Management of Route Knowledge

Synopsis

This document sets out requirements and guidance relating to the route knowledge of staff. This includes training, development, monitoring and assessment.
**Management of Route Knowledge**

**Issue record**

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| Two   | 07/12/2014 | Replaces issue one.  
Revised document includes additional requirements and guidance dealing with drivers who transfer in (section 2.2.3) or are employed on 'zero hours’ contracts (section 2.2.4). The changes have been made in response to a RAIB recommendation. Minor editorial changes have also been made throughout the document. |
| Three | 07/03/2020 | Replaces issue two.  
a) Changes made to incorporate the findings of RSSB research projects T1108 and T1151.  
b) New requirements, rationale and guidance which provide details on the route risk assessment and the development of a route learning plan and route learning material.  
c) New appendices providing guidance on route knowledge requirements for drivers and for guards, how to create a route story and develop a route learning plan, and integrating non-technical skills (NTS) into a route learning plan. |

Revisions have not been marked by a vertical black line in this issue because the document has been revised throughout.

**Superseded documents**

The following Railway Group documents are superseded, either in whole or in part as indicated:

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<td>RIS-3702-TOM Rail Industry Standard for Management of Route Knowledge for Drivers, Train Managers, Guards and Driver Managers, issue two</td>
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Supply

The authoritative version of this document is available at www.rssb.co.uk/railway-group-standards. Enquiries on this document can be submitted through the RSSB Customer Self-Service Portal https://customer-portal.rssb.co.uk/
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Part 1  Purpose and Introduction

1.1  Purpose

1.1.1  This document is a rail industry standard on the management of route knowledge.

1.1.2  This document sets out requirements and guidance relating to the route knowledge of staff who carry out safety critical activities. This includes training, development, monitoring and assessment of staff on route knowledge and route risks, regardless of the type of signalling in operation. This document also contains additional guidance to be considered by railway undertakings during the development and management of their route learning and assessment processes.

1.1.3  Route knowledge is defined as the information required to predict, identify and interpret route specific cues to complete an operational railway task safely and effectively. The required information must be available when needed for the task(s) being carried out, whether it is provided by long-term memory (through knowledge and experience) or through documentation/verbal advice.

1.1.4  The requirements and guidance are consistent with legal obligations set out in the Railways and Other Guided Transport Systems (Safety) Regulations 2006, the Technical Specification for Interoperability relating to the operation and traffic management subsystem (OPE TSI) and the Train Driving Licences and Certificates Regulations 2010 (TDLCR).

1.2  Application of this document

1.2.1  Compliance requirements and dates have not been specified because these are the subject of internal procedures or contract conditions.

1.2.2  If you plan to do something that does not comply with a requirement in this RIS, you can ask a Standards Committee to comment on your proposed alternative. If you want a Standards Committee to do this, please submit your deviation application form to RSSB. You can find advice and guidance on using alternative requirements on RSSB’s website www.rssb.co.uk.

1.3  Health and safety responsibilities

1.3.1  Users of documents published by RSSB are reminded of the need to consider their own responsibilities to ensure health and safety at work and their own duties under health and safety legislation. RSSB does not warrant that compliance with all or any documents published by RSSB is sufficient in itself to ensure safe systems of work or operation or to satisfy such responsibilities or duties.

1.4  Structure of this document

1.4.1  This document sets out a series of requirements that are sequentially numbered. This document also sets out the rationale for the requirement, explaining why the requirement is needed and its purpose and, where relevant, guidance to support the requirement. The rationale and the guidance are prefixed by the letter ‘G’.
1.4.2 Some subjects do not have specific requirements but the subject is addressed through guidance only and, where this is the case, it is distinguished under a heading of ‘Guidance’ and is prefixed by the letter ‘G’.

1.5 Approval and authorisation of this document

1.5.1 The content of this document was approved by Traffic Operation and Management Standards Committee (TOM SC) on 3 December 2019.

1.5.2 This document was authorised by RSSB on 31 January 2020.
Part 2 Requirements for Managing Route Knowledge

2.1 Determining what route knowledge is required by staff

2.1.1 Railway undertakings shall identify and document the elements of route knowledge essential to their staff for the safe operation of trains.

Rationale

G 2.1.2 Having a complete understanding of the route knowledge features that are essential to complete tasks safely and effectively enables railway undertakings to create effective and efficient route learning programmes for their staff.

G 2.1.3 Accurate recording and retention also helps to identify any changes that may be required to route knowledge requirements or the tasks that members of staff are required to carry out. These changes could be as a result of changes to the infrastructure, signalling, the introduction of new rolling stock or new/altered methods of working.

Guidance

G 2.1.4 The route knowledge elements required by staff can be identified using a structured task/risk-based assessment.

G 2.1.5 T1108 Achieving a step change in route knowledge management provides guidance on the development of route learning processes, materials and assessments for drivers, driver managers and route conductors.

G 2.1.6 T1151 Making a step change in guards/on-board operational staff route knowledge provides guidance on the development of route learning processes, materials and assessments for guards and train managers.

G 2.1.7 Carrying out a task analysis of each individual job role can be an efficient way to start to identify the elements of route knowledge required to achieve the safe operation of trains.

G 2.1.8 If carrying out an analysis of tasks in order to identify the route knowledge requirements, it is worth considering the impact different types of signalling systems, train dispatch methods and driver aids may have on route knowledge requirements.

G 2.1.9 Route knowledge requirements identified during RSSB research projects T1108 and T1151 can be found at Appendices C and D.

G 2.1.10 It is important to consider whether the identified essential route features can be retained by memory or by other means such as verbal, pictorial or written information.

G 2.1.11 Methods of providing route information can be found in Appendix H.

G 2.1.12 To help to understand the knowledge required by staff on a particular route, an organisation needs to understand and manage its risks on an ongoing basis. This will help to capture any changes that are required to be made.

G 2.1.13 RSSB has published two key documents regarding risk management and making changes that affect safety:
a) *Taking Safe Decisions* v3 (RSSB, 2019) - industry’s consensus view on how safety is taken into account when taking decisions


These documents are useful as a primary resource for an organisation making a decision that affects safety.

G 2.1.14 Many tasks that staff perform have specific risk assessments associated with them, particularly when they involve complex interaction with other roles and/or may be infrequent in occurrence.

G 2.1.15 Where applicable, consideration can be given to the impact that driver aids may have on the route knowledge elements that drivers retain in their memory. It may be the case that driver aids could be used as a method of receiving route information. This can include the driver machine interface (DMI) when operating under the European Railway Traffic Management System (ERTMS).

### 2.2 The route risk assessment

2.2.1 Railway undertakings shall carry out and record a route risk assessment to identify the information staff need to know to operate safely and effectively over a specific route.

**Rationale**

G 2.2.2 The route risk assessment identifies the key or significant risks that will be encountered by staff operating over a specific route.

G 2.2.3 The findings of the risk assessment can be used along with the findings of the task/risk-based assessment detailed in Appendix A of this document to determine the information that each member of staff needs to know when operating over the route concerned.

G 2.2.4 When staff fully understand the tasks they are expected to complete and the risks associated with those tasks, they will be able to operate over the route safely, with confidence and in an efficient manner.

G 2.2.5 Efficient operation can lead to safety, environmental, financial and performance benefits.

**Guidance**

G 2.2.6 A route story can be developed to complete the route risk assessment. This involves developing detailed information for each cue on the route in a sequential list for each line of a route using the essential route requirements identified. Further guidance on how to develop a route story is provided at Appendix B.

G 2.2.7 When carrying out a route risk assessment, the following factors can be considered:

a) Factors about the route provided by experienced staff, managers and trainers, where applicable
b) Learnings from incident investigation reports

c) Recommendations of signal sighting committees

d) Route factors from the infrastructure manager

e) Best practice from local, regional or national cross-industry risk management groups

f) The complexity of station, junction and yard layouts and associated signalling

g) Local instructions in operation over the route

h) Time of day and year when climatic conditions may negatively affect a route or part of a route.

2.2.8 It is good practice that route risk assessment processes are applied consistently across each individual route to ensure consideration is given to all factors, appropriate to the type of operation, which might affect safe operation.

2.2.9 Railway undertakings that operate over the same infrastructure may benefit from collaborating to consider factors that affect their operations and the risk mitigation measures that may be applied to reduce those risks ‘so far as is reasonably practicable’ (SFAIRP).

2.2.10 Consideration may be given to freight train and on-track machine operations when identifying risks as they are likely to encounter a wider range of signal aspects and spend more time running from loop to loop and through relief lines.

