

# Managing the competence of transport maintenance staff

## Railway Safety's response to the Risk Solutions Research Report

August 2002



**RAILWAY SAFETY**

Working for a safer railway

## **Railway Safety's response to the report by Risk Solutions entitled 'Managing the competence of transport maintenance staff '**

### **1. Purpose**

- 1.1. The purpose of this paper is to outline Railway Safety's response to the attached report, and to summarise the actions being taken by Railway Safety.
- 1.2. The report, commissioned jointly by Railway Safety and London Underground Ltd (LUL), was prepared by Risk Solutions. The report provides a picture of current practice in managing maintenance staff competence across a variety of transport industries and considers the advantages and limitations of each approach.
- 1.3. The research involved a survey of how transport organisations tackle the issue of competence of maintenance staff and management where it has a critical impact on the safety of other employees or members of the public,.

### **2. Railway Safety response**

- 2.1. The nature and extent of Railway Safety's involvement and contribution to this initial piece of research was fairly limited (£7000): LUL initially commissioned the research and was responsible for project management. However, there is value to be gained from building on it and focusing on the activities of the mainline rail industry.
- 2.2. Recommendation

*That a detailed survey of the industry's rolling stock maintainers is commissioned to:*

- *understand the concerns of each train operator and their ideas for change*
- *gauge the level of compliance with the existing standard*
- *review the elements of good practice highlighted in this report and assess whether they could be included in a revised system for the industry.*

### 2.3. Response

- 2.3.1. Railway Safety is to commission further research to consider current compliance with the industry standard for competence management and what improvements could be made to competence management and assurance systems, focussing on rolling stock maintenance.

## 3. **Contact**

- 3.1. Contact Guy Woodroffe, Stakeholder Manager, Railway Safety Research Programme for any enquiries related to this report or the research programme more generally.  
[Woodroffeg.railwaysafety@ems.rail.co.uk](mailto:Woodroffeg.railwaysafety@ems.rail.co.uk). 020 7904 7971



RISK SOLUTIONS

## **Competence management systems - Maintenance staff**

A research report for  
London Underground Ltd  
& Railway Safety

March 2002

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# Executive Summary

## Introduction

Work carried out by the Health & Safety Executive has indicated that accidents caused by the errors and omissions of maintenance staff are on the increase, indicating that the competence of such staff and their managers may be an issue that requires attention.

This report details the findings of a survey into how transport organisations ensure that the engineering staff are competent to carry out maintenance work on vehicles.

## Competence

Several definitions exist for ‘competence’, but all agree that competence consists of these elements:

- the ability to perform activities consistently to a recognised standard
- the requirement to address a combination of practical and thinking skills, experience and knowledge

Competence management systems (CMS) are the management systems that provide assurance (through techniques such as observation, questioning, written and practical examinations) that individuals are competent to do the work required of them. National Vocational Qualifications provide a suitable framework that covers many (though not all) of the elements of a good competence management system and several examples exist where this framework has been used to monitor the ongoing competence of staff.

## Case studies

Several organisations within the transport sector have been surveyed as part of this project, with the aim of providing a representative view of how organisations cope with the issue of competence. The organisations/industries surveyed were:

- UK road vehicle servicing
- UK road freight transport
- UK main line rail operator
- European rail operator
- UK hovercraft operator
- UK civil aviation industry

- UK Underground rail vehicle maintainer

## Key Findings

- All organisations surveyed were aware of the importance of staff competence, but all had different interpretations of what this meant and the controls that were necessary to ensure that it was achieved.
- The degree of ‘formality’ of the systems in use varied greatly
- Two key factors appear to influence organisations in their decision to implement a formal competence management system:
  - **Industry regulation** - safety regulators requiring a system to be in place
  - **Systems of work** – the degree of direct supervision, closeness of working relationships or frequency of quality control checks that take place are all factors cited for having/not having a formal system. For example, if all work is directly supervised by an experienced engineer, then the organisation is less likely to have introduced a formal competence management system for maintenance staff
- Issues for system design included:
  - Buy-in of management and staff – influenced by the amount of involvement they had in the design and running of the system and whether the system lead to a nationally recognised award.
  - Scope - many systems surveyed were found to be limited in scope, for example to purely safety critical activities, neglecting other business critical activities, or to just engineering activities, excluding important non-engineering tasks such as correct booking on.
  - Integration with other systems: None of the organisations surveyed had integratd competence management systems with other management systems.
  - Resources - required to implement the system .

NVQ-type systems had been adopted by many of those surveyed. The belief that they require a high level of management and employee effort to build a portfolio of evidence was substantiated by the survey.

## Conclusions for Railway Safety

Although the main line rail industry appears to have a comprehensive standard for the management of maintenance staff competence, it is understood that the industry has concerns that:

- To meet the standard a high level of resourcing is required
- Because of this, the standard may not be delivering the intended assurance of competence

This survey reveals that a wide range of different approaches and detailed design solutions have been implemented in the transport industry. Elements of these represent good practice in competence management and may be very relevant to the main line rail industry helping address many of the concerns. However there is a need to fully understand the concerns and limitations of the current system.

### **Recommendations**

We therefore recommend that a detailed survey of the industry's rolling stock maintainers is commissioned to:

- Understand the concerns of each train operator and their ideas for change
- Gauge the level of compliance with the existing standard

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Risk Solutions  
 1st floor, Central House  
 14 Upper Woburn Place  
 London  
 WC1H 0JN  
 United Kingdom  
 Telephone +44 20 7554 5505  
 Facsimile +44 20 7554 5510

**Risk Solutions is a trading name of RiskSol Consulting Ltd**

	<b>Name</b>	<b>Signature</b>	<b>Date</b>
<b>Author</b>	J.P.Baker		12 <sup>th</sup> March 2002
<b>Approved by</b>	H.L.Wilkinson		12 <sup>th</sup> March 2002



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# 1 Introduction

This research report has been written for London Underground Ltd and Railway Safety. The research has involved a survey of how transport sector organisations, where the competence of maintenance staff has a critical impact of the safety of other employees or members of the public, tackle the issue of competence of maintenance staff and management.

The HSE are concerned that accidents caused by the errors and omissions of maintenance staff are increasing. The competence of such staff is therefore becoming an increasing area of concern and attention by safety regulators. The Press Release (dated 3<sup>rd</sup> August 2000)<sup>1</sup> from the HSE illustrates this concern:

*“Overall, the general accident trend in Britain is downwards but the role of maintenance error as a root or contributory cause of major accidents has increased. There have been many high-profile examples, both in Britain and elsewhere, e.g. Clapham Junction, Bhopal, Piper Alpha and a number of aviation accidents.*

*Recent near-misses resulting from errors during maintenance include a large release of natural gas from an offshore production platform and a spillage of 17 tonnes of highly flammable liquid at an onshore refinery. Fortunately, in both cases there was no ignition..... HSE expects to see industry tackle maintenance risks in a structured and proactive way, making it part of every company's safety management system. HSE is committed to pursuing the continued reduction of accidents resulting from maintenance activities through advice and, where necessary, enforcement.”*

This project has attempted to provide a picture of current practice in managing maintenance staff competence across a variety of transport industries and to comment on the advantages and limitations of each approach.

This study has been jointly sponsored by London Underground Limited and Railway Safety. This report addresses some of the issues within the Railway Safety Research Programme theme ‘Management of Safety – competence’.

