The future of driver training: defining training needs and integrating non-technical skills

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The current situation

The overall model for train driver training in Great Britain has remained largely the same since the introduction of formalised driver training in the 1970s. Although the model is successful to an extent, it focuses predominantly on development of technical skills and underpinning knowledge. As a result, it tends to be rules-based, trainer-centred and reliant on time as a means of assuring competence. The recent withdrawal of mandatory GB Railway Group Standards and associated guidance relating to training provides an opportunity to review current training models and refocus them in line with safety requirements and business needs.

RSSB have initiated two interrelated projects in response to evidence of leading practice in training provision. The first project focused on the development and evaluation of a behaviour-based training programme (non-technical skills) and the second sought to promote greater rigour in the overall design of driver training programmes within the industry (review of driver training programmes). Each project will be discussed in turn before a summary is provided of the implications of both projects for the rail industry.

Non-technical skills

Background

Analyses of incident and accident reports in the rail industry have shown that the majority of errors that occur relate to people at the front line (63%) rather than to management (30%) or design factors (7%) (Gibson, 2009). Closer evaluation of incident and accident reports has shown that consistently, non-technical skills (NTS) such as situational awareness and workload management are key contributors to these events. This is supported by other research across safety-critical industries highlighting how important NTS are to safety (Flin, O’Connor and Crichton, 2008). NTS have been defined as the cognitive, social and personal resource skills that complement technical skills and contribute to safe and efficient task performance (Flin, O’Connor & Crichton, 2008). NTS are more general than technical skills and can be applied to a range of tasks and procedures. NTS can be used with technical skills to enhance the way that a task or procedure is carried out and can increase safety by helping to manage threats and errors when they occur.

While behavioural preferences form part of the train driver selection criteria¹, there is very little formal coverage of NTS in other areas of the driver competence management system. At present training programmes for operational staff within the GB rail industry are based largely on rules and traction handling, and ongoing competence development is concerned only with technical skills.

Similar training programmes (known as Rail Resource Management or Crew Resource Management) have already been implemented in rail industries in other countries, and in other safety-critical industries. It can be difficult to outline the exact commercial benefits of training interventions, particularly when accidents occur on an infrequent basis, but the available information regarding the costs and benefits of NTS training are encouraging (Lowe, Hayward & Dalton, 2007). The case has been argued that the application of NTS training to the Rail industry can be regarded as an investment (Roop et al, 2007). Evaluations of NTS training in a range of safety critical industries show that it generally produces positive reactions among trainees (Salas et al, 2006). Evidence suggests that NTS training has resulted in improvements in knowledge, behaviour and attitudes in a range of industries (e.g. O’Connor, Flin & Fletcher, 2001; Salas et al, 2001; Powell & Hill, 2006). For example,

¹ As part of RSSB project T948 Driver selection, new assessment techniques have been designed to better measure behavioural preferences in candidates applying for the train driver role. Piloting and evaluation of these methods is still in progress but for more information please contact research@rssb.co.uk.
evaluations of non-jeopardy observations in the aviation industry have shown desired changes in behaviour (Helriech & Foushee, 1993). Behavioural improvements of between 6% and 20% have been consistently reported (Salas et al, 1999). The Federal Railroad Administration (FRA) in the USA notes positive safety benefits across a range of safety critical industries including improved communication and situational awareness (Morgan et al, 2006). NTS training is reported to have contributed to a reduction in the number of accidents and incidents caused by human error in rail (Klampher et al, 2007), aviation (Fleming & Lardner, 2000), and shipping (Bydorf, 1998). For example, Canadian Pacific Railway report a 46% decrease in human-caused incidents and the lowest incident rate for Class One Railways in North America and attribute this to the Rail Resource Management Program that they implemented in 2002 (Klampher et al, 2007).

The decision to make Crew Resource Management training mandatory for pilots (Civil Aviation Authority in the UK) and crew (Federal Aviation Authority in the USA) within the aviation industry, and the increasing adoption of this style of training into other safety critical industries is a clear demonstration that NTS training is considered effective and worthwhile.