2.3 Developing a route learning plan

2.3.1 Railway undertakings shall develop a route learning plan to provide staff with the necessary knowledge to operate trains in normal and degraded conditions.

Rationale

G 2.3.2 Having a route learning plan will ensure that all staff who have been identified as requiring route knowledge to complete tasks specific to their job role are trained at an appropriate time during their development.

G 2.3.3 A pre-defined route learning plan for each individual job role and for each individual route can also link to the assessment plan for each member of staff.

G 2.3.4 It may be the case that separate companies operating over the same route have different route learning plans for that route. The route learning plan would reflect the tasks that a member of staff is required to carry out over that particular route.

Guidance

G 2.3.5 When creating a route learning plan, the evidence from the route risk assessment will help to decide:

a) The route knowledge requirements for each member of staff;

b) The media provided for route learning;

c) The method of training (such as coaches or cab rides) - see Appendix E and Appendix H; and

d) The timescales for the training.
G 2.3.6 Route learning is normally preceded by:
   a) Briefing on the principles of route learning;
   b) Providing the learner with route information materials;
   c) Briefing the learner on the route learning requirements; and
   d) Providing a means to enable the route learner to note key points in a structured way.

G 2.3.7 Factors that can affect the ability of staff to learn and retain route knowledge can include:
   a) The complexity of the route (such as junctions and stations) as identified in the route risk assessment
   b) The variation of traction-specific operating instructions for each individual route
   c) The differences between the route concerned and other routes over which the member of staff operates. For example:
      i) Is a driver learning a route controlled by absolute block signalling for the first time?
      ii) And will they need refresher training on how absolute block signalling works so that they can familiarise themselves with rules and operational procedures associated with learning a different type of train control?
   d) The frequency over which the route is operated in any given conditions, such as:
      i) Bi-directional working, including simplified bi-directional working (SIMBIDS)
      ii) Pilotman and modified working.

G 2.3.8 The risk of skill fade in relation to the routes over which members of staff are already competent is an important consideration when creating a route learning plan. A reduction in the risk of skill fade may be achieved by allowing a member of staff a period of driving over a freshly learnt route prior to commencing training on a new route.

G 2.3.9 Assessing the levels of route knowledge competence already held by newly employed staff can help to determine if further training is necessary. The assessment may include the following:
   a) Conducting a detailed training needs analysis, taking into consideration the individual’s experience
   b) Determining any potential competence gaps
   c) Creating and documenting a detailed individual training plan to meet the identified needs
   d) Providing training in accordance with the plan
   e) Assessing and documenting the member of staff’s competence using company processes.

G 2.3.10 Consideration can then be given to:
   a) The last time over which the route(s) has been operated and whether this is aligned with company policy;
   b) The amount of time previously spent operating over the route(s); and
c) The different operating characteristics of traction and train types to those operated in the past, such as stopping / fast services, suburban / intercity services, freight / passenger, high-speed operation, multi-mode, operation of doors and their location within the train.

G 2.3.11 If deemed necessary, and where practicable, additional training and development can be provided to staff who have not had opportunities to experience non-routine and degraded operations on the routes being learned. This can be designed to include:

a) Route-specific simulators
b) Table top simulation
c) Safety update days
d) Additional rules and procedures training
e) ‘Shunt of the month’ briefings
f) Professional discussions.

G 2.3.12 If the railway undertaking that is employing the route learner cannot facilitate route learning over the route to be learnt, for example if they are not operating trains over the route at the time of route learning, alternative training may be considered. One option is for an arrangement to be agreed with another operator so that the route learner can travel on the other operator’s train. In this case, a cab entry authority can be agreed between both railway undertakings.

G 2.3.13 Some of the required skills and knowledge may be delivered by providing experience of working trains either in the real-time environment or with the use of simulators:

a) During weekend/evening engineering diversions;
b) At night; and
c) During the leaf fall period.

G 2.3.14 When operating during engineering works, the likelihood of experiencing rarely used shunt movements is greater. These movements would be deemed as high risk as they are infrequently used. Additional briefing plans and materials can be prepared to help staff who are required to operate during engineering works.

G 2.3.15 Different methods of route learning and their strengths and weaknesses can be found in Appendix E and Appendix H.

2.4 Developing the training materials

2.4.1 Railway undertakings shall provide up-to-date training materials that include risk factors and the information needed to operate safely and efficiently over a route.

Rationale

G 2.4.2 The production of appropriate training materials for staff and using the information identified in the risk assessment allows staff to gain a full understanding of all the information that they will need whilst operating over a particular route, including risks that they may encounter.
Creating and maintaining route learning materials can enable railway undertakings to identify any material that requires amendment due to changes in the tasks and activities to be carried out by staff.

**Guidance**

Developing a ‘route story’ (see Appendix B) to use as route learning material is an effective method of achieving consistency of information across training materials.

Understanding the route factors that could affect the ability of staff members to learn the route and to retain the information learnt can help a railway undertaking in deciding the content of the training materials that it produces.

The production of route training materials can be made more efficient and inclusive if operators work together.

When developing training materials, it is important to consider the following factors to ensure that the materials are appropriate for the different user-requirements/needs:

- a) New entrants with no previous operational experience of the railway environment
- b) Existing staff learning new or revised routes
- c) Staff with previous operational experience
- d) Learning styles of the staff
- e) Timescales allocated to the staff within which to learn the route.

Greater accuracy may be achieved if the person creating the route story has experience of carrying out the operational tasks over the route concerned.

Considering whether these materials will be provided in paper-based form or digitally may also be influenced by company policies on the use of electronic equipment in the operational environment.

Methods of providing route information are described in Appendix H of this document.

### 2.5 Assessing route knowledge

Railway undertakings shall base route competence assessment processes for each task on the essential route knowledge requirements and identified route risks.

**Rationale**

Basing the route competence assessment on the requirements identified during the task and route risk assessments will ensure that staff are competent in all the areas required to operate over the route concerned.

With staff trained and assessed as competent in the methods of degraded operation, the risks presented by these operational tasks, including the fact that they are infrequently implemented, will be reduced.

**Guidance**

Route competence assessments include but are not limited to:
a) Initial assessment of competence  
b) Periodic/continual assessment of competence  
c) Assessment following period of route refreshing  
d) Assessment after learning changes to infrastructure  
e) Assessment of any new methods of working introduced following changes to infrastructure or the introduction of new rolling stock.

G 2.5.5 Allowing members of staff to measure their competence at intervals throughout the training can help to ensure that the assessment is taken at the correct time. This measuring of competence can be achieved through regular catch-up meetings or by having short knowledge check-style assessments.

G 2.5.6 Supplying the route learner with an outline of the assessment criteria helps them to make a decision as to when they are ready to take the assessment.

G 2.5.7 It is good practice to make the level and nature of route competence assessments proportional to the hazards and risks associated with the tasks of the role and as identified by the route risk assessment.

G 2.5.8 Assessment methods can involve, among other methods:
   a) Direct observation  
   b) Unannounced monitoring (for example, driving style assessed)  
   c) Use of a simulator  
   d) Route map drawing  
   e) Written and verbal assessments using open and multiple choice questions  
   f) Commentary  
   g) Online assessments.

G 2.5.9 Route competence assessment criteria is intended to be unambiguous and state clearly the intended task outcomes so that it promotes a consistent standard of assessment irrespective of by whom it is performed.

G 2.5.10 Within the route competence assessment, along with practical application of the task, the testing of recall and reasoning will enable the assessor to gain a greater understanding of the level of knowledge relating to each task the route learner has obtained.

G 2.5.11 Railway undertakings may consider developing an internal assurance process to check that route training and competence assessments are being carried out consistently and achieving the intended outcomes.

G 2.5.12 It is appropriate to consider including within the route competence assessment specific methods of operation over a route that differ during degraded operations.

2.6 Route knowledge retention

2.6.1 Railway undertakings shall calculate the frequency each staff member operates over a route in order to retain their competency.
**Rationale**

G 2.6.2 Calculation of the minimum frequency that a staff member needs to operate over a route is used to ensure that their route competency does not expire. The calculation, based on the risk assessment, can also be incorporated within train planning and rostering programmes.

G 2.6.3 As individuals retain information over various lengths of time, having a system for staff members to request refresher training can help to optimise their confidence over a route whilst also maintaining their competency. This system for requesting refresher training can also empower staff to take ownership of their route competency.

**Guidance**

G 2.6.4 One of the most effective methods of retaining route knowledge is by working regularly over the route during normal operations. Considering this when rostering can help to achieve a balanced level of knowledge retention for all members of staff.

G 2.6.5 The most effective method of route refreshing to be used in any given situation can be selected with the help of a training needs analysis.

