Research Programme

Management

Competence management - rolling stock organisations

Rail Safety and Standards Board's (RSSB) response to the report by Risk Solutions entitled 'Competence management - rolling stock organisations' April 2003

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1.   Purpose

1.1   The purpose of this paper is to outline RSSB's response to the attached report, and to summarise the actions being taken by RSSB.

1.2   The report was commissioned as part of the Rail Safety Research Programme (RSRP) and was prepared by Risk Solutions. The research was designed to gain an understanding of the difficulties that rolling stock maintenance organisations experience in complying with Railway Group Standard GO/RT3260 *Competence management systems for safety critical work*, and to inform the debate on whether the standard can deliver the required level of assurance.

1.3   The research may be viewed in the context of a report, *Competence Management*, submitted by Risk Solutions in March 2002 (published by RSSB in August 2002) which provided comparisons of vehicle maintenance competence management systems for road, rail and aircraft maintenance organisations.

1.4   The recommendations shown in italics below have been paraphrased and numbered sequentially for simplicity. Readers may refer to the full wording on pages 46 and 47 of the report.

2.   RSSB Response

2.1   Recommendation 1   *Railway Group members (RGMs) should review their arrangements to ensure that their suppliers of safety critical parts and services are fully compliant.*

        Response: The members will be given this report to inform them of the potential benefits of conducting such a review.

2.2   Recommendation 2   *RSSB should commission further research into how the benefits of the ' task' and 'system' level approaches to risk assessment can be realised for rolling stock competence management systems, whilst minimising the disadvantages of each approach.*

        Response. This will be considered and weighed against competing demands for research funding. It is likely that it will be judged as being of fundamental importance within the traction and rolling stock Competence Management System (CMS). This will aid the development of a CMS at task, system and generic levels.

2.3   Recommendation 3.   *RSSB should consult with professional bodies, such as the The Institution of Incorporated Engineers (IIE), with a view to establishing a body to set core competence standards and accreditation for rolling stock practitioners.*

Response: Consultation should commence when Recommendation 2 has progressed. Proposals should then be formed to present to the industry. The Institution of Mechanical Engineers (IMechE) should be consulted as well as IIE. The consultation should explore ways in which the accreditation can be linked to National Vocational Qualifications (NVQs).

2.4   Recommendation 4.   *RSSB should develop a system for reviewing outputs from the audit programme. This should address variations in members' competence standards and re-assessment frequencies to understand and challenge such variations.*

Response: RSSB will have no compliance audit capability from 31 December 2003. There may be a role, to be defined by the RSSB strategic review, in reviewing audits carried out by others. It should be noted that there is nothing intrinsically wrong with variations in members' competence standards and re-assessment, provided that the system meets the minimum standards laid down and the arrangements specified in the duty holder's Railway Safety Case. Such variations are to be expected if systems are designed to meet the specific needs and exposures of each duty holder.

2.5   Recommendation 5.   *RSSB should lead the industry through provision of a national conference and regional workshops to share good practice.*

Response: RSSB will consider this when Recommendation 2 has been progressed and policy developed on the competence management system or rolling stock maintenance.

2.6   Recommendation 6.   *RSSB should re-issue the Guidance Note on the design and development of competence management systems.*

Response: RSSB will use the information contained in this report to inform the development of a Good Practice Guide in this area.

2.7   Recommendation 7.   *RSSB should ensure that future changes to the standard should address:*

    a. *The scope of rolling stock competence management systems, eg whether it should be widened to include other staff such as technical support staff and managers.*

    b. *Integration with other management systems.*

c. *Competence as a variable, developing with training and experience.*

d. *The validity of alternative assessment methods, eg peer review and practical demonstrations.*

e. *Where responsibilities lie for gaining and maintaining competence.*

Response: RSSB will use the information contained in this report (and the *Competence Management* report by Risk Solutions published in August 2002) to inform the revision of the Railway Group Standard (RGS).

3. Contact

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Competence Management - Rolling Stock Organisations

A report for Railway Safety

April 2003

Executive Summary

This report details the findings of research undertaken across a range of industry stakeholders to:

- Understand the difficulties that rolling stock maintenance organisations have had complying with Railway Group Standard GO/RT3260 – 'Competence management systems for safety critical work'

- Comment on whether GO/RT3260 can deliver the required level of assurance

We were requested not to consider the changes currently being made to the Group Standard (which will result in a new Group Standard being issued – GO/RT8031), to ensure that an objective view of current the current situation could be made.

A series of telephone interviews were conducted with a cross-section of industry organisations to collect information on the key issues relating to competence management. The telephone interviews were supplemented by six depth interviews where it was possible to undertake a more detailed examination of the system's operation. The depth interviews also allowed the views of a wider cross-section of individuals to be understood, including supervisory staff, technical trainers and maintenance personnel. The interviews were structured using the requirements of the Railway Group Standard, its associated Code of Practice and issues identified from a desktop literature search of competence management practices in other industries.

Findings

Overall, we found that organisations have developed systems that meet the requirements of the Group Standard, largely without external guidance. In several cases systems have been further developed to be more sophisticated, covering a wider scope. Some of the areas where organisations have experienced difficulty are:

- The development of standards of competence and re-assessment frequencies that are relevant to the type of rolling stock in use and appropriate to the risk that would be posed had the work not been carried out competently

- How to implement a competence management system that ensures competence through the supply chain

- How to involve line management in competence management systems whilst maintaining consistent, meaningful and objective assessments

- How to make best use of the competence management system through integration with other management systems

- The development of systems that develop the all-round competence of individuals to bring real business benefits rather than a system that will satisfy the Railway Safety audit teams

We also found that there are wider issues that the industry has not fully considered in its approach to managing competence:

- There are inherent weaknesses in the NVQ approach

- Competence is a variable rather than an absolute

- There are many factors that can affect an individual's competence

- Different parties have key roles to play in maintaining and developing competence

Conclusions

Overall, traction and rolling stock organisations have developed systems that are compliant with the Railway Group Standard. The one area where we believe that compliance with the Group Standard is **not** being achieved is in ensuring that supplier organisations have the same, or equivalent, systems and standards in place.

There are other areas where rolling stock organisations have encountered difficulties:

- *System scope* – whether competence management should be focused at a task or system level; whether the scope of the system should be widened to include managers and technical staff

- *Competence standards* – which standards should be adopted ('off the shelf' or developed in-house); how to differentiate between basic and specialised competences

- *Assessment methods* – whether there are methods other than the NVQ approach which may be more appropriate for rolling stock organisations; how to achieve unobtrusive monitoring

- *Demonstrating compliance* – how an overview of the approaches adopted by rolling stock organisations can be achieved

The introduction of the Railway Group Standard has meant that competence assurance is now an accepted part of normal operations. This should make it easier for the industry to develop and refine systems in the future. However, if the Group Standard was fully effective then compliance with its requirements would ensure competent practitioners. Our research indicates that practitioner competence is being achieved through the recruitment and selection policies of individual rolling stock organisations, their commitment to training and the quality of their line management. The prevailing view was that rolling stock organisations already had controls in place for ensuring staff competence and that the having formal systems that complied with the Group Standard brought few additional benefits.
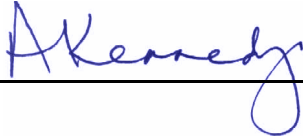
Recommendations

For the Group Standard to improve the standard of competence management within rolling stock organisations, several amendments would be required. In addition, further guidance is required to ensure that good practices are understood and shared .To address these issues we recommend that:

- Railway Group members should review their arrangements to ensure that their suppliers are fully compliant with the requirements of the Railway Group Standard

- Railway Safety should commission further research into how the benefits of the task and system level approaches to risk assessment can be realised for rolling stock competence management systems, whilst minimising the disadvantages of each approach.

- Railway Safety should consult with professional bodies, such as the IIE, to explore the feasibility of such a body setting common core engineering competence standards for rolling stock practitioners and to provide formal accreditation of both practitioners and training organisations.

- Railway Safety should develop a system for reviewing variations in Railway Group members' competence standards and re-assessment frequencies to understand and challenge why such variations exist.

- Railway Safety should lead the industry in sharing of good practice in competence management within rolling stock organisations, through the provision of a national conference for senior managers and for a series of regional workshops for those designing and operating competence management systems.

- Railway Safety should re-issue the Guidance Note to assist Railway Group members in the design and development of competence management systems. In particular, guidance on defining 'competence', the use of risk assessments, development of competence standards, the management of assessments and methods of unobtrusive assessment should be covered.

- Railway Safety should ensure that any future changes to the Railway Group Standard consider and address the following issues:

  - The scope of rolling stock competence management systems, in particular whether other groups of staff should be included.

  - How competence management systems should be integrated with other management systems to deliver further and increase performance

  - How systems should cater for the fact that competence is a variable, developing over time with training and experience

  - The validity of alternative assessment methods to rolling stock engineering organisations (such as peer review and practical demonstrations).

  - Where the various responsibilities lie for gaining and maintaining competence.

Title	Competence Management - Rolling Stock Organisations

Customer	Railway Safety

Customer reference	T101

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Appendix A – Marked-up Survey Questionnaire

1   Introduction

1.1   Aims

This research project was commissioned to provide an insight into the difficulties that rolling stock maintenance organisations have experienced in attempting to comply with Railway Group Standard GO/RT3260 – 'Competence management systems for safety critical work'. A further aim was to inform the debate on whether GO/RT3260 can deliver the required level of assurance; in effect whether compliance with the Railway Group Standard will ensure a competent workforce.

We were requested <u>not</u> to consider the changes currently being made to the Group Standard (which will result in a new Group Standard being issued – GO/RT8031), to ensure that an objective view of the current situation could be made.

1.2   Scope

To achieve the aims described above required a cross-section of the industry to be surveyed. A total of 21 organisations participated in the survey and included:

- Passenger train operators – Arriva Trains Merseyside, Connex South Eastern, Eurostar UK Limited, First Great Western, GNER, South Central, South West Trains and Wales & Borders Trains

- Freight train operators – EWS and Freightliner

- On-track plant maintainers – Balfour Beatty Plant and Jarvis,

- Rolling Stock leasing company – Porterbrook

- Rail vehicle maintenance providers – Maintrain, Bombardier

- Railway competence management system consultancy – Rail Professional Development

- Private-owner vehicle maintainer – Mendip Rail

- Rail industry materials provider – Railpart

- Railway and engineering union – RMT

- Engineering professional body – Institute of Incorporated Engineers

- Railway safety regulators and inspectors – Railway Safety

The passenger train operators were selected to reflect the different types of operation across a wide geographical area to ensure that the different issues faced by operators were considered (staff turnover rates, age and complexity of rolling stock etc).

1.3   Report structure

Section 2 of this report discusses the methodology of the study, with an introduction to the Railway Group Standard provided in Section 3.

Sections 4 to 7 of the report discuss the findings of the research against the requirements of the Railway Group Standard. A summary of the key issues is included at the end of each section. The sections follow a logical progression of system design through to assessment and demonstration of compliance.

To inform the debate on whether compliance with the Railway Group Standard can deliver the required level of assurance we have included (in Section 8) a discussion of current competence management practice in other industries and academic thinking on the subject. Although outside the scope of the project requirements, we believe that it is important to provide an overview of the strategic issues concerning competence management. Rather than provide answers to the issues described, this section is intended to stimulate interest in the issues and promote further debate within the rail industry.

Conclusions are drawn from the findings and discussions of the previous sections and are presented in Section 9 of this report, with recommendations to address the key issues presented in Section 10.

The Appendix provides a copy of the structured questionnaire used in the telephone interviews, marked up with the responses where appropriate.

2   Methodology

2.1   Telephone interviews

We conducted a series of telephone interviews with a cross-section of industry organisations to collect information on the key issues relating to competence management.

In each of the interviews with train operators, the primary contact was the Director responsible for rolling stock maintenance and engineering activities. In many cases we were referred to the line managers responsible for the development, implementation and operation of competence management systems for these personnel. The profile of respondents from train operating organisations is shown in the chart below:
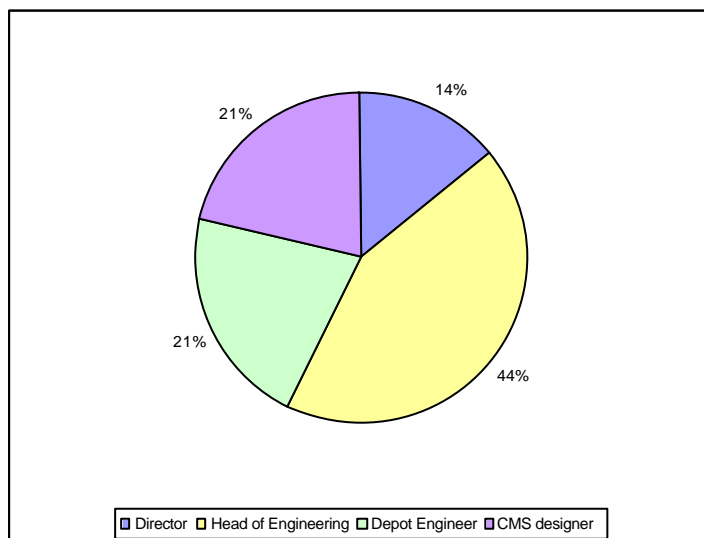
Chart 1; Job role of train operator respondents

This chart shows that 14% of those interviewed were at Director level, with a further 65% at senior management level (roles of Head of Engineering and Depot/Fleet Manager). 21% of those surveyed were at middle management level, responsible for the development, implementation and operation of the competence management system within the organisation.