When the FRA applied outcomes from the aviation industry to the actual and estimated data from the rail industry, they concluded that NTS training can be expected to have similar benefits in the rail industry and net positive effects at an industry and individual company level (Morgan et al, 2006).

**Aim**

In summary, evaluation of the current provision of training within the industry suggests that there is scope for development in this area based on the evidence emerging from railway incidents and leading training practice. In response to this, RSSB undertook a project to develop, pilot and evaluate a NTS training course. This process involved the development of a complimentary NTS course for managers, and guidance on company policy on the integration of NTS into competence management systems and on the implementation of NTS training.

**Method**

The first stage was to develop a draft list of NTS applicable to the driver role and corresponding behavioural markers (examples of good and poor behaviour). A thorough approach was taken to the development of this list and the markers. The draft list was based upon a review of existing information including; the selection criteria used for recruitment of train drivers, previous work conducted by RSSB with a train operating company to identify and measure NTS in the simulator (Bonsall, 2009), incidents and accidents recorded on the RSSB Human Factors incident database, research literature on the role of behaviour in safety critical roles (e.g. Flin, O’Connor & Crichton, 2008), a list of NTS compiled by RailCorp and used in task analysis workshops to identify training needs (RailCorp, 2008), and National Occupational Standards for train drivers (GoSkills, 2009). The markers were developed in accordance with the available guidance on behavioural marker development (Daimler-Und, & Benz-Stiftung, 2001).

This draft list was then validated by subject matter experts through a number of workshops. In these workshops attendees were presented with an inventory of all the tasks that drivers are required to carry out as part of their role (more detail on this inventory process is provided in part two of this paper).

The list of NTS was used as a source of reference during the task inventory workshops. Attendees were asked to consider, for each element of the driver role, which (if any) of the NTS were relevant and why. Feedback was also sought on the comprehensiveness of the NTS list and markers, and whether and re-wording or description was necessary. The results of these workshops confirmed the relevance of each NTS on the list, and the clarity and appropriateness of each behavioural marker. The final NTS list is provided in table 1 below.
# Figure 1 - NTS related to the train driver role (categories and sub-skills)

<table>
<thead>
<tr>
<th>NTS Category</th>
<th>NTS Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Situational awareness</td>
<td>1.1 Attention to detail</td>
</tr>
<tr>
<td></td>
<td>1.2 Retain information (during shift)</td>
</tr>
<tr>
<td></td>
<td>1.3 Maintain concentration</td>
</tr>
<tr>
<td></td>
<td>1.4 Maintain global awareness</td>
</tr>
<tr>
<td></td>
<td>1.5 Anticipation of risk</td>
</tr>
<tr>
<td>2 Workload management</td>
<td>2.1 Multi-tasking and selective attention</td>
</tr>
<tr>
<td></td>
<td>2.2 Prioritising</td>
</tr>
<tr>
<td></td>
<td>2.3 Calm under pressure</td>
</tr>
<tr>
<td>3 Decision making and action</td>
<td>3.1 Effective decisions</td>
</tr>
<tr>
<td></td>
<td>3.2 Timely decisions</td>
</tr>
<tr>
<td></td>
<td>3.3 Diagnosing and solving problems</td>
</tr>
<tr>
<td>4 Conscientiousness</td>
<td>4.1 Positive attitude towards rules and procedures</td>
</tr>
<tr>
<td></td>
<td>4.2 Systematic &amp; thorough approach</td>
</tr>
<tr>
<td></td>
<td>4.3 Checking</td>
</tr>
<tr>
<td>5 Communication</td>
<td>5.1 Clarity</td>
</tr>
<tr>
<td></td>
<td>5.2 Listening</td>
</tr>
<tr>
<td></td>
<td>5.3 Assertiveness</td>
</tr>
<tr>
<td></td>
<td>5.4 Sharing information</td>
</tr>
<tr>
<td>6 Cooperation and working with others</td>
<td>6.1 Treating others with respect</td>
</tr>
<tr>
<td></td>
<td>6.2 Considering others’ needs</td>
</tr>
<tr>
<td></td>
<td>6.3 Supporting others</td>
</tr>
<tr>
<td></td>
<td>6.4 Dealing with conflict / aggressive behaviour</td>
</tr>
<tr>
<td>7 Self-management</td>
<td>7.1 Motivation</td>
</tr>
<tr>
<td></td>
<td>7.2 Confidence and initiative</td>
</tr>
<tr>
<td></td>
<td>7.3 Maintain and develop skills and knowledge</td>
</tr>
<tr>
<td></td>
<td>7.4 Prepared and organised</td>
</tr>
</tbody>
</table>
The second stage of this work was to develop, pilot and evaluate a NTS training course.

