ASLEF Engagement day

Welcome to RSSB
Welcome to RSSB

Ann Mills, RSSB
<table>
<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
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<tbody>
<tr>
<td>10:20</td>
<td>Welcome to RSSB</td>
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<tr>
<td>10:30</td>
<td>RSSB Research and Development – what is it and what to look out for</td>
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<tr>
<td>10:45</td>
<td>One year on - where are we with CDPs?</td>
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<tr>
<td>10:00</td>
<td>SMIS and the 10 incident Factors – the link to just culture</td>
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<td>11:45</td>
<td>Refreshment break</td>
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<tr>
<td>12:00</td>
<td>Everything you ever wanted to know about Non-Technical Skills – and more</td>
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<tr>
<td>12:45</td>
<td>Lunch</td>
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<td>13:15</td>
<td>Fatigue</td>
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<td>14:00</td>
<td>Refreshment break</td>
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<td>14:15</td>
<td>The Rail Technical Strategy – what does it mean for you</td>
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<td>14:35</td>
<td>Wrap up</td>
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R&D programme: the journey so far

Key expertise was in procuring and supervising the delivery of research

Focus on improving safety

Programme created in response to Uff and Cullen reports into rail accidents

Programmes combined to drive efficiencies following spending cuts

Focus on:
- industry strategies
- cost reduction
- performance improvement
- system capability

2001

2008

2010

2012

2017

March 2020

DfT grants strategic research funding

Innovation grant starts

DfT decision to route innovation funding through Innovate UK

Key expertise includes prioritising, assessing and specifying research; supporting implementation; and delivering some in-house research

Focus on:
- industry strategies
- cost reduction
- performance improvement
- system capability
R&D programme – Stakeholder landscape

RSSB’s R&D programme allows **industry to work together to explore and develop opportunities**. The programme is driven by **industry’s ideas and needs**. We deliver projects with different degree of steer from industry and then work with industry to ensure the **insights make a real difference**.

- **£9m plus annual grant from DfT**
- **The money comes with requirements to:**
  - Do truly cross-industry research that no individual player or group of players could and should undertake by themselves
  - Have an approx. 50/50 mix of long term, high impact/high uncertainty research and shorter term, incremental research
  - Leverage co-funding when appropriate
Research: from idea to making an impact

**Mechanisms for delivery**

- **Directly managed**
- **Internally delivered**
- **Academic feasibility**
- **Strategic partnership(s)**
- **Grant scheme**

**Defining the research**

- Costs and benefits evaluation and project specification

**Wider RSSB Ideas**

- Technical advice
- Contract/project management
- Technical review

**Dissemination of findings**

- Publication on the web and presentation to cross-industry groups and companies in industry

**Implementing findings**

- Working with partners to ensure research is used and makes the desired impact, facilitating implementation where appropriate

**Role played by standards**

- Comms and engagement team

**Research ideas**

- Driven by industry needs and strategic priorities

**ASLEF event**

- 4th October, 2017
R&D Pipeline – generation of content

- ‘Top down’ ideas identified to support cross-industry strategies and initiatives

- Ideas from cross-industry groups and from RSSB members and other external organisations (‘bottom up’)
  - Recommendations/requests from cross industry groups and individuals
  - Extensions and follow-on tasks from existing or past projects

- Implementation support and facilitation
From research ideas to funding decisions

Eligibility for funding
- Requires cross-industry coordination
- Generates new knowledge / novel concepts
- Co-funding consideration

Attractiveness
- Support from industry
- High probability of technical success
- Clear and understood route to implementation
- Expectation of significant rewards
- Enabler for cross-industry strategies

Scope and business case
- Full specification and assessment
- Revisit attractiveness scores
- Conduct quantified cost-benefit analysis
- Industry sponsorship

Budget authorisation
- Funding availability
- Overall merits and issues of the specific projects
- Balance of programme between tactical needs and strategic research
Two examples
Case study 1 - the adhesion challenge

- Wheel/rail adhesion - an issue since railways began
- 350,000 delay minutes across the network
- It doesn’t get more cross-industry than this!
- Adhesion Working Group and Adhesion Research Group to promote and coordinate progress
Adhesion – Fundamental Research

A range of projects to better understand the fundamental science of poor adhesion

- Two main types of poor adhesion:
  - ‘Wet rail’ – small amounts of water (dew) with contamination
  - Leaf fall – leaves on the line, Autumn associated conditions

- T1077 - The effect of water on the transmission of forces between wheels and rails

- COF-UoH-12 Train Braking Model LABRADOR (The T1077 work will feed into the COF-UoH12 model)
Adhesion – New Technologies

The challenge

How can we achieve predictable optimised braking?

Idea generation

Horizon scanning to identify potential technologies and solution

Call for research to the academic community

Research

The use of dry-ice for rail head cleaning - University of Sheffield

Non contact ultrasonic cleaning - University of Southampton

Moisture detection system - University of Birmingham

Improving rail wettability - TRL

Development and commercialisation

The Smart Moisture sensing technology has been patented, following trials with LU and is being marketed as AutumnSense.