## 2 Competence

### 2.1 What is 'competence'?

The Collins English Dictionary<sup>2</sup> makes the following definitions:

**“Competent** – *having sufficient skill, knowledge etc; capable*”

**“Competence** – *the condition of being capable; ability*”

In the specific application of competence in the railway industry, Railway Group Standard GO/RT3260<sup>3</sup> provides this definition:

**“Competence** – *The ability to perform activities to the standard expected.....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.*”

A further definition specific to the railway industry is provided by the Health & Safety Executive in their guidance on Railway Safety Case acceptance criteria<sup>4</sup>:

**“Competence** – *....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.*”

Both the Railway Group Standard and the HSE definition imply that there is a need to ensure that staff are competent on an ongoing basis, rather than a once-off assessment of competence. Note that the HSE definition also includes reference to the *attitudinal* component of competence.

From these definitions an assumption could be made that competence focuses on performance at the level of the individual. However, at the team, departmental or organisational level the combined skills, experience and knowledge of a number of individuals (if used intelligently and effectively) could provide the overall degree of competence that is required. This strategic element is reflected in the definition of competence in a report produced by Railtrack's Safety & Standards Directorate (now Railway Safety) on competence in strategic safety management in 2000<sup>5</sup>:

**“Competence** – *A person, a team of people or an organisation is competent when they work consistently to an expected level of performance. Expected levels of performance change over time*”

This report concentrates on managing and measuring competence at the individual level, but also discusses how these tactical processes should link with organisational strategy.

### 2.1.1 How is competence achieved?

From the definitions above, it is apparent that ‘competence’ cannot be achieved by education, training or experience *on their own*. Rather, it is a combination of all of these applied to the specific activities and work functions of each individual’s job. Nationally, there has been a drive to introduce vocational qualifications that recognise the skills and knowledge that have been acquired through the performance of work (rather than through academic study) and on demonstrating occupational competence in the workplace. These qualifications are known as National Vocational Qualifications (NVQs). Modern apprenticeships (recently launched by the Department for Education & Skills<sup>6</sup>) lead to either an NVQ level 2 or 3 in a structured way usually over a time period of 3 years.

The NVQ approach to achieving and assessing competence covers all the main aspects of an occupation, including current best practice, the ability to adapt to future requirements and the knowledge and understanding which underpins competent performance. The employee discusses with a qualified assessor their current standard of performance and how best they can acquire the knowledge skills and experience they need to progress to the next level. This may involve a mixture of formal training and on-the-job experience. A structured approach is used to assess the competence of the individual. The NVQ assessment method underpins many of the competence management systems surveyed in this report and so a brief description of the NVQ method is given in Box 1 below<sup>7</sup>:

#### **Box 1 - National Vocational Qualifications**

National Vocational Qualifications (NVQs) were created to provide qualifications that were flexible, widely recognised by industry, comprehensive, rigorously assessed, coherent and voluntary. NVQs are divided into five levels:

**Level 1** - Foundation skills in occupations

**Level 2** - Operative or semi-skilled occupations

**Level 3** - Technician, craft, skilled and supervisory occupations

**Level 4** - Technical and junior management occupations

**Level 5** - Chartered, professional and senior management occupations

The first award (at Level 2) was made in 1988.

The main features of the NVQ approach are listed below:

- **National Occupational Standards:** statements of performance that describe what competent people in a particular occupation are expected to be able to do. They cover all the main aspects of an occupation, including current best practice, the ability to adapt to future requirements and the knowledge and understanding which underpins competent performance.
- **Units of competence:** broad descriptions of the different functions the people perform
- **Elements of competence:** detailed descriptions of the standard of performance expected
- **Performance criteria:** criteria to assess if the candidate's performance meet the National Occupational Standard
- **Knowledge requirements:** what the candidates need to know in order to perform to the National Occupational Standard

- **Evidence requirements:** the evidence candidates must show to prove to an NVQ assessor that they are competent

NVQs are achieved through assessment and training. Assessment is normally achieved through on-the-job observation and questioning and is designed to test candidates' underpinning knowledge, understanding and performance to make sure they can demonstrate competence in the workplace. Candidates need to provide evidence to prove they have the competence to meet the NVQ standards. Assessors 'sign-off' units when achieved.

When a new candidate starts, their assessor will usually help them to:

- identify what they can do already
- agree on the standard and level they are aiming for
- analyse what they need to learn
- choose and agree on activities which would allow them to learn what they need

Assessors can be in-house employees that have received appropriate training or external people brought in specifically to conduct assessments

Possibilities for achieving the necessary competence may include:

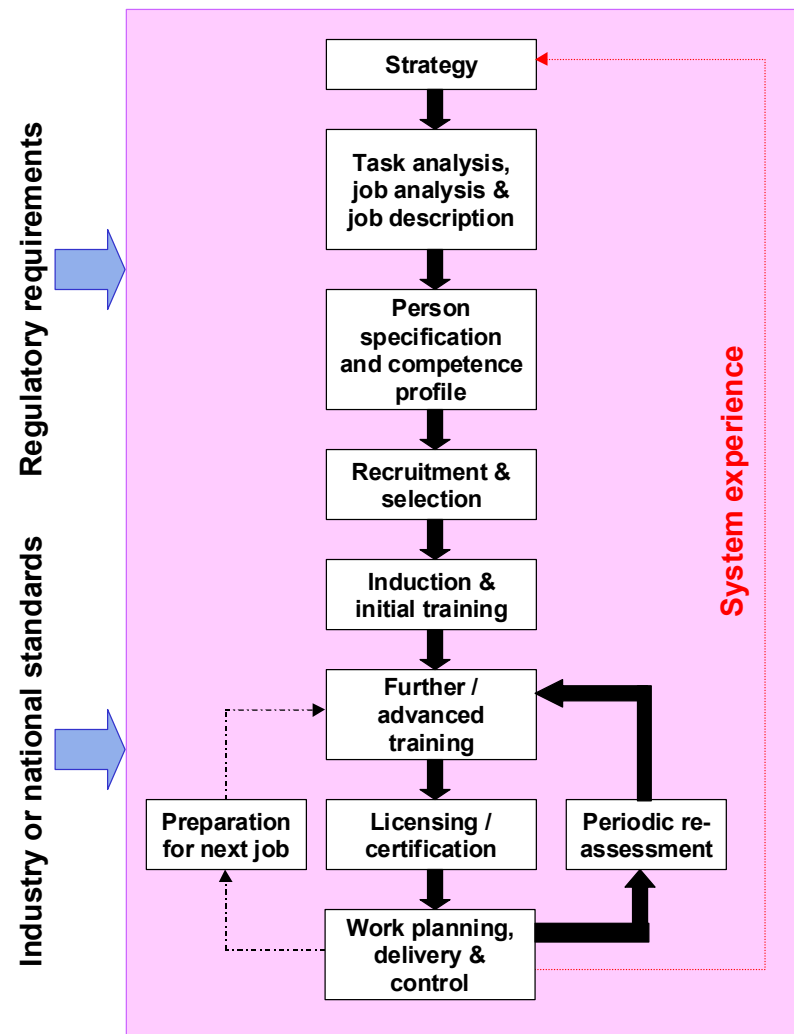
- taking a training course to gain the necessary underpinning knowledge
- doing slightly different work, or work in a different way, so that they can get the evidence of competence they need
- moving to a different part of the company, or having a placement in another company, to get different experience

## 2.2 Competence management systems

A 'Competence Management System' is the means by which an organisation ensures that its employees are competent to carry out the tasks required of them. Railway Group Standard GO/RT3260<sup>3</sup> provides a useful definition of such a system:

***“Competence management system** – A documented system by which an employer ensures, so far as is reasonably practicable, that its employees achieve consistently the standards of competence required for their work.”*

A Competence Management System (CMS) should enable organisations to better identify and control risks associated with the performance of its workforce (including behavioural aspects of performance). The use of such systems is also acknowledged as bringing benefits in the communication of safety priorities and for creating a 'safety culture'. The maximum benefits will only be realised of course if the system is suitably resourced and integrated with other management systems - training, reward, quality, recruitment and promotion for example. This is illustrated in Figure 1 below:



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**Figure 1; Model of an Integrated Competence Management System**

### 2.2.1 Reasons for introducing competence management systems

Safety is one of the primary driving forces for introducing a competence management system, particularly where there is the potential for death or serious injury if tasks are not performed correctly. The Health and Safety at Work etc. Act<sup>8</sup> requires employers to provide any necessary training to ensure, so far as is reasonably practicable, the health and safety of their employees at work.