Course development began with a collation of relevant underpinning information for each NTS, for example on the limitations of the human information process system (RSSB, 2008). Training staff from across the industry were then invited to participate in the development of a NTS course for drivers. Working with RSSB, the group produced a training course which combines a collection of learning methods (e.g. group discussion, practice and role play), drawing on relevant industry incidents to illustrate the relevance of NTS to the driver role. Pre-course materials, a facilitator guide and delegate workbook were also designed to complement the course delivery. Given the potential relevance of NTS to other safety-critical roles in the industry, the course materials were developed to be generic enough to be adaptable to other roles, and guidance was included on suitable adaptations.

The course materials were then reviewed by more senior training representatives from across the industry, and union members, to ensure that they were supportive of the content and methods used. It is widely agreed that demonstrable support from management (e.g. Predmore, 1999) and reinforcement of principles (e.g. Helmreich, Merritt & Wilhelm, 1999) are vital to the success of NTS training programmes. For this reason, as well as involving senior personnel throughout the project in steering groups and review meetings, a specific course was also developed for the staff who manage the personnel who will receive the NTS training.

This manager course outlined the importance of the role of the manager in promoting the value of NTS, and in developing the competence of drivers from ‘competent’ to expert. It included practical guidance on how to observe and document NTS, how this related to existing competence management systems, and how to provide meaningful feedback to promote NTS development. Within the course and throughout the project it was made clear that the purpose of the NTS training was to raise awareness of such skills and promote their development, and not to make pass/ fail assessments. The guidance on feedback included on the course was based on a combination of findings from previous RSSB research (Bonsall, 2009) and literature on effective management and coaching (e.g. Lombardo & Eichinger, 2006). The course combines theory, group discussion and the opportunity to practice (e.g. through the observation of pre-recorded driver simulator sessions). Practical resources were developed to complement the course delivery and the managers’ role, including quick-reference guides. Finally, the course content was reviewed for suitability by a sample of managers across the industry.

Next steps

The courses will be piloted with a sample of managers and drivers from two train operating companies in early 2011. Trainer representatives from these two pilot companies have been included throughout the project in order to gain their complete understanding and buy-in to the project. These trainers will deliver the courses within their respective companies.

In order to attempt to demonstrate the effectiveness of the NTS training course, methods have been put into place to evaluate the course. The method of evaluation of the driver course is designed to assess the Four Levels of Evaluation outlined by Kirkpatrick (1979); reactions, learning, behaviour and results. Reactions will be gathered through course feedback sheets distributed after each course module and question sessions will be used to check learning during the course. Behaviour change will be measured through two methods. Once the managers have received their training, they will conduct a pre-course measurement of their drivers’ NTS, and they will repeat this process one month and 6 months following their drivers’ completion of the course. Drivers will also complete a self-measurement of their NTS at the start of the course, and will be encouraged to keep a self-reflective log of their progress. It is expected that the investment in this training, along with support and reinforcement from managers, will lead to a reduction in incidents and accidents. The companies involved in the piloting of the training programme have committed to monitoring their incident and accident rates over time.

Following evaluation, a final guidance report will be produced and the training materials will be made available to the industry. The report will include guidance on suitable adaptations that individual companies could make to reflect the knowledge, skills and attitudes of staff within their company, as well as more general recommendations for integrating NTS into company culture, for example through safety briefing days, and incorporating the consideration of NTS into incident investigations. Industry
will also be advised to re-visit their training provision and competence assessment at a more general level, in line with an RSSB project to provide an overall review of driver training that has been running in parallel to the non-technical skills project.

