of the SJE, MMI, WAF-V, VIGIL, 2HAND and the test of written communication. Analysis of the collected data to assess whether the tests meet the acceptance criteria including validity, reliability and fairness, the production of a scoring framework (development of integrated scoring rules and cut-offs to map the full suite of psychometric tests onto the train driver selection criteria).
**Abstract, cont.** Final customisation and refinement of the SJE, MMI, WAF-V, VIGIL (if required) 2HAND and written communication tests, to meet GB assessment centre requirements. RSSB will develop a new draft of RIS-3751-TOM, to include the new selection criteria and recommended tests. Industry will be consulted and invited to endorse the new standard via the normal process. The reports produced as part of this R&D project and the previous relevant projects (T340 and T628) will provide the evidence needed for this process. The benefits for the rail industry will be the implementation of a properly integrated and valid standardised assessment process which has safety and business benefits and is unlikely to require further changes for 10 to 15 years.

<table>
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<th>Published</th>
<th>Ongoing</th>
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<td><strong>Current Position</strong></td>
<td>In progress</td>
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Where can I find research?

All the research outputs that have been published since RSSB began its programme can be found at ‘Research Topics and Projects’:

www.rssb.co.uk/RESEARCH/Pages/ResearchandDevelopmentTool.aspx

We suggest you order the projects by topic and then scroll down the list to the Operations projects; the most recent will be at the bottom of the list.

If you know the reference number for the project – eg TXXX - or key words of the title, you can use the ‘Search’ field.

The previous pages contain listings of the published and current Operational research projects – correct at the time of publication.

We hope this helps you find the information that is most relevant to you. If you can’t find what you’re looking for, please contact us – enquirydesk@rssb.co.uk

The website is easy to navigate
Each project has a research brief that provides a concise summary.

The full report can be downloaded to drill down to more detail.
RED is a series of programmes about operational safety initiatives, including SPADs, which are of interest to anyone operating and managing the railway: from drivers and signallers to managers and specialists at all levels. Designed for driver managers to use in briefings, the aim is to promote a more progressive and open safety culture in which there is respect for the contribution of all and recognition that there are still many systemic issues that must be addressed if improvements are to be delivered.

If you would like to know more about RED, please contact RSSB on enquirydesk@rssb.co.uk or look at Opsweb www.opsweb.co.uk.
The RSSB R&D e-newsletter is an email bulletin that keeps the industry updated on the latest research projects to be started or published.

To view the most recent edition and to sign up for your own copy, visit:

www.rssb.co.uk/research/pages/randdenewsletter.aspx

If you have enquiries about research – contact research@rssb.co.uk or the RSSB Enquiries Desk – enquirydesk@rssb.co.uk, tel 020 3142 5400

You can also access more information - including research - from Opsweb, the website of the Operations Focus Group, facilitated by RSSB. It’s easy to sign up for access on-line and from there you can obtain a wealth of information and good practice from across the industry. Go to www.opsweb.co.uk
Operational research

More information

Annual Safety Performance Report

RSSB's Annual Safety Performance Report examines the range of risk experienced by passengers, the railway workforce and members of the public, before considering areas that affect us all: train accidents and road-rail interface. We have also included chapters on progress against the Strategic Safety Plan trajectories and other targets, benchmarking railway performance and data quality. For further information please visit:

www.rssb.co.uk/spr/reports/pages/default.aspx
Industry Shared Risk Database

The Industry Shared Risk Database identifies shared risk areas which require a collaborative approach to risk control, clarifying the types of operators involved and suggests the most likely duty holder responsible for each main risk area. This database provides industry with a simple, user friendly resource which:

- Identifies shared risk that affects more than one duty holder.
- Clarifies responsibility for each shared risk across three stages of accident causation and loss mitigation (hazard prevention, event prevention, and loss mitigation).
- Identifies likely control measures.
- Provides links to supporting documentation for each control measure to provide guidance on the management of shared risk.

For further information or to create an account, please visit:

http://isrd.rssb.co.uk