Specifically for the rail industry, the Health & Safety Executive requires holders of Railway Safety Cases<sup>4</sup> to demonstrate that they have an effective competence management system in place:

*“**Criterion 6.1:** The Safety Case should summarise the duty holder's policy for managing the competence of all staff (including suppliers) to carry out work with a health and safety dimension.”*

In addition, organisations that have implemented a Quality Management System to ISO9001:2000<sup>9</sup> must have a system for managing the competence of their staff (Clause 6.2.2 of the Standard).

### 2.2.2 System sophistication

There are many ways that organisations can design systems to manage the competence of their employees. The degree of formality, scope and frequency of assessment will be influenced by several factors, including:

*Consequences of failure* – if the consequences of a task being performed incorrectly are not safety critical, then a system that requires a high degree of formal monitoring may not be appropriate

*Complexity of tasks* – if tasks are complex then competence in their performance may be harder to gain and retain and a higher degree of training, assessment and monitoring may be required

*Frequency of task performance* – if a task is only undertaken infrequently, then retention of competence will be difficult and a higher degree of training, assessment and monitoring may again be required

*Degree of supervision, inspection & testing* – if tasks are subject to close supervision, quality control checking etc, then the competence of staff carrying out the maintenance task becomes less critical (note that the competence of those checking, supervising and inspecting the work **will** be of critical importance)

*An individual's past performance* – if an individual has been found responsible for accidents or incidents in the past, then a formal method of assessing their competence and monitoring it on an ongoing basis may be required

## 2.3 Ongoing assessments of competence

Both the NVQ approach, which focuses on demonstrating occupational competence in the workplace, and academic qualifications, which focus on the knowledge acquired by the individual, only provide an assessment of an individual's abilities at a particular moment in time. This 'once off' assessment of competence may not be sufficient for tasks which have an impact on safety (or would have a significant impact on the business, such as reputation damage or significant financial penalties) especially where these tasks are complex or rarely-performed.

Many organisations have recognised this limitation and have further developed their systems to provide a level of ongoing assessment of staff competence.

The UK Fire Service provides an example of this approach where Firefighters continue to have assessments made of their competence against the National Occupational Standards. This 'Phase three' of a firefighter's training is summarised in the excerpt from the Firefighter Integrated Personal Development Working Group website<sup>10</sup> in Box 2 below:

**Box 2 - Firefighter Phase Three; *Maintenance of Knowledge and Skills***

Having completed Phases One [initial training] and Two [application of skills/knowledge], the firefighter is now considered to be competent and will be as qualified for the role of a firefighter as is reasonably expected. Individuals now have a choice as to whether they wish to continue as a firefighter or seek progression to the role of a crew commander.

Where individuals remain in the role of firefighter they must maintain the level of knowledge and skills already acquired and continually demonstrate competence within that role.

This means that;

- A role-based training programme designed to meet the needs of individuals will be needed to enable firefighters to maintain their competencies,
- Such programmes will be focused on the demonstration of workplace performance of the National Occupational Standards and,
- Ongoing assessments of all experienced firefighters will be required.

Based on the above two requirements it can be seen that a prescriptive and generic training programme would not be able to meet the diverse circumstances of individual firefighters, all of whom will have different levels of competence, experience and consequently training needs.

The cycle of assessment and individually based training, albeit delivered within the context of the individual's own workplace, will be a continuous process and therefore individuals remaining in the role of firefighter will remain in Phase Three."

## 2.4 Certification and licensing

In most competence management systems the assessment of an individual as being 'competent' leads to that person being provided with a certificate or licence. The use of the terms 'certificate' and 'licence' appears to vary from organisation to organisation and in some cases are used interchangeably. For the purposes of this report the following distinctions have been made between the two:

**Certificate** – awarded on the successful completion of a course of academic study and/or practical training. The certificate provides confirmation that at the time of the assessment the individual was competent in the areas assessed.

**Licence** – awarded on the successful completion of a course of academic study and/or practical training. The licence provides confirmation that at the time of the assessment the individual was competent in the areas assessed ***and the individual is authorised to undertake work in the areas specified on the licence.***



### 3 Case Studies

To obtain a picture of the competence management systems that are in use by maintenance organisations in the transport sector, several industry bodies and commercial organisations were surveyed.

The aim was to provide a representative view of how organisations cope with the issue of competence. The organisations/industries surveyed were:

- UK road vehicle servicing
- UK road freight transport
- UK main line rail operator
- European rail operator
- UK hovercraft operator
- UK civil aviation industry
- UK Underground rail vehicle maintainer

The survey investigated the following key factors:

- *Reason for system*
- *Scope of system*
- *System design*
- *Recruitment & selection*
- *Initial training*
- *Assessment*
- *Certification & licensing*
- *Records*
- *Indicators of performance*
- *Resource requirements*

It is presented in full in Section 6. Our overall findings are presented in the next section.

## 4 Findings

The findings drawn from the case studies are presented first, allowing readers to quickly understand the key issues from the survey:

### Approach to competence management

- All organisations surveyed were aware of the importance of staff competence, but all had different interpretations of what this meant and the controls that were necessary to ensure that it was achieved.
- The degree of ‘formality’ of the systems in use varied greatly as indicated on the figure below. ‘Formal’ systems were typified by:
  - Documented standards of occupational competence
  - Procedures for assessing competence against these standards
  - Full documentary evidence of the results of assessments and corrective actions taken

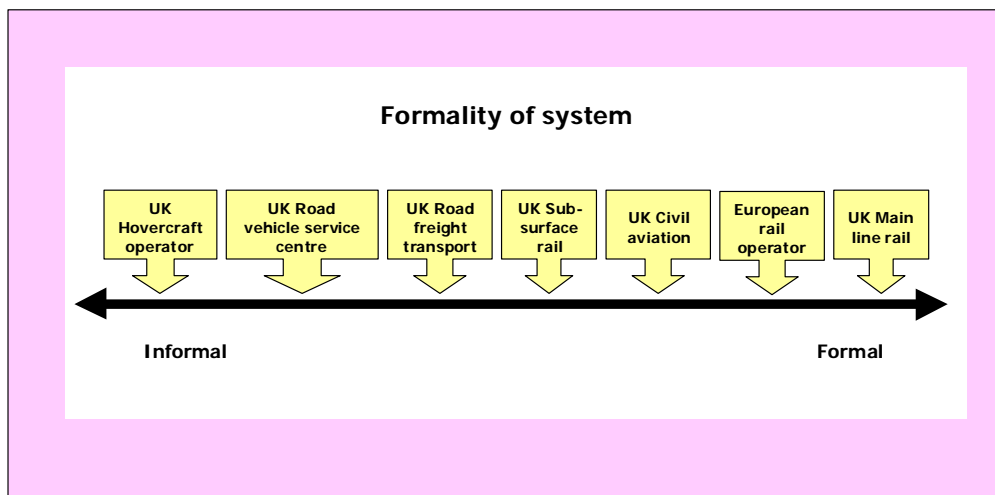


Figure 2; Formal and informal competence management systems

- Two key factors appear to influence organisations in their decision to implement a **formal** competence management system:
  - **Industry regulation** - safety regulators requiring a system to be in place
  - **Systems of work** – the degree of direct supervision, closeness of working relationships or frequency of quality control checks that take place are all factors cited for having/not having a formal system. For example, if all work is directly supervised by an experienced engineer, then the organisation is less likely to have introduced a formal competence management system for maintenance staff
- The role of the safety regulator in competence assurance activities varied considerably in the industries surveyed. The table below indicates some of the major differences:

Industry	Safety regulator	Who sets competence standards	controls	Who carries out competence assurance activities
Marine	Marine Coastguard Agency	Operator	Operator	Operator
Road vehicles	HSE / Vehicle Inspectorate	Operator	Operator	Operator
Underground rail	HMRI	LUL	Operator	Operator
Civil aviation	CAA	CAA	CAA	CAA (with operator self-assuring)
Main line rail	HMRI	Railway Safety	Operator	Railway Safety (with operator self-assuring)

## System design

- About half of the organisations surveyed had implemented bespoke systems, and half had purchased ‘off the shelf’ systems.
- Many systems surveyed were found to be limited in scope, for example to purely safety critical activities, or to just engineering activities. This meant that some business-critical activities or important non-engineering tasks (such as correct booking on procedure) were not included in the system’s scope.
- Systems that used the maintenance manuals as the basis for developing the units and elements of competence had the most relevance to the activities carried out.
- Involvement of staff at all levels of the organisation in the design of the system was found to improve buy-in and was more likely to result in effective implementation of the system
- The use of a system that leads to a nationally-recognised qualification (an NVQ for example) also appears to have significant benefits in securing employee commitment to the system.
- There is a belief that the adoption of an NVQ-type system requires a high level of management and employee effort to build a portfolio of evidence. Evidence from organisations surveyed that are using such an approach substantiates this belief.
- The NVQ approach does not require on-going assessment of competence. Approximately 50% of the organisations surveyed believed that carrying out training (with some form of post-training assessment) was sufficient to guarantee competence without the need for further monitoring.
- None of the organisations surveyed made use of information technology to assist with operating and managing their competence management systems – all relied on paper records. It should be noted that by not using sophisticated technology systems the competence management system was generally simple to operate. However, the major disadvantages of this approach can be concluded as being:

- Accessibility of records – records could not be accessed remotely and in some cases unavailable outside of office hours
  - Accuracy of records – it was observed in many cases that paper records could not be verified as being the latest version and in several cases backlogs of filing on to personal files were observed
  - Integration with other systems – IT systems for rostering, training, employee details etc existed in many cases, but were not linked with competency information
- Of the organisations surveyed that had a formal competence management system in place, none had integrated it fully with other management systems.

### **Conclusions for Railway Safety**

- The main line rail industry has the most comprehensive and detailed competence management system of those surveyed. However it is understood that concerns exist regarding the level of management that this system requires and hence its useability, although in the organisation surveyed this did not appear to be an issue.
- The Civil Aviation Authority system of national licensing and effective assurance systems appears to offer a thorough approach to competence management without the disbenefits of the system in use in the main line rail industry.

## 5 Recommendations

This survey has gathered information about how various transport organisations manage the competence of the maintenance staff that they employ. Many of the recommendations for change will be specific to Railway Safety or London Underground Ltd, as they currently mandate different approaches to competence management.

### 5.1 Recommendations to Railway Safety

Although the main line rail industry appears to have a comprehensive standard for the management of maintenance staff competence, it is understood that the industry has concerns that:

- To meet the standard a high level of resourcing is required
- Because of this, the standard may not be delivering the intended assurance of competence

This survey reveals a wide range of different approaches and detailed design solutions have been implemented in the transport industry. A number of these represent good practice in competence management and may be very relevant to the main line rail industry helping address many of the concerns. However there is a need to fully understand the concerns and limitations of the current system.

We therefore recommend that a detailed survey of the industry's rolling stock maintainers is commissioned to:

- Understand the concerns of each train operator and their ideas for change
- Gauge the level of compliance with the existing standard
- Review the elements of good practice highlighted in this report and assess whether they could be included in a revised system for the industry

## 6 Case Studies

To obtain a picture of the competence management systems that are in use by maintenance organisations in the transport sector, several industry bodies and commercial organisations were surveyed. The survey investigated key factors in each case:

- *Reason for system* – why the organisation had introduced a competence management system, whether this was led by the organisation itself or whether industry regulation was the key driving factor
- *System overview* – a summary of the main features of the system
- *Scope of system* – who the system covers and over what geographical area
- *System design* – what standards have been used to define competent performance and where these were derived from
- *Recruitment & selection* – the degree to which competence standards form part of selection criteria
- *Initial training* – how the organisation provides training and development opportunities to get staff to a basic level of competence
- *Assessment* – how competence is assessed both post-training and on an on-going basis
- *Certification & licensing* – whether staff receive a formal licence once passed as competent and how these are controlled
- *Records* – the records that the system generates and the degree to which IT is used
- *Indicators of performance* – how potential shortfalls in competence are detected
- *Resource requirements* – the level of resourcing required to operate the system

Comments on the system have been made to highlight the potential strengths and limitations of the approach used.

## 6.1 UK main line rail on-track plant vehicle maintainer

### Organisation

The organisation surveyed maintains and operates track maintenance and renewal machinery across the British railway network.

The competence management system has been developed by a consultancy specialising in such systems within the rail industry.

### Reason for system

The on-track plant maintainer is part of the Railway Group of companies and as a result must comply with the Railway Group Standard on Competence Management Systems (GO/RT3260). The system was developed following recommendations from an audit carried out by the industry's safety regulatory body.

### System overview

The system developed by the consultancy is similar to the National Vocational Qualification (NVQ) system in that it uses a series of Units of Competence, with each Unit having a series of Elements of Competence within it, but does not lead to a nationally-recognised award. In this system the assessment takes place over a two year rolling programme. When all units and elements for an individual have been assessed (and the candidate acknowledged as being competent in all of these) a Certificate of Competence is issued and the assessment programme starts over again.

### Scope of competence management system

The system currently covers all skilled maintenance staff carrying out maintenance tasks on rail plant.

The system does not yet cover operator/maintainers (semi-skilled staff that operate on-track machines and who also carry out basic servicing tasks). The system also does not yet include skilled staff who maintain small plant equipment.

### System design

The system is based around the requirements of the maintenance manuals for each of the types of on-track plant. The maintenance manual was reviewed and tasks identified that were either 'safety critical' (according to the definitions in the Railway Safety Critical Work Regulations and Railway Group Standards) or 'critical to safety' (a definition used by the organisation, which covers a wider range of activities). The tasks identified were grouped together to form the Units and Elements of Competence.

### Recruitment & selection

The minimum requirement for new maintenance staff is that they must have completed a recognised engineering apprenticeship.

Operator/maintainers do not have to have completed a recognised engineering apprenticeship.

### Initial training

Upon appointment, the individual discusses their existing competences with the Competence Assurance Manager. Training needs are identified and training courses delivered.

### Assessment

Assessments can be either planned or unannounced. A variety of methods are used to assess the competence of the individual:

- *Observation*; the preferred method, particularly when the candidate talks through what he is doing and why
- *Simulation*; used when it is not possible to carry out the actual task. Types of simulation could include talking through the task, carrying out the task in a classroom/workshop (rather than on the vehicle)

- *Questioning*; mainly used to supplement observation, to test the underpinning knowledge of the candidate
- *Testimony*; training/competence certificates awarded for by 3<sup>rd</sup> parties for particular tasks, such as fork-lift truck proficiency licences for example

Assessors must be qualified assessors and also have occupational competence in the maintenance of the on-track plant.

Periodic verification of the competence assessments take place by a qualified verifier.

### **Certification & licensing**

When all units/elements of competence for an individual have been assessed (and the candidate passed as competent in each of these) a Certificate of Competence is issued. This certificate is valid for two years.