G 2.6.6 Route knowledge retention can be influenced by:

a) Route complexity  
b) The types of train operating over the route  
c) Operations during degraded working.

G 2.6.7 Additional consideration can be given to the retention levels achievable over infrequently used routes, rarely executed shunt moves and locations where the route is considered as complex. The provision of route refreshing materials can help to reduce knowledge fade.

G 2.6.8 By collaborating with infrastructure managers in advance of engineering works being carried out, any infrequently used shunt movements and diverging routes can be identified. Once identified, additional/refresher training or the provision of conductor drivers can be planned to address any concerns about the route competency of staff.

G 2.6.9 Sharing the minimum frequency requirements for route knowledge retention with all staff involved in rostering, training and the management of route learning can help to identify individuals who may be nearing the minimum frequency and therefore allow mitigating measures to be taken.

G 2.6.10 The following factors may affect the frequency that staff operate over a route:

a) Changes to roster structures  
b) Mutual exchanges in turns of duty  
c) Annual leave, sickness, absence or employment in other duties  
d) Changes to the train plan/timetable.

G 2.6.11 When deciding when staff are in need of route refresher training, the following factors can be considered:

a) The last time over which the route(s) was operated or learning was refreshed and whether this is aligned with company policy  
b) The total amount of time already spent operating over the route(s)
Management of Route Knowledge

2.7 Competence of staff involved in the development of route learners

2.7.1 Staff involved in the development of route learners shall have sufficient, relevant and up-to-date occupational competence.

Rationale

G 2.7.2 Having a clearly defined competence criteria makes it easier to identify any additional training needs for staff involved in the development of route learners if they transfer from one railway undertaking to another.

G 2.7.3 Should there be any members of staff that transfer from one location to another, if the training and assessing has been completed using the same criteria across all railway undertakings, any additional training required will be identified more effectively.

G 2.7.4 The Train Driving Licences and Certificates Regulations (TDLCR) 2010 describe the route competence criteria for train drivers.

G 2.7.5 The TDLCR 2010 requires that route knowledge training is provided by a recognised trainer.

Guidance

G 2.7.6 It is important that railway undertakings consider both the professional skills (such as leadership, communication, coaching) and occupational competence (skills and experience in related job role) required for staff who train and assess route knowledge.

G 2.7.7 The occupational competence required of instructors, assessors and managers can be determined through the completion of a training needs analysis for each individual job role.

G 2.7.8 Following completion of a training needs analysis for staff involved in the development of route learners, any additional professional and/or occupational development can be identified, and a suitable training plan created.

G 2.7.9 Competence assessments and continued professional development of staff involved in the development of route learners form an important part of the overall competence management system. Competence assessments would be of greater benefit if they are planned to occur at regular intervals during the competence cycle.

G 2.7.10 Assurance processes may be used to monitor the competence of managers operating the competence management system.

G 2.7.11 Consideration may be given to the skills and knowledge of staff assessing those who carry out route conducting. Where skills or knowledge gaps are identified, additional training would normally be provided. These gaps in skills and knowledge can be identified by carrying out a training needs analysis.
Methods and guidance on how to assess route knowledge competency can be found in Appendix J of this document.

2.8 Changes to route knowledge requirements

2.8.1 Railway undertakings shall undertake regular reviews of operational tasks and route risk assessments to establish the impact of any changes that may affect route knowledge requirements.

Rationale

G 2.8.2 Reviews of existing route risks and operational tasks against any changes that may affect route knowledge requirements will aid in identifying any new risks arising from the changes or any risks that may no longer be present following the changes.

G 2.8.3 Reviewing the impact of any changes that may affect route knowledge requirements will identify any amendments that may be required in the training of route knowledge.

Guidance

G 2.8.4 Railway undertakings may consider reviewing operational task requirements of a role and route risk assessments when:

a) There are changes to the infrastructure (such as resignalling, new signalling systems and remodelling)
b) There are changes to timetables
c) New or altered rolling stock are to be introduced
d) Train lengths and loads are either increased or decreased (to consider train paths and the uses of loops and sidings)
e) Incident investigations reveal shortcomings in route knowledge
f) Close call reporting identifies potential new risks
g) Potential route risks are identified by staff, trainers or their managers.

G 2.8.5 The review of route risk assessments and operational task requirements is intended to identify, amongst other things:

a) Any new or increased risks arising from infrastructure changes;
b) Any existing requirements that are no longer relevant;
c) Appropriate measures to control the risks SFAIRP;
d) The effects that changes may have on the ability of members of staff to retain the required level of route knowledge;
e) Required changes to:
   i) The training plans and materials used for route knowledge training; and
   ii) The competence management system and assessment processes.

G 2.8.6 It is important that all staff affected by changes to route knowledge requirements are briefed. There may be a need to apply different levels of briefing depending on the level of risk of the changes, as identified during the route risk assessment.
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Methods of providing route learning materials can be found in Appendix H of this document.

2.9 Records of route risk assessments and route knowledge training and assessment

2.9.1 Railway undertakings shall maintain records of all route risk assessments, route knowledge training and assessment, and reviews of route knowledge.

Rationale

G 2.9.2 Maintaining records of route risk assessments will aid railway undertakings in identifying when any reviews of the route risks are required. The records can be used to review changes to route knowledge requirements and/or operational tasks and help determine the extent of the changes and what route learning materials need to be amended.

G 2.9.3 If records of route knowledge training and assessments are suitably maintained, any requirements for re-assessment or re-training can be easily identified.

Guidance

G 2.9.4 It is good practice for records on route knowledge training and assessment of individuals to include, at least, the following details:

a) Routes over which the individual has been certified competent
b) Route learning provided, including duration, method(s) used, time spent gaining operating experience (or reasons if operating experience is not provided)
c) Staff competence and assessment records.

G 2.9.5 Railway undertakings would usually document and brief the conditions under which the route learner is permitted to operate a train and the arrangements for supervision whilst the route learner is doing so.
Appendices

Appendix A  How to carry out a task-risk based assessment

The content of this appendix is intended for guidance only.

A.1 This appendix will explain a method for carrying out a new task/risk assessment. It is important that a full risk management process is completed after making any changes to the route knowledge competence process. Figure 1 illustrates a method for carrying out a generic risk assessment. This method is explained in more detail below the diagram.

Figure 1: A possible process for determining route knowledge requirements

Step 1. Identify the tasks for the job role held by the member of frontline staff (in normal, degraded and emergency operations)

A.2 The route features that could be route knowledge requirements will depend on the tasks for the job role. Therefore, the first stage involves identifying all the tasks that the member of staff is required to complete. This may also include steps in a task that they must not undertake (for example, do not open rear doors for a short platform). For the guard, for example, these tasks may include train dispatch, monitoring for risks at the platform-train interface (PTI) and emergency communications. A risk based training needs analysis will identify tasks applicable to a certain job role. For the driver, for example, these tasks may include things like maintaining an appropriate speed and stopping at the correct stations along the route.
Management of Route Knowledge

A.3 It is important to consider differences in operations. For example, there may be tasks that have different associated route knowledge requirements in degraded/emergency operations or there may be local instructions at specific locations.

Step 2. Identify which tasks require route knowledge

A.4 From the complete list of tasks that the member of staff is required to complete, the tasks that will require route knowledge are identified, and the route cues that are necessary to complete the tasks noted. This process can be done by consulting:

a) GERT8000 (‘The Rule Book’);
b) Existing company route risk assessments; and/or
c) Experts within an organisation (for example, guards, drivers and guard/driver managers)

A.5 This will result in a shorter list of tasks that require route knowledge to be completed, and the associated route cues required to complete them.

Step 3. Identify the credible consequences if there is a lack of route knowledge

NB: Steps 3, 4, 5, and 6 do not need to be completed chronologically.

A.6 Step 3 can be approached in two different ways. Each of the tasks identified in Step 2 can be examined to identify the consequences if the member of frontline staff tried to complete the task without route knowledge, or the list of cues that are associated with the tasks can be examined in the same way. Often, the list of tasks will be the more streamlined approach (meaning there are less tasks than cues so the process is shorter). However, for larger scale operations, it may be more efficient to consider the cues rather than the tasks.