In total, 21 interviews were conducted during the period from September to December 2002. In most cases[i] we conducted the interview using a structured interview questionnaire that had been reviewed by Railway Safety. The questionnaire was based on

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i   The structured interview questionnaire was not deemed appropriate for the interviews with Railway Safety, the IIE, RMT, Railpart and Rail Professional Development. Of the organisations where the questionnaire was used, not every question could be answered by every respondent. For example, we had as few as 6 responses for one question and up to 14 responses for the majority of the other questions.

the requirements of the Group Standard. The majority of questions asked were designed to probe the respondents' views and to gain an understanding of why particular courses of action had been adopted. A marked up copy of the questionnaire is reproduced in Appendix A.

Interviews lasted between 45 and 80 minutes, with the average time being 1 hour. All interviews covered the relevant points with time variations being due to the time that the interviewee had available and differences in the detail of the answers given.

Confidentiality was an important issue for all respondents and only by providing assurance that their responses would be treated as confidential were interviewees willing to speak openly and honestly. The majority of interviewees requested that their responses were anonymised in the final report and this has been respected.

Interviews were arranged in advance so that interviewees were able to allocate sufficient time. In general, interviewees welcomed the research, appeared relaxed and to be giving their honest opinions and the resulting analysis yielded rich and extensive findings.

Summary transcripts were produced for each interview conducted. The content of each interview transcript was then analysed in order to identify the key themes. Each question and general topic area was analysed to understand the key themes. The general topic areas were:

- Definitions of 'competence'

- System design

- Employment, recruitment and selection

- Competence standards

- Competence assessments

- Competence through the supply chain

- System benefits

- Assurance

2.2   Depth interviews

Once the key issues from the telephone interviews had been identified, we conducted six site visits. The organisations selected for these depth interviews were felt to have competence management systems with particular points of interest or were industry bodies with an important viewpoint on system development and operation. The organisations were nominated by us and approved by Railway Safety.

During the site visits we carried out face-to-face interviews with the organisation's telephone interview contact. Site visits lasted between 5 and 6 hours.

Documentation used in the development and day-to-day operation of the organisation's competence management system was examined and examples of competence assessments, risk assessments and plans were taken. In addition, face-to-face interviews were carried out with personnel that had responsibility for the operation of the system (Team Leaders / Shift Supervisors) and individual practitioners (maintenance staff) where

possible. These interviews were used to gauge how effective the competence management system was from those directly involved with competence measurement.

3   Railway Group Standard GO/RT3260

3.1   Scope

The Railway Group Standard GO/RT3260 'Competence Management for Safety Critical Work'[1] was introduced to clarify how the Railways (Safety Critical Work) Regulations should be applied to the UK rail network (specifically the Railtrack-controlled infrastructure). The Group Standard also defines the work that is to be considered 'safety critical' and the key requirements for Railway Group members' competence management systems. The Group Standard therefore applies to a wide range of activities undertaken on the railway network:

- **Engineering activities** (installation, inspection, maintenance, testing and repair) on:
  - Track and structures
  - Train control and operational communication systems
  - Electrification equipment
  - Plant and machinery (such as point heating equipment, road-rail vehicles, on-track machinery and compressors/pumps that could affect safety if they failed to operate)
  - Traction and rolling stock
  - Electrification equipment
- **Operational activities** associated with:
  - Operating trains (train driving, shunting, train loading, train despatch for example)
  - Protecting persons working on or near the line (setting up safe systems of work, acting as lookout or site warden for example)

The Group Standard was introduced in August 1998, with Railway Group Members being required to be fully compliant by 1st April 2001.

3.2   Requirements of the Group Standard

The key requirements of the Group Standard are that Railway Group members shall:

- Identify and document work that they carry out (or are responsible for) which meets the 'safety critical' definition
- Ensure that the people carrying out such work are competent and physically fit to do so. This is to be achieved through the Railway Group member developing and applying a formal competence management system

3.3   Competence management systems

Competence management systems developed by Railway Group members must have the following:

- Documented standards against which the competence and medical fitness of an individual can be measured

- A formal assessment system that is capable of identifying and remedying shortfalls in competence on an ongoing basis

- Individuals that are competent to assess others

- A means of verifying that the system is effective and achieving consistent results

- A means of identifying which individuals are competent to carry out the various safety-critical activities

It should be noted that Railway Group members are responsible for ensuring that contractors used by them to carry out safety-critical work are competent.

4   Findings: System Scope

4.1   Definition of the term 'competence'

Before an organisation can develop systems to manage the competence of its personnel there obviously needs to be a clear understanding of what the term 'competence' actually means. 'Competence' is a complex concept, consisting of many inter-related elements. The Railway Group Standard[1] defines 'competence' as:

> *"The ability to perform work to the standard expected in employment…. it includes the practical and theoretical knowledge, experience and skill required to carry out safety critical work so as to ensure the safety of any person who might be affected."*

The key elements of this definition are:

- Practical knowledge

- Theoretical knowledge

- Experience of carrying out the work

- Skill

- A performance standard must exist against which an individual's performance can be compared

These elements are defined at a fairly high level in the Group Standard, with no further guidance being given in the associated Code of Practice, GO/RC 3560 'Code of Practice: Competence Assessment'[3].

There are definitions of competence that include additional elements to those identified in the Railway Group Standard. In particular, the HSE in their publication 'Developing and maintaining staff competence'[2] define competence as:

> *"….the ability to undertake responsibilities and to perform activities to a recognised standard on a regular basis. Competence can be considered to include a combination of practical and thinking skills, experience and knowledge, and may also include an attitudinal component (e.g. willingness to do work in a prescribed manner). The precise combination required depends on what needs to be done, in what circumstances, and how well. Coupled with competence is the need to provide staff with appropriate tools and resources to deliver the intended outcome."*

This definition, although similar to that in the Railway Group Standard, provides a richer picture of what 'competence' means.

- Practical skills (how to carry out the task, use of tooling and documentation)

- Thinking skills (for example approaches to fault finding, fault identification and testing methods)

- Experience of carrying out the work

- Knowledge (understanding what needs to be done, when, where and why it needs to be done, as well as who should be informed)

- That the activities must be performed to the required standard on a regular basis

- That there is an attitudinal component to competence

- That the organisation has a significant role to play in achieving competent individuals through the provision of resources and a satisfactory working environment

The Rail Industry Training Council provides a more concise definition in their National Vocational Qualifications for engineering maintenance[9]:

> *"The ability to perform in the workplace to the standards required in employment"*

The survey respondents were asked (Q A1) what they believed the term 'competence' meant. This question was asked to provide an insight into what organisations were hoping to achieve through having competence management systems in place. There were a variety of definitions encompassing many of the points from the definitions above, as well as some additional elements that the respondents believed were important in their particular cases:

> *"…have demonstrable ability to complete work to the required standard; first time every time"*

> *"Ability to carry out specific duties in a safe way"*

> *"From risk analysis identifying what knowledge people require to carry out tasks, so that risk is not imported onto the infrastructure"*

Several of the definitions given were quite narrow, being limited to single elements of knowledge, training or fitness. In only one case was the attitudinal component specifically recognised as being one of the key factors affecting competence.

From these varying formal definitions and the survey responses we believe that what is meant by 'competence' is still not entirely clear.

4.2   What is assessed?

The Railway Group Standard requires safety examination, repair, modification and maintenance activities undertaken on safety critical systems to be within the scope of an organisation's competence management system, unless these activities are then subject to inspection or testing. Where this is the case, the inspection and/or testing activity must then be within the scope of the competence management system.

The rolling stock systems that are defined as being safety critical within the Group Standard are:

1. Wheelsets, bogies and suspensions

2. Brakes

3. Wheelslip/slide equipment

4. Power controls

5. Speed indicating equipment

6. Inter-vehicle couplings and connections

7. Traction current collection equipment

8. Fuel systems

9. Exterior doors and door locking systems

10. Train-borne equipment required for train control and communications systems, including AWS, ATP, TPWS, radio, tripcocks, track circuit actuators, RETB equipment

11. DSD, DRA

12. Head, tail and marker lamp systems

13. Windscreen wiper and washer systems

14. Fire safety systems

15. Fastenings that secure/retain hatches or covers or which prevent loads from becoming detached from a vehicle

16. Safety interlocks

17. Bolts and other retaining devices that prevent underfloor equipment from falling to the ground (e.g. diesel engines, electric machines, fuel tanks, cardan shafts, brake gear, gearboxes, converters, equipment modules)

18. Steam locomotive boilers, valve motion etc

19. Air pressure vessels

20. Warning horns

The list in the Group Standard covers all systems that pose a direct risk to the health and safety of people operating and/or using the railway and provides a broader definition than is contained in the Health & Safety Commission's guidance[11] to the Railways (Safety Critical Work) Regulations. The Group Standard also makes it clear that the above list is not exhaustive and that operators should identify and document those activities that are safety critical. It should be noted that some vehicle systems not included in this list may have an *indirect* effect on operational safety and the health and safety of those using the railway. For example, an engine or transmission failure that causes long delays, with passengers unable to leave the train is likely to cause a short term increase in probability of staff assaults. 21% of organisations have recognised these indirect risks, as well as identifying the financial implications of such occurrences, and have created a competence management system that caters for an expanded list of vehicle systems and components. By doing so, these organisations are increasing the business benefits from operating their competence management systems.

All the organisations surveyed had realised that to assess the competence of their staff in all the above areas could lead to a competence management system that was extremely broad in scope and would result in a level of resourcing that would be impractical. As a result, many of the organisations had carried out some form of risk assessment to

determine what activities should be included within the scope of their competence management system and also to help define the high risk areas. A variety of different approaches were noted, but most used the traditional likelihood/consequence matrix with a 3x3 or 5x5 scale. Some of the differences noted in shaping the final risk score were:

- Consideration of emerging failure trends

- Consideration of past safety and reliability performance of rolling stock systems

The most significant difference between risk assessment approaches was in *what* had been risk assessed. Two distinct approaches were noted:

- Risk assessments carried out on each *task* that appears in the Vehicle Maintenance and Overhaul Instructions (VMOI) or Depot Maintenance (DM) schedule for each vehicle type in use

- Risk assessment conducted at rolling stock *system* level (e.g. 'brakes')

There are advantages and disadvantages with each of these approaches, as shown below:

	Advantage	**Disadvantage**
System-level approach	Relatively fast to complete (20 systems to be assessed, as listed in the Group Standard)	Only provides an aggregate assessment of risk – may miss tasks within each system that have a much higher (or lower) level of risk
Task-level approach	Major exercise, may be 1000's of tasks that require assessment	Provides a comprehensive framework from which re-assessment frequencies can be determined and also whether 'generic' or 'specialised' competencies are required for competent performance

Table 1; System and task-level approaches to risk assessment

Risk assessments were generally seen as a once-off task and were rarely, if ever, reviewed. The Group Standard does not mandate a particular approach and the Code of Practice does not provide guidance on any of the above points.

4.3   Who is assessed?

The majority of organisations (79%) have developed their system in order to achieve compliance with the requirements mandated in the Railway Group Standard (Q B2). As described above, this covers those people that carry out:

- *"…safety examinations intended to ensure that a vehicle is safe to operate on Railtrack Controlled Infrastructure……"*

- *"…repairs, modifications or maintenance to safety critical systems and components, or which directly affect such systems or components unless subject to testing or inspection on completion…"*

In this latter example, if the work *is* subject to subsequent testing or inspection then the test/inspection becomes safety critical and therefore that individual's competence falls within the scope of the system. Very few organisations have expanded the scope of the system to include other groups of staff that could have an indirect impact on safety, such as supervisors and technical experts.

From the depth interviews it became apparent that some organisations have developed (or are in the process of developing) competence standards and assessment programmes for other groups of staff. These include supervisory staff, technical engineers and staff that enter information about safety critical components into computer systems (such as maintenance/repair records and serialised component fitment). In the 'Wider Issues' section of this report we discuss whether the scope of the Group Standard to include such groups.

