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2TRAIN

TRAINing of TRAIN Drivers in safety relevant issues with validated and integrated computer-based technology

Catalogue of standards for drivers’ competencies and training content

D1.2.1

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DEFINITIONS

The definitions below prepare for a common understanding of constantly used terms during the course of the project. These definitions do not intend to be universally valid.

- *Initial training*: Training for train driver in preparation aiming to pass the exam (other: education, apprenticeship)
- *Advanced training*: Training for examined train drivers (other: continuous training, further training, on going training)

- *Assessment*: The process of measuring the performance/competence
- *Examination*: Assessment for the purpose of getting a specific (driver) licence
- *Performance Check*: Assessment for the purpose of regular competence assurance (other: performance monitoring)
- *Evaluation*: Ascertain the overall quality of the training (not the driver's performance)

- *Training objective*: The specific knowledge, skill, or attitude that the trainees are to gain as a result of the training activity
- *Training content*: Describes what is done in the training to reach the training objectives (other: Topic)
- *Training model*: Describes the circumstances of the training including the specification about the training schedule (e.g. non-recurring, monthly, once or twice a year), the overall duration of one session, the circle of addressees, the presence of an instructor, the necessity of a briefing/debriefing etc.

- *Training method*: Describes how and with the aid of which means and technologies (classroom lesson, CBT/WBT, simulation, real vehicle) the training is conducted
- *Training technology*: Computer-based training methods e.g. simulation, CBT/WBT
- *Training tool*: Add-on systems for training technologies

In combination with Simulator or Training:
- *Session*: A whole training unit (may include briefing, a pre-test, train preparation, the actual drive, and debriefing)
- *Drive*: Driving in the simulator (there may be more drives in one session)
- *Event*: A specific operational or technical occurrence in the course of a drive; there could be several events in one training drive (other: situation)
- *Scenario*: the actual figuration of the drive e.g. the sequence of events, the choice of the route, specific train settings, the weather conditions etc.

1 OVERVIEW

The 2TRAIN project starts with a twofold benchmarking process:

Firstly, comparing currently used training technology in the field of train driver's training with the existing standards in Europe. The existing standards will be ascertained in Task 1.1, the currently used training technology in Task 1.3.

Secondly, comparing currently used training contents and training models in the field of train driver's training with the existing standards in Europe. The existing standards will be ascertained in Task 1.2, the currently used contents and models in Task 1.4.

The arising gaps and discrepancies between these standards and the current state will display the requirements for future research and technical developments.

This report outlines the work on Task 1.2, i.e. the examination and description of existing standards concerning training contents and training models in Europe. To do so it seems to be necessary to broaden the scope and having an additional look on existing standards concerning the overall drivers' competencies, standards or recommendations concerning training methods and having a particular view on the subject of assessment. This leads to an investigation in five different areas (see columns in Table 1) (cp. the introductory definitions of this report):

- *Competencies*: The competencies are the vocational qualifications constituted by the whole of the things to know, to know how and to know how to be. It is hence the ability to act adequately and professional as a train driver (cp. Olsen et al., 2002).
- *Training Content*: The training content describes what is done (e.g. scenarios) during the training to reach the training objectives and to make the train driver competent. Different training contents are for example: driving under normal conditions, irregularities during train operation, operation of train control systems, human factors, decreased adhesive circumstances, etc.
- *Training Method*: The training method describes how and with the aid of which means and technologies (classroom lesson, CBT/WBT, part task trainer, simulation, real vehicle) the training is conducted.
- *Assessment*: Assessment is a process that involves (1) the collection of performance data, (2) the judgement of the data against objective criteria, and (3) using these results to make decisions about competence (cp. RSSB, 2005).
- *Training Model*: The *training model* describes the circumstances of the *initial* and *advanced training* (duration, frequency, addressee, briefing/debriefing,

etc.). Furthermore, the term includes the circumstances of training development and *evaluation*.

The existing standards of these five different areas have to be extracted from different information sources as the European railways are subjected to a strong hierarchy of rules, procedures, regulations, and work instructions (Shannon et al., 2004).