**Review of driver training**

**Background**

As outlined in the introduction, as well as a need to introduce formal non-technical skills training, there is a case for revisiting the overall design of training programmes. In 2008, RSSB carried out a series of interviews and surveys with HR/Operations Directors, Heads of Training, Driver Trainers, Driver Instructors and Newly-Qualified Drivers to explore perceptions of current driver training. Data from these surveys was compared and integrated with a report on the history of driver training (Evans, 2009), a literature review of leading practice in training (Pitsopoulos, 2009a), outputs from a series of interviews with representatives of other safety critical industries exploring leading practice in training (Pitsopoulos, 2009b), and a report exploring adult learning and innovation (Taylor, 2009). Options for improvement were generated in a summary report (Pitsopoulos, 2009c).

This summary report included an analysis of risk-based training needs analyses (RBTNAs) supplied to the project team by rail industry companies. This analysis showed that there is an inconsistent approach to the practice of RBTNA within the rail industry. A lack of clarity in available guidance and the differing requirements of each company were identified as the reasons for this. Therefore, in follow-up to this review, on the request of industry representatives, a project was initiated to refine the process for risk-based training needs analysis (RBTNA).

**Aim**

The overall aim of the project was to develop and pilot a more practical and usable methodology for the RBTNA process, with a generic case study that companies could customise to their own operations. This would enable a reappraisal of the suitability of companies’ training programmes, and help determine and identify areas for change.

This generic RBTNA was predicated on the basis that companies have broadly similar requirements for the training of train drivers. However, during testing of the training priority assessment methodology by two members of the project team, both from passenger train-driving backgrounds (one high speed, the other high-density commuter), it became clear that the characteristics of common tasks vary enough between different companies to preclude assigning generic training priorities, rendering a generic RBTNA invalid. Therefore, the project was re-scope to provide an RBTNA template which could be easily customised by each duty holder.

The RBTNA template was developed as a framework for collating and analysing all the necessary data for supporting decisions about training. These decisions can pertain to overarching issues such as structure and grading of content. Or, they can pertain to specific instructional design, aligning with adult learning principles (such as explored in Taylor, 2009), making best use of leading practice in training methods (Pitsopoulos 2009a, 2009b) and the full range of training media. Some assumptions and constraints for obtaining and interpreting this data were provided. The process for customising and completing the template was designed to be as user-friendly as possible, while yielding useful information.

To best meet the needs of the GB rail industry, the project team avoided developing an RBTNA process that *automatically* specifies a training programme by determining how much time and resources should be spent on each task, or grouping them artificially through common ratings. Dictating the training in this way may lead to a one dimensional approach and disable the ability of training staff to make good decisions about learning and assessment that support individual learners’ needs.
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Method

The starting point for the development of the RBTNA template was RSSB's RS/220 Good Practice in Training guide (RSSB, 2007). The overall structure of the RBTNA, as recommended in RS/220, was retained, with three main phases; role definition, prioritisation of training needs and identification of training options. These stages are outlined in Figure 2 - . A train operating company undertook a pilot of this methodology and template, feedback from which was used to make improvements and refinements.

Figure 2 - Overview of the risk-based training needs analysis process

a) Role definition

The first step in role definition is to break down the role into its component parts.

The RBTNA guidance in RS/220 suggests using the human factors discipline of hierarchical task analysis (HTA), which is defined as:

‘...a method of defining goals and tasks for a particular job (using factors such as time, plant status, conditions, instructions and sequence) and then dividing each goal into ’sub goals’, each with its own plan, in order to produce the most effective method of achieving the final aim.’ (Shepherd, 2001)

In order to reduce the complexity of the RBTNA, some elements of HTA, including plans, were considered unnecessary. Hierarchy of goals, tasks and subtasks was an important concept for the development of the RBTNA, but is not represented beyond goals and tasks in the final output, which is a comprehensive list of tasks that can be analysed for training priority and options. This simplified HTA is denoted as the task ‘inventory’.

The starting point for the development of the task inventory was a review of National Occupational Standards (GoSkills, 2009) and elements of existing task analyses from a range of previous projects. It was then developed through a series of workshops with industry stakeholders. During these workshops, the comprehensiveness of the task inventory was checked and tasks broken down into sufficient levels of detail to allow for analysis of training priorities (see below).