The dry ice project is being developed to the full scale testing phase with funding through RSSB’s Innovation Programme.
Adhesion – Tactical improvements

Optimising sanders

Un-suppress trailing sanders for multiple units and replace particular track circuit types

T1046 - Looked back through 10 years of data of SPADs and wrong side track circuit to trade off lost of detection risk and SPAD risk

Multiple and variable sanders

Builds on previous lab research which simulated the braking results to really test variable rate/distributed sanders. Currently happening at RIDC Melton

Enabling Magnetic Track Brakes on GB Mainline Rail

T1099 considered (i) existing uses (T&W, trams, continental); Compatibility issues; economic case for retrofit and new – found that case is really for new; identified some particular constraints on legacy S&C and older TCs
Case study 2 – Red aspect approaches to signals (RAATS tool)

Can big data analysis give industry a better understanding of risk at signals? Yes - Rail companies can now harness the power of big data to identify how frequently a signal is approached at red, thanks to a new tool funded by the RSSB R&D programme and developed in partnership with the University of Huddersfield.

Idea

- Better trending and normalisation of SPAD data
- Insights into the underlying causes of SPADs
- Enhancements to decision support tools such as the Signal Overrun Risk Assessment Tool (SORAT)

To support take-up:
- Improving usability and functionality based on industry feedback
- Link to live data feeds (it is currently based on a static 420-day period)
- Further R&D focused on potentials beyond safety
Knowledge services

Text-based research
Knowledge analysis
Technology watches
Horizon scanning
Trends monitoring
Patent activity

Knowledge searches
- Research industry problems
- Inform industry strategies
- Identify solutions from other countries
- Investigate technology transfer opportunities
- Assess new/disruptive technologies

SPARK
- A library of over 20,000 reports, papers and test facilities
- SPARK helps you to understand who is doing what, where
- It is a way of sharing and promoting research
Examples of knowledge searches

How can defining passenger capacity and crowding metrics benefit the rail industry?

RSSH Knowledge Brief 5293
August 2017

The Value for Rail

Capacity is the maximum number of people a train/carriage may contain, whilst crowding defines the number of people that fill a space almost completely leaving little room for movement. Recently, concerns of overcrowding have been raised regarding the number of passengers travelling in excess of the train’s capacity during peak travel times (Department for Transport Statistical Release, 2016). As such, defining metrics to assess passenger capacity and crowding will likely benefit the railway industry and services targeted to the second, through using more value from data. Key to this is the APS Capability Delivery Plan (2016). Access to available seats on trains is a key passenger priority (62 out of 8 priorities for rail Improvements, Transport Focus, 2016), whilst ‘sufficient room for all passengers to sit/stand’ on trains accounted for 80% of rail complaints in 2016, and 80% satisfaction on the National Rail Passenger Survey (2015). Metrics that enable operators to find available seats and sufficient room on a train will likely improve customer satisfaction when travelling during peak periods. Additionally, passenger loading behaviour into various carriage designs, can yield valuable information for operators to identify areas of improvement concerning trains curving under and over capacity. Metrics that enable operators reduce dwell times incurred by overcrowding can reduce network disruptions.

Current Knowledge

Various metrics quantifying crowding capacity have been discussed in the literature, broadly captured by The Transit Capacity and Quality of Service Manual (2008) five capacity categories below:

1. Maximum (theoretical) capacity – the maximum number of passengers that can fit within the train carriage.
2. Gross (theoretical) capacity – the seated number of passengers travelling to provide a quality service.
3. Vehicle capacity – the number of vehicles passing through certain points or per hour during a journey.
4. Passenger capacity – the number of people per vehicle against the design capacity.
5. Passengers – the product of vehicle and passenger capacity, measured as number of people per hour passing through certain points during a journey.

Typically, passenger loading levels and vehicle design specifications are used to determine the above categories, expressed as passengers/m² or m³ at three levels: (a) Crush load - capacity 4 passengers/0.2 m² (uncomfortable, frequent body contact); (b) Reasonable service load - 5 passengers/0.6 m³ (occasional body contact, movement requires some effort); and (c) Comfortable service load - 1 passenger/0.4 m³ (no body contact, easy air circulation).

Measuring overcrowding may provide performance metrics, two of which the House of Commons (2013) report on overcrowding on public transport: (a) passenger travelling in excess of capacity (2012), and (b) the percentage of standard class passengers standing during a journey. However, the report called for improvements to be made to data accuracy. Including automated systems of passenger counting, considering the carriage design, and reporting on specific routes. Automated passenger counting systems are increasing, while the inclusion of the above capacity metrics may increase awareness of metrics assessed. Advances in automated counting systems include sensor and CCTV technology counting passenger sitting the train, while advanced methods include movement tracking via passenger flow heat flow.

How can Sentiment Mapping improve customer experience and the end-to-end journey?