- The highest level of this hierarchy is assigned to the legislation including European directives and national laws.
- On the second level there are the regulations and safety rules of the national railway bodies as well as the operational rules and directives. Additionally, the companies' competence profiles and job descriptions for train drivers should be taken into account.
- Furthermore, the scientific research literature including results from former European projects (cp. Matthews, 2006) and publications of European and international railway organisations have to be consulted.

Table 1 gives an overview of the scope of 2TRAIN Task 1.2 "Standards for drivers' competencies and training contents in Europe" on the basis of different standard areas and different information sources:

Scope of 2TRAIN Task 1.2		Competencies	Training Contents	Training Methods	Assessment	Training Models
Legislation	European					
	National[1] (only consortium members)					
Companies	Rules & Directives (only consortium members)					
Scientific research						

Table 1: Scope of 2TRAIN Task 1.2 "Standards for drivers' competencies and training contents in Europe"

[1] Laws and regulations of national railway bodies

2 EUROPEAN LEGISLATION

2.1 Technical Specifications for Interoperability (TSIs)

In accordance with Article 2(c) of Directive 2001/16/EC, the trans-European conventional rail system is subdivided into structural and functional subsystems. In accordance with Article 23(1) of the Directive, the subsystems are required to be covered by a Technical Specification for Interoperability (TSI). The Interoperability Directives set out the essential requirements (safety, reliability, availability, health, technical compatibility, etc) to achieve interoperability.

The Directives also require the production of mandatory TSIs which define the technical standards required to satisfy those essential requirements. The development of TSIs is the responsibility of the European Rail Agency (ERA) which was established as part of the "second railway package".

A number of TSIs have been, or are being, developed to cover a number of subsystems (e.g. infrastructure, rolling stock, energy and control, command and signalling). Each TSI is divided into a number of sections dealing with the following;

- Sub-system definition / scope
- The essential requirements
- Characteristics of the sub-system
- Interoperability constituents
- Assessment of conformity and / or suitability of use
- Implementation

The process for development of a TSI involves a number of key stages, as follows;

- Drafting and development of the TSI by the ERA
- Adoption of the draft TSI by the Article 21 Committee
- Adoption of the TSI in a decision by the European Commission (EC)
- Notification of the EC Decision to member States (by formal letter)
- Publication of the TSI in the Official Journal of the European Union (OJEU)
- The TSI becoming "applicable" (i.e. becoming active)

The date of notification by the EC is the date of the letter to the Member States, and the date the decision becomes applicable is usually six months later. Publication of the TSI in the OJEU occurs at some point in between.

The Member States have a period of six months after being notified of the adoption of a TSI in which to notify their National Technical Rules (NNTRs) to ensure the NNTRs are available at the same time as the TSI. The current status of TSIs is provided as Appendix A.

2.2 Traffic Operation and Management TSI

The Traffic Operation and Management TSI is the TSI which includes a specification for competence and training requirements in order to support interoperability. The first step in establishing the TSI was to develop a draft TSI, which was drawn up by the European Association for Railway Interoperability (AEIF), which was appointed as joint representative body.

The AEIF has been given a mandate to draw up a draft TSI for the "Traffic Operation and Management" subsystem in accordance with Article 6(1) of Directive 2001/16/EC. The basic parameters provided for in Article 6(4) of this Directive have been identified. The draft Traffic Operation and Management TSI was accompanied by an introductory report containing a cost-benefit analysis as provided for in Article 6(5) of the Directive. The draft TSIs were examined by the Committee set up by Council Directive 96/48/EC of 23rd July 1996 on the interoperability of the trans-European high-speed rail system and referred to in Article 21 of Directive 2001/16/EC, in the light of the introductory report.

It is acknowledged that in its current version, the TSI does not deal fully with all aspects of interoperability. The items that are not dealt with are classified as "Open Points" in Annex U of the TSI. The verification of interoperability has to be established by reference to the requirements of the TSIs, in accordance with Article 16(2) of Directive 2001/16/EC. It is seen as necessary during the transition period between the publication of this Decision and the full implementation of the TSI, to lay down the conditions to be complied with, in addition to those explicitly referred to in the TSI.