A.7 There are five main types of consequence to consider:

a) Non-compliance with requirements
b) Commercial
c) Performance
d) Employee relations
e) Safety

A.8 When considering safety consequences, it is important to take into account the impact of insufficient or absent route knowledge rather than more general incidents. For example:

a) If a guard does not have good route knowledge about the important elements of the platform layout, then the platform starting signal may not be checked or not checked properly. This could be a consequence of not including platform layouts in guard route knowledge for train dispatch.

b) For drivers, if a driver does not have good route knowledge about the location of tunnels along the route, they may mistake one tunnel for another and consequently misinterpret their location. However, train faults or PTI incidents that may occur because of the train safety check not being adequately completed are a significant risk but not a route knowledge related risk.
Step 4. Identify existing control measures and whether route knowledge needs to be memorised

A.9 The objective of this section is to identify whether there are any control measures in place that would mitigate the identified consequences in Step 3. There may be a technological control measure in place which means that additional mitigating measures might not be required, for example, for the task of contacting the signaller in an emergency, staff may be able to make a GSM-R Rail Emergency group Call (REC).

A.10 Route information may need to be memorised by the route learner and therefore need to be part of route knowledge training. However, there are other ways that route knowledge can be provided to staff without relying on the recall of information from long-term memory. The formats in which route knowledge can be provided to staff are outlined in table 1.

A.11 The way that information is provided to staff is considered when identifying existing control measures in place.

<table>
<thead>
<tr>
<th>Route knowledge provision</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory (provided by training of staff)</td>
<td>The training and competence development of staff is the basis of route knowledge currently. Training on essential route cues and information provides the knowledge and skills for staff to complete operational tasks. Initial training, assessment and refresher training are required to build and retain route-related information.</td>
</tr>
<tr>
<td>Technology</td>
<td>Many members of staff are provided with company phones or tablets which can be used to provide information. For example, guards may have access to an app showing the train’s live location on a map. It can show if the train is stopped at a red signal and sometimes why (for example, to allow a fast train to cross over ahead or a crossing failure). This technology can support a guard’s situational awareness.</td>
</tr>
<tr>
<td>Documentation</td>
<td>Documentation may be used to support staff in their role. However, ease of access during operations, content and presentation all need to be carefully considered.</td>
</tr>
<tr>
<td>Verbal advice</td>
<td>Verbal advice is a particularly useful support for route knowledge in unusual or degraded situations where long-term memory knowledge is not regularly applied.</td>
</tr>
</tbody>
</table>

Table 1: Formats for route knowledge provision
Management of Route Knowledge

Step 5. Identify specific route knowledge requirements

A.12 This step involves identifying the specific route knowledge that would be required for the relevant job tasks identified in Step 2. This should not be confused with other competencies. For example, for the role of a guard undertaking the task of dispatching a train, the location of the platform starting signal and platform layout are route knowledge requirements but how to complete the train safety check is not.

A.13 Sources that can be used to ensure all relevant route features are considered as potential route knowledge requirements include:
   a) GERT8000 (‘The Rule Book’)
   b) Existing company route risk assessments
   c) Experts within an organisation (for example, guards and guard managers).

A.14 The output of this step will be a list of route knowledge requirements that map to tasks the member of frontline staff must undertake.

Step 6. Review Steps 3, 4, and 5 to decide which route knowledge requirements are essential

A.15 Reviewing the frequency of the tasks, the consequences of undertaking these tasks without route knowledge, and the existing control measures in place, will determine how route knowledge will be provided for each task. Documenting the reasons for each decision may be helpful if there is a subsequent need to carry out a full risk management process. Taking Safe Decisions (RSSB, 2019) provides guidance on how to take decisions that are grounded in risk-based evidence.
Appendix B  How to create a route story to complete the route risk assessment

The content of this appendix is intended for guidance only.

B.1 Operators can carry out a route risk assessment that includes both route information and route specific risks. A good way to complete the route risk assessment is through developing a ‘route story’. This appendix will provide step-by-step guidance on how to create a route story.

B.2 Route story is the term given to the approach to route learning presented in this document. A route story defines route knowledge requirements by drawing together a sequential list of route cues and detailing what the learner needs to know about each one. This is done for each line on a route and aims to be the minimal set of route cues required for safe operation in a job role over a route. The route story covers both route cue information (for example junction speeds, station names) and route risks (for example irregular signal spacing) required for task competence in both normal and degraded modes.

Step 1. Where to begin and what a route story looks like

B.3 Creating the route story begins with an individual or group of people who are competent on a route going through the route as it would be worked, noting down, in the sequence they appear on the route, the cues that are required for the tasks within the job role. Those creating the route story may benefit from a trip over the route in order to refresh themselves on the cues and the order in which they appear.

B.4 The route cues that are required to safely work the route can be noted down in the sequence they appear on the route in a spreadsheet and this list will be the base of the route story.

B.5 The exercise to create a route story might not need to be started from scratch because some of the information needed will already be available in existing route maps, route videos or route risk assessments. However, this information can be checked against the route knowledge requirements in Appendix C and Appendix D of this document.

B.6 Once all the cues have been noted down in sequence, those making the route story compare their list with the list of cue types that were identified in the generic risk assessment (Appendix C and Appendix D of this document). If there are any cue types in the risk assessment that have not been captured in the route story list, they are added so that all cue types from the risk assessment process are included unless they are not applicable to the route (for example if there are no platforms where platform sharing (permissive working) could occur on a route, that would not be in the route story).

B.7 Tables 2 and 3 are examples of route story spreadsheet outputs.

<table>
<thead>
<tr>
<th>Type</th>
<th>Unique Information</th>
<th>Speed/dispatch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station, platform</td>
<td>Brentwood, plt 3, 8 car</td>
<td>DOO Lookback</td>
</tr>
</tbody>
</table>
Management of Route Knowledge

<table>
<thead>
<tr>
<th>Type</th>
<th>Unique Information</th>
<th>Speed/dispatch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signalling type</td>
<td>4 aspect signalling</td>
<td></td>
</tr>
<tr>
<td>Low adhesion</td>
<td>End</td>
<td></td>
</tr>
<tr>
<td>Location cue</td>
<td>M25</td>
<td></td>
</tr>
<tr>
<td>Gradient</td>
<td>Downhill gradient</td>
<td></td>
</tr>
<tr>
<td>Permissible speed decrease</td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>Station, platform</td>
<td>Harold Wood plt 3, 8 car, DOO Lookback</td>
<td></td>
</tr>
<tr>
<td>Neutral section</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permissible speed warning with AWS</td>
<td></td>
<td>50 (40)</td>
</tr>
<tr>
<td>Junction</td>
<td>Gidea Park Junction: L474 - Main plus theatre box ‘UM’ to UM</td>
<td>30</td>
</tr>
<tr>
<td>Station braking area cue</td>
<td>15mph crossover board, L470 and Gidea Park staff building</td>
<td></td>
</tr>
<tr>
<td>Permissible speed decrease</td>
<td></td>
<td>50 (40)</td>
</tr>
<tr>
<td>Station, platform</td>
<td>Gidea Park plt 3, 8 car, Right hand door release, CD/RA</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Example of a driver’s route story spreadsheet output

<table>
<thead>
<tr>
<th>Type</th>
<th>Unique information</th>
<th>PTI</th>
<th>Customer service or other info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junction</td>
<td>Whitehall East</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Could be diverted along this route)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junction</td>
<td>Whitehall West</td>
<td></td>
<td>Conductors do not currently sign the Whitehall curve</td>
</tr>
<tr>
<td>Junction</td>
<td>Holbeck</td>
<td></td>
<td>End of OHLE</td>
</tr>
</tbody>
</table>
### Management of Route Knowledge

<table>
<thead>
<tr>
<th>Type</th>
<th>Unique information</th>
<th>PTI</th>
<th>Customer service or other info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station, platform</td>
<td>Bramley</td>
<td>Maximum 4 car 158</td>
<td>No Booking Office (BO)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potential crowding in evening peak</td>
<td>TVM card only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Narrow platform</td>
<td>Full DDA via ramp</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wooden platform</td>
<td>Mainly commuters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Staggered platforms</td>
<td></td>
</tr>
<tr>
<td>Station, platform</td>
<td>New Pudsey</td>
<td>Platform starting signal</td>
<td>BO with public WC at top of ramp</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Concave curve to platform at front end</td>
<td>TVM at top of ramp</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Signal slightly obscured, may need to reposition during dispatch if working 3 car or greater</td>
<td>Full DDA via ramp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mainly commuters</td>
</tr>
</tbody>
</table>

**Table 3:** Example of a guard’s route story spreadsheet output
**Management of Route Knowledge**

**Type** - This column contains the cue types. Caution is advised on the number of types of cue labels because they can be used to filter the visible information in a spreadsheet. Therefore, their meaning must be easily interpreted and there must be a manageable number of cue types.

**Unique information** - Unique information about the route cue that tells the route learner everything they need to know about each cue. The information will vary depending on the individual risks identified around each cue but it should tell the route learner everything they need to know about the cue.