Licences are held on the personal files of the candidates rather than being issued to the candidate and are only valid within the organisation. These measures provide protection against the fraudulent issue and use of licences.

### **Records**

The system uses a number of paper forms to record the following:

- *Assessment plan* (used to record the units and elements to be assessed, the methods of assessment that will be used, the candidate's agreement of the plan).
- *Progress record* (used to record the progress in assessing the candidate's competence in the applicable units & elements of competence and the performance criteria that should be met)
- *Observation of Standards record* (used to record an assessment of a candidate against one or more of the applicable units/elements of competence)

- *Feedback record* (used to record feedback given to a candidate following an assessment session)
- *Certificate of Competence* (awarded after all units/elements of competence have been assessed and the candidate deemed competent)

All the above are records that relate to an individual and are held on personal files. In order to manage and operate the system, a number of simple tools are employed:

- 'T' card wall planner, providing an overview of all the competence assessments that are planned over a two year period
- Competence summary, printout of the units/elements of competence for each individual, available in A4 binder for use by supervisory staff when planning and allocating work.

### **Indicators of performance**

Supervisory staff can request additional assessments if they believe that an individual's performance is not up to the expected standard.

### **Resource requirements**

The competence management system is operated and managed by two full-time staff. In addition, some consultancy support is bought in each year. This level of resourcing is sufficient to operate and manage a competence management system for 70 maintenance staff spread out over a large geographical area.

Line managers/supervisors of the maintenance staff are viewed as users of the system and do not have an active role to play in the formal assessment of their staff. They can however trigger additional assessments if they believe that closer monitoring is required.



## Comments on system

The competence management system developed by the consultancy and in use at within the on-track plant maintenance organisation provides a well-structured, comprehensive means of managing the competence of its on-track plant maintenance staff.

A number of particular strengths and potential weaknesses exist with the approach used, these are discussed in the tables below. Many of the limitations identified with the system relate to how the organisation has chosen to implement the system developed by the consultancy, these are not seen as being fundamental problems with the system design.

Strengths	Limitations
<p><b>Easy to implement and operate</b> - The system has been designed by a consultancy that has many years' experience of developing competence management systems within the industry. As a result, the time for development and implementation of the system within an organisation is much reduced. The relative simplicity of the system also means that it requires a minimal number of staff to operate and manage it. In particular, in this implementation the supervisory and management time required to operate the system is minimal.</p> <p><b>No reliance on technology</b> - The system uses paper forms and simple methods for its operation and management. It requires no specialist IT equipment, communications links or software. This does however introduce information handling limitations.</p> <p><b>Designed for the industry</b> - Organisations within the rail industry that purchase this system will then have a competence management system that is compliant with regulatory requirements and industry standards, without the need for additional development work.</p> <p><b>Standard system</b> - Support for the system is available from the supplier. Organisations that have purchased the system also benefit from annual user group workshops where users are brought together to discuss issues of common interest and influence future developments of the system.</p> <p><b>Focus on maintenance tasks</b> - By using the maintenance manual as the core material for developing the units and elements of competence a system has been created that is highly relevant to the tasks that the staff undertake.</p>	<p><b>Lack of supervisory / management staff ownership</b> - The system in use has been implemented so that two managers operate and manage the whole competence management system. Supervisory and management staff have no formal involvement in the competence assessment and monitoring of their staff. As a result, there is little ownership of the system and supervisors / managers make little use of the outputs of the system in planning and strategic decision making.</p> <p><b>Focus on current requirements</b> - The system has been developed to address competence in safety critical tasks carried out on existing equipment. The system does not look at future competence requirements either in terms of new equipment that may be procured or in terms of preparing individuals for their next job (development of management competencies for example).</p> <p><b>Focus on safety critical tasks</b> - By focusing purely on tasks that have an impact on safety, the system may not address competence in tasks that have significant business risk associated with them (reliability, customer environment for example).</p> <p><b>Stand-alone system</b> - The competence management system exists as a self-contained system with the organisation. As a result there is no integration with other management systems (training, strategy) with the potential for tactical and strategic decisions to be taken that may be compromised.</p>

## 6.2 UK motor car service centre

### Organisation

The organisation surveyed was founded approximately 30 years ago and is now a major automotive parts repair and replacement specialist. The organisation currently employs more than 10,000 people, servicing the needs of more than 8 million motorists a year.

### Reason for system

There are no industry regulatory requirements to have a competence management system, but the organisation has developed their system to ensure that high standards of quality exist. The competence of maintenance staff is now a key marketing message.

### System overview

The organisation operates a formal, validated scheme to assure the training and competence of its maintenance staff to the internally-generated standards of competence.

The system provides a once-off assessment of competence (there is no formal method of assessing competence on an ongoing basis) and focuses on the technical tasks that are undertaken by its staff.

All assessors are formally trained by a training consultancy (now a wholly-owned subsidiary) and all assessments are against documented standards of competence.

Area Managers may train and assess staff in all technical tasks, except those identified as being technically complex (for example, brakes). The training and assessment for these specific tasks may only be carried out by qualified technical personnel.

### Scope of competence management system

The system currently covers all skilled and semi-skilled staff carrying out maintenance tasks on vehicles.

### System design

The system uses performance and knowledge standards produced by the organisation for each of the tasks that are carried out at their service centres.

### Recruitment & selection

The minimum requirement for new maintenance staff is that they must achieve the required standards in occupational health. It is not essential for new maintenance staff to have completed vocational training specific to the car repair industry.

New entrants that join the apprenticeship scheme receive full training leading to an NVQ.

### Initial training

Upon appointment, the individual discusses their existing competences with the Area Manager, training needs are identified at this time and training courses arranged to fill gaps.

Staff are permitted to work on agreed tasks, under close supervision, for a period of one month before being formally assessed by the Area Manager.

An alternative way to gain competence is for the individual to attend an in-house training course.

### Assessment

After this initial period of 'on-the-job' learning, the individual will be assessed against the organisation's standard for the task (for example battery charging, testing and diagnosis).

Assessment is normally through unobtrusive observation. Once the assessor has observed the individual carry out the task questioning is used to test underpinning knowledge.

At a formal training course the assessment is carried out on the completion of training by the technical trainer.

In either case, if the individual is successful, they may then work unsupervised and inspect the work of others carrying out this task.

Assessors must have passed the organisation's training course in assessment methods and must themselves be assessed as being competent in the relevant tasks.

### **Certification & licensing**

When an individual is passed competent for a task (for example, exhausts) a result form is filled out by the Area Manager and sent to the central training function. This information is entered on a licence database, with hard copies being issued to service centre managers monthly so that their accuracy can be confirmed.

These hard copy licences are held on the personal files of the candidates rather than being issued to the candidate and are only valid within the organisation. These measures provide protection against the fraudulent issue and use of licences.

### **Records**

The system uses a number of paper forms to record the following:

- *Assessment plan* (used to record the units and elements to be assessed, the methods of

assessment that will be used, the candidate's agreement of the plan).

- *Observation of Standards record* (used to record an assessment of a candidate against one or more of the applicable units/elements of competence)
- *Technical Competency Assessment Result Form* (awarded after all units/elements of competence have been assessed and the candidate deemed competent for a specific task)

### **Indicators of performance**

Shortfalls in competence may be detected during Quality Control checks or as a result of feedback from customers. In either case, the individual concerned would receive further training locally, but this would not result in a formal reassessment.

### **Resource requirements**

The system is operated and managed by approximately 30 administration and training staff as well as the part-time involvement of the Area Managers.

This level of resourcing is sufficient to operate and manage a competence management system for several thousand maintenance staff spread out over a large geographical area.

## Comments on system

The competence management system developed by the organisation provides a structured method for assessing competent performance of the tasks that its staff perform on customers' vehicles. The system is simple to operate and requires a minimal amount of paperwork to be completed.