To this end, Member States are to inform other Member States and the Commission of the relevant national technical rules in use for achieving interoperability and meeting the essential requirements of Directive 2001/16/EC, in addition to the bodies it appoints for carrying out the procedure for the assessment of conformity or suitability for use as well as the checking procedure in use for verifying the interoperability of subsystems within the meaning of Article 16(2) of Directive 2001/16/EC.

The Commission will carry out an analysis of the information forwarded by the Member States and, where appropriate, discuss with the Committee the need for the adoption of any further measures. The TSI does not demand the use of specific technologies or technical solutions except where this is strictly necessary for the interoperability of the trans-European conventional rail system.

To encourage innovation and in order to take account of experience acquired, the TSI is subject to periodical revision at regular intervals. Where innovative solutions are proposed, the manufacturer or the contracting entity will state the deviation from the relevant section of the TSI. The European Rail Agency (ERA) will finalise the appropriate functional and interface specifications of the solution and develop the assessment methods. Critically, rail traffic currently operates under existing national,

bilateral, multinational or international agreements. It is important that those agreements do not hinder current and future progress towards interoperability.

A Commission Decision (2006/920/EC) was published in the Official Journal of the European Union (OJEC) on 18th December 2006 (1) concerning the technical specification of the interoperability relating to the subsystem "Traffic Operation and Management" of the trans-European conventional rail system. This Decision comes into force on 14th February 2007 (six months after notification).

The revised High Speed Traffic Operation and Management TSI is pending. It would appear that there are differing requirements for drivers in these two European Directives. It is understood the Commission is aware of this issue and is trying to resolve it.

It is also understood that most of the requirements relating to drivers will be developed and completed when the Driver Licence Directive (3rd package) is available. The third package is currently in discussion between the EU Parliament and EU Council.

2.3 Commission Decision (2006/920/EC)

As far as train drivers are concerned, this Decision applies to cross-border conventional rail services only. The technical specification for conventional traffic (1) covers a variety of considerations for the TSI, including that of professional qualification and training (of the driver). Section 4.6 of the Commission Decision (2006/920/EC) deals with the professional and linguistic competency and assessment process required for staff to achieve competency. It identifies and describes a number of key competencies, as follows;

- Professional competency, including;
    - Professional knowledge
    - Ability to put knowledge into practice
- Linguistic competency, including;
    - Principles
    - Level of knowledge
- Initial and on-going assessment of staff, including;
    - Basic elements, such as;
        - Selection of personnel
        - Initial professional training
        - Initial assessment
        - Competency retention
        - Refresher training
    - Training needs analysis (TNA) and updating of TNA
    - Route knowledge
    - Knowledge of rolling stock
    - Auxiliary staff

2.4 Driver Licensing Directive

On 3rd March 2004, the European Commission published its third railway package, which is currently being taken through the EU legislative process. One of the key elements of the third railway package is a proposal for a Driver Licensing Directive.

The objectives of the draft Directive are to facilitate the interoperability of cross-border operations by developing a licence for train drivers that will be recognised by all railway undertakings. It involves developing common standards of driver competence. It is hoped that this will create a more flexible labour market, with freedom of movement from one employer to another. The Directive potentially covers around 200 000 drivers in twenty-five Member States. The licensing covers three categories of driver, namely shunting, passenger and freight.

The proposal is for a two tier licence system – a European portion covering competencies, identification, educational levels, age, mental and physical fitness and language ability which will be recognised across all Member States, and a supplementary national certificate that covers national rules, rolling stock and route knowledge. The Licence would be issued by a competent authority or delegated to a certified body (railway undertaking). The text of the common position includes a provision for domestic drivers to be excluded from the requirements of the Directive, subject to a negative cost benefit analysis being developed.