**For drivers: Speed/dispatch** - This column is where the permissible speed for each cue is provided. This shows the speed profile of the route and is provided for every row in the Excel spreadsheet apart from the ‘station, platform’ cue types. The method of train dispatch is provided for the ‘station, platform’ cue types in this column. The ‘station, platform’ cues have also been made bold as they are most commonly used as location cues and are significant points of reference along the route.

**For guards: PTI and customer service/other info** - These columns contain station/platform information. In trials, one train operator chose to split its station information into ‘need to know’ (PTI) and ‘nice to know’ (customer service/other info).

---

**Step 2. Adding additional information to the route story**

B.8 If there are additional cues in the route story list that are not in the requirements listed in Appendix C or D of this document, a decision needs to be made around whether to include them in the final route story. Risks that could be mitigated by general staff competence are dealt with through this means and not included in the route story.

B.9 When providing learners with additional information to that listed in the requirements, it is advisable to be sparing with that additional information. Question what the learners need to do with the information. It can be tempting to include lots of information because it had been in there previously, but if learners are overloaded with information it will impact their learning.

B.10 Any additional information included will be accompanied with the information gathered during Step 1 and will form a good initial route story. However, this will need to be validated for the accuracy of content and the information included as outlined in Step 3.

---

**Step 3. Validating the content of the route story**

B.11 Steps 1 and 2 will produce a route story draft. However, it is important to validate and ‘sense check’ the:

a) Type of information included
b) Amount of information included
c) The accuracy of the information included.
Route stories can be validated with either staff who have route knowledge competence for the route or their assessors/managers who have route knowledge competence for the route. It is difficult to get the information in route stories completely accurate, so it is advisable to keep the document live and update it as mistakes are spotted.

**Step 4. Diversionary routes and simplification of route stories**

B.12 How a train operator chooses to operate over a route will influence the details which needs to go into the route story. For example, if a train cannot stop at a certain station then it is not necessary for the guard to know about PTI risks at that station. Additionally, for drivers who only operate on diesel units, it is not necessary to have knowledge of neutral sections along the route.

B.13 Route stories are simplified to include only those elements required to operate over the route.
Appendix C  List of route knowledge requirements - Drivers, Driver Managers and Route Conductors

The content of this appendix is intended for guidance only.

C.1 Table 4 contains the factors that were identified during research project T1108 Achieving a step change in route knowledge management, as core driver route knowledge requirements for colour light signalling. Full justification and further details of these requirements can be found in the T1108 report.

C.2 The process for developing these route knowledge requirements is aligned with Taking Safe Decisions and can be applied to determine route knowledge requirements for other job roles, signalling systems and technologies.

<table>
<thead>
<tr>
<th>Category</th>
<th>Route knowledge requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stations</td>
<td>Details of stations and other stopping locations to be called at on the route. Includes platform lengths, stopping points, and methods of dispatch. PTI risks (where necessary). All station names.</td>
</tr>
<tr>
<td>Gradients and low adhesion areas</td>
<td>Significant gradients and areas of low adhesion.</td>
</tr>
<tr>
<td>Lineside signage</td>
<td>Whistle boards</td>
</tr>
<tr>
<td>Signals</td>
<td>Signals with significant read-across or read-through risk, late sighting, irregular distances, potential for misinterpretation, and multi-SPAD signals. Details of the signalling and protection systems in place throughout the route, including details of transitions to alternate arrangements (for example changes in signal aspect). This excludes passive systems such as train protection and warning systems (TPWS). Signal box names.</td>
</tr>
<tr>
<td>Junctions</td>
<td>The signals, names and types of running line, and permissible speeds associated with junctions where drivers may be required to take a diverging route. Diverging junctions where the driver is not required to take a diverging route, particularly regarding the routes they are not supposed to take.</td>
</tr>
</tbody>
</table>
### Management of Route Knowledge

<table>
<thead>
<tr>
<th>Category</th>
<th>Route knowledge requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permissible speed increases and decreases</td>
<td>Permissible speeds applicable to the traction being driven. Permissible speed reduction warning indicators.</td>
</tr>
<tr>
<td>Section gaps and neutral sections</td>
<td>Section gaps, neutral sections.</td>
</tr>
<tr>
<td>Level crossings</td>
<td>Level Crossings, but not user worked and footpath crossings.</td>
</tr>
<tr>
<td>Other</td>
<td>Spring catch points</td>
</tr>
<tr>
<td></td>
<td>High-risk stopping points (for example viaducts, tunnels).</td>
</tr>
<tr>
<td></td>
<td>Locations with special instructions which affect the driver (for example certain tunnels).</td>
</tr>
<tr>
<td></td>
<td>SPAD indicators</td>
</tr>
<tr>
<td></td>
<td>Significant distractions from route cues.</td>
</tr>
<tr>
<td></td>
<td>Walking routes at the commencement and termination of journeys.</td>
</tr>
</tbody>
</table>

**Table 4:** Driver route knowledge requirements
Appendix D  List of route knowledge requirements - Train managers and guards

The content of this appendix is intended for guidance only.

D.1 Table 5 contains the factors that were identified during research project T1151 Making a step change in guards/on-board operational staff route knowledge. Full justification and further details of these requirements can be found in the T1151 report.

D.2 The process for developing these route knowledge requirements was aligned with Taking Safe Decisions and can be applied to determine route knowledge requirements for other job roles, signalling systems and technologies.

<table>
<thead>
<tr>
<th>Category</th>
<th>Route knowledge requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stations</td>
<td>Name and order of all stations along route (including request stops)</td>
</tr>
<tr>
<td></td>
<td>Which side the platform will be for each direction at each station</td>
</tr>
<tr>
<td></td>
<td>Platform length for capacity (whether train fits or you need to use selective door operation (SDO))</td>
</tr>
<tr>
<td></td>
<td>Stopping location for each platform (ensure the train is accommodated)</td>
</tr>
<tr>
<td></td>
<td>Platforms where platform sharing may occur</td>
</tr>
<tr>
<td></td>
<td>Specific risks for each platform - based on risk assessment (including level crossings adjacent to platforms, poor underfoot conditions, obscured locations on platforms)</td>
</tr>
<tr>
<td></td>
<td>Whether each platform has step free access, lifts</td>
</tr>
<tr>
<td></td>
<td>Optimal dispatch location and procedure(s) for each platform for different tractions and formations (as per company instructions) including in degraded situations and whether there are dispatch/customer service staff</td>
</tr>
<tr>
<td></td>
<td>For each platform stopping position, any visible signal which applies and what indicator is needed (including platform starting signals, junction indicators, OFF indicators, banner repeaters, and Train Ready To Start (TRTS) buttons). Knowledge must include signal type, the position, sighting (for example, if on right hand side or ERTMS is in operation)</td>
</tr>
<tr>
<td>Other information</td>
<td>Choose an appropriate cue on approach to each station for passenger announcements (considering the type of station, for example interchange)</td>
</tr>
<tr>
<td>Category</td>
<td>Route knowledge requirement</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Know maximum line speed and direction of travel</td>
</tr>
<tr>
<td></td>
<td>Understand the type of electrification in operation</td>
</tr>
<tr>
<td></td>
<td>Crossovers/diversions that can be taken in degraded workings that would take the train into a different platform</td>
</tr>
<tr>
<td>Other</td>
<td>Local operating and emergency arrangements specific to the line(s) of route</td>
</tr>
<tr>
<td></td>
<td>Layout of relevant stations/yards/depots (including walking routes, access to/from platforms, for example, if it is across track, exits, mess rooms, personal needs break areas)</td>
</tr>
<tr>
<td></td>
<td>Knowledge of how to contact the controlling signaller / electrical control operator (ECO) in a timely manner</td>
</tr>
</tbody>
</table>

**Table 5:** Factors to consider when creating Train Manager and Guard route knowledge requirements
Appendix E  How to develop a route learning plan

The content of this appendix is intended for guidance only.

E.1 Once a route story has been produced, a training plan can be devised. This section will consider how to select the best route learning format, brief learners on the route and advise on how to determine the duration of the training.

Select route learning format options

E.2 There are a number of formats that route learning will take. As route knowledge is required to carry out specific tasks (for example train dispatch, driving), elements of learning need to be based around the task as a whole and undertaken in the actual task environment if there is the opportunity to do so and it is appropriate for the route being learned. Where changes are being made to a route a member of staff already has competence for, route knowledge may be developed through other, less intensive approaches.