The Group Standard requires operators to ensure that their suppliers (both of goods and services) also have competence management systems in place. The HSE's guidance[2] amplifies this requirement and suggests that organisations should apply their own competence management system to the supplier organisation. Of all the areas examined during the survey (Q G1-G2), this was the area where systems were seen to be weakest. This was particularly true of suppliers of goods (organisations supplying new, repaired or overhauled safety-critical components). In the majority of cases there was a reliance on contract conditions stipulating that 'all Railway Group Standards were to be complied with'. We found no examples of where an organisation had reviewed a supplier's competence management system or verified that the competence standards in use by the supplier were equivalent (or better) than their own. The rail industry's major procurement and logistics organisation, RailPart, has been proactive in requiring suppliers of wheelsets to introduce competence management systems, but this only covers a small percentage of the safety critical systems listed in the Group Standard. Obviously there are a number of other controls that exist in this area that help to reduce the risk:

- Work is normally undertaken in controlled environments (e.g. a factory or workshop)

- The goods should be covered by some form of quality assurance system at the supplier

- The goods should be covered by some form of quality assurance system by the operator when goods are received

- Components that are fitted will generally be subjected to some form of operational test before the vehicle is permitted to enter service

A greater degree of control is often exercised for the supply of services (e.g. contract staff employed to carry out safety-critical work on rolling stock). Many different approaches appear to be in use to provide assurance that the contractor's staff are competent, varying in the degree of assurance that is provided:

- Statement in contract conditions that suppliers must 'comply with all relevant Railway Group Standards' (36% of respondents used this method)

- Rely on periodic checks/audits of work done to verify that the work has been done competently (21%)

- Review contractor's competence management system and standards prior to work commencing (14% of respondents)

- Insist suppliers meet the train operator's own competence standards before commencing work (29% used this approach)

This is illustrated in the chart below:
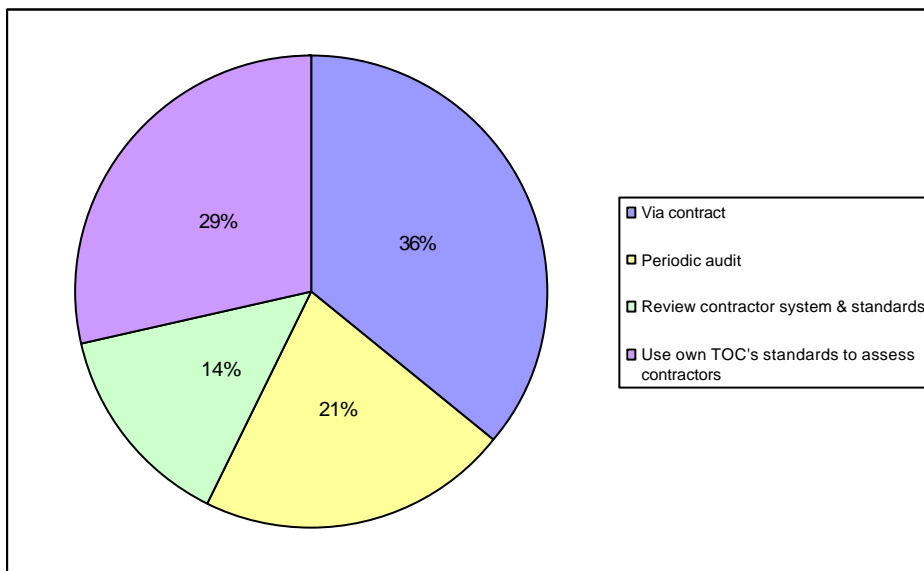
Chart 2; Methods used to assess service supplier competence

Of all these methods, the latter two (review of contractors' system and use of the operator's own system and standards) could be considered to be compliant with the Group Standard and the HSE's guidance.

4.4   System scope: summary of issues

The Group Standard is the rail industry's interpretation of how the Railway (Safety Critical Work) Regulations should be applied and as such it would be reasonable to expect that the definition of 'competence' contained in the Group Standard should match that adopted by the HSE. In fact, the Group Standard definition is narrower than that developed by the HSE and as a result the industry could be seen not to be adopting the good practice outlined in the HSE's guidance.

A small number of organisations have recognised that business benefits can be obtained by having their competence management system cover an expanded list of vehicle systems. This enables the organisations to manage the competence of individuals that not only have a direct effect on safety risk, but also have an impact on other risk areas (such as operational performance).

To ensure that attention is focused on high risk areas, several organisations have used risk assessments to prioritise activity. Two approaches to the use of risk assessment were noted: either a detailed assessment of every task that practitioners are required to

undertake, or a general assessment of activities at a system level. The task-level approach is the more thorough (and could be used to provide a picture of system-level risk), but requires significant resource commitment to undertake. Although the Code of Practice implies that risk assessment methods should be used in the design of a competence management system, use of such methods is patchy. As a result, assurance cannot be provided that the competence management systems in use across the industry have been designed based on risk priorities.

An area where the majority of organisations have found it difficult to achieve compliance is in the application of formal competence management into their supply chain. The majority of organisations do not ensure that their contractors have competence management systems in place and that the competence standards are at least as good as their own. The risk in this area is reduced however by other assurance arrangements (such as quality inspections and component testing).

5   Findings: Competence Standards

5.1   Standards defining competent performance

Underpinning any competence management system is the framework of standards that define 'competent' performance. The Group Standard requires organisations to have identified and documented competence standards applicable to the work being carried out. It does not mandate the use of specific competence standards, such as those developed by the Rail Industry Training Council (RITC) for NVQ levels 2 and 3. As can be seen from the chart below, 29% of organisations have made use of the RITC standards with the majority (71%) having developed their own standards of competence. Of those organisations that developed their own standards, 70% used some form of consultancy help with the remaining 30% using in-house resources only.

50%

21%

29%

Developed own ▫ Use RITC ▫ Developed with consultancy help
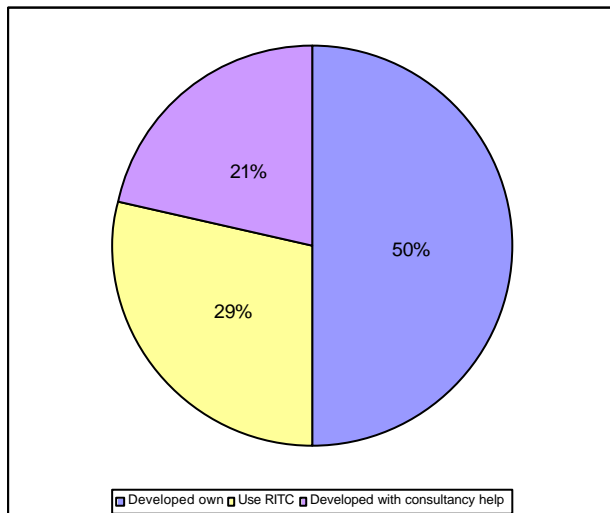
Chart 3: Development of competence standards (n=14)

The low adoption of the RITC standards is mirrored in the wider rail industry for the award of NVQ qualifications. Indeed, the SRA and Department for Education & Skills have commented in their report for the rail industry[8] that take-up of NVQs for engineering maintenance has been disappointingly low. In the period up to September 2001, 420 individuals registered to take an NVQ Level 3 in Railway Engineering Maintenance (the level normally required for skilled engineering maintenance personnel), but to date only 7 of these had achieved the Level 3 qualification. It should be noted that these figures include all engineering personnel engaged in maintenance activities across all asset types (for example track, signalling, civils, traction & rolling stock) – a population that must be many thousands. This lends weight to criticisms that the NVQ system is overly-bureaucratic and difficult to administer which suggests that their use in any competence management system should be treated with some caution. Some of these problems are explored in Section 8 (Wider Issues) of this report.

The fact that organisations have developed different standards defining what competent performance is means that there are potentially many different 'standards' in existence across the industry for similar activities (e.g. maintenance work on identical safety systems on different types of rolling stock, such as AWS, DRA or TPWS). Indeed, a greater concern is that there are different 'standards' across the industry for ***identical*** activities (e.g. maintenance work on braking systems for the same type of stock in use by several operators). This is not only inefficient; it could also imply that some organisations are willing to accept a lower standard of competent performance than in other organisations. This raises two fundamental questions:

- Should there be a common standard applied across the industry where identical equipment is in use?

- Who should set (and validate) such a standard?

We believe that it is difficult to justify the existing arrangement where different standards exist for similar or identical equipment and that Railway Safety has a leading role to play in this area.

5.2   Structure of competence standards

The use of the NVQ structure using 'Units' and 'Elements' of competence was a common theme from all the telephone interviews. This structure satisfies the requirements of the Group Standard and the Code of Practice. This structure is shown in the diagram below:
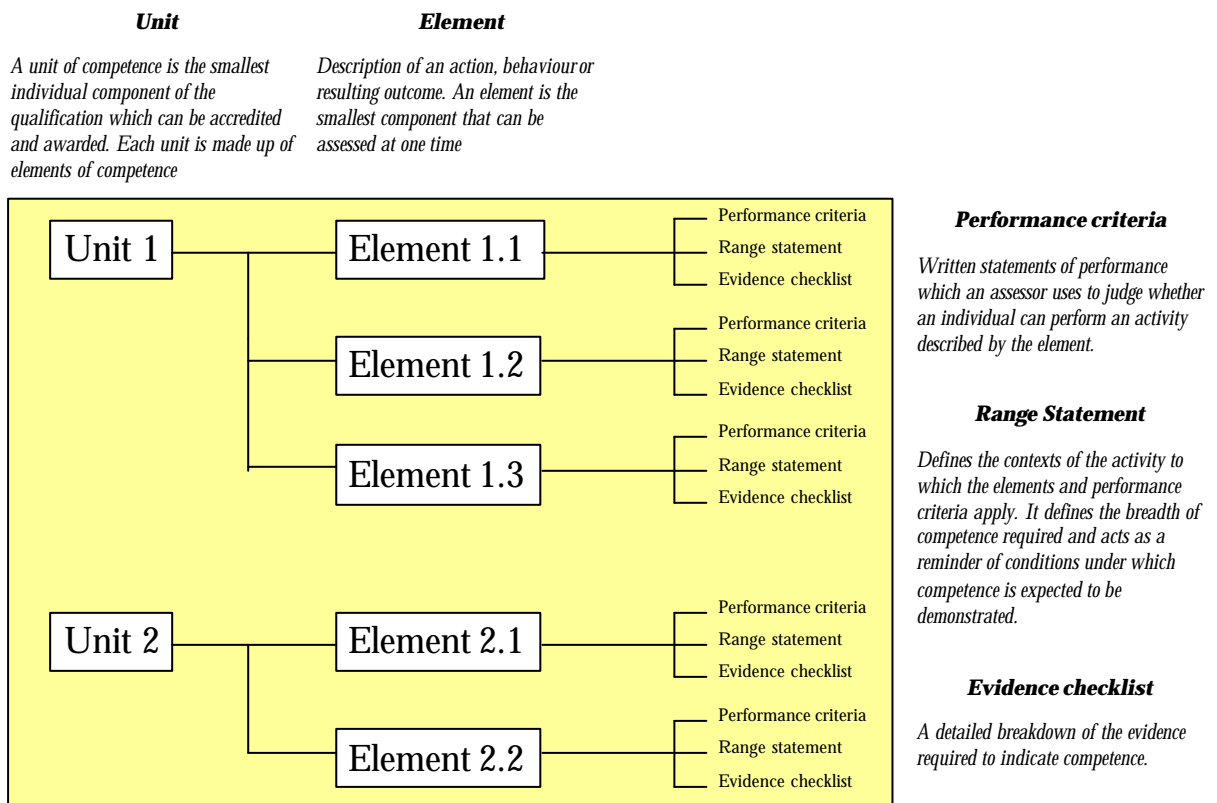

Figure 1; Structure of NVQ-type competence standards

'Units' of competence cover a broad aspect of a practitioner's job, with a number of 'Elements' of competence providing more detail of specific areas within these broad headings.

As discussed in Section 5.1 the telephone interviews revealed that there are two distinct approaches to the development of competence standards:

- Use of proprietary standards (e.g. RITC NVQ standards)

- Development of bespoke standards (either using in-house resources or with consultancy help)

From the telephone interviews it was apparent that the two approaches used the same structure, using Units and Elements of competence, Performance Criteria and Evidence Checklists. However, the depth interviews revealed that these two approaches have resulted in subtly different standards. The RITC NVQ Units and Elements focus on activities (e.g. 'checking', 'diagnosing') that can then be applied to any asset, system or component, for example:

Unit	Elements
1) Check engineering product/asset compliance with specifications	i) Inspect engineering products/assets
	ii) Deal with defects in engineering products/assets

In contrast, the Units developed in-house focus on asset systems, with the Elements describing the activity to be assessed on the particular asset area. An example of the contrasting approaches is shown below:

Unit	Elements
1) Wheels	i) Determine wheel diameter
	ii) Determine tread/flange wear
	iii) Identify loose/moved tyres

'Performance criteria' are the outcomes that a person has to achieve in order to demonstrate competent performance. Both the approaches described above make use of explicit performance criteria in the standards. The examples viewed during the survey differed, again as a result of whether NVQ or in-house standards were being used. As with the Units & Elements, the NVQ standards use language that ensures that the performance criteria can be applied to any system on any type of traction & rolling stock. The performance criteria developed in-house by organisations are specific to the application.