The Council of Ministers published a Common Position on 6th July 2006, confirming that the Directive would only apply to train drivers (i.e. not other train crew) (see section 2.4.3). The Common Position also revised the timescales for phasing in the Directive, now stating that following the establishment of registers required under Article 22, licences shall be issued;

- After 1 year: To drivers involved in cross-border services, cabotage or freight services in another Member State, or working in more than one Member State – and to drivers that already worked on those services , but who will require a new licence or certificate
- After 3 years: Applicable to drivers who need a new licence or certificate
- After 8 years: Applicable to all drivers

2.5 Agreement between ETF and CER

In addition to the TSIs for interoperability, there is also a text of an agreement made in Brussels in January 2004, between the European Transport Workers Federation and the Community of European Railways on Driver competence for cross-border services (2). The Agreement is planned to be implemented by CER-affiliated companies pending a European Directive. Again, there are differences between this document and the two European Directives. The Agreement covers a variety of implementation considerations, including:

- Issuing and scope of the licence
- Ownership and structure of the licence
- Required aptitudes and skills
- Provision of documents

- Maintaining aptitudes
- Withdrawal of a licence
- Liability
- Provision of real-time information
- Assistance to the driver in the case of incident or accident
- Inspection
- Informing of staff representatives
- Monitoring of the Agreement

The licence will have a renewal validity not exceeding three years. This Agreement identifies four mandatory categories of licence, namely:

- General Knowledge: The knowledge and practice of the railway systems and the operating safety regulations imposed by each of the countries travelled in, enforced on the railway network driven on, for each particular service
- Rolling Stock Knowledge: The knowledge and control of the specific features of the rolling stock driven on the infrastructure, assuming that the driver is already authorised to drive such rolling stock
- Route and installation knowledge: Knowledge of the railway routes and the working sites that the driver will be driving through (or is likely to drive through) on his / her travels. This includes the location of railway stations and working sites, the location of signals and the regulations and various operating modes implemented in the various countries concerned.
- Language abilities: Appropriate knowledge of the language used to regulate traffic – both oral and written – so as to be able to talk with the person in charge of the infrastructure in all situations that may arise (such as when traffic is disturbed or disrupted). This requirement entails the need to set required levels of proficiency for language abilities.

In addition, the training centres and/or examiners and/or trainers for the operating rules in a country in which the driver will have to drive, shall be certified by the competent authorities of this country or by their authorised agents.

2.6 Accreditation of Rail Training Facilities

Work is also underway to review the accreditation of all types of railway training facilities. This work is also being led by the European Rail Agency (ERA). ERA is tasked with drawing up criteria for the accreditation of trainers, examiners and training establishments. The Directorate-General for Energy and Transport (DG TREN) of the European Commission have recently launched a study on the training needs and offers in the European railway area for the next 15 years. DG TREN has contracted with a consortium of consultants belonging to the Danish Technological Institute. This study will make an inventory of the European capacity for rail training, including:

- Train drivers

- Other on-board staff responsible for train and passenger safety
- Staff responsible for rolling stock inspection
- Staff responsible for assembling trains
- Staff responsible for dispatching and control-command

3 NATIONAL LEGISLATION

3.1 Legislation in the United Kingdom

3.1.1 Institutional arrangements

The first part consists of the key stakeholders and the role they play in the United Kingdom rail industry: Government, Regulatory bodies, Infrastructure manager and Railway undertakings.

3.1.2 Government

Department for Transport (DfT)
The Department for Transport's is a government department, which has the objective to deliver an integrated UK transport policy that works for everyone. This means a transport system that balances the needs of the economy, the environment and society. To achieve this aim the Department for Transport provides leadership across the transport sector, working with regional, local and private sector partners who deliver many of the services

3.1.3 Regulatory bodies

Office of Rail Regulation (ORR)
The Office of Rail Regulation is the integrated safety and economic regulator for the UK railway industry. The ORR sets out the minimum service levels which customers can expect from their train lines and can impose heavy penalties on train operating companies and the infrastructure managers Network Rail, should they fail to reach the required standards.

In addition to the role of economic regulator, the Railways Act 2005 gave overall responsibility to the ORR as the Health and Safety regulator for the rail industry encompassing the roles and responsibilities of HM Railway Inspectorate (HMRI). The Railways and Other Guided Transport Systems (Safety) Regulations 2006 (ROGS) have been developed as part of a legislative reform project to implement the Railway Safety Directive (RSD). ROGS replace the Railway Safety Case Regulations 2000 (RSCR); the Railways and Other Transport Systems (Approval of Works, Plant and Equipment) Regulations 1994 (ROTS), the Safety Critical Work Regulations 1994 (SCWR) they also implement outstanding recommendations from Lord Cullen's inquiry into the Ladbroke Grove rail crash.