E.3 There are strengths and limitations in different learning approaches which is why there are advantages to using multiple methods to ensure that use of route learning time is maximised and takes account of different learning styles. Appendix H shows the methods that can be used in this mixed-methods approach. Some of the route learning format options are displayed in table 6.

<table>
<thead>
<tr>
<th>Format</th>
<th>Definition</th>
<th>Strengths</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trips over the route (driving/working the doors).</td>
<td>Trips over the route being learned where the learner is driving/working the train.</td>
<td>Practical application of knowledge.</td>
<td>Can be logistically challenging to set up.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Experience working in different conditions (for example peak times, darkness).</td>
<td>Need supervision which can be affected by resourcing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Good for practical learners.</td>
<td>Not possible to control what conditions are experienced.</td>
</tr>
</tbody>
</table>
Table 6: Methods of providing route knowledge factors in mixed method approach.

**Develop route briefings based on the route story**

**E.4**

The objectives of route briefings are to make learners aware of key risks and features on a route and to provide the opportunity for the learner to raise and ask questions about parts of the route. This will help the individual to develop their knowledge and use their route learning materials. If route briefings are provided, they should be based on the route story and reflect the information that is included within that route story.

**How to determine the time needed to learn the route: Monitoring route knowledge competence development**

**E.5**

Learners will acquire route knowledge at different paces due to individual differences. Therefore, it is best to base route learning durations on individuals’ needs. To understand when individuals are ready to take their assessment, their competence can be monitored throughout their route learning.

**E.6**

Learning durations can be considered on a case-by-case basis or by monitoring a number of learners to establish the duration spread which can be fed into future planning processes in the form of a suggested range of time/trips. For new routes without this evidence base, it will be necessary to use estimates of route learning durations based on operational experience and a risk assessment.
E.7  This monitoring can be completed continuously (for example, daily) or at fixed points (for example, beginning, midpoint, end) during route learning. If monitoring reveals that the individual has reached competence and the learner is confident in their knowledge of the route, the assessment can be undertaken. Monitoring route knowledge development during learning also builds up the evidence base of the time it takes individuals to learn routes. This evidence base can be used to modify learning time allocations given to learn certain routes.

E.8  Another consideration for duration is the length of the route; it may be necessary to split up a long route into smaller sections for learning purposes.

Benefits of monitoring competence development

E.9  Route knowledge competence is assessed when the route learner is ready rather than at a defined time point. This enables route learners who have achieved competence sooner than a designated assessment point to ‘pass out’ earlier. Those that need extra time can ‘pass out’ at a later point to cater for individual differences in learners.

E.10 Methods of monitoring route competency can be found in table 7.
<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Strengths</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learners’ self ratings</td>
<td>Route learners are provided with a list of the key route cue types, for example junctions, stations or dispatch methods. Learners are asked at regular time intervals to provide a rating for how complete they thought their route knowledge is for that cue (for example, from 1-5).</td>
<td>Easy to administer. &lt;br&gt;Quick method to collect information. This might improve the likelihood of completion. &lt;br&gt;Tests the learner’s confidence to work the route. &lt;br&gt;Progress can be tracked and learning objectives set/amended.</td>
<td>Tests learners’ perceptions rather than actual competence. &lt;br&gt;Can become repetitive so needs to be administered at sensible time intervals.</td>
</tr>
<tr>
<td>Probe questions</td>
<td>A set of questions is developed and administered at regular intervals during route learning.</td>
<td>Route story can be used as the basis. &lt;br&gt;Easy and quick to administer. &lt;br&gt;Learners can use this exercise to identify areas where their knowledge may be weaker. &lt;br&gt;Progress can be tracked and learning objectives set/amended.</td>
<td>If not supported with visual information, then this can be difficult for visual learners. &lt;br&gt;Not held in the context of the task so perfect performance will not be achieved.</td>
</tr>
</tbody>
</table>
## Management of Route Knowledge

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Strengths</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route drawings</td>
<td>This technique involves providing a sheet of blank paper to route learners and asking them to list the information on the route that they can recall. Learners can choose how they displayed this information, for example drawings or writing information down in lists/tables.</td>
<td>Good test of recall.</td>
<td>Tests recall rather than reasoning.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gives learners a range of ways to display information so they can use their preferred methods.</td>
<td>Does not suit everyone's learning style.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Easy and quick to administer.</td>
<td>Can take some learners a long time if they want to add a lot of detail.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Progress can be tracked and learning objectives set/amended.</td>
<td></td>
</tr>
<tr>
<td>Catch-ups with instructors</td>
<td>This method can take a number of forms. For example, a catch up with a route learner may be completed in person formally or casually or over the phone. The instructor completing this activity should find out regularly how route learning is going (for example, whether trips are being completed), barriers to learning (for example, access to cabs), parts of the route that they find challenging. These conversations may identify where additional support is needed or alternative learning.</td>
<td>Relationship building with instructor.</td>
<td>Requires instructors to find the time for this exercise.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Issues with route learning can be identified before the assessment.</td>
<td>Learners may not want to share certain information with their instructors, for example through embarrassment of not knowing route information.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Progress can be tracked and learning objectives set/amended.</td>
<td></td>
</tr>
<tr>
<td>Method</td>
<td>Description</td>
<td>Strengths</td>
<td>Limitations</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Learners’ diaries</td>
<td>The learner keeps track of their own competence development (any difficulties and confidence in working the route) and this is either discussed or reviewed with instructors regularly throughout learning.</td>
<td>Easy to administer for instructors.</td>
<td>Need to specify the information that should be recorded.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can take a number of forms.</td>
<td>Learners may not want to share certain information with their instructors, for example through embarrassment of not knowing route information.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Learners can record and keep track of route knowledge development.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Barriers to route learning can be identified early in the process.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Progress can be tracked, and learning objectives set/amended.</td>
<td></td>
</tr>
<tr>
<td>Self-monitoring</td>
<td>Learners reflect on their own competence development and tell the instructor/assessor when they feel ready to take the assessment.</td>
<td>No resource required</td>
<td>Learners could become competitive or feel pressure to say they are ready when they are not.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Learners tend to have a good understanding of how ready they are for their assessment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Putting the ownership of competence on the individual learners</td>
<td></td>
</tr>
</tbody>
</table>

**Table 7: Methods of monitoring competency**
Coaches

E.11 Coaches can often be the key role model that learners have throughout their route learning. Coaches are often very highly valued by learners and their influence on route learners can be significant. Coaches are often able to offer more nuanced information and advice that would not necessarily be found on written learning materials. Companies could harness this in-depth knowledge of routes to ensure that their learning materials and assessments are optimised and up to date. Because of their influence on learners, it is important that information provided by coaches is aligned with the route story.

Agreeing the plan with the learner

E.12 The purpose of this section is to look at how a training plan is agreed with the learner. Key points to cover during this conversation are:

a) Set objectives for the training for either the end of the training or intermediate objectives that are updated throughout learning. Ensure that the learner understands what is expected from them to achieve competence at the end of the training.

b) Ensure that route learners are told about the learning opportunities which are available to them, for example formats of training and available materials. A suite of materials is recommended to suit learners with different individual learning styles.

c) Ensure that the training format is clear to the learner and that they are given sufficient time to complete that training plan. Some adults may take longer to acquire new knowledge or skills. Make sure that it is clear that the length of time for the training can be modified depending on the time taken to learn the route.

d) Offer the option of having learners interact with each other if it is identified as beneficial.

e) Encourage the learner to seek support if needed during the training and that they should not feel foolish or incompetent when they make mistakes.

f) Ensure there are opportunities to practice or apply new knowledge or skills.

g) Make clear the assessment and monitoring methods that will be used to measure competence at the end of the training.

h) Trainers should ask at the outset of training what barriers may affect their ability to apply what they learn (Ekey, 2012).
Appendix F Integrating non-technical skills (NTS) into the route learning plan

The content of this appendix is intended for guidance only.

What are NTS?

F.1 Non-technical skills are ‘…the cognitive, social and personal resource skills that complement technical skills (what you need to do for a safety critical task) and contribute to safe and efficient task performance’ (RSSB, Summary Guide to Integrating Non-Technical Skills into Rail Safety Critical Roles 2016).