RSSH Knowledge Brief 5290
August 2017

The Value for Rail

"Sentiment" represents a richness of real-time insight into customer experience. Sentiment analysis determines how a customer feels about an aspect of their experience. "Sentiment mapping" localizes that information to a time and place. Capturing this information can have wide ranging benefits, including:

- Business insight into the passenger perception of their journey from start to end. Previously unknown issues affecting passenger comfort can be identified, and the importance of issues for sub-sections of the passenger population can be determined.
- Improved relationship with passengers, who may feel more engaged with a transport network if they realize that their opinions are valued and used to make real changes.
- Using passenger sentiments on social media is used to identify accidents, safety issues, emissions, or cleanliness issues on the network.

Current Knowledge

Sentiment mapping and analysis is being increasingly widely used by organizations and projects, as ubiquitous smart phone use has made collecting sentiment data and mapping it in real time and space relatively straightforward.

Existing Projects

TransportAid provides access to real-time data on transport timetables, departures, fares, ticket pricing and performance data metrics. The Transport Cables project used this to develop "Owlhead" a proof-of-concept tool for gathering real-time passenger sentiment information across the transport network, via Twitter. Outputs include insights into passenger behaviour, travel patterns, and areas where passenger experience and network efficiency can improve.

Salford University has made TransportAid to create transport sentiment mapping for projects including Galloway and British Railways. GATEway captured the public response to the introduction of driverless vehicles in the North Greenwich area. The public were invited to provide feedback online about their experience of these vehicles. Responses were analyzed by their sentiment (positive or negative), time and location. British Railways used the service to improve cycling and walking experiences in the city of Keighley. The project specifically targeted "safety issues" which would be hard to detect in isolation. Many small problems with the infrastructure were addressed, creating a substantial net improvement in passenger experience. A valuable result of the project was identifying areas where performance was poor, which resulted in proactive interventions, and increased the perception of safety, making cycling a more attractive option. Similar strategies could be leveraged in rail to identify small problems that could be improved to enhance passenger experience.

Cambridgeshire employs active data collection, directly inviting users to provide feedback. This approach does not violate the user's sense of privacy, and it feels valued and engaged. Active sentiment monitoring also limits the amount of spurious data collected. However, the data may be skewed by unsolicited participation by different passenger...
How can we work together?

Let us know if you have any research questions; we can provide analytical skills for scoping, assessing and building the case.

Knowledge search requests; input to our horizon scanning activities.

Providing access to the wider academic and international portfolio of rail research.

Funding for research from the DfT grant, supported where appropriate by members and other stakeholders, including trade unions.
Thank you
One year on – where are we with CDP’s

Andy Hourigan, ASLEF
Safety Management Intelligence System

• Operating since 1997
• A database which railway companies all report in to and share data in
• Updated in 2017
• 75,000 events per year
  • Fatalities and injuries to people while they are on the rail network
  • Collisions, SPADs and derailments
  • Signalling failures
  • TPWS activations
  • Station overruns
Why is it important to you?

- Used for safety reporting and the national risk model

- Can play its part in developing a fair culture:
  - Capturing information on human performance contributing to incidents (errors and violations)
  - Providing information on underlying causes so we can understand that human performance
  - Providing information on individual and company contributions to incidents
  - Providing a common language that can be used in investigations

- Aim to today:
  - Provide an insight in to how underlying causes can be captured and how that data can be use.
Zooming In

Signal passed at danger (SPAD)

Signal passed at danger
Zooming in more

What were the possible causes to this SPAD event?

1. Error or violation
2. Verbal communication
3. Fatigue, health and wellbeing
6. Competence management
7. Infrastructure, vehicles, equipment and clothing
Framework – A common language for safety – from investigation through to safety reporting and change

SMIS Classification System

Human Performance

1. Slip/lapse
2. Intentional rule breaking
3. Decision error
4. The person was asleep or unable to respond to the situation

10 Incident Factors

- Verbal Communication
- Fatigue, health and wellbeing
- Processes and procedure documents
- Written information on the day
- Competence management
- Infrastructure, vehicles, equipment and clothing
- The person’s environment
- Workload (real or perceived) and resourcing
- Teamworking and leadership
- Risk management
### 10 Incident Factors

<table>
<thead>
<tr>
<th>Icon</th>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td>🎤</td>
<td><strong>Verbal communication</strong></td>
<td>The exchange of spoken information concerned with how safety critical information is communicated between staff</td>
</tr>
<tr>
<td>🧑‍⚕️</td>
<td><strong>Fatigue, health and wellbeing</strong></td>
<td>The individual’s fatigue, health and wellbeing which is the joint responsibility of the organisation and the member of staff</td>
</tr>
<tr>
<td>🧿</td>
<td><strong>Process and procedure documents</strong></td>
<td>Written rules, standards, processes and methods of working which guide and structure activities undertaken</td>
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<tr>
<td>📝</td>
<td><strong>Written information on the day</strong></td>
<td>Information that can be renewed day-to-day or week-to-week, and supports people in carrying out an activity or task</td>
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<tr>
<td>🧑‍🎓</td>
<td><strong>Competence management</strong></td>
<td>The company competence management systems regarding selection, training and assessment</td>
</tr>
<tr>
<td>🔧</td>
<td><strong>Infrastructure, vehicles, equipment and clothing</strong></td>
<td>The infrastructure, vehicles, equipment or clothing used to undertake or support a task</td>
</tr>
<tr>
<td>🎧</td>
<td><strong>The person’s environment</strong></td>
<td>The environmental stressors such as lighting levels, noise and temperature which can affect the performance of a person</td>
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<tr>
<td>🧱</td>
<td><strong>Workload (real or perceived) and resourcing</strong></td>
<td>Workload is the demands on a person which are influenced by the task, its context, the individuals who carry out the activity, and resourcing</td>
</tr>
<tr>
<td>🟢</td>
<td><strong>Teamworking and leadership</strong></td>
<td>How people are organised to work together, and how they relate to and influence each other to undertake their work safely</td>
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<tr>
<td>📊</td>
<td><strong>Risk management</strong></td>
<td>The processes used to identify, assess, reduce and monitor potential safety concerns</td>
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</table>
Verbal communication
Fatigue, health and wellbeing
Process and procedure documents
Written information on the day
Competence management
Infrastructure, vehicles, equipment and clothing
The person’s environment
Workload (real or perceived) and resourcing
Teamworking and leadership
Risk management
Using the 10 Factors to structure an investigation
Group Exercise