ROGS have implemented requirements in the Railway Safety Directive (RSD) for railways (operators and infrastructure managers) to: maintain a Safety Management System (SMS); and hold a safety certificate (or 'authorisation' for infrastructure managers) indicating that the SMS has been accepted by the safety authority.

Rail Safety and Standards Board (RSSB)

The RSSB's primary objective is to lead and facilitate the railway industry's work to achieve continuous improvement in the health and safety performance of the rail-

ways in the UK. As part of its operation the RSSB writes, controls and reviews all Railway Group Standards used within the UK Rail industry. Railway Group Standards (RGS) fall into four main categories they are:

- RT- Railway Group Standards

These standards are technical and operational documents that lay down minimum safety requirements. They are mandatory for Railway Group members as detailed in their Railway Safety Case. Relevant Railway Group Standards include;

- GO/RT 3251Train Driving (Issue 4, October 2002)
- GO/RT 3255Train Working Competence & Fitness (Issue 2, October 2000)
- GO/RT 3260Competence Management for Safety Critical Work (Issue 2, August 1998)
- RC Railway Group/Railway Safety Approved Code of Practice (RACoP)

Non-mandatory documents detailing suitable and sufficient means of meeting the mandatory requirements of a RGS. Relevant RACoPs include;

- GO/RC 3560 Competence Assessment (Issue 1, August 1998)
- GN Railway Group Guidance Notes

Non-mandatory documents providing helpful information relating to the control of hazards associated with railway operations. They may include industry good practice. Some will give guidance on how to comply with a specific RGS, others will set out the intended policy in a specific area and will be stand alone documents.

- RM Manual

This manual is a suite of Railway Group Standards covering a particular area or activity.

In addition, the RSSB also provides *Good Practice Guides*, which give an indication of acknowledged best practice and approach on specific topics. It must be emphasised that Good Practice Guides are regularly updated in line with emerging knowledge. Relevant RSSB Good Practice Guides include;

- RS/501 Simulation as a Tool for Training & Assessment (Issue 1, April 2005)
- RS/220 Good Practice in Training (Issue 1, October 2002)

Rail Accident Investigation Branch (RAIB)
The Rail Accident Investigation Branch (RAIB) is the independent railway accident investigation organisation for the UK. It investigates railway accidents and incidents on the UK's railways to improve safety, but not to establish blame. The RAIB is part of the DfT, but is independent from the rail industry, safety regulators and prosecution bodies.

3.1.4 Infrastructure Manager

Network Rail
As the principal infrastructure controller, Network Rail owns the main national rail network. Network Rail is responsible for the maintenance, repair and renewal of the

track, stations, signalling and electrical control equipment for enhancing the network. It operates under a network licence issued by the Secretary of State for Transport and administered/enforced by ORR.

Network Rail also has overall responsibility for operating the network and its performance, including leading industry planning, setting timetables and directing service recovery. Network Rail works closely with the train operators, focused on marketing, customer service and train maintenance.

3.1.5 Railway Undertakings

Train Operating Companies (TOCs)
TOCs provide passenger train services. They are granted franchises (operating contracts) by the DfT and then apply for licences to operate from ORR. Licenses will only be issued after a stringent review of the company policies and procedures, including an often lengthy process of verification relating to the proposed company safety case and safety management system.

The operating licenses issued allow the TOCs and Network Rail to undertake track and station access agreements. TOCs work to strictly controlled contracts that are normally 6 to 9 years in length. To remain the preferred operator the TOCs must adhere to the all obligations that have been laid down, this will include attaining the necessary performance targets, customer satisfaction levels and improvement projects. Currently there are 23 individual TOCs providing passenger carrying services on the UK's Rail Network. All Train Operating Companies are members of ATOC (Association of Train Operating Companies

Freight Operating Companies (FOCs)
FOCs provide rail freight services. They are granted operating contracts by the DfT and then apply for licences to operate from ORR. FOCs Work closely with Network Rail to enable appropriate track access and operating costs.