F.2 Route knowledge underpins and supports many technical tasks that guards and drivers undertake. NTS also underpin and support those tasks. Therefore, it can be helpful to embed NTS into the route knowledge competence process and allow them to work together. The ways in which you embed NTS into the competence process can be decided when creating route learning plans. The relationship between NTS and route knowledge and how this benefits performance is shown in Figure 2

F.3 For more detailed information on NTS, there are lots of materials available on the RSSB website which help companies to incorporate NTS into a competence management system. These include:

a) An NTS integration guide which provides guidance on the following:
   i) Generating interest in NTS in different organisations
   ii) Developing a plan for integration and a business case to support this plan
   iii) Identifying the right NTS for all safety critical roles
   iv) Integrating NTS into the selection process for safety critical roles
   v) Training and measuring the NTS of leaders, managers, trainers, assessors and frontline staff
   vi) maintaining the momentum of the NTS integration programmes.

b) An NTS awareness and integration course which aims to help attendees feel confident in integrating NTS into their business.

c) An NTS refresher course which can be useful to refresh understanding of NTS.

F.4 When integrating NTS into your route knowledge processes you could start by thinking about the task the learner is doing. For example, the task might be checking the signal aspect before dispatching a train. Think about what four or five NTS a member of staff needs to do really well to make their performance of this task as robust as possible. Or think about the way in which the best person that you have seen carry out this task. How did they do it? This task may need: ‘Checking’, ‘Maintain concentration’, ‘Systematic and thorough approach’, ‘Anticipation of risk’ and ‘Sharing information’. You can then base your training around imparting these skills as part of your training on this task. Think about what strategies and techniques you’d give members of staff in to how to undertake the task.
<table>
<thead>
<tr>
<th>NTS category</th>
<th>How route knowledge and NTS work together to improve human performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situational Awareness</td>
<td>Situational awareness supports route knowledge by enhancing individuals’ abilities to correctly observe and listen to indications, maintain overall awareness and concentration and to know where they are. Route knowledge gives people an opportunity to check what they have observed against what they should be seeing. This will ultimately help individuals understand what is going on through their overall awareness and what might come next through their anticipation of risk.</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>Conscientiousness is important to route knowledge because using a systematic approach to observe and check relevant information in the environment can help the member of staff to identify and prioritise information.</td>
</tr>
<tr>
<td>Communication</td>
<td>Communication works with route knowledge to help guards/driver with their roles. Staff need to actively listen, be clear and assertive, and think about what information needs to be shared. Route knowledge is important in identifying key information in conversation through listening and in the content of communications to other staff and passengers (communicating route relevant information clearly).</td>
</tr>
<tr>
<td>Decision making and action</td>
<td>Route knowledge will be a key part of the information that staff use to make decisions. Without knowing the right information, provided by route knowledge, guards/drivers will not be able to make effective decisions (e.g. whether it is safe to dispatch the train). Additionally, without good decision-making skills, staff will not be able to turn their route knowledge into actions.</td>
</tr>
<tr>
<td>Cooperation and working with others</td>
<td>These NTS include being able to consider the needs of others, support others and treat them with respect. Being able to deal with conflict in an appropriate way is also included in this category. Route knowledge can be utilised to provide a common understanding between two people (e.g. guard/driver and signaler) and subsequently to deescalate conflict by providing correct and concise route information (e.g. A guard/driver being able to tell a member of staff their current location).</td>
</tr>
<tr>
<td>Workload management</td>
<td>Workload management has an important relationship with route knowledge as it allows the guard to correctly prioritise information in the environment and know what they can ignore due to it being a potential distraction. This awareness of complex and high-risk areas can help manage workload. For example, a guard completing ticket duties at least 10-30 seconds before arriving at the station to plan for dispatch duties.</td>
</tr>
<tr>
<td>Self-management</td>
<td>The most relevant self-management NTS to route knowledge are about maintaining skills and knowledge as it helps staff to keep their route knowledge up to date. This also relates to being prepared and organised for work in terms of having any supplementary route information easily to hand and having the confidence to apply these.</td>
</tr>
</tbody>
</table>

**Figure 2:** How route knowledge and NTS work together to improve human performance
Appendix H  Methods of providing route information

The contents of this appendix is intended for guidance only.

H.1 When deciding the best methods of providing route knowledge material, the following factors can be taken in to consideration:

a) The complexity of the route - where a route is deemed complex, a cab ride and map may need to be supplemented with simulation of shunting movements that can be made at that location.

b) The length of the route – a shorter route may lend more to the use of a map as opposed to a DVD in terms of cost and production time.

c) Whether the learners have prior knowledge of the route, for example route learning following a resignalling project – if the learners have a prior knowledge of the route and its features but are required to learn the layout of new signals, a good way of doing this would be by using video simulation.

d) The learning styles of the learners – people learn in different ways so the greater variety of methods of providing route learning materials will cater for a more diverse group of learning styles.

e) The time allocated to learn the route – If it has been agreed that the route is to be learned within a certain amount of time, the methods of route learning used reflect this. For example, a heavy reliance on cab rides that may be affected by disruption may not be suitable to tight timescales.

f) What other training methods may be used – for example, if it has already been decided that route DVDs are to be used then it may not be necessary or cost-effective to then also use route simulation apps.

H.2 Some of the methods of providing route information are explained below. With each of the methods, it is important that the information is kept up to date.

Sectional Appendix

H.3 Produced by the infrastructure manager, the Sectional Appendix contains information including line names, junctions and line speeds. The Sectional Appendix is best suited as a piece of support information alongside other route learning methods.

Weekly Operating Notice (WON) and Periodical Operating Notice (PON)

H.4 Also produced by the infrastructure manager, these documents contain amendments to a route that can be used to update the Sectional Appendix.

Signalling plans

H.5 Signalling plans are produced by infrastructure managers to reflect changes to the infrastructure. They contain detailed information concerning the track layout and the signals. Signalling plans are ideal as a method of learning routes that have undergone change.

Route maps - paper or interactive

H.6 Produced by railway undertakings, route maps can contain a variety of different pieces of route information presented sequentially. The information on the route map
Management of Route Knowledge

is derived from the route story. Typically, these maps contain more detail than the Sectional Appendix and can be tailored towards the type of operation for which that railway undertaking is responsible. Although optimally used alongside other route learning aids, for shorter routes and routes over which there is limited access for route learning, the route map could be used as a sole method of route learning, if deemed appropriate following company risk assessment.

H.7 Maps are presented in a way that is easy for learners to read and interpret, for example suitably spaced out across pages, written in a font size that is readable, and contain a ‘key’ if symbols are used.

H.8 Too much information on a single map may reduce its suitability for training. If the map is to be used for multiple purposes, a layering format may be considered with different levels of detail available on each layer (for example, layer one might show signals and stations, layer two, line speeds and gradients, layer three, junctions). Layering allows the learner to customise what they will be viewing on the map at any given time.

H.9 Route maps can be provided electronically or on paper.

H.10 The benefits of providing route maps in an electronic format are that:
   a) The route maps are interactive and therefore support route knowledge competence development. The layered functionality on the interactive route maps allows competence to be developed by cue type (for example starting with stations then adding in other cue types such as line speeds/junctions as competence develops)
   b) The information visible can be customised to an individual’s pace and learning style
   c) There is less need to print paper-based route maps which can reduce printing costs, is more environmentally friendly, and is less weight for staff to carry with them
   d) It caters to learners who are more comfortable or more used to learning using electronic and interactive materials
   e) It can be updated and re-issued quickly if the interactive maps are created internally
   f) The electronic maps can be printed and used as paper-based route maps.

Route booklet

H.11 Route booklets are produced by railway undertakings and can be presented as a a printed booklet or via an electronic device. The route booklet is ideal for route learners who are learning a route for the first time as it can display a large amount of information in a convenient way. The information in the booklet comes from the route story.

Video of the route

H.12 Video of the route would usually be taken from the driving cab of a train using specialist equipment or forward-facing or tail light cameras where fitted, compatible and of a sufficient standard. Once recorded, the video can be viewed as recorded or edited to include information added to the screen (route story information, station
names, platform information etc). Videos of a route are useful for all types of route learning and refreshing. The use of video is ideally suited to the learning or refreshing of a route over which there are infrequent services.

Photos of the route

H.13 Photographs of a route can help the learner to contextualise the route aspect that they are learning. Photographs are an ideal accompaniment to route maps and route booklets and illustrate things a learner needs to know. It is important they are bright enough, not blurry, and add meaning to the written information. Photos can be really effective if they are good enough quality.

Blank route maps

H.14 A blank route map would merely contain the track layout of a route. This would be created by railway undertakings and allow the route learner to populate the map with route features as they progress with their route learning activities. For the blank route map method to be effective, the information inserted by the learner is checked and verified by a competent person.

Immersive technology

H.15 Immersive technology such as virtual reality, augmented reality, and gamification can offer many benefits when used appropriately to supplement the delivery of safety critical training.

H.16 Immersive technology could be used as part of the route knowledge training, perhaps to help learners familiarise themselves with stations, or to recreate the conditions of an extremely busy platform.