The testing of the 'underpinning knowledge' of a practitioner is also a common theme, in use in all the organisations surveyed. The RITC NVQ standards use a checklist of underpinning knowledge requirements against each of the performance criteria, as shown in the example below:

Performance criteria	Knowledge specification
Records of the checks and assessments made are current, clear, and accessible to authorised personnel	Why it is important to maintain records of the checks made and the assessments that result from those checks, what information should be entered on those records and where they should be kept

Table 2; Performance criteria and knowledge specification (RITC)

The common approach where competence standards had been developed in-house was through the use of a 'question bank' – a series of questions (with model answers) developed by system specialists. Some or all of the questions could be used in the course of an assessment to test a practitioner's depth of knowledge in a particular element. The questions normally relate to the various steps that a practitioner would be following in a maintenance procedure. An example (for a competence element relating to TPWS power up and sequence testing) is given below:

1. Under what circumstances can the TPWS Temporary Isolation Switch <u>not</u> be sealed when going into service?

2. What other circuits must be made to allow TPWS to power up?

3. During a successful power up test does the Train Stop Override (TPWS Drivers Control Panel) light illuminate steady or flashing?

4. What indications will be apparent on the TPWS Drivers Control Panel in the event of a TPWS equipment failure?

5.3   Basic and specialised competences

One organisation has focused its competence standards on the specialised competences required for its rolling stock, all other competences being considered as 'generic' – competences that all apprentice-trained engineering personnel should possess. This has been achieved through an analysis of all the tasks carried out in the vehicle maintenance & overhaul instructions (VMOI). Those tasks that require 'examination', 'removal', 'fitment' or 'repair' are considered as requiring 'generic' competences and those tasks that require 'testing' or 'fault-finding' are considered to require specialised competence. The Group Standard and the Code of Practice do not identify (and therefore do not give guidance) that 'generic' and 'specialised' competences may exist. The issue of differentiating between 'basic' and 'specialised' or 'expert' competences is further discussed in Section 5.5 of this report.

5.4   Competence standards: summary of issues

The majority of competence standards have been developed independently by Railway Group members, with some use of the national occupational standards for NVQ Levels 2 and 3 developed by the RITC in evidence. Whilst use of the RITC NVQ standards should theoretically be very attractive to industry participants (e.g. applicable to any type of traction, easily available), there appear to be a number of drawbacks that have caused them to be rejected by the majority of organisations, the most significant of which are:

- The RITC NVQ standards use a vague form of language that requires interpretation by assessors, which may lead to inconsistent assessments

- Units and elements of competence are not easily related to the safety-critical systems in the Group Standard because of the generic nature of the RITC NVQ standards

As a result of organisations independently developing standards that define competent performance the industry now has different 'standards' for similar or identical activities. The fact that different approaches have been applied makes it difficult to compare standards of competent performance across organisations.

Some train operating organisations have recognised that some competences are generic to the engineering profession and that others are specific to the traction and rolling stock application. The Group Standard and Code of Practice do not make this distinction and do not provide guidance in this area.

6 Findings: Assessment Methods

6.1 How is competence assessed?

All the organisations surveyed have adopted an NVQ-type method of assessment[ii], using a formal assessment session where performance is observed and supported by questioning to gauge a practitioner's underpinning knowledge. This approach is not mandated by the Group Standard, although the supporting Code of Practice does recommend an approach that includes many of the elements that are a feature of the NVQ method. The universal adoption of the NVQ approach by the rolling stock community may be as a result of:

- This approach already having been adopted by other groups of staff (particularly train driving)

- The NVQ provides an 'off the shelf' method of assessment, with formal training available

As such, the NVQ approach to competence assessment provides a relatively simple means of enabling organisations to comply with the Group Standard requirements. There are problems associated with this approach however; those relating to NVQ standards have been commented on already in Section 5 and the more fundamental problems are discussed as one of the Wider Issues in Section 8.

In many cases the output of the assessment is a 'portfolio' of evidence that supports a practitioner's claim to competence, although this is not mandated by the Group Standard. This provides a comprehensive audit trail but is costly (in terms of the time taken to produce and verify the documentation) to produce.

It was noted that all organisations had approached the formal assessment of competence as developmental rather than as a punitive measure. Many of the organisations surveyed stated that assessments are used as opportunities for coaching and communicating changes to staff.

Several organisations have structured the outputs of competence assessments in a way that they can be used directly for the award of an NVQ. This means that should the organisation, or an individual, wish to pursue an NVQ qualification a large proportion of evidence (in the right format) is readily available.

6.1.1 Unobtrusive assessment methods

The formal assessment process undoubtedly means that a practitioner's behaviour will change whilst the assessment is being conducted. Unobtrusive methods of observing a practitioner's competence are used routinely in the train driving environment via on-train monitoring & recording (OTMR) devices and through assessors travelling in passenger

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[ii] All the organisations surveyed had adopted the NVQ D32 and D33 standards for assessors, with assessment verifiers being trained to the D34 standard.

compartments. Such direct unobtrusive monitoring is more difficult to achieve in the workshop environment. The Railway Group Standard Code of Practice suggests that formal assessments should be supplemented with in-process checks by line managers. Whilst this does occur, the depth interviews have shown that this is often difficult to achieve in practice. Various other methods of unobtrusively assessing competence are in use, with all organisations stating that they use one or more of these methods:

- Informal, unobtrusive observations by line managers as part of their management activities

- Random vehicle checks after maintenance work has been completed. These 'product quality audits' provide an indication of competent performance of the individuals that carried out the maintenance work

- Use of failure, incident and accident reports to provide an indication of competent performance

- Use of feedback from warranty reports

6.2   Who conducts competence assessments?

The Railway Group Standard requires those that are conducting assessments to be competent to carry them out. The Code of Practice expands on this requirement to include occupational competence (i.e. competent in the traction & rolling stock activity that is being assessed). To meet these requirements a number of different approaches were noted during the study.

6.2.1   Dedicated Assessor

The most common approach (58% of respondents) is to use dedicated assessors, often part of the rolling stock training group within the organisation. In this model (designated here as 'Type A'), the assessors are outside of the line management structure of those being assessed.

The organisations using this model of assessment believe that there are a number of discernible benefits in this approach:

- Assessment is more likely to be impartial as assessors do not have direct management responsibility for those being assessed

- Assessment across teams should be to a consistent standard

- Assessments can be programmed and are more likely to be completed according to the plan because of the absence of immediate production-oriented pressures

However, the challenge with this assessment model is how to ensure that the line managers (Team Leaders/Supervisors) have some degree of 'ownership' of the system and of the competence of their staff. In this model, assessors communicate directly with line management on competence issues regarding their staff. This model is represented diagrammatically below:
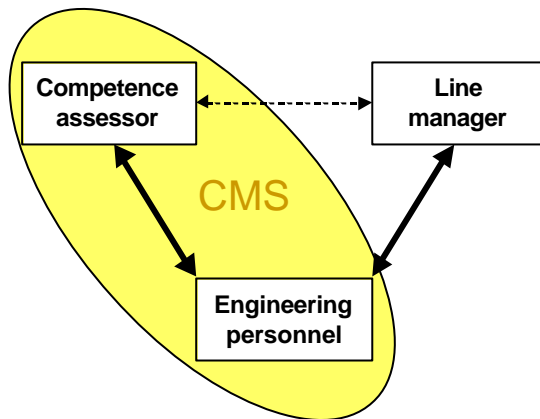
Figure 2; Relationship between line management, assessor and practitioner – Type A (Risk Solutions)

The solid arrows in the above diagram represent direct, formal interactions:

- Between competence assessor and practitioner, within the context of the competence management system (competence assessment plans, assessments and feedback)

- Between line manager and practitioner, within the normal work management/production environment

The dotted arrow indicates the need for two-way interactions between the competence assessor and line manager to ensure that:

- A balanced view of an individual practitioner's competence can be obtained (the line manager is likely to observe the individual's performance on a frequent basis, whereas the assessor may only observe the practitioner once in six months for example)

- Concerns regarding aspects of competent performance can be discussed and corrective actions implemented

From the depth interviews we have found a number of weaknesses with this approach:

- Line managers are not directly involved in assessing the competence of their staff and may abdicate responsibility for assurance to the competence assessors

- Assessors tend to be office-based staff that work 9-5 hours, therefore assessments will only take place during a limited set of situations rather than across the full range experienced by the engineering personnel

- Because they have limited involvement in assessing the competence of their staff, line managers may have limited knowledge of who has been certified as competent to do what

One of the depth interview respondents was aware of these potential weaknesses and is currently exploring ways to further develop their system.

6.2.2   Line Manager

An alternative approach, used by 42% of respondents, uses line management to carry out the competence assessments of their staff. This approach has been adopted for one of two reasons:

- The organisation has recognised the important relationship between line management and their staff and believes that this model is the most effective means of achieving the necessary 'ownership'

- The organisation has limited resources or has a geographically dispersed workforce which would make a dedicated assessment team impractical or highly inefficient

This Type B model is represented in the figure below:

Figure 3; Relationship between line management, assessor and practitioner – Type B' (Risk Solutions)

In this model, there is a direct interaction between the line manager and individual practitioner within both the normal working environment and the competence management system. This method minimises the weaknesses of the Type A approach, but has weaknesses of its own:

- Because the line manager is often responsible for delivery of rolling stock for service, assessments may be completed less thoroughly, or postponed, when production pressures occur

- Assessments across teams may be carried out to different standards, unless an effective assessment verification programme is in place

6.2.3   Hybrid Approach

From the discussions above it is apparent that an 'ideal' model, combining the strengths of both the approaches described above, should be possible. Such a model would use assessors with enough independence to ensure impartial and objective assessments, whilst line managers are sufficiently involved and engaged in the process. Several of the organisations surveyed had recognised the shortfalls of their adopted approach and were

working towards this 'Type C' model, although none could be said to have a fully effective system at the time the survey was conducted.

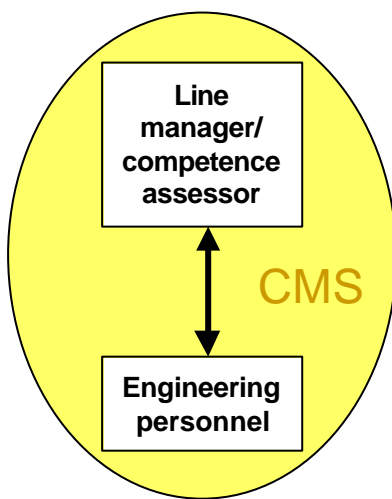The Type C model is shown below:
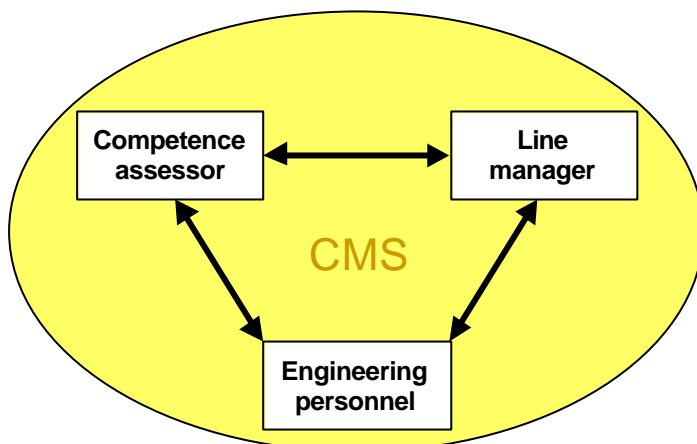
Figure 4; Relationship between line management, assessor and practitioner – 'Type C' (Risk Solutions)

In this model, formal and direct interactions take place between assessors, the individuals being assessed and their line managers. Likewise, line managers play a formal, direct, role in the day-to-day assessment of competence through their management role. This occurs through activities such as formal in-process checks and through the normal, unobtrusive, observation of individuals that naturally takes place in the workshop environment. Such observations are directly used to support the formal assessments carried out on a periodic basis by the assessors. The challenge with implementing this model is that it is difficult to capture the less formal observations and assessments of competence made by line managers.