Strengths	Limitations
<p><b>Bespoke system</b> - The systems have been designed specifically for the organisation's operation and is supported by a consultancy with experience of such developing such systems. The system assures a consistent approach throughout the large number of service centres.</p> <p><b>Little reliance on technology</b>- The system uses paper forms and simple methods for its operation and management. It requires no specialist IT equipment, communications links or software other than a central database which stores the competency details for each person. This does however introduce information handling limitations.</p> <p><b>High supervisory / management staff involvement</b> - The system has been implemented such that Centre and Area Managers have significant formal involvement in the competence assessment and monitoring of their staff. As a result, there is high ownership and understanding of the system.</p>	<p><b>No ongoing assessment of competence</b> – The system provides a 'once-off' check of an individual's competence, so competence in tasks that are complex, safety-critical or infrequently-performed is not assessed routinely. However, the close degree of supervision and inspection (every task performed is checked by the Centre Manager) means that errors are normally detected before the vehicle leaves the service centre.</p> <p><b>Reliance on occupational competence of Partners, technical trainers etc</b> - The competence standards developed by the organisation are generic to particular systems (exhausts, batteries etc). There is a high reliance on the experience of Centre and Area Managers and other staff in the specifics of different vehicles (see note below). There is no ongoing assessment of the competence of these managers.</p>

### Note

The organisation experiences significant difficulties in obtaining information from vehicle manufacturers on how to carry out tasks on new vehicles. This is because the organisation is in direct competition with the manufacturers' own service centres who see considerable competitive advantage in retaining all such information. This has resulted in costly errors being made by the organisation's staff who were not competent to undertake the task on an unfamiliar piece of equipment. This appears to be an inherent problem within the car industry.

## 6.3 UK road freight transport industry

### Organisation

The road freight transport industry in the UK is represented by the Freight Transport Association (FTA).

Engineering personnel within the industry are represented by The Society of Operations Engineer's (SOE).

### Reason for system

Almost two years ago, the Engineering Council asked each of its nominated bodies (including the Society of Operations Engineers) to investigate whether the licensing of 'Competent Persons' could be feasible in their particular sectors of engineering.

This was in response to increasing public concern over safety and the competence of maintenance staff within the road transport industry.

For example, in the 12 months to April 2000;

- of 105,000 lorries inspected by DETR Vehicle Inspectorate 10% had defective braking systems
- of 28,000 buses inspected by DETR Vehicle Inspectorate 4% had defective braking systems
- Also, 7% of all cars and 9% of all light goods vehicles inspected by DETR Vehicle Inspectorate failed to comply with minimum standards of roadworthiness

Although a number of transferable formal engineering qualifications exist within the industry, these qualifications are not mandatory for maintenance staff and, where obtained, do not require verification by additional retraining/reassessment.

### System overview

A system has been developed by the Institute of Road Transport Engineering Council (IRTEC). This scheme is similar to the National Vocational

Qualification (NVQ) system in that it is based upon competence 'modules'. The modules are:

1. Braking
2. Legislation
3. Suspension
4. Transmission systems
5. Inspection

Each module comprises 'technical standards of competence', formulated by an Advisory Board, which supervises technical sub-committees.

In addition, the assessment centres are approved and audited by an independent organisation, with competences counting towards an NVQ qualification.

The scheme is not currently mandatory within the industry, although recommendations have been made to make it so.

The scheme is similar to ones adopted by some other countries within the EU and has been launched within the Passenger Service Vehicle sector (coaches and buses), with the Heavy Goods Vehicle sector to be included in early 2002.

### Scope of competence management system

The system is intended to cover all skilled maintenance/technical staff within the commercial freight industry.

### System design

The system is based around the requirements of the maintenance standards associated with each of the five modules.

Technical standards of competence to meet these requirements have been designed and validated by the SOE, in collaboration with stakeholders within the commercial freight industry (including FTA, commercial organisations within the industry and the Confederation of Passenger Transport).

## Assessment

Assessments are planned and:

- Take place at approved assessment centres
- Include a written examination, with a pass mark of 70%

## Certification & licensing

When all five modules of competence for an individual have been successfully completed, a revocable licence is issued which is valid for five years. It is intended that licences will be recognised across the industry.

Licences are both held centrally on the personal files of the candidates at the assessment centres and issued to the candidate. This dual approach to licensing attempts to both provide flexibility within this fragmented industry and reduce the likelihood of fraud.

## Indicators of performance

Supervisory staff can request additional assessments if they believe that an individual's performance is not up to the expected standard.

## Resource requirements

The competence management system is operated and managed by the SOE, with support from external consultancies. This level of resourcing is sufficient to operate and manage a competence management system to cover a large geographical area at a cost to the user of £180 per employee.

Line managers/supervisors of the maintenance staff are viewed as users of the system and do not have an active role to play in the formal assessment of their staff. They can however trigger additional assessments if they believe that closer monitoring is required.

## Comments on system

The competence management system that has been developed provides a well-structured, comprehensive means of managing the competence of maintenance/technical staff.

<b>Strengths</b>  <b><i>Involvement of key stakeholders</i></b> - The system has been designed by industry bodies in collaboration with potential users, with the result that a wide range of views have been included at the design stage of the system.  <b><i>Standard system</i></b> - Support for the system is available from the professional body (SOE). Organisations that adopt the system also benefit from access to the SOE's resources and IRTEC scheme committees where users can discuss issues of common interest and influence future developments of the system.  <b><i>Focus on maintenance tasks</i></b> - By using generic maintenance tasks on road freight vehicles as the core material for developing the units and elements of competence, a system has been created that is highly relevant to the tasks that the staff undertake.	<b><i>Strengths continued</i></b>  <b><i>Integration with national awards scheme</i></b> – Completion of elements in the scheme can count toward the achievement of an NVQ, helping to secure acceptance from users.  <b>Limitations</b>  <b><i>'Off the shelf' product</i></b> - The standardised five module system may be inflexible to the needs of specific organisations, where staff may only be required to complete selected tasks.
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## 6.4 European main line rail operator

### Organisation

The state-owned organisation surveyed maintains and operates the passenger and freight rail transport within a small European country. It operates over 2,500 passenger trains and 200 freight trains per week, which are maintained at one of three facilities across the country.

### Reason for system

The current competence assurance system for maintenance staff has been developed to meet the internal needs of the organisation, rather than any specific external requirements or recommendations. However, the government is currently drafting legislation aimed at clarifying definitions and responsibilities with regard to 'safety critical' activities which may have an impact on the competence management systems required.

### System overview

The system developed by the organisation is similar to the National Vocational Qualification (NVQ) system in that it uses a series of Units of Competence within it but does not lead to a nationally recognised award. Within the system, the candidate is considered as being competent for specific time periods, with the length of the time period ranging between 12 and 24 months depending on a risk-based assessment of the activity. Details of the scope and expiry of an individual's competence is detailed within their personalised Safety Certificate.

### Scope of competence management system

The system incorporates all staff within the organisation associated with the maintenance and/or operation of the rail system.

### System design

The system is based upon a series of internally-generated manuals that identify activities which are deemed to be Safety Critical.

### Recruitment & selection

The minimum requirement for new maintenance staff is that they must have completed a recognised engineering apprenticeship and achieve minimum standards in occupational health. It is not essential for new maintenance staff to have completed vocational training specific to the rail industry.

### Initial training

The organisation's centralised training function assimilates information from local training needs analyses. These are used to design and deliver suitable training packages. Training normally takes place outside of the workplace.

### Assessment

Assessments can be either planned or unannounced. Two main methods are used to assess the competence of the individual:

- *Observation*
- *Questioning*

Assessors are occupationally-competent authorised line managers.