The final task inventory supplied with the RBTNA template works on a generic level, as the tasks contained are easily customised either through deleting unnecessary tasks or adding in more detail, where necessary.

Skills and knowledge requirements were mapped onto the task inventory. Initially, the skills and knowledge requirements section included a column for ‘technical skills’, as found in some examples of RBTNAs available. However, during the development of the generic task inventory, it became evident that the information that could be inputted into this column was not particularly useful, as often it just matched the description of the task. There are some specialist technical skills that are worthy of
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capture, particularly those which are associated with personal injury hazards, such as accessing/egressing from driving cabs and operating train control equipment from the driving seat. in order to capture these important technical skills, they are described as tasks within the task inventory.

non-technical skills were mapped to the task inventory as described earlier in this paper.

generic skills were previously known as ‘key skills’, but now renamed by the uk government as ‘functional skills’ were also mapped. in addition to those functional skills defined by the government (english, mathematics (referred to as ‘numeracy’ within the rbtna template) and information and communications technology), the project team also added ‘spatial ability’ (the ability to make speed and distance judgements based on sensory cues) to the list of ‘functional skills’.

b) priorisation of training needs

in the background research to this project, a lack of consistency was identified in how the dif analysis, as detailed in the rssb good practice in training guide (rssb, 2007), is used within the industry (pitsopoulos, 2009c). in particular, it was unclear how some of the ratings were reached. the project team examined the various existing criteria used for each of the different ratings and identified potential refinements to the process:

- the difficulty rating could be strengthened by having three ratings (as with importance and frequency) rather than just ‘not difficult’ and ‘difficult’.
- the difficulty rating only takes difficulty of learning into account. consideration of competence retention factors (other than frequency) and performance factors would refine the rating.
- ‘frequency’ is sometimes mistakenly regarded as ‘frequency of hazards’ (a component of ‘importance’) rather than ‘frequency of task being carried out on the job’.
- subject matter experts carrying out ratings may find it hard to quantify ‘importance’ accurately in terms of safety risk, often making one or both of the following false assumptions:
  - error is intrinsically linked to importance. ie every error results in a hazardous event.
  - every hazardous event should be analysed to the ‘nth’ degree. ie every hazardous event could result in the most serious consequences of multiple fatalities and serious injuries.

in response to this, an enhanced version of dif was developed. the performance characteristics (difficulty and frequency) were separated from the safety risk characteristics (importance). objective safety risk data (rssb, 2009) was used to guide subject matter expert judgements. the process represented in figure 3 and elaborated on below seeks to strike a balance between refinement to produce more accurate outputs and simplicity to make the process usable.

figure 3 - overview of training priority assessment process
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i) Performance characteristics rating

The Performance Characteristics rating looks at (a) frequency: how often the task is performed and (b) difficulty: how difficult the task is in terms of learning, competence retention and performance.

Frequency is how often the task is performed, on average, by someone in the role being considered by the RBTNA. The rating should be based on an average employee’s normal pattern of work. Therefore, long absences from work, such as for annual or sick leave, should not be considered.

The frequency ranges in Figure 4 are based on DIF guidance (RSSB, 2007) and were fine-tuned during workshops with Arriva Trains Wales, VolkerRail and First Great Western.

<table>
<thead>
<tr>
<th>Description</th>
<th>Frequency range</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very frequent</td>
<td>Once a shift or greater</td>
<td>1</td>
</tr>
<tr>
<td>Frequent</td>
<td>Once every 2 to 6 shifts</td>
<td>2</td>
</tr>
<tr>
<td>Infrequent</td>
<td>Once every 7 shifts or less</td>
<td>3</td>
</tr>
</tbody>
</table>

The difficulty of the task is a combination of the following factors:

Learning: How much learning, practice and reinforcement activity is needed in order to master the task?

Competence retention: How likely/quickly are skills and knowledge likely to fade and how long does it take to relearn them? This does not take into account frequency of task performance, but rather the fact that some tasks are more prone to skills fade than others.

Performance: Is the task prone to error due to the level of non-technical skills required or the circumstances in which the task is usually performed?²

These elements of difficulty are based on existing DIF guidance from the RS/220 Good Practice in Training guidance (RSSB, 2007) and were refined during workshops with several train operating companies.