We believe that it is right that the Railway Group Standard and the Code of Practice do not mandate or suggest which approach should be used, but organisations would benefit from having the strengths and weaknesses of each approach made explicit in the guidance.

6.3   When is competence reassessed?

Another consequence of organisations having developed systems independently of each other is that the periodicities for re-assessment of individuals vary significantly. We found that the majority of organisations surveyed have a maximum interval of 3 years between reassessments (5 years in one case and 2 years in four other cases), indicating that there is no consistent approach to determining reassessment frequencies. This is evidenced by the fact that train operators with the **same rolling stock** (e.g. HSTs) being operated in **similar operating environments** (where the same reassessment frequency might therefore be expected), reassess the competence of staff at different frequencies. Specific examples of this (taken from the depth interviews) are shown in the table below:

	TOC A	TOC B	TOC C	TOC D	MODE
Wheelsets	3 years ↑↑	2 years	2 years	2 years	2 years
Brakes	3 years	1 year ↓↓	3 years	5 years ↑↑	3 years
WSP equipment	3 years	3 years	3 years	N/A	3 years
Power control	3 years	3 years	3 years	5 years ↑↑	3 years
Speed indicating systems	3 years	3 years	1 year ↓↓	2 years	3 years
Inter-vehicle couplings	3 years	1 year ↓↓	3 years	5 years ↑↑	3 years
Traction current collection eqpt.	3 years	3 years	N/A	N/A	3 years
Fuel systems	3 years	3 years	3 years	5 years ↑↑	3 years
Exterior doors	3 years	1 year ↓↓	3 years	N/A	3 years
AWS/ATP/ TPWS	3 years ↑	2 years	1 year ↓	2 years	2 years
Head, tail & marker lamps	3 years	3 years	3 years	5 years ↑↑	3 years
Windscreen wipers & washers	3 years	3 years	3 years	5 years ↑↑	3 years
Fire safety systems	3 years	3 years	3 years	5 years ↑↑	3 years
Hatch/cover fasteners	3 years	2 years ↓	3 years	5 years ↑↑	3 years
Bolts & retaining devices	3 years	2 years ↓	3 years	5 years ↑↑	3 years
Warning horns	3 years	3 years	3 years	5 years ↑↑	3 years
Legend: Assessment periodicity is ↑ 1 year higher than mode ↑↑ 2 years higher than mode ↓ 1 year lower than mode ↓↓ 2 years lower than mode					

Table 3: Re-assessment frequencies of those engaged in work on safety-critical systems

The table shows that, for these 4 TOCs, the most common periodicity (i.e. the mode) is 3 years for everything apart from wheelsets and AWS/ATP/TPWS, which are both 2 years. The arrows identify any activities for which the assessment periodicity is above or below the mode, and shows that TOC B tends to re-assess competencies more frequently than its peers whereas TOC D has generally opted to extend the re-assessment frequencies.

Variation of this sort could be understood if there were significant differences in the skills, experience and knowledge of practitioners in each of the organisations, but from the telephone and depth interviews this does not appear to be the case.

6.3.1 The impact of staff turnover rates on reassessment frequency

Sites with a higher staff turnover would necessarily have a higher proportion of new and inexperienced staff, so some recognition of this increased risk through lower competence levels might have been expected and evidence that controls had been put in place to manage this risk. An example of this might have been more frequent re-assessments of competence for locations with a high staff turnover.

Our study revealed (Q C1) that in 71% of cases staff turnover rates for rolling stock maintenance personnel were viewed as being very low (typically less than 5% per year). In 21% of cases the staff turnover rates were considered to be moderate (5% - 10%) and in 8% of cases the turnover rate was considered high (greater than 10%). Those organisations with generally low staff turnover rates that also operated in the London area noted that the turnover rate is much higher in the capital (often estimated at 15% or greater). The competence management systems within individual organisations did not appear to cater for differing staff turnover rates at different sites. This is an issue that is not explicitly recognised in the current Group Standard.

6.4   Assessment methods: summary of issues

The NVQ assessment methodology adopted by all organisations provides a relatively simple means of achieving compliance with the Group Standard, with training readily available for assessors and system verifiers. Whilst industry participants have commented on problems they have experienced with this approach (largely relating to the mechanistic and overly-bureaucratic nature of the assessments), it undoubtedly provides a simple means for organisations to begin assessing competent performance.

Unobtrusive monitoring of competence has been difficult for rolling stock organisations to achieve, particularly those methods that assess competence directly. As a result, indirect methods have been developed, such as the use of accident and incident reports.

By using assessors outside of the line management chain it is more likely that assessments will be carried out (as the assessor is removed from production-oriented pressures) and that the assessments will be free from bias. Using assessors in this way should also mean that assessments are completed to a consistent standard across work teams. The main strength of using line managers to carry out assessments is that they then have 'ownership' of the assessment process. On balance however, the benefits from using independent assessors are greater and we believe that this should be the preferred approach.

Considerable variations exist in the re-assessment frequencies across organisations for the traction & rolling stock systems identified in the Railway Group Standard, even where identical rolling stock is being operated in similar circumstances. Such variations cannot be explained by significant differences in the organisations concerned and as a result are difficult to justify. An area where differences in reassessment frequency was expected, but not found, was in locations where staff turnover was high. In these locations it would be expected to find lower overall competence levels, as competence is directly linked to experience, knowledge and skills gained over time.

7   Findings: Demonstrating Compliance

7.1   Assurance methods

All the organisations surveyed had assurance measures in place for their competence assessment system (Q K1-K5). In every case the emphasis was on formal auditing (both internal and external) for compliance with the Group Standard. However, there was considered to be a reliance on checking compliance with the system rather than the effectiveness of the system.

We found that in the majority of cases (82% of respondents) external audits, conducted by Railway Safety, were viewed as providing a fair assessment of an organisation's compliance with the Group Standard. The remaining 18% of organisations believed that in general the audit provided a fair assessment, but they had some concerns regarding the consistency of approach across individual auditors. These organisations stated that they had previously experienced real difficulties in developing a compliant system as a result of auditors' comments; changes had been made to their system as a result of feedback from one auditor, only to have these changes criticised by a different auditor on a subsequent visit.

Perceived benefits from the Railway Safety audit programme include:

- It is an independent review of the organisation's competence management system

- Railway Safety auditors are likely to have observed many different approaches and should be able to help organisations adopt good practice

7.2   Records

Our research revealed that the retention period of competence assessments varies, with some organisation retaining records since the system had begun. Other organisations have made the decision to keep one full cycle of assessments records (covering 2, 3 or 5 years depending on the re-assessment frequency that had been adopted). The Code of Practice[3] accompanying the Group Standard recommends that the quantity of documentation should be kept to a minimum, provided that sufficient material is available to enable auditors to make a *qualitative* judgement on the system's compliance. From the depth interviews of organisations using the NVQ approach we noted that assessment records (including the supporting evidence required for NVQ award) could result in large portfolios for each individual, making storage space a problem. As discussed previously, a small proportion of organisations feel that the Railway Safety audits vary in their approach. From the depth interviews one case was highlighted where the Railway Safety auditor required a statistically significant sample of all records to enable a more quantitative analysis to be made.

7.3   Views on system effectiveness

Our telephone interviews revealed that respondents believe that the introduction of their competence management system has generally delivered improvements in staff competence. There are a small proportion of organisations that do not believe that this is the case. These organisations tend to be those that have developed their system to *comply with the Group Standard*, rather than as a tool for competence development.

The majority of organisations surveyed believe that the introduction and operation of competence management systems have brought benefits of some kind, even if this is not an increase in overall levels of practitioner competence. Examples include:

- Highlighting of training needs

- On-the-spot refresher training or coaching could be delivered

- Providing an increased level of customer confidence

- Fulfilling legal obligations

- Maintaining safety case compliance

7.4   Demonstrating compliance: summary of issues

Assurance is provided in all cases through formal audits, with the Railway Safety audits forming a key part of the assurance process. The majority of organisations believe that Railway Safety audits provide a fair assessment of their system, although some variation was commented on. The main concern regarding the Railway Safety and internal audits is that they focus on compliance with the Group Standard, rather than looking for *effectiveness* of the system to produce competent practitioners.

There was a broad consensus within the rolling stock community that competence management systems have the potential to increase staff competence levels, if implemented effectively. The majority of organisations believe that current systems have brought business benefits of some form.

8   Wider Issues

In the previous section we explored some of the difficulties that organisations are experiencing in their attempt to produce competence management systems that comply with the Railway Group Standard. These difficulties have largely occurred as a result of organisations interpreting different meanings or having adopted widely different approaches in their attempts to achieve compliance.

In this section we explore some of the wider issues that could have a direct impact on these problems. The majority of issues identified are as a result of desktop research into the subject of vocational training and competence management in industries outside of the railway environment, particularly healthcare.

8.1   Design and scope of competence management systems

8.1.1   Senior management commitment

The study revealed (Q B5) that in the majority of cases (50%) the competence management system had been developed by senior managers (Depot/Fleet Engineers) within the traction & rolling stock function of the organisations concerned. In 29% of cases there had been active involvement from managers at board level and in 21% of cases the system had largely been developed by managers at a local level (often these were Training or Competence Managers). This demonstrates that the development of competence management systems has been recognised as being an important issue with significant management resource committed.

In those cases where competence management systems had been developed without significant input from senior management we observed that the system often operated as 'standalone', with little integration with other management systems or initiatives. The benefits of integrating the competence management system with other management systems are discussed in Section 8.1.3 of this report.

8.1.2   Who should be included in the scope of the system?

As discussed throughout this section on wider issues, there are a number of parties whose competent performance has an effect on system safety or on safe interworking. The key influencers are identified in the figure below:
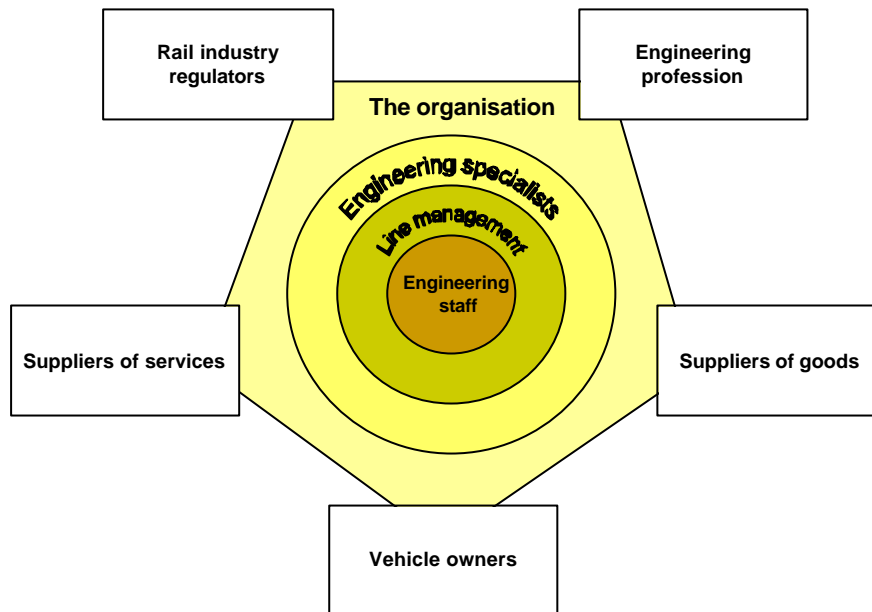
Figure 5; Influencers on competence management (Risk Solutions)

This figure indicates that within an organisation line management, engineering specialists and the wider organisation all have influences on the competence of individual practitioners. This influence can be through the provision of tooling, documentation, training and coaching as well as through management systems as discussed further in Section 8.1.3.

Outside the employing organisation there are also factors that can influence the scope and operation of competence management systems and, to a lesser degree, an individual practitioner's competence:

- *Regulatory bodies* (HMRI/HSE and the Strategic Rail Authority for example); By setting legislation or creating national frameworks the scope and content of competence assessment systems can be mandated and national award programmes (such as industry-specific NVQs) created

- *Engineering profession*; professional bodies (such as the Engineering Council and the various institutes) set generic competence standards and registration schemes

- *Suppliers of goods*; the reliability of the components and the quality of supporting documentation can impact on the competence requirements for individual practitioners

- *Suppliers of services*; the competence standards and the assurance systems in place in organisations supplying services will influence the design and scope of the competence management system in place in the client organisation

- *Vehicle owners*; leasing companies may take an active interest in the competence standards of maintenance organisations

The influence of other individuals in the organisation has been recognised by the HSE in their assessment criteria for railway safety cases[5] and more recently in their publication on competence in the rail industry[2]. Indeed, in this latter publication it is suggested that the competence of managers operating a competence management system also needs to be managed and assessed. In this context the HSE defines 'managers' as individuals carrying out the following activities:

- Competence assessments

- Recruitment & selection

- Training & development

- Verification

- Auditing

- Record keeping

- Administration

In addition, the role of senior managers in developing effective strategic safety management systems has been recognised by Railway Safety who have issued a good practice guide[4] to tackle senior management competence in this area.