• Watch a non-driver train incident reconstruction from France

• Review it a second time as a group and note down against the 10 incident factors any issues which you identify.

• Discuss as a group.

• Groups feed back factors in turn, to see how many of the 10 factors are relevant.
What about human performance?

1. The person was familiar with what they were doing and knew how to correctly respond to the situation but did something wrong without realising (ie slip/lapse)

2. The person understood the situation and realised what they were expected to do, but deliberately did something else (ie intentional rule breaking)

3. The person misunderstood the situation or did not know how to correctly respond, so they made the wrong decision or had the wrong strategy for that situation (includes when the person’s strategy has become incorrect over time or through experience)

4. The person was asleep or unable to respond to the situation
Learning points

- 10 Factors can help to identify different factors in investigations
- The framework supports a fair culture approach
- Outputs can help safety learning when we look across incidents
Creating Safety Data
OUTPUT: SPAD: Passenger Versus Freight 10 Factors (n=257)
OUTPUT: SPAD: Passenger Versus Freight Driver Error (n=257)

- Slip/Lapse: 50%
- Decision Error: 20%
- Intentional Rule Breaking: 10%
- Not classified: 10%

- Freight
- Passenger
Making a change
Example Analysis Output – Safety Critical Communications

- Verbal communications contributing to incidents:
  - What types of communication issue?
  - What safety management issues contribute to communication issues?

- Sample of 95 GB investigation reports involving communications as a factor (SPADs, track worker near miss, derailment, collision)

- Applied the HF framework in the SMIS database

- Identified 541 incident factors in 95 incidents (average 6 per incident)
  - 383 communication issues
  - 158 underpinning safety management issues from the 10 incident factors
Communication Factors Issues

- A. Not communicating: 15%
- B. Communicating with wrong person: 3%
- C. Person talking leaves out important details, says something that is vague, wrong or overly complex: 31%
- D. Person is talking too quietly, or with a strong accent or dialect: 0%
- E. Person receiving the communication doesn’t hear, mishears or misunderstands: 14%
- F. Rule Book communication protocols are not followed: 32%
- G. Problem with communication method: 4%
## Underpinning Safety Management Factors

<table>
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<tr>
<th>10 incident factors</th>
<th>Total</th>
<th>%age</th>
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<tbody>
<tr>
<td>Workload (real or perceived) and resourcing</td>
<td>22</td>
<td>18%</td>
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<tr>
<td>Infrastructure, vehicles, equipment and clothing</td>
<td>22</td>
<td>18%</td>
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<tr>
<td>Fatigue, health and wellbeing</td>
<td>21</td>
<td>17%</td>
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<tr>
<td>Competence management</td>
<td>19</td>
<td>15%</td>
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<tr>
<td>Processes and procedure documents</td>
<td>16</td>
<td>13%</td>
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<tr>
<td>Written information on the day</td>
<td>15</td>
<td>12%</td>
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<tr>
<td>Teamworking and leadership</td>
<td>4</td>
<td>3%</td>
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<tr>
<td>Risk management</td>
<td>3</td>
<td>2%</td>
</tr>
<tr>
<td>The person's environment</td>
<td>3</td>
<td>2%</td>
</tr>
<tr>
<td>Total</td>
<td>125</td>
<td>100%</td>
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4th October, 2017
What did we do with the data?