H.17 A brief explanation of when and how to use immersive technology was created as part of RSSB research project T1131 and can be found on the RSSB website. T1131 gathered case studies of immersive technology being used in training, set out some of the benefits of using it, and highlighted some key considerations for companies before using it.

Commentary

H.18 The use of commentary combines observation with a verbal description of what the person is thinking, doing and the reasons behind their actions. It is important that any member of staff who is commentating on their actions does not allow the commentating to distract them from the task they are undertaking.

Symbol library

H.19 The symbols displayed in Figures 3 and 4 are examples of the symbols that can be used when creating route learning material.
### Symbol Example Library Table 1

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>4 aspect signal</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>3 aspect signal</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>2 aspect signal (proceed and stop authorities)</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>2 aspect signal (proceed and caution aspects)</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>3 aspect signal with junction indicator</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>4 aspect signal with junction indicator</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>4 aspect signal with flashing aspects</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Signal with a SPAD indicator</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Viaduct</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Underbridge</td>
</tr>
</tbody>
</table>

**Figure 3:** Symbol example library table 1
### Symbol Example Library Table 2

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Overbridge</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Permissible speed board</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Differential speed board</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Low adhesion</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Signal box name</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Station name</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Tunnel</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Station braking area cue</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Station shut off area cue</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Up direction</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Down direction</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Banner repeater</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Neutral sections</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Countdown markers</td>
</tr>
</tbody>
</table>

**Figure 4:** Symbol example library table 2
Appendix J  Methods of assessing route knowledge competency

The content of this appendix is intended for guidance only.

J.1  The table on the following page sets out methods and guidance on how to assess route knowledge competency.
<table>
<thead>
<tr>
<th>Assessment method</th>
<th>Definition</th>
<th>Strengths</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct observation</td>
<td>The instructor or other competent assessor observes the route learner working the route and determines competence by their actions and responses to questions whilst working the train. It is advised that there are criteria that assessors are working to, in order to ensure there is consistency in assessments. It is advised that these criteria are based on the route story.</td>
<td>Practically assesses competence of the learner in the real world environment. Captures information about processes and behaviour as well as outcome. Closest assessment method to the actual task.</td>
<td>If no assessment criteria, there can be inconsistency in assessment and influenced by subjective judgements. Unable to understand the reasoning behind learner actions. Questions asked at certain times can be distracting. Resourcing of instructor time. May result in a ‘special performance’.</td>
</tr>
<tr>
<td>Interviews</td>
<td>Interviews with route learners to understand level of route learning competence. Can comprise both open and closed questions and be based on the route story. This approach may be more effective if supporting visual information is provided as this adds context to the questions.</td>
<td>Based on the route story. Tests reasoning and recall. Allows in depth exploration of knowledge and understanding.</td>
<td>Can be resource intensive for instructors. Can be hard to determine pass/fail criteria. Not in the real world environment so may be difficult for visual learners. Does not assess driving style/how the route is worked. Relies on skills of assessors.</td>
</tr>
</tbody>
</table>
### Management of Route Knowledge

<table>
<thead>
<tr>
<th>Assessment method</th>
<th>Definition</th>
<th>Strengths</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questionnaires/written assessments</td>
<td>Similar to interviews, but the questions are administered in a paper/electronic format to the learner. Like interviews, questionnaires can comprise both open and closed questions and be based on the route story. This approach may also be more effective if supporting visual information is provided as this adds context to the questions.</td>
<td>Based on the route story. Tests reasoning and recall. Is less resource intensive for instructors than interviews, particularly if done electronically.</td>
<td>Can be hard to determine pass/fail criteria. Not in the real world environment so may be difficult for visual learners. Does not assess driving style/how the route is worked. Does not allow in depth exploration of knowledge and understanding.</td>
</tr>
<tr>
<td>Closed questions</td>
<td>Closed questions have a right/wrong answer and are usually answered with single words or short phrases. These questions will assess the recall of information by route learners.</td>
<td>Based on route story information. Easy to administer and mark. Less resource needed. Quick and easy to administer.</td>
<td>Best used as a method alongside a practical assessment. Asking questions not in the real-world environment/practical setting. Visual learners might struggle. Can be influenced by the person writing the questions so the route story should be the base of these questions to develop an objective question set.</td>
</tr>
</tbody>
</table>
### Table 8: Methods of assessing route knowledge competency

<table>
<thead>
<tr>
<th>Assessment method</th>
<th>Definition</th>
<th>Strengths</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open questions</td>
<td>Open ended and allow the respondent to provide a full answer based on their knowledge. These questions are most likely to measure respondents’ reasoning and thought processes rather than simply their recall of knowledge</td>
<td>Based on the route story. Tests reasoning rather than recall. Obtains first hand evidence of underpinning knowledge quickly.</td>
<td>Usually associated with model answers rather than correct/incorrect answers. This can lead to subjectivity in marking, for example, some instructors may be stricter in their marking of model answers compared to others. Can be more time intensive to mark. Hard to determine pass/fail criteria if these are used. Not in the real world environment so may be difficult for visual learners. Relies on questioning skills of assessors. Does not assess driving style/how the route worked.</td>
</tr>
</tbody>
</table>
Definitions

CSM RA

degraded operations
Situations where trains are unable to continue on their planned route due to infrastructure, signalling or energy supply problems.

diverging route
Any signalled line beyond a diverging junction that is not designated as the principal route. This includes routes on which only a shunt movement authority (MA) applies.

ERTMS
European Rail Traffic Management System.

freight train
Trains signalled as classes 3 to 8 and 0. By this definition, light engines and trains comprising empty coaching stock or parcels trains, are permitted to use facilities provided for freight trains.

Global System for Mobile Communications - Railway (GSM-R)
The European Standard specific to railway applications for the transmission by radio of voice and data between train and trackside installations. Source: GERC8517 Issue 1

infrastructure manager (IM)
Any ‘body’ or firm responsible in particular for establishing, managing and maintaining railway infrastructure, including traffic management and control-command and signalling; the functions of the infrastructure manager on a network or part of a network may be allocated to different bodies or firms. Source: Article 3(2) of Directive 2012/34/EU.

level crossing
An intersection at the same elevation of a road, footpath or bridleway and one or more rail tracks. Source: IEV 821-07-01, modified

line speed
Maximum speed measured in kilometres per hour for which a line has been designed. Source: ENE TSI.

Office of Rail and Road (ORR)
The independent safety and economic regulator for Britain’s railways.

Railway Emergency Call (REC)
The highest priority call in the GSM-R network, configured as a group call, conveying an emergency stop request to all trains in receipt of the REC. A REC will be broadcast over defined GCAs.

railway undertaking (RU)
Any private or public undertaking the principal business of which is to provide rail transport services for goods and/or passengers, with a requirement that the undertaking must ensure traction; this also includes undertakings which provide traction only. Source: Article 3 (a) of Directive 2004/49/EC.

Weekly Operating Notice (WON)
The official printed notice which includes advice to drivers of temporary speed restrictions and alterations to permissible speeds.
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References

The Standards catalogue gives the current issue number and status of documents published by RSSB: [http://www.rssb.co.uk/railway-group-standards](http://www.rssb.co.uk/railway-group-standards).

<table>
<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>RGSC 01</td>
<td>Railway Group Standards Code</td>
</tr>
<tr>
<td>RGSC 02</td>
<td>Standards Manual</td>
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Documents referenced in the text

### RSSB documents

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEGN8646</td>
<td>Guidance on the Common Safety Method for Risk Evaluation and Assessment</td>
</tr>
<tr>
<td>GERT8000</td>
<td>The Rule Book</td>
</tr>
<tr>
<td>RSSB 2016</td>
<td>Summary Guide to Integrating Non-Technical Skills into Rail Safety Critical Roles</td>
</tr>
<tr>
<td>RSSB 2019</td>
<td>Taking Safe Decisions v3</td>
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<tr>
<td>T1108</td>
<td>Achieving a step change in route knowledge management</td>
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<tr>
<td>T1131</td>
<td>Evaluating the Potential for Virtual Reality, Augmented Reality and Gamification in Rail Industry Safety Critical Training</td>
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<td>T1151</td>
<td>Making a step change in guards/onboard staff route knowledge</td>
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### Other references

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<td>Ekey, C, 2012</td>
<td>Literacy Coaches Training</td>
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<td>ROGS</td>
<td>Railways and Other Guided Transport Systems (Safety) Regulations 2006</td>
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<td>TDLCR</td>
<td>Train Driving Licences and Certificates Regulations 2010</td>
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