Despite broad acceptance of the role that the competence of other parties has in ensuring overall system safety, the industry has focused its attention on assessing the competence of those who provide the 'last link in the chain'. The competence assessment systems developed by the industry (as required by the HSE's Principles & Guidance and Railway Group Standards) make the implicit assumption either that others will perform competently or that shortfalls in competence will be detected by assessments carried out on front-line practitioners. This is represented in the figure below:
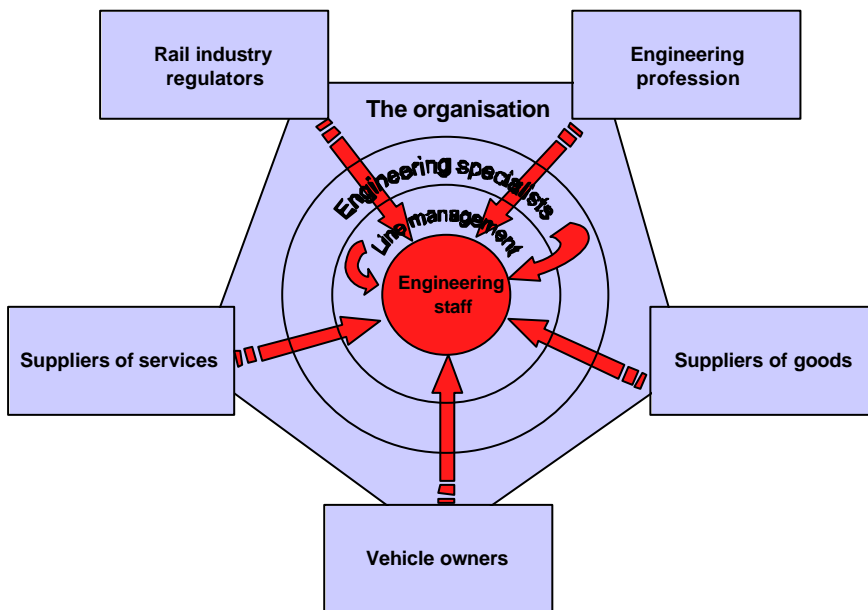

Figure 6; Focus of formal competence assessment in the rolling stock environment (Risk Solutions)

This diagram builds on the idea that there are a number of organisations and groups of people that have an influence on competence management, as described above. If there is a lack of competence or weaknesses (in standards or procedures for example) in any of these areas the effect will ultimately become apparent either *to* the maintenance staff or observable in the actions (or inactions) *of* the maintenance staff.

By exclusively focusing attention on the formal assessment of competence on the maintenance staff there is a risk that systematic problems will be noticed at a very late stage, possibly after an incident or accident has occurred.

Whilst there are undoubtedly other assurance processes that may detect shortfalls in competence elsewhere in the system (such as supplier audits, review processes for technical specifications etc) we believe that there is a case for extending the principles of competence management up the management chain.

The process of developing a competence management system coupled with the outputs from such systems have the potential to be used in strategic planning to define and develop the competences that individuals will require in order for the organisation to operate effectively and safely.

8.1.3   Integration with other management systems

The Railway Group Standard and the HSE's Principles and Guidance do not require competence management systems to be considered within the context of other management systems. However, we believe that competence, and therefore competence management, is dependent on a number of other management systems, as shown below:
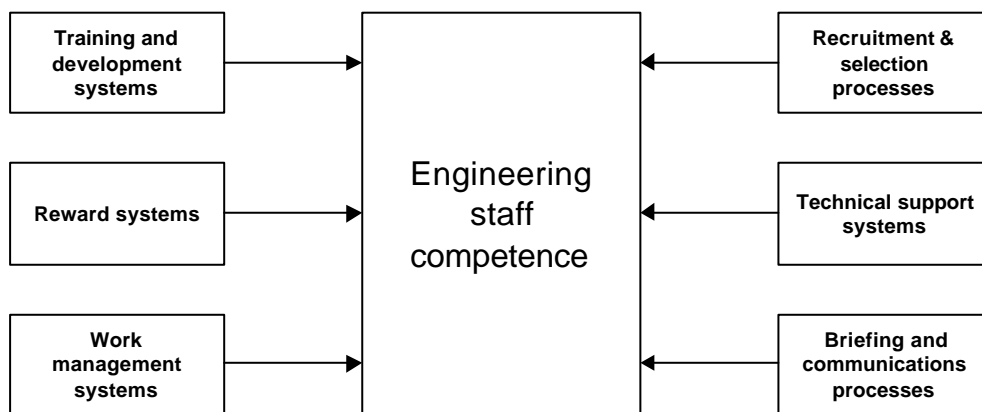
Figure 7: Relationship between human resource systems and individual competence (Risk Solutions)

Whilst it is certainly possible to create a stand-alone competence management system, by doing so the organisation will be missing out on a number of benefits as well as potentially duplicating management and administrative effort by operating systems independently of each other. The linkages represented in the figure above between individual competence and other management systems are described below:

Training and development systems; The provision of appropriate training and development opportunities is important for developing and maintaining (through the use of refresher courses and coaching) the *knowledge* aspect of a practitioner's competence. It is likely that

the absence of such opportunities will have an effect not only on the knowledge aspect of competence but also on the attitudinal component.

Recruitment and selection systems; This includes all aspects of effective job design, role profiling, recruitment and selection systems. Having effective systems in this area should ensure that that only those individuals with a good basic engineering competence are employed and that those selected for employment have a high probability of developing the specialised competences required for rolling stock systems. As a result, the effectiveness of the recruitment and selection system (coupled with an understanding of the local employment market) should have an impact on the whole structure of the competence management system – what is to be assessed, how frequently re-assessments take place etc.

Reward systems; The role of appropriate reward systems in competence management has yet to be fully utilised in the railway industry. Whilst its effect will mainly be on the attitudinal component of competence, innovative reward systems can provide powerful incentives for practitioners to develop their competence profiles.

Technical support systems; The provision of accessible technical support, in the form of specialist engineers, technical manuals and drawings, can have an impact on many of the components of competence. If used effectively, specialist engineers can provide a coaching role to practitioners and accurate and up to date technical information can provide a means of developing their knowledge.

Work management systems; The retention of competence is dependent on practitioners having the opportunity to apply their *knowledge* and practical *skills*. Work management systems have a significant role to play in ensuring that practitioners are given experience with the variety of rolling stock systems that their role demands. Work management systems encompass the mix of line management (supervisors and team leaders issuing tasks to practitioners) and information technology (records of when an individual last worked on a particular system). Shift patterns will have an effect on the level of fatigue that an individual may be experiencing, as well as possibly impacting on some environmental factors (such as lighting levels and temperature). These factors, particularly fatigue, can affect all components of competence and should therefore play a central role in competence management.

Briefing and communications processes; Effective systems in this area can have a significant effect on the *knowledge* of a practitioner. At a national level much work is done to communicate safety issues (particularly SPADs) to the train driving community, with focus groups, workshops, conferences, video and paper-based newsletters all being part of an established communications network. Similar arrangements do not exist for the rolling stock engineering community.

8.1.4   Others factors affecting individual competence

The factors described above all have an effect at a system level, affecting *all* practitioners. There are also a number of factors that can affect an *individual* practitioner, either for a short period (perhaps part of a working shift) or over a longer timescale.
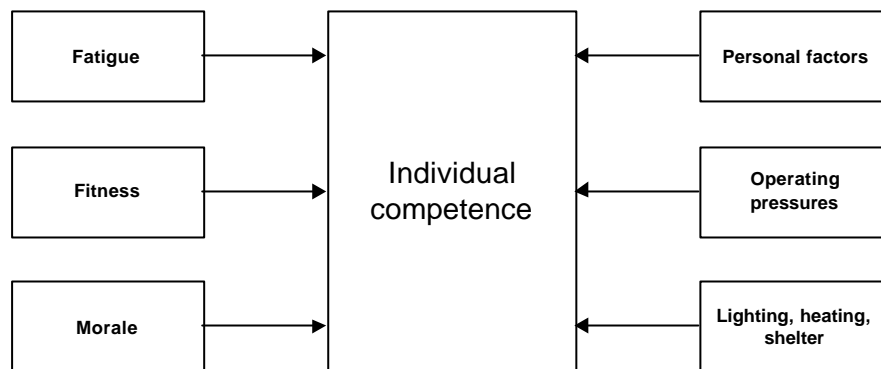
These factors are illustrated in the figure below:

Figure 8; Other factors affecting individual competence (Risk Solutions)

Fatigue is not only an effect of excessive hours worked (where there are Group Standard controls in place already), but may be a particular issue where staff have long commuting journeys to and from work. Much work has been carried out on lifestyle and fatigue issues for the train driving community, but there appears to be little transfer of this knowledge to the rolling stock maintenance environment.

Personal factors, where an individual is distracted by events taking place in their personal lives or through illness, it may cause competent performance to suffer.

Physical fitness requirements are covered by the existing Group Standard, but mainly relate to the safety of an individual on the operating railway. Individuals with fitness limitations are often permitted to work in a workshop environment, but the impact that these limitations may have on competence should be carefully considered.

Operating pressures may cause practitioners to rush through a task or to operate outside of their knowledge limits, in order to relieve the pressure that they are experiencing. Examples of where such pressure may be exerted include: working on a failed train, where the presence of hundreds of passengers and operating staff wanting to clear the line cause an individual to experience high stress levels; or completing planned maintenance in a short space of time to permit the rolling stock to be released for service.

Morale and motivation; the combination of any of the above factors, coupled with the effects of local and organisational systems, policies and management can cause an individual to be demotivated and less likely to perform competently.

Lighting, heating, shelter – competent performance of tasks may be hampered if a practitioner is working in environmental conditions that are unpleasant or sub-standard. Examples include repair work undertaken outside in cold, wet weather in a dimly-lit yard or siding.

Each of the factors described above are unlikely to be detected through the formal assessment methods required by the current Group Standard, as this focuses attention at a less strategic level. We believe that senior management commitment and involvement is essential to ensure that an organisation's management systems address all these factors.

8.2   Competence standards

8.2.1   The NVQ approach

Across all industries there has been much debate regarding the NVQ approach and the difficulties that this introduces.

A fundamental issue with the NVQ approach is that it over-simplifies complex areas of work and is capable of assessing only technical aspects of performance. This derives from the fact that the standards are produced as a result of a *functional analysis* of the work undertaken by practitioners. This is a technique for identifying the necessary roles, tasks and duties of the occupation, rather than the skills of successful role incumbents. As a result the standards fail to capture the values, ethics, and judgement associated with the role.

One difficulty that often appears in such debates is the language and presentation methods used for NVQ specifications. The standards typically use a passive, impersonal style of language which makes difficult reading and can lead to confused interpretations. Recent standards have improved in this respect and guidance from QCA and its partners has promoted greater flexibility, however these problems are still apparent in many standards.

A further concern with the NVQ approach is that action and knowledge are treated separately. The standards currently specify what a practitioner is expected to do (action), with a separate statement of the 'underpinning' knowledge that a practitioner is required to possess. Often the underpinning knowledge requirements form a relatively fragmented list of things that the practitioner needs to know, which may lead the assessor to test for formal knowledge rather than respecting the working understanding and knowledge-in-use of the practitioner.

Finally, the NVQ approach traditionally requires the practitioner to produce a portfolio of paper-based evidence. This can create a major barrier for practitioners, either because the practitioner is not used to gathering evidence of this sort or because work pressures mean that other activities always take priority.

8.2.2   Competence profiles

The Railway Group Standard requires Railway Group members to 'identify and document competence standards applicable to Safety Critical work for which they are responsible'. All organisations believed that their systems had complied with this requirement. The depth interviews revealed that this had been further developed to identify the competence required:

- For work teams as a whole

- By individual practitioners

There are business benefits in identifying competence requirements at both these levels, especially when used in conjunction with other human resource systems:

- 'Entry level' competences are identified and can be used in the selection process for new personnel

- Competences ranging from 'basic' through to 'expert' are made explicit and can be used to assist development of career progression frameworks

- Training and development can be planned to ensure that work teams have the necessary competences within them, particularly where specialist competences are concerned

8.3   Methods of assessment

8.3.1   Basic or specialised competence?

Some of the organisations that have developed more sophisticated competence management systems have identified that individuals should possess both 'generic' engineering competences and 'specialised' competences that relate to the particular assets in operation (as discussed in Section 5.3). Indeed, analysis of management competences undertaken by Bethell-Fox[7] revealed that there are two key levels of competence: 'threshold' and 'differentiator'. The 'threshold' level consists of the characteristics that jobholders must have simply to survive and the 'differentiator' level consists of those characteristics, which distinguish outstanding performers from average performers. In developing this approach for engineering personnel we believe that there are two levels of competence that could be assessed:

Basic	The knowledge and skills that any individual engaged in general engineering maintenance, repair, diagnosis and testing should be expected to have. This includes the use of common tools, skills, diagnostic techniques, safe systems of work, use of engineering specifications/drawings and reporting methods.
Specialised	The specific knowledge and skills that are required to undertake work on railway-specific systems or systems that are complex. Examples include train protection systems, railway braking systems and passenger door locking systems.