• Fed in to a national training package to support consistent communication competence development across the GB rail industry

• Project: “Developing a safety critical communication training package”

• Following slides use the incident data to provide background for the national training course
Safety Critical Communications

MODULE: FOUNDATION
1 in 5 accidents involves a communication error.
ACCIDENTS
Errors include:

- Leaving out important details
- Saying something vague
- Not communicating when you should
- Not following basic protocols
Analysis done as part of this training shows that communications mistakes occur across the rail industry and are not the fault of one group of workers.
Thank you
Group exercise

What makes a good member of safety critical staff?
What are NTS?
**Why?**

- Lack of NTS can contribute to incidents and accidents
- NTS looks at **HOW** tasks are done – which can have a positive benefit on the outcome
- Understand better the human performance of technical tasks
- Helps staff to move from competent to proficient to expert
- Improve engagement with staff through meaningful training
- Improve safety culture
# Non-Technical Skills categories

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<th>NTS categories</th>
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<tbody>
<tr>
<td>Situational awareness</td>
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<td>Decision making and action</td>
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<td>Cooperation and working with others</td>
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<td>Self-management</td>
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Non-Technical Skills

1. Situational awareness
2. Conscientiousness
3. Communication
4. Decision making and action
5. Cooperation and working with others
6. Workload management
7. Self-management

Key: NTS Category  NTS Skill
Non-Technical Skills

1. Situational awareness
   - 1.1 Attention to detail
   - 1.2 Overall awareness
   - 1.3 Maintain concentration
   - 1.4 Retain information
   - 1.5 Anticipation of risk

2. Conscientiousness

3. Communication

4. Decision making and action

5. Cooperation and working with others

6. Workload management

7. Self-management

Key: NTS Category | NTS Skill
## Non-Technical Skills

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| 4. Decision making and action            |                                       |
|------------------------------------------|                                       |

Key:  
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- **NTS Skill**
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**Key:**
- **NTS Category**
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# Non-Technical Skills

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</tr>
<tr>
<td>4. Decision making and action</td>
<td>4.1 Effective decisions  &lt;br&gt;4.2 Timely decisions  &lt;br&gt;4.3 Diagnosing and solving problems</td>
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<tr>
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</tr>
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<td>6. Workload management</td>
<td></td>
</tr>
<tr>
<td>7. Self-management</td>
<td></td>
</tr>
</tbody>
</table>

**Key:**  
- **NTS Category**  
- **NTS Skill**
Non-Technical Skills

1. Situational awareness
   1.1 Attention to detail
   1.2 Overall awareness
   1.3 Maintain concentration
   1.4 Retain information
   1.5 Anticipation of risk

2. Conscientiousness
   2.1 Systematic & thorough approach
   2.2 Checking
   2.3 Positive attitude towards rules & procedures

3. Communication
   3.1 Listening (people not stimuli)
   3.2 Clarity
   3.3 Assertiveness
   3.4 Sharing information

4. Decision making and action
   4.1 Effective decisions
   4.2 Timely decisions
   4.3 Diagnosing and solving problems

5. Cooperation and working with others
   5.1 Considering others’ needs
   5.2 Supporting others
   5.3 Treating others with respect
   5.4 Dealing with conflict / aggressive behaviour

6. Workload management

7. Self-management

Key:  NTS Category  NTS Skill
## Non-Technical Skills

<table>
<thead>
<tr>
<th>1. Situational awareness</th>
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<tbody>
<tr>
<td>1.1 Attention to detail</td>
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<table>
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<tr>
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<th>6. Workload management</th>
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<tbody>
<tr>
<td>2.1 Systematic &amp; thorough approach</td>
<td>6.1 Multi-tasking and selective attention</td>
</tr>
<tr>
<td>2.2 Checking</td>
<td>6.2 Prioritising</td>
</tr>
<tr>
<td>2.3 Positive attitude towards rules &amp; procedures</td>
<td>6.3 Calm under pressure</td>
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</table>

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<tbody>
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<tr>
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</tr>
</thead>
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<td></td>
</tr>
<tr>
<td>4.2 Timely decisions</td>
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</tr>
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6. Workload management
   - 6.1 Multi-tasking and selective attention
   - 6.2 Prioritising
   - 6.3 Calm under pressure

7. Self-management
   - 7.1 Motivation
   - 7.2 Confidence and initiative
   - 7.3 Maintain and develop skills and knowledge
   - 7.4 Prepared and organised

Key: NTS Category  NTS Skill
NTS ‘True or False'
NTS in investigations
SPAD Error Details

70% of SPADs have driver slips/lapses as causal/contributory factors

46% of SPADs have driver distraction factors underpinning slip/lapses
SPAD Error Details

70% of SPADs have driver slips/lapses as causal/contributory factors
46% of SPADs have driver distraction factors underpinning slip/lapses

33% of SPADs have driver errors related to expectation and mind set
## Ealing Broadway

<table>
<thead>
<tr>
<th>Non technical skill</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Attention to detail</td>
<td><strong>Train Operator and Service Controller</strong>&lt;br&gt;Failed to spot the detail of the points required for the move&lt;br&gt;Missed 39a points</td>
</tr>
<tr>
<td>1.4 Retain information</td>
<td></td>
</tr>
<tr>
<td>2.1 Systematic &amp; thorough approach</td>
<td></td>
</tr>
<tr>
<td>2.2 Checking</td>
<td></td>
</tr>
<tr>
<td>3.1 Listening</td>
<td><strong>Train Operator and Service Controller</strong>&lt;br&gt;Failed to listen correctly to instruction&lt;br&gt;Neither party communicated clearly nor checked the instructions in the authorisation</td>
</tr>
<tr>
<td>3.2 Clarity</td>
<td></td>
</tr>
<tr>
<td>3.4 Sharing information</td>
<td></td>
</tr>
<tr>
<td>6.2 Prioritising</td>
<td><strong>Train Operator</strong>&lt;br&gt;Either failed to prioritise due to levels of workload OR&lt;br&gt;Failed to maintain calmness under pressure which impacted on his ability to pay attention to communication</td>
</tr>
<tr>
<td>6.3 Calmness under pressure</td>
<td></td>
</tr>
</tbody>
</table>
Organisational level