There is no formal periodic verification of the competence assessments.

### Certification & licensing

Details of competences and expiry dates are detailed within personalised Safety Certificates. These are held on the personal files of the candidates rather than being issued to the candidate and are only valid within the organisation. Fraudulent issue and use of such

licences/certificates is not perceived to be an issue due to the absence of contracted staff. Although the Safety Certificates do not have an expiry date, individual activities within the certificate do.

- Safety Certificate (used to record details of all units/elements of competence that have been successfully completed)

## Records

The system uses a number of paper forms to record the following:

- Assessment plan (used to record the units and elements to be assessed, the methods of assessment that will be used, the candidate's agreement of the plan).
- Observation of Standards record (used to record an assessment of a candidate against one or more of the applicable units/elements of competence)
- Feedback record (used to record feedback given to a candidate following an assessment session)

## Indicators of performance

Supervisory staff and/or auditors can request additional assessments if they believe that an individual's performance does not meet the standard expected.

## Resource requirements

The competence management system is operated and managed by a centralised training function. This level of resourcing is significant, but is required to meet all of the organisation's training commitments (40,000 training days in 2001).

Line managers and supervisors of the maintenance staff also have roles within the system, especially in the formal assessment of their staff.

## Comments on system

Strengths	Limitations
<p><b>Bespoke system</b> - The current system has been designed and implemented by staff in the organisation, which results in it meeting its specific needs.</p> <p><b>No reliance on technology</b> - The system uses paper forms and simple methods for its operation and management. It requires no specialist IT equipment, communications links or software.</p> <p><b>Supervisory/management staff ownership</b> - The system in use requires the active involvement of supervisory and management staff during the training needs analysis, competence assessment and monitoring of staff. As a result, there is significant ownership of the system and supervisors/managers make use of the outputs of the system in planning and strategic decision making.</p> <p><b>Integrated system</b> - The competence management system is integrated with the organisation's management systems.</p>	<p><b>Focus on safety critical tasks</b> - By focusing only on tasks that have an impact on safety, the system may not address competence in tasks that have significant business risk associated with them (reliability, customer environment for example).</p> <p><b>Focus on current requirements</b> - The system has been developed to address competence in safety critical tasks carried out on existing equipment. The system does not look at future competence requirements either in terms of new equipment that may be procured or in terms of preparing individuals for their next job (development of management competencies for example).</p>



## 6.5 Underground rail network rolling stock maintainer

### Organisation

The organisation surveyed maintains the rolling stock (and other infrastructure) for several lines of London's underground rail network. Each line has a maintenance depot for rolling stock – the depot surveyed as part of this project has 76 staff engaged in maintenance operations.

### Reason for system

The system was introduced as a pilot scheme for maintenance staff to gain National Vocational Qualifications in rail vehicle maintenance, as a result of this formal approach it was anticipated that overall competence levels would be raised. The system is still in development.

### System overview

The system uses the National Occupational Standards for the rail industry developed by the Rail Industry Training Council. Entry into the system to work towards an NVQ is voluntary, but take up has been high. The system uses the NVQ framework for rail vehicle maintenance, with the target being achievement of an NVQ at Level 2.

Once an individual achieves the NVQ he is deemed competent and no further assessments currently take place of ongoing competence.

### Scope of competence management system

The system is open to all train maintenance staff at the maintenance depot. It is intended that the system will be expanded to cover other maintenance depots in the future.

### System design

To gain an NVQ at Level 2, train maintenance staff have to complete 8 mandatory units covering generic engineering tasks on rail vehicles and 3 elective units (from a choice of 6).

The 8 mandatory units are:

1. Maintaining condition of engineering assets
2. Return engineering assets to service by component removal & replacement
3. Prepare resources for routine engineering activities
4. Reinstate work area after engineering activities
5. Conduct specified testing of engineering assets
6. Check engineering assets' compliance with specifications
7. Contribute to the effectiveness of work activities
8. Contribute to minimising risks to life, property & the environment

The organisation has selected common engineering tasks on rail vehicles so that staff from different work areas would be able to work towards the NVQ. The tasks selected cover 3 main engineering systems in use on rail vehicles: electrical, mechanical and hydraulic/pneumatic. Within these broad systems, more specific elements relate to brake systems, traction supplies, safety devices etc.

### Recruitment & selection

At present the system does not incorporate recruitment and selection

### Initial training

When an individual applies to start work towards the NVQ an initial assessment of existing skills and knowledge is made by the depot NVQ assessor. Gaps can then be filled by classroom or on-the-job training and coaching.

### Assessment

Assessors are qualified to the national NVQ assessor standard. Individuals are assessed using the standard NVQ approach of:

*Observation* – assessors observe the candidate performing the activities

*Questioning* – candidates answer structured questions to demonstrate that they have the required level of underpinning knowledge

*Documentary evidence* – candidates provide a portfolio of documentary evidence to demonstrate that they have undertaken the required activities

### **Certification & licensing**

As discussed, the system leads to an NVQ Level 2. The organisation also operates a ‘skills licensing’ system where individuals are licensed to carry out specific tasks (such as maintenance examinations, daily checks, operation of fork lift truck).

### **Records**

The NVQ system requires each individual to compile a large portfolio of evidence, assessment records for each element and unit are also maintained by the depot NVQ assessor.

### **Indicators of performance**

The system does not currently have a feedback mechanism whereby a further assessment of an individual’s performance can be made if a possible shortfall in competence is suspected.

### **Resource requirements**

The system is managed and operated by a local NVQ assessor/technical trainer and covers 76 maintenance staff.

## **Comments on system**

The system in use was not originally intended as a full competence management system, rather it was intended to introduce the concept of NVQ’s to recognise the skills of the workforce. It has been recognised that the system offers significant scope for development into a sophisticated competence management system that can be used to monitor ongoing competence as well as providing individuals with a nationally-recognised award for the skills that they possess.

<b>Strengths</b>	<b>Limitations</b>
<p><b>National award</b> – with the system leading to a nationally-recognised award, it has proven to be very popular with maintenance staff, resulting in a high level of ‘buy-in’ from individuals.</p> <p><b>Structured approach</b> – the NVQ approach provides a high level of consistency in standards and excellent records providing a full audit trail of an individual’s achievement of competence.</p>	<p><b>Focus on award</b> – the system focuses the engineering activities that are required to meet the NVQ national standard. This means that all safety-critical activities may not be covered and non-engineering activities (such as the correct performance of booking-on tasks) are also not covered.</p> <p><b>No ongoing assessments</b> – with the objective of the system being the achievement of an NVQ, there are no ongoing assessments of competence. The organisation has recognised this limitation and is already considering implementing further assessments of individuals.</p>

	<p><b>Limitations</b> <i>Continued</i></p> <p><b><i>Integration with other systems</i></b> – the NVQ system operates independently of most other management systems in the organisation. For example, the organisation also operates separate licensing schemes for individuals that carry out defined safety-critical roles:</p> <ul style="list-style-type: none"> <li>• Offering a train as being fit for service</li> <li>• Offering a train into service</li> <li>• Offering a train back into service</li> </ul> <p>Basic competence assessments are undertaken for individuals carrying out these roles and licences issued. The competence assessments are not as thorough or structured as the NVQ process and generally are not applicable to those individuals that are carrying out maintenance tasks on vehicles. This system operates independently of the NVQ system.</p>
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## 6.6 UK commercial passenger airline industry

### Organisation

The UK's civil aviation industry has the Civil Aviation Authority (CAA) as the regulatory body for safety, economic and consumer issues.

Within the CAA, the Safety Regulation Group (SRG) is specifically responsible for safety issues, for example;

- Pilot licensing
- Airworthiness of aircraft
- Airlines, aerodromes and air traffic control services
- Maintenance engineer licensing

The competence assurance systems associated with engineering maintenance staff responsible for the airworthiness of aircraft are considered here.