Table 4; Basic and specialised competence

As many of the tasks undertaken by rolling stock maintenance personnel require only the basic engineering competences it could be argued that, provided the organisation has effective recruitment and selection systems, there need be no ongoing assessment of these core competences. Indeed, one of the organisations surveyed has made the decision to focus on the specialised competences that have safety-critical implications, carrying out a once-off assessment of basic engineering competence. It is planned to review the basic competences every 3 years, but they would only be reassessed if unobtrusive monitoring (through casualty/incident reports etc) or specialised competence assessment feedback highlighted that a problem might exist with an individual's basic competence. This approach needs to be treated with some caution as even basic competences can be lost if not used for a period of time. Also, these basic competences can become outdated as a result of changes in the operating environment (technology changes, changes to instructions for example). We believe that a periodic review of basic competences, perhaps at a greater time interval, is required to ensure safe operation is maintained.

From the systems surveyed during this research it was apparent that competence was primarily considered to be a binary condition – 'not yet competent' or 'competent'. We believe that competence should be considered as a dynamic condition that changes as experience, knowledge and skills increase.

The figure below develops the idea of basic and specialised competence and places competence on a continuum:

Characteristics	Novice	Advanced Beginner	Competent	Proficient	Expert
Characteristics	•Rigid adherence to taught rules •Little situational perception •No discretionary judgement	•Guidelines for action based on attributes or aspects of the situation (recognisable after some prior experience) •Situational perception still limited •All attributes and aspects of a situation treated separately and given equal importance	•Now sees actions at least partially in terms of longer-term goals •Conscious, deliberate planning •Standardised and routinised procedures •Coping with crowdedness	•Sees situations holistically rather than in terms of aspects •Sees what is most important in a situation •Perceives deviations from the normal pattern •Decision-making less laboured •Uses maxims for guidance, whose meanings vary according to the situation	•No longer relies on rules, guidelines or maxims •Intuitive grasp of situations based on deep tacit understanding •Analytic approaches used only in novel situations or when problems occur •Vision of what is possible
How knowledge is treated	Without reference to context	In context			
Recognition of relevance	None		Present		
How context is assessed	Analytically			Holistically	
Decision making	Rationally				Intuitively

Figure 9; Competence continuum (developed from Dreyfus[10])

The above figure suggests that when an individual is first in the work situation, with little or no prior knowledge, there is a reliance on taught rules and little understanding of the operating context (the 'novice'). As experience and knowledge increase over time, so do the characteristics of the individual:

- The individual is increasingly able to view their actions in relation to long-term goals or objectives
- Situations that are abnormal are perceived intuitively
- Decision making becomes faster and more accurate
- The operating context is understood

If competence is to be considered as a variable, and we believe that it should, then this has implications for the design of future competence management systems:

- Systems should assess someone with 20 years' experience in a different way to a new starter

- The differences and similarities in evaluating someone at different stages of their career should be researched and taken account of in the assessment system

8.3.2 Alternative assessment methods

Other industries, particularly the medical profession, have trialled various methods of assessing competence. These include:

- Management review of Continuous Professional Development activity (requiring practitioners to actively seek out appropriate training and development opportunities)

- Peer review

- Practical demonstrations

Research into management competencies by McClelland[6] has concluded that whatever method is adopted, the following must be considered:

1. *Testing should be based on criterion sampling, that is a careful analysis of what the job requires the job holder to be able to do, followed by a direct testing of those component competencies…*

2. *The measurement instruments so devised should be sensitive to change so that scores rise as a person becomes more effective at his or her job….*

3. *Methods should be found by which individuals can learn to improve the characteristics tested. These methods should be made public and explicit*

If adopted, these principles would ensure that any competence management system would be directly relevant to an individual's job and would provide both a means of measuring improvement over time and a framework for continuous learning. As a result, we believe that these principles should be included in any revisions to the Group Standard.

8.3.3 Competence assessment when recruiting and selecting

Our research revealed that rolling stock organisations have a minimum requirement for new-entrant practitioners to have served a recognised engineering apprenticeship. This appears to be standard practice throughout the industry, although not a requirement of the Group Standard. All the organisations stated that it was not possible to take qualifications and experience in other engineering fields (road vehicle, military, marine) at face value; some form of further assessment was required.

The most common method of selection (used by all but one of the organisations surveyed) was the technical interview. In this method of selection, the practitioner is interviewed by the operator's engineering managers to assess technical knowledge and experience. There was only one example where selection was carried out by non-engineering (HR) staff. In four cases the technical interview was supplemented by the use of psychometric testing. There was only one example from the organisations surveyed where the competence assessment criteria (for general engineering skills) was used as part of the selection process.
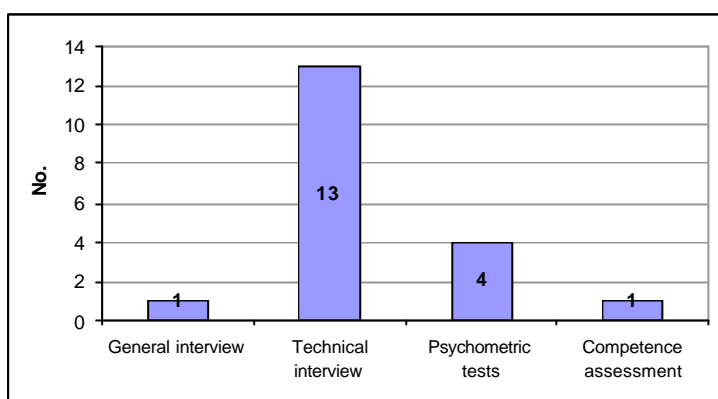
These results are shown in the chart below:

Chart 5; Methods used to assess competence at employee selection stage

From these results it can be seen that the competence profiles, standards and assessment methodologies play little part in selecting candidates for employment.

8.4 Organisational culture

There is a culture within the rail industry of following specifications, work instructions, operating rules and procedures. Whilst this is often useful for ensuring safety in complex or unfamiliar situations, in the environments considered in this report it can lead to engineering personnel not applying the basic engineering principles that they have learned in their professional development. The whole training, briefing etc processes of the organisation can produce a culture where the content of the instructions/specifications is not challenged. This can result in blind compliance even when it should be apparent to a competent engineer that an instruction is incorrect. An example of this occurring in practice was quoted during one of the depth interviews of this study: a torque setting for bolts securing sanding equipment to vehicle lifeguards was specified by a design engineer. The torque setting was based on the belief that the bolts to be used would be machined steel, degreased and dry when fitted. The torque setting quoted was therefore high – far higher than would normally be expected for lifeguard fixings. In fact, the bolts used at the maintenance depot were not degreased and when tightened to the torque setting quoted occasionally sheared and frequently failed in service soon after fitment had taken place. Although the maintenance personnel had noted the high torque setting, no one had queried whether it was correct - the written instructions had been blindly followed.

In effect, this has transferred some of the responsibility for competence up the organisational hierarchy to those that are writing and validating the engineering specifications (who may not have a full understanding of the operational environment). If this is the case then the question arises as to whose competence should be assessed, as discussed in Section 8.12.

8.5   Responsibility for ongoing competence

8.5.1   Whose responsibility is it?

Understanding and making explicit where the responsibility for assuring ongoing competence rests is an issue that has been highlighted by our research. Because of the way that many of the competence and production management systems have been structured, the responsibility for maintaining competence rests largely with the *employing organisation* rather than with the individual. This is for a number of reasons:

- The system was designed and implemented to demonstrate compliance with the Railway Group Standard, rather than as the key method of developing the competence of individuals

- The individual is often dependent on the organisation to provide him/her with training

- The individual is dependent on their line manager to provide a suitable variety of work to maintain competence and gain experience in new areas

- There is little or no incentive provided in the organisation's management systems for an individual to be proactive in demonstrating their ongoing competence or for gaining competence in new areas.

We believe that there are a number of stakeholders that have a role to play in ensuring ongoing competence, as shown below:
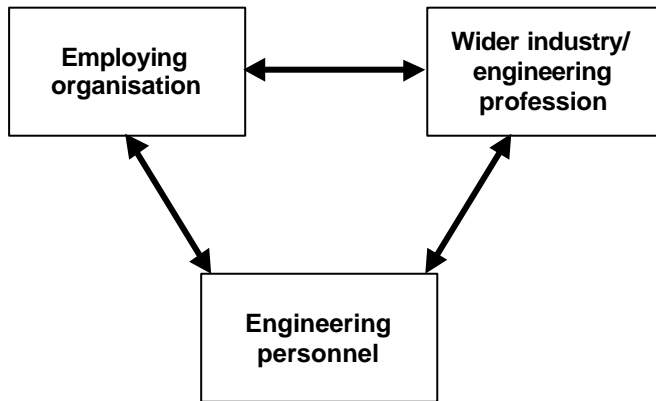
Figure 10: Relationship between individual competence and other stakeholders (Risk Solutions)

The figure indicates that there are a number of two-way interactions that need to be occurring to ensure that engineering personnel achieve competent performance:

Employing organisation – can help through the provision of effective management, training and development programmes, engineering specifications and drawings, performance-led reward systems, adequate tooling and facilities

Wider industry/engineering profession – has a role to play through the development of national standards, education programmes through to the provision of effective rolling stock designs (reliable, maintainable) and engineering expertise

Engineering personnel – each individual has a responsibility to seek opportunities to maintain and develop their competences, challenging situations where the specifications they are presented with appear incorrect

The current perception and arrangement of many of the competence management systems in the industry (where practitioners have a fairly passive role) may present an important legal issue – that of liability. This has been highlighted in other professions, particularly in the healthcare sector. If an incident were to occur where an individual's competence was a factor, where would the liability for malpractice rest:

- With the individual for not recognising their lack of competence?

- With the employing organisation for certifying the employee as competent, even though they were not?

- With industry safety regulators for not identifying weaknesses in the employing organisation's competence management systems?

8.5.2   Role of professional bodies

The Institute of Incorporated Engineers (IIE) is the professional body that caters for engineering personnel from entry into the profession, onward to NVQ level 3 (Engineering Technicians) and through to Chartered Engineers. As such, the IIE is probably the most relevant body for the rolling stock maintenance personnel considered in this report.

There are principally two roles that a professional body could play in the assurance of competence:

- Approving and accrediting the training and development systems (encompassing competence assessments) for individual organisations to a common standard

- Assessing an individual's basic engineering competence for registration with the Institute

The IIE already operates the licensing scheme for signalling technicians on behalf of the Institute of Railway Signalling Engineers (IRSE).

8.5.3   National registration/licensing

This report has highlighted the issue of whether basic or specialised competence should be measured and the difficulties that the industry has experienced in producing consistent standards of competence. From this, we believe that there is a case to support the development of a scheme similar to that employed in the aircraft industry. This could entail the national registration and/or licensing of engineering personnel using the appropriate professional body for the profession (e.g. the IIE).

There are a number of benefits that could be realised from implementing such a system:

For organisations –

- Provides an independent means of assuring the basic engineering competence of practitioners

- Should permit competence management systems to be streamlined as they could then be focused on the specific competences required of practitioners

- Makes explicit the role of the individual practitioner in achieving and demonstrating basic competence

For individuals -

- International professional recognition (registration with Engineering Council), EngTech designation

- Support network available through the professional body (engineering resources, career and personal development opportunities)

- Sustained employability

During the study we asked whether there was support for some form of national licensing or registration (Q H6), using a similar approach to that operated by the Civil Aviation Authority (CAA)[iii]. The results from the telephone interviews are shown below:
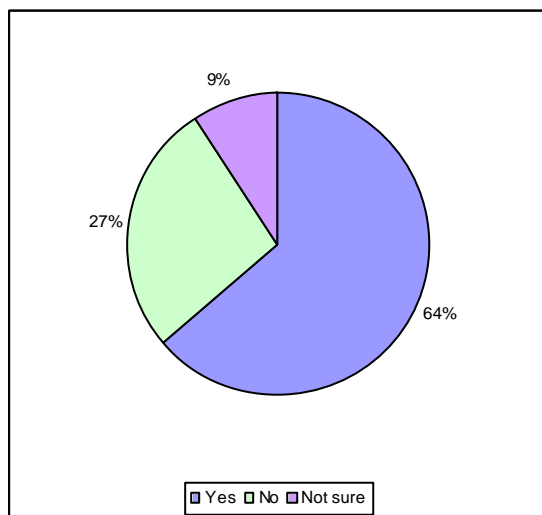
Chart 6; Support for national licensing/registration

This chart shows that the majority of respondents (64%) are broadly supportive of some form of national scheme, 9% are unsure of the benefits from such a scheme and 27% do not believe that such a scheme would be of value in the rail industry.