Weighing these different factors up against each other, a difficulty rating can be assigned. This ultimately needs to be a judgement made by the rater(s), because unlike ‘Frequency’, difficulty is not based on a quantitative scale. Figure 5 shows some qualitative statements which help make this judgement.

<table>
<thead>
<tr>
<th>Description</th>
<th>Difficulty example</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not difficult</td>
<td>For example, the task is not difficult to learn, retain and/or perform accurately.</td>
<td>1</td>
</tr>
<tr>
<td>Somewhat difficult</td>
<td>For example, the task may be moderately difficult to learn, retain, and/or perform accurately.</td>
<td>2</td>
</tr>
<tr>
<td>Difficult</td>
<td>For example, the task may be difficult to learn, retain, and/or perform accurately.</td>
<td>3</td>
</tr>
</tbody>
</table>

² For example, the task of ‘Open doors’ is neither difficult to learn, nor retain. It is, however, very easy to perform incorrectly (as evidenced by instances of wrong-side door opening or doors being released when not at a station).
The frequency and difficulty ratings are combined automatically in the RBTNA spreadsheet, based on the matrix shown in Figure 6, in order to determine a Performance Characteristics rating for each task.

**Figure 6 - Performance Characteristics matrix**

<table>
<thead>
<tr>
<th>Performance characteristics matrix</th>
<th>Difficulty of task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of task</td>
<td>Not difficult - 1</td>
</tr>
<tr>
<td>Infrequent – 3</td>
<td>3</td>
</tr>
<tr>
<td>Frequent – 2</td>
<td>2</td>
</tr>
<tr>
<td>Very frequent – 1</td>
<td>1</td>
</tr>
<tr>
<td>Somewhat difficult - 2</td>
<td>4</td>
</tr>
<tr>
<td>Difficult – 3</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>4</td>
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<tr>
<td></td>
<td>3</td>
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<tr>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

ii) Safety risk characteristics rating

The safety risk characteristics rating uses objective safety risk data from the RSSB Risk Profile Bulletin (RSSB, 2009), to help subject matter experts quantify the ‘importance’ rating from the original DIF analysis.

Subject matter experts identify what types of hazards might occur if a task was to be performed incorrectly (or not performed at all). In simple terms, it involves determining ‘what could go wrong’ for each task in the inventory. The safety risk data associated, slightly customised to reflect its relationship with performance of driver tasks, is then applied to a sensible logarithmic scale to return a safety risk characteristics rating of one to five.

The two ratings obtained as a result of the above process are also from 1 to 5. It was originally envisaged that these ratings would be combined to return an overall training priority rating of 1 to 9 for each task. However, such an approach may be invalid, as there is no way of proving that the two ratings are proportionally equivalent. For example, 2+4 does not necessarily equal 4+2.

The other limitation of the enhanced process (although it was also a limitation of the existing DIF analysis) is that it does not take into account business risk. Again, to do so would be to undermine the validity of the safety risk rating. Therefore, acknowledgement of business risk has been built into the process separately. Subject matter experts can link poor/non-performance of specific tasks company ‘key performance indicators’, based on historical evidence. For example, tasks associated with train faults may be linked to timetable performance.

c) Training options analysis

The training options analysis completes the data generated by the completion of the RBTNA process which enables decisions to be made about training and assessment options. It does this by taking the data identified during the scoping study about the target audience (i.e. the role being considered), the equipment, personnel and geographical areas to be considered and combining it with data pertaining to business needs. This is usually an operational requirement for a certain amount of personnel to be trained within a certain time frame. Other factors such as resources, including training infrastructure and staff and budget available for training and assessment are also considered.

In order to identify optimum methods and media, an analysis of the fidelity requirement for each task versus the available fidelity is carried out, as well as a general analysis of the availability, location and capability of training staff to use various learning and assessment methods and media.

**Result**

The training staff who undertook the pilot of the RBTNA methodology using the template provided feedback. This was positive about the potential application of the data yielded from the process:
'Overall a very positive and worthwhile process which allowed me to think much more deeply about what emphasis is placed on different parts of driver training. Were we spending too much time or conversely not enough time on certain aspects? Yes, in some cases I think we are and this process has allowed us to open that discussion.'