### Reason for system

The objectives of competence assurance systems, under the responsibility of the CAA, are primarily based upon a hierarchy of prescriptive specific standards and recommend practices for civil aviation stemming from the first International Civil Aviation Conference (Chicago, 1944). Examples include;

- Joint Aviation Requirements (JAR), which are harmonised with European standards
- British Civil Aviation Requirements (BCAR), which apply at a national level

### System overview

The CAA prescribe entry requirements for individuals to become aircraft engineers, set a syllabus for education and training and undertake the final assessment before individuals are presented with a licence which provides them with the authority to work on aircraft. The individual must then gain further work experience on specific aircraft types with a CAA-licensed maintenance organisation .

organisation before they are permitted to release aircraft to service (termed a 'Certifying Engineer').

### Scope of competence management system

The system encompasses all UK skilled maintenance staff associated with releasing civil aircraft into service – approximately 6000 individuals.

### System design

The role of the safety regulator in this industry (the CAA) differs markedly from all the other industries surveyed. Here the safety regulator not only sets the competence standard but also carries out the initial assessment of individuals and the issue of the licence.

### Recruitment & selection

Entry requirements to become a maintenance engineer have been set, based on both academic qualifications and relevant experience.

### Initial training

The CAA has developed the standards and syllabus for maintenance staff covering general aircraft systems and maintenance procedures.

### Assessment

Following the initial training, candidates are required to take a written examination followed by an interview. If the candidate is successful in both of these a basic licence will be awarded. This licence does not give the individual any certifying privileges (i.e. the right to sign an aircraft as 'fit for service'), this is only gained after the individual has gained experience of specific aircraft types with an approved maintenance organisation.

## Certification & licensing

There are two types of licence:

1. **British light aircraft licence** ('Section L' licence, where aircraft is less than 5700kgs)
2. **Joint Aviation Authority (JAA) licence** (where aircraft are greater than 5700kg), which is generally recognised across the (predominantly European) member nations. This licence is specified in JAR-66, which aims to provide a qualification in aircraft maintenance that demonstrates the achievement of an underpinning level of knowledge

Licences are issued by the CAA for life. However, individuals must undertake continuation training within their organisation every two years. This training will cover changes to aircraft systems, working practices and company procedures. Evidence that this training is being carried out is sought when the CAA undertakes surveillance audits on the organisation.

## Records

The CAA maintains a record of all the certifying engineers who have been issued with the basic licence.

## Indicators of performance

Audits covering the maintaining organisation as a whole are conducted by the CAA on both time and risk-based intervals. Such audits will not only check the competence records of individual maintenance personnel but also whether the level of resourcing on a particular shift was adequate to permit certifying engineers to carry out their responsibilities.

## Resource requirements

The competence licensing and assurance/audit programme has approximately 60 staff employed (known as 'surveyors'). These staff cover 436 approved maintenance organisations and approximately 7,000 licenced maintenance engineers.

## Comments on system

The system in place in this industry forms part of the wider accreditation and assurance process for aircraft maintenance organisations. The industry appears to have a good relationship and clear understanding of the role of the CAA as safety regulator.

<b>Strengths</b>  <b>Holistic process</b> – the close involvement of the safety regulator in all aspects of the maintenance organisations' operations means that there is less emphasis on detailed ongoing assessments of an individual's competence. Instead, the whole of the management systems for maintenance engineers to get trained, gain experience etc is subject to scrutiny – the focus is at the organisational rather than the individual level.	<b>Strengths continued</b>  <b>National licensing scheme</b> – This operates on two levels:  <i>Individual</i> - The CAA assesses each maintenance engineer before granting them a basic licence.  <i>Organisational</i> – The CAA operates an accreditation scheme for maintenance organisations, only those organisations that are approved by the CAA may carry out maintenance work on aircraft  <b>Limitations</b>  <b>Complex to implement</b> – the system is holistic in nature and has evolved over many years, making it difficult to replicate in other industries.
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## 6.7 UK hovercraft operator

### Organisation

The organisation surveyed designs, builds, maintains and operates a small number of passenger-carrying hovercraft in the UK. The safety regulation of this industry now falls within the remit of the Maritime & Coastguard Agency (MCA). However, up until recently the safety regulator for hovercraft operations was the Civil Aviation Authority (CAA).

### Reason for system

The organisation is fairly small and as a consequence it is recognised that it is critical to commercial success to have employees that are capable of performing a wide variety of tasks to keep the fleet safe and reliable. At present the regulatory body has not required a formal competence management system to be introduced.

### System overview

The system is very informal and is heavily reliant on local knowledge of potential employees (these are drawn from a small local community) and close working relationships with existing workforce.

### Scope of competence management system

The system covers all maintenance, repair and construction work at the main works and passenger terminal.

### System design

The system has evolved over several years in the light of operational experience and business needs. Staff turnover is very low and working relationships are very close and a formal process of assessing staff competence has not been felt to be necessary.

### Recruitment & selection

New staff are drawn from a small local community, where the individuals are well known to the managers of the organisation. Staff are generally recruited after they have completed a recognised apprenticeship or have gained relevant experience.

### Initial training

Training courses are being developed, covering all the main systems of the craft. This comprises both classroom and practical training and is conducted in-house by suitably experienced staff.

### Assessment

Assessment is carried out through supervisory staff observing and questioning individuals 'on the job' once they have completed their initial classroom and practical training. There is no ongoing formal assessment of competence.

### Certification & licensing

There is no formal licensing scheme in place for the routine tasks of maintenance and repair work. Specialist tasks (such as propeller repair and balancing for example) are carried out only by staff that have successfully completed a manufacturer's training course.

### Records

Post-training assessments of individuals are being recorded as these are introduced. No records of assessments are maintained.

### Indicators of performance

The close working relationships mean that errors are normally detected before a craft leaves maintenance and individuals can receive immediate coaching where necessary.

### Resource requirements

There are no resources dedicated to operating this system, all training and assessment being carried out by engineering managers and supervisory staff.

### Comments on system

The means by which staff competence is assured within this organisation is through informal methods, relying heavily on close working relationships and staff experience. There is no pressure from the industry regulatory body to introduce formal systems, although this requirement may change in the future.

Strengths	Limitations
The informal arrangements that currently exist for assessing staff competence help to maintain the close working relationships that exist between maintenance staff and their managers.	The absence of competence standards, formal assessment process and associated records would make the organisation very vulnerable in the event of an accident or incident occurring where maintenance staff error could have been a factor.

## 7 References

1. HSE Press Release E140:00 - 3 August 2000; “Maintenance accidents through human error increasing, warns HSE”
2. Collins English Dictionary, 3<sup>rd</sup> Edition
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4. Health & Safety Executive – “Assessment criteria for railway safety cases; Section 6 – Developing and maintaining staff competence”
5. Railtrack Safety & Standards Directorate – July 2000; “Competence in strategic safety management. A good practice approach to assessing and developing senior management teams.”
6. Department for Education & Skills (DfES), Modern Apprenticeships website: <http://www.dfes.gov.uk/modapp>
7. Department for Education & Skills (DfES), NVQ website: <http://www.dfes.gov.uk/nvq>
8. Health & Safety at Work etc Act, 1974
9. ISO9001:2000 – Quality Management Systems
10. Firefighter Integrated Personal Development Working Group (a joint venture comprising representatives from across the UK Fire Industry), website: <http://www.firepod.org.uk>

### **Other references used in the writing of this report:**

The Management of Health and Safety at Work Regulations 1992

Rail Industry Training Council; National Occupational Standards for the rail industry

Health & Safety Executive – “Southall Rail Accident Inquiry Recommendations”