[iii]   In the airline industry, the CAA assess the basic competence of skilled aircraft technicians, who must first be qualified to a standard industry qualification.

9   Conclusions

Overall, traction and rolling stock organisations have developed systems that are compliant with the Railway Group Standard. The one area where we believe that compliance with the Group Standard is **not** being achieved is in ensuring that supplier organisations have the same, or equivalent, systems and standards in place.

In developing systems to comply with the Group Standard, rolling stock organisations have encountered some difficulties. These have been resolved largely in isolation from other organisations and as a result systems have evolved that are quite different in their approach.

The key conclusions arising from our research are:

System Scope

- The definition of 'competence' in the Railway Group Standard to set the framework for industry competence management systems is narrower than that used by the HSE in their Principles and Guidance. This may lead to systems that do not consider some important factors in individual competence
- There is considerable evidence of senior management involvement in setting up competence management systems within rolling stock organisations, but there is only limited recognition of the wider benefits to the business that can be realised by integrating competence management with other management systems
- There are two risk-based approaches to identifying the required competency standards: task and system level. Task-level is comprehensive but very onerous, system-level is simpler and faster to undertake, but is necessarily less detailed
- The Group Standard requires a rolling stock organisation to focus its competence management system on practitioners, without recognising the crucial role supervisors, designers and managers have to play in the competent performance of these staff
- As stated above, the majority of rolling stock organisations do not ensure that their contractors have competence management systems in place and that the competence standards are at least as good as their own. The risk in this area is reduced however by other assurance arrangements (such as quality inspections and component testing)

Competence Standards

- Most rolling stock organisations have developed their own competence standards, with a smaller number of organisations using the RITC NVQ standards. All have used an NVQ-type format for structuring their standards, using 'elements' and 'units'
- Developing competence standards in-house has resulted in significant differences in what competences are assessed and the frequency of reassessment – even for identical rolling stock types and common vehicle systems

- Few organisations have distinguished between 'basic' and 'specialised' competences, nor have they identified the competences required at the individual and team level
- Professional bodies (such as the Institute of Incorporated Engineers) could have a significant role to play in assessing basic engineering competences for individual practitioners in rolling stock organisations, as well as validating training and development programmes

Assessment Methods

- The NVQ approach to assessment is mechanistic and tends to be bureaucratic, but this approach can be attractive to rolling stock organisations as training external assessors/verifiers are readily available
- Unobtrusive monitoring has been hard to achieve in the rolling stock area, unlike in train driver assessment where both technological systems and guidance on how to achieve such monitoring exist
- Formal assessments need to be supported by in-process checks and informal monitoring carried out by line managers

Demonstrating Compliance

- Formal audits by Railway Safety play an important role in assessing compliance with the Railway Group Standard, but there is no industry-wide review of the approaches applied to identify and understand the inconsistencies
- There is a belief that the introduction of systems that comply with the Railway Group Standard have yielded benefits for rolling stock organisations, however the prevailing view was that many of the controls for maintaining and developing practitioner competence were already in place

Wider Issues

Our research has shown that there are many factors affecting individual competence that rolling stock organisations should be aware of when designing and developing their competence management systems. Several of these factors are currently not addressed by the Group Standard nor explained in guidance documents available to the industry. These factors include:

- The role of others (e.g. those designing, managing and regulating rolling stock activities) in affecting individual practitioner competence

- The role of existing management systems in helping to maintain and develop practitioner competence and the value of ensuring that such systems are integrated

- The weaknesses inherent in the NVQ methodology have not been challenged by the industry and few systems recognise the limitations of this approach

- There appears to be little recognition that competence is a variable (fluctuating over time and increasing with experience) rather than an absolute (classifying individuals as either 'competent' or 'not yet ready')

- There has been little, if any, exploration of alternative assessment methods (such as peer review and monitoring of development activities) that may be more appropriate to the rolling stock engineering environment

- The emphasis on compliance with instructions and rules can lead to 'trained incompetence' where practitioners do not challenge things that their engineering training and skills should indicate are wrong

- Employing organisations, the engineering profession, regulatory bodies and individual engineering personnel all have responsibilities for ***assuring*** ongoing competence

- Responsibility for ***maintaining*** ongoing competence should be the rest with individual practitioners, but employers have a responsibility to provide a conducive environment for developing and maintaining competence

10   Recommendations

To address the issues revealed by our research, we recommend that:

- Railway Group members should review their arrangements for competence management to ensure that their suppliers of safety critical parts and services are fully compliant.

- Railway Safety should commission further research into how the benefits of the task and system level approaches to risk assessment can be realised for rolling stock competence management systems, whilst minimising the disadvantages of each approach.

- Railway Safety should consult with professional bodies, such as the IIE, to explore the feasibility of such a body setting common core engineering competence standards for rolling stock practitioners and to provide formal accreditation of both practitioners and training organisations.

- Railway Safety should ensure that a system exists for reviewing, at a strategic level, the outputs from their audit programme. Such reviews should explore variations in Railway Group members' competence standards and re-assessment frequencies to understand and challenge why such variations exist.

- Railway Safety should lead the industry in sharing of good practice in competence management within rolling stock organisations. An ideal approach would be through a national conference for senior managers and for a series of regional workshops for those designing and operating competence management systems. The purpose of a national conference would be to present the underlying principles of competence measurement, the approaches used in other industries, the views of professional bodies and industry regulators and proposals for changes to the Group Standard. The regional workshops would provide a forum for operational managers to share experiences and develop a common understanding of the issues detailed in this report.

- Railway Safety should re-issue the Guidance Note to assist Railway Group members in the design and development of competence management systems. In particular, this guidance should cover defining 'competence', the use of risk assessments, development of competence standards, the management of assessments and methods of unobtrusive assessment.

- Railway Safety should ensure that any future changes to the Railway Group Standard consider and address the following issues:
  - The scope of rolling stock competence management systems, in particular whether other groups of staff (such as technical support staff and managers) should be included.
  - How competence management systems should be integrated with other management systems to deliver further benefits in competence management

for rolling stock organisations. Such integration of systems may also deliver wider benefits to the business.

- Recognition that competence develops over time through increases in knowledge and experience and that assessment systems should therefore not treat competence simply as a binary condition.

- The validity of alternative assessment methods to rolling stock organisations (such as peer review and practical demonstrations).

- Where the various responsibilities lie for gaining and maintaining competence.

11   References

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10.   S.E.Dreyfus; 'Four models of human situational understanding: inherent limitations on the modelling of business expertise', 1981. USAF Office of Scientific Research, ref. F49620-79-C-0063

11.   Health & Safety Commission; 'Railway safety critical work: Guidance on the definition of activities regarded as safety critical under the Railways (Safety critical work) Regulations 1994', 1999.

Appendix A – Marked-up Survey Questionnaire

The following marked-up questionnaire displays the top line findings of the research study. All figures are expressed as percentages. Where totals do not sum 100% this is due to rounding errors. All questions are based on the sample size stated.

A   Definitions

A1   What do you understand by the term 'competence'?

B   System overview

B1   Do you have a documented system to ensure that rolling stock maintenance staff are consistently achieving the standards of competence to do the work?

	n= (14) %
Yes	100
No	0

B2   Why did you choose to introduce such a system?

	n= (14) %
Predominantly compliance with RGS	79
Mixture of business benefits & compliance	14
Predominantly business benefits	7

B3   What is the scope of the system?

B4   When was your current system developed & fully implemented?

	n= (13) %
Within the last year	15
1-2 years ago	31
>2 years ago	54

B5   Who in your organisation developed the system?

	n= (14) %
Led by director	29
Led by senior managers (Depot/Fleet Engineers)	50
Led by local managers (Training/Competency Managers)	21

B6   Did you have any external assistance in developing the system?

	n= (14) %
Yes, consultancy	50
Yes, other TOCs	7
No	43

B7   How useful was the Railway Safety Approved Code of Practice GO/RC 3560 in developing the system?

	n= (11) %
Very useful	18
Fairly useful	36
Not very	18
Did not use	28

B8   Is the system fully compliant with the Group Standard?

B9   What are the main features of the system?

C   Employment

C1   How high is turnover of staff covered by this system?

	n= (14) %
Low	71
Moderate	21
High	8

C2   Do you have difficulty in recruiting suitable staff?

	n= (13) %
Yes	31
No	69

C3   How do you assess whether potential employees are competent before they are offered employment?

	n= (14) %
Interview only	64
Interview and psychometric tests	29
Competence assessment	7

C4   How do you determine whether engineering qualifications are appropriate in the rolling stock environment?

D   Competence standards

D1   How were competence standards developed?

D2   Who developed these standards?

D3   Did you make use of the National Occupational Standards for railway rolling stock?

	n= (14)
	%
Yes	43
No	57

D4   If 'yes', how useful did you find these?

	n= (6)
	%
Very	50
Moderately	33
Not very	17

D5   What support was available when these were being developed?

	n= (10)
	%
Lots	20
Some	40
None	40

E   Assessment

E1   What system do you have for assessing the competence of staff?

E2   Does this system provide for staff to be assessed before their initial certification?

	n= (8)
	%
Yes	75
No	25

E3   How were the frequencies for reassessment determined?

	n= (9) %
Used frequency adopted by other functions within the business (e.g. train drivers)	22
Selected a period that was felt to be 'reasonable'	33
By risk assessment	11
Based on practical constraints of assessment workload for assessors	33

E4   Who conducts the assessments?

	n= (12) %
Line managers	42
Dedicated assessors	58
External body	0

E5   How are assessors selected?

E6   How do assessors maintain their occupational competence?

E7   What do assessments cover?

E8   Are there systems for ensuring that completed competence assessments are verified by qualified individuals?

E9   What are the arrangements for carrying out assessments outside of the normal programme?

E10   Do people ever fail the assessments?

	n= (13) %
Yes, occasionally	69
Yes, rarely	8
Never	2

E11   Are corrective actions ever identified as a result of assessments?

	n= (14) %
Yes, re-train and then re-assess	86
Yes, allow practitioner to gain further experience and then re-assess	7
No	7

F   Maintaining competence

F1   How does the organisation know which tasks have been undertaken by individuals (highlights critical tasks that are infrequently carried out)?

G   Competence assessment of contractors

G1   How do you ensure that any contractors undertaking safety critical work on your rolling stock have a compliant competence management system?

G2   How do you ensure that their competence standards are of the same level as your own?

	n= (14) %
Stipulate in contract only	36
Via periodic audit of contractor	21
Review contractor's system prior to work commencing	14
Use own competence standards to assess contractor's staff	29

H   Licensing & certification

H1   How are the competences of individuals recorded?

H2   Are there methods for providing formal licences/certificates detailing the types of work that an individual is competent to perform?

H3   Do licences/certificates have expiration dates?

H4   How is the length of time before an individual requires refresher training (and re-licensing/re-certification) determined?

H5   How is the fraudulent issue of licences controlled?

H6   Do you think that there would be benefits in introducing some form of national licensing scheme?

	n= (11)
	%
Yes	64
No	27
Not sure	9

J   Cost

J1   How is the manpower effort required to operate and maintain the system be quantified?

J2   How are the contractor costs quantified to operate and maintain the system?

J3   In your opinion, does having such a system bring identifiable benefits to the business?

	n= (14)
	%
Yes	100
No	0

K   Assurance

K1   How do they ensure that their system meets the requirements of the Railway Group Standard?

K2   How often do you review your system?

K3   Who conducts the review?

K4   What was the outcome of the last Railway Safety audit?

K5   In your opinion, did the audit provide a fair assessment of the performance of your system?

	n= (11)
	%
Yes, definitely	82
Yes, although assessment result variable between auditors	18
No	0

L   Performance measurement & improvement

L1   What indicators are used to detect a shortfall in competence?

	n= (13) %
Unobtrusive observation by line managers only	38
Failure, accident & incident data plus observation	15
Combination of both of the above	46

M   Strategic application

M1   How does the organisation consider changes in the external environment that may have an impact on your organisation's competence standards (new technology, regulation or legal requirements for example)?

M2   How is this understanding translated into defining future competence requirements?

M3   How are individuals developed so that they have the necessary knowledge and skills for their next job prior to starting it?

N   Conclusion

N1   What aspects of the Group Standard and its associated Code of Practice would you like to see changed?

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