Organisation
- Safety culture
- Knowledge and skills (CMS and training)
- Supervision and management
- Change
Job or Workplace level

- Equipment
- Workload
- Communication and teamwork
- Practices, processes and information
- Work environment
Individual level

Individual

- Distraction
- Fatigue
- Physical and mental well-being
- Work-related attitudes
- Experience
- Non-technical skills
SPAD 10 Incident Factor causes

- **Passenger (n=197 incidents)**
- **Freight (n=54 incidents)**

Bar chart showing the percentage distribution of incident factors between passenger and freight incidents.
Swiss Cheese Model

Defences and Weaknesses

Layers of cheese
Defences against accidents

Holes in the cheese
Weaknesses in these defences

When all the holes align
There are no defences and accidents happen
# Investigator’s skill set and NTS

<table>
<thead>
<tr>
<th>Knowledge / Skills / Attitude</th>
<th>Further explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of safety-critical NTS and their relevance to the role</td>
<td>Able to explain what each NTS is and how this relates to the driver role.</td>
</tr>
<tr>
<td>Knowledge of what should be documented and how</td>
<td>Knows how to effectively record NTS using company forms.</td>
</tr>
<tr>
<td>Self-awareness</td>
<td>Aware of influence the manager has. Awareness of own communication style and how this could be interpreted. Awareness of own competence and challenges in NTS.</td>
</tr>
<tr>
<td>Objective observation</td>
<td>Ability to make observations based on objective evidence rather than assumptions or other biases.</td>
</tr>
<tr>
<td>Prepared and organised</td>
<td>Structured evidence-based feedback session</td>
</tr>
<tr>
<td>Good listener</td>
<td>Listens to others and keen to understand others’ rationale for actions and behaviour.</td>
</tr>
<tr>
<td>Clear communication</td>
<td>Get points across clearly &amp; in plain english so that they can be understood by others.</td>
</tr>
<tr>
<td>Flexible</td>
<td>Able to adapt feedback style to the individual</td>
</tr>
<tr>
<td>Motivational skills</td>
<td>Able to engage others and convince them of the importance of NTS. Enables people to want to do well, rather than bullying them into it. Know what sort of positive and negative reinforcement works for each individual.</td>
</tr>
<tr>
<td>Assertive</td>
<td>Able to provide feedback in a constructive way</td>
</tr>
<tr>
<td>Positive approach to NTS and keen to promote their relevance and value</td>
<td>Demonstrates an interest in and commitment to promoting the importance of NTS.</td>
</tr>
<tr>
<td>Keen to contribute to the ongoing development of NTS within the organisation</td>
<td>Demonstrates an interest in and commitment to integrating NTS into organisational practices to help staff development.</td>
</tr>
<tr>
<td>Takes a learning approach to mistakes</td>
<td>Willing to listen to the driver’s perspective in discussions around NTS and uses mistakes as an opportunity to learn.</td>
</tr>
</tbody>
</table>

ASLEF event  | 4th October, 2017  | ASLEF event
Competence Development Plans

- Determine if CDP is required
- Identify requirement
- Develop CDP
- Implement CDP
- Re-assess and close out
Where to find more information on NTS
A Good Practice Guide to Integrating Non-Technical Skills into Rail Safety Critical Roles
Model for integration

1. Plan integration
2. Identify NTS
3. Integrate into selection
4. Train and promote NTS
5. Measure NTS
6. Revise and renew integration
New RSSB guidance on NTS integration

Good practise guide on NTS integration:  

Resources for NTS

1. **Extranet** (for NTS course slides, non-driver materials and facilitator guides and other support materials for the integration guide): https://www.rssb.co.uk/extranet

2. **Opsweb** (for RED DVD’s and other resources): https://www.rssb.co.uk/opsweb

3. **SPARK** (For NTS research and most other rail topics): https://www.sparkrail.org


Thank you
Fatigue on the railway

Dan Basacik

ASLEF Engagement Day
4th October 2017
Major crashes in the ‘80s and ‘90s
Past research

We’ve done plenty of research in the past into the fatigue issue:

– T059 Human factors study of fatigue and shift work
– T299 Human factors study of obstructive sleep apnoea in train drivers
– T699 Fatigue and shiftwork for freight locomotive drivers and contract trackworkers
– T997: Managing occupational road risk associated with road vehicle driver fatigue
– T1082: Developing fitness for duty checks and predicting the likelihood of experiencing fatigue
– T1083: Preparing rail industry guidance on biomathematical fatigue models
– T1084: Preparing rail industry guidance on first night shifts

This is all available on our SPARK web portal (access via the RSSB website)
How tired are we?