'Obviously this is just the beginning and much more work will be needed to map the results to a new and improved training package but overall I am pleased to have been involved in this process which has made me think much more about how we train out process and principles and look forward to taking it forward to the next step as and when this happens.'

Industry workshops were held to examine and interpret the data from the case-study RBTNA developed through the pilot. The workshops identified some weaknesses with the current overall model of driver training:

- Knowledge drives structure (rather than the whole competence profile, with relatively little attention given to skills development)
- There is a lack of graded, blended, task-based learning.
- On-the-job training lacks structure.
- It is difficult to identify below-average learning performance and to pinpoint the reason for the deficiency.

**Next steps**

Various ideas for improving existing models, or developing completely new models were floated by workshop participants, along with a realistic appraisal of some of the barriers to implementing new ideas. The ability of industry to overcome these barriers and implement changes to driver training, is its next challenge.

Following publication of the research report and RBTNA guidance, an industry implementation group will be set up to oversee the roll-out of the RBTNA template. This group will also help the industry to decide on the implications of company’s undertaking more consistent RBTNAs, including the possible development and piloting of new models for driver training, and the application of RBTNA outputs to the design and implementation of enhanced competence management systems.

**Limitations and further research/work**

Each project was carefully planned to bring maximum benefit to all stakeholders in the rail industry. However, due to practical limitations, it has only been possible to work with a limited number of companies on both projects.

For the pilot and initial evaluation of the NTS course, it will only be possible to do this with a small sample of drivers and managers from two train operating companies. This means that the conclusions that will be drawn following the evaluation of the NTS course can only be indicative, and ongoing evaluation will be required to give a more accurate indication of success. With time, as more companies adopt the course, and as changes in accident rates may become apparent, this will enable more firm conclusions to be drawn.

It is anticipated that as companies participating in the NTS pilot project have had close involvement in the work they may find it easier than other companies to implement the training. Each company involved in the pilot is considered to be culturally ‘ready’ for the intervention. Companies that have more of a ‘blame’ culture may face more challenges in encouraging drivers to be open and honest about their NTS development (Lowe, Hayward & Dalton, 2007). In anticipation of this issue, the course materials and facilitator guides have been developed in as user-friendly a form as possible, and RSSB are planning industry briefing days and other support arrangements, as well as the inclusion of guidance in the final report.

Similarly, although several companies were involved with the development of the RBTNA methodology, only one company was able to pilot the RBTNA template. The conclusions drawn from this case study can be applied across GB rail to an extent, as the overall training model is the same (Taylor, 2009). However, beyond the overall generic model, each companies’ individual training
requirements and provision will be sufficiently different necessitate the completion of their own fully customised RBTNA. The ability of individual companies to commit resources to undertaking the RBTNA process, let alone implementing any improvements identified as a result of examining RBTNA data, will depend on their individual corporate circumstances.

Looking forward, given how closely NTS and technical skills are used together in safety critical roles, the aim should be to deliver NTS training alongside technical training. Non-technical skills should also be integrated into the complete competence management system process, from recruitment to initial training, assessments and ongoing development. Furthermore, as these skills relate to all manner of safety critical roles, steps should be taken to apply NTS to competence management systems for other staff. There are also potential applications of the RBTNA methodology to competence management systems, particularly using the enhanced DIF analysis to better inform type and periodicity of assessment.

The case-study RBTNA was developed to examine the case for the development of new models of driver training, and the NTS course evaluation will provide an initial indication of the success of this course. The industry will be in a position to decide whether this case has been proven and, if so, when and how new training models should be implemented.

Acknowledgement and integration of NTS into a more rigorous process for analysing training needs will help companies re-evaluate their existing training and competence activities, optimising them to balance the needs of the learner and the business. Both work streams represent a proactive step towards developing the competence of front-line staff and improving safety. Given the link between NTS and industry incidents, it is expected that the wide-scale implementation of this course will, over time, improve the safety of the rail industry. Use of the RBTNA template will help companies use training as a means of better managing business risk, of which safety risk is one part.


Challenge G: An even more competitive and cost efficient railway