% of duties where particularly fatigued

- Passenger drivers: 20%
- Freight drivers: 40%
- Trackworkers: 20%
What is driving fatigue (in our industry)?

**Shift system:**
- Start time
- Shift length
- Rotation
- Rest period
- Recovery time
- Breaks

**Job factors:**
- Workload
- Difficulty
- Working environment
- Task familiarity

**Individual:**
- Age
- Body clock
- Personality
- Fitness & health
- Domestic arrangements

How much sleep we get
How mentally tired we get
How physically tired we get
How does fatigue affect people?

Comparing people who are tired to people who are at the drink drive limit for alcohol

Table 6  Equating the effects of sleep deprivation and alcohol consumption

<table>
<thead>
<tr>
<th>Test and measure</th>
<th>BAC 0.05%</th>
<th>BAC 0.1%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>95% CI</td>
</tr>
<tr>
<td>Reaction time task:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed (ms)</td>
<td>18.04</td>
<td>17.12 to 18.96</td>
</tr>
<tr>
<td>Accuracy (misses)</td>
<td>17.31</td>
<td>16.51 to 18.11</td>
</tr>
<tr>
<td>Dual task:</td>
<td></td>
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</tr>
<tr>
<td>Speed (ms)</td>
<td>17.73</td>
<td>16.75 to 18.71</td>
</tr>
<tr>
<td>Hand-eye coordination (level of difficulty)</td>
<td>18.43</td>
<td>17.41 to 19.45</td>
</tr>
<tr>
<td>Tracking task:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand-eye coordination (level of difficulty)</td>
<td>18.25</td>
<td>17.37 to 19.13</td>
</tr>
<tr>
<td>Mackworth clock vigilance:</td>
<td></td>
<td></td>
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<tr>
<td>Speed (ms)</td>
<td>17.08</td>
<td>16.20 to 17.96</td>
</tr>
<tr>
<td>Accuracy (misses)</td>
<td>17.64</td>
<td>16.72 to 18.56</td>
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<tr>
<td>Symbol digit task:</td>
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<tr>
<td>Speed (ms)</td>
<td>18.55</td>
<td>17.43 to 19.67</td>
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<tr>
<td>Speed (symbols inspected (n))</td>
<td>18.52</td>
<td>17.46 to 19.58</td>
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<tr>
<td>Accuracy (correct (%))</td>
<td>16.91</td>
<td>15.72 to 18.10</td>
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<tr>
<td>Spatial memory task:</td>
<td></td>
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<tr>
<td>Accuracy (length of recalled sequence)</td>
<td>18.05</td>
<td>17.09 to 19.01</td>
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</tbody>
</table>

Reaction time, hand-eye co-ordination, vigilance, splitting attention between tasks, etc.

People who have been awake 16-19 hours straight, perform as badly as people who are at the drink drive limit.
How does fatigue affect people?

- Degraded visual performance  (I can’t see straight)
- Degraded cognitive performance  (I can’t think straight)
- Reduced vigilance  (I can’t pay attention)
- Increased errors  (I can’t do anything right)
- Longer to respond  (I can’t do anything quickly)
How big an impact does fatigue have on railway operations?

‘Analysis identified fatigue as a factor in 21% of incidents; however, the relevant check box in SMIS was only marked for 1% of incidents’

‘Home-life related fatigue was the most cited reason for the fatigue (40%) followed by work-related fatigue (38%).’

‘Relevant fields for fatigue are often not completed in SMIS...’
What can happen if we get fatigued?
Fatigue and health

- 50+ hours of work per week
- Less than 6 hours of sleep a night
- Frequent sleep complaints

• Heart disease
• Diabetes
• Gastrointestinal trouble
• Musculoskeletal troubles
• Poor mental health

Insomnia
Sleep apnoea
Chronic fatigue syndrome
Group discussion (5 minutes)

If you are concerned about a fatigue issue in your organisation what would you do to try to get it resolved?

Have you had any successes in resolving fatigue-related issues?
What should companies do?

- Identify safety critical workers affected
- Set standards and define working patterns
- Limit exceedances
- Consult with safety critical workers
- Record the arrangements
- Provide information to safety critical workers
- Monitor
- Take action when workers are fatigued

Don’t forget your role and your union’s role in this process!!
Fatigue reporting

You’ve had about 4 or 5 hours sleep because

• You’ve been out with friends and got carried away
• Your body just can’t get on with the new shift pattern you’re working
• Your new baby was crying in the night
• You have been stressed about work
• Your neighbours were noisy in the night

and you’re feeling really tired. Would you report that you are too tired?
Fitness for duty decisions

Will Jane be dangerously tired at any point in her shift?

Dave
Jane’s manager

Jane
Train driver
Examples of types of tools evaluated

Fatigue Score Calculator

<table>
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<tr>
<th>Score</th>
<th>Now</th>
<th>12:00</th>
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<th>14:00</th>
<th>15:00</th>
<th>16:00</th>
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<td>2.00</td>
<td>3.00</td>
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<td>6.00</td>
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<td>11.00</td>
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- Monitor
- Take action when workers are fatigued

Don’t forget your role and your union’s role in this process!!
What works for people?

Managing Fatigue-related Risk

It’s about sleep -stupid

Drew Dawson,
Centre for Sleep Research
University of South Australia
What works for people?

- Knowing how your body works
- Recognising health problems and getting help for them
- Getting enough, good quality sleep!!
- Taking naps to top up sleep
- Breaks

...easily said.
Thank you
Rail Technical Strategy

4 October 2017
Presented by Trevor Bradbury
Why do we need a Rail Technical Strategy?

• Our Strengths
  • 1.7 Billion passenger journeys per annum
  • 0.5 Billion tonnes of freight per annum
  • Excellent safety record

The railway is a success! 😊
Why do we need a Rail Technical Strategy?

• Threats and Opportunities
  • Mobility as a Service
  • Autonomous vehicles
  • Phasing out of diesel in automotive and introduction of electric drivetrains
Why do we need a Rail Technical Strategy?

The British Railway Network before and after Beeching

1963 1984

2020?
Why do we need a Rail Technical Strategy

• The railway is part of an overall transport system

• The RTS gives us control of our own destiny, keeping us in step with developments in other modes

• It’s about ensuring the sustainability of the industry in a changing transport market

• It’s about growth – more capacity, more connections, more routes.
Rail Technical Strategy – The story so far...

- **2007**
  - DfT publishes the first Rail Technical Strategy

- **2012**
  - Industry (TSLG) publishes the Second Rail Technical

- **2012 – 2015**
  - Industry capability mapping
  - Portfolio maps

- **2015 – 2016**
  - Prioritisation
  - Whole system approach

- **2016 – 2017**
  - Technical Leadership Group (Nov 2016)

Increasing Industry Maturity

Delivery Plan (Jan 2017)
Rail Industry Support Engine: Video train positioning technology

Last updated on 27 January 2017 19:36

Project reference: SC1-RSE-05

Status: Underway

Start date: -

End date: -

Project abstract/description:

PROBLEM STATEMENT: We need to provide a speed and positioning sensor that locates a train on a precise track anywhere on the network.

SOLUTION: RDS video positioning technology uses a forward facing camera to locate a train's position using real time image processing. The solution provides a train-borne positioning sensor with low life cycle costs. It offers significant advantages over existing approaches that are heavily reliant on infrastructure equipment or GPS. The patented RDS technology uses image processing algorithms to provide distance measurement output and also to identify infrastructure elements such as switches, crossings and signs.

Attachments

Attachments may be available to logged in users, contributors or members
Key Capabilities
Delivery Structure
## RTS Work Package Owners

<table>
<thead>
<tr>
<th>WP No.</th>
<th>Rail Technical Strategy Key Capability</th>
<th>Donor Organisation</th>
<th>Name</th>
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<tbody>
<tr>
<td>WP01</td>
<td>KC01 Running trains closer together</td>
<td>BAE Systems</td>
<td>Dr Karan Lane</td>
</tr>
<tr>
<td>WP02</td>
<td>KC02 Minimal disruption to train services</td>
<td>Network Rail</td>
<td>Janine Fountain</td>
</tr>
<tr>
<td>WP03</td>
<td>KC03 Efficient passenger flow through stations and trains</td>
<td>Rail Delivery Group</td>
<td>Phil Swain</td>
</tr>
<tr>
<td>WP04</td>
<td>KC04 More value from data</td>
<td>Network Rail</td>
<td>Karl Butler-Garnham</td>
</tr>
<tr>
<td>WP05</td>
<td>KC05 Optimum energy use</td>
<td>Alstom</td>
<td>Ouahcene Ourahmoune</td>
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<tr>
<td>WP06</td>
<td>KC06 More space on trains</td>
<td>Angel Trains</td>
<td>James Brown</td>
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<tr>
<td>WP07</td>
<td>KC08 Intelligent trains</td>
<td>Altran</td>
<td>Ben Carrington</td>
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<tr>
<td>WP08</td>
<td>KC10 Flexible freight</td>
<td>Stobart Rail</td>
<td>Richard Errington</td>
</tr>
<tr>
<td>WP09</td>
<td>KC11 Low-cost railway</td>
<td>Unipart</td>
<td>Neil Tinworth</td>
</tr>
<tr>
<td>WP10</td>
<td>KC12 Accelerated research, development and technology deployment</td>
<td>RSSB</td>
<td>James Hardy</td>
</tr>
<tr>
<td>WP11</td>
<td>Research, development and technology into industry planning</td>
<td>Network Rail</td>
<td>David Rowe</td>
</tr>
</tbody>
</table>
Rail Industry Readiness Levels

1. Technology Readiness
2. Manufacturing Readiness
3. Integration Readiness
4. System Readiness
5. Software Readiness
6. Reliability Readiness

Improve

Rail Industry Readiness Levels
Gate Process
Want to know more - [www.rssb.co.uk/rail-technical-strategy](http://www.rssb.co.uk/rail-technical-strategy)
Thank you
In summary...
Thank you and keep in touch