Currently there are 7 individual FOCs providing freight carrying services on the UK Rail Network, Each of these Freight Operating Companies are members of Rail Freight Group (RFG). RFG members benefit by improving the political, legal and planning environment in which the rail freight industry operates, by attracting new investment and in promoting the development of the industry through its organisations.

3.2 Legislation in France

3.2.1 Institutional Arrangements

The first part consists of the key stakeholders and the role they play in the German rail industry: Government, Regulatory bodies, Infrastructure manager and Railway undertakings.

3.2.2 Government

Ministry of Transport
The Ministry of Transport is responsible for the traffic policy in France.

3.2.3 Regulatory bodies

Etablissement publique de Sécurité Ferroviaire (EPSF)
EPSF is a subordinate of the Ministry of Transport and is responsible for the safety of railway operation in France. By this function EPSF also issues the Safety Certificates, needed by every Train Operating Company in France.

3.2.4 Infrastructure Manager

Réseau Ferré de France (RFF)
RFF owns the track infrastructure in France. Every railway undertaking (if licensed by EPSF) can use the track network. An access without discrimination is granted.

3.3 Legislation in Germany

3.3.1 Institutional arrangements

The first part consists of the key stakeholders and the role they play in the German rail industry: Government, Regulatory bodies, Infrastructure manager and Railway undertakings.

3.3.2 Government

Federal Ministry of Transport, Building and Urban Affairs
The Ministry of Transport is responsible for Germany's transport policy. Three main documents for railway operation in Germany are issued by this ministry:

- The railway construction and operation regulations
- The general railway regulations
- The railway signalling regulations

3.3.3 Regulatory bodies

Federal Railway Authority (subordinate to the Federal Ministry of Transport, Building and Urban Affairs)
The German Federal Railway Authority is in general responsible for the safe railway transport within Germany. This includes among other issues e.g. the licences for railway undertakings that want to operate trains, the approval of rolling stock, as well as for the infrastructure (incl. buildings, bridges and tunnels) itself and for its operators. Furthermore it is acting as a supervisor of the railway operation. This is done by visits of driving cabs, signalling towers and other operational sites, done on a randomised basis. Also the official railway accident investigation in Germany is done by a special department (Division 91) of the German Federal Railway Authority. The free of discrimination access of other companies to the track network of Deutsche Bahn is also controlled by the German Federal Railway Authority.

3.3.4 Infrastructure Manager

DB Netz AG
More than 90 percent of Germany's railway infrastructure is owned and managed by DB Netz, a part of Deutsche Bahn AG. Every licensed railway undertaking can use

the track network. An access without discrimination is granted and under supervision by the German Federal Railway Authority.

3.3.5 Railway Undertakings

The largest train operating company is still Deutsche Bahn AG (incl. its subsidiaries), the privatised successor of the former German Federal Railways. Deutsche Bahn AG is a state owned shareholding company. Its division DB Netz has also the functions of the Infrastructure Manager. Beneath Deutsche Bahn AG at present there are more than 300 other railway undertakings registered to operate trains in Germany. Nearly all of them are operating local trains or freight trains.

3.4 Legislation in the Czech Republic

3.4.1 Institutional arrangements

The first part consists of the key stakeholders and the role which they play in the rail sector in the Czech Republic: Government, Regulatory bodies, Infrastructure manager and Railway undertakings.

3.4.2 Government

Ministry of Transport
The Ministry of Transport is responsible for the Czech Republic's transport policy. In the rail sector, its railways and Railway Transport Department is responsible for administration and supervision of the sector. It also takes the lead in all international relations affecting the rail industry.

Its approach to the governance of the Czech rail sector and infrastructure development is determined by legislation: The **Track Act No 266/1994 Coll.** (hereinafter Track Act), as amended, and **Land Use and Buildings Act No 50/1976 Coll.,** as amended.

3.4.3 Regulatory bodies

Track Inspectorate
The Track Inspectorate is responsible for investigation of accidents on the Czech Republic's railways. It identifies any problems with the rail infrastructure and issues requirements for remedies and monitors compliance. Persistent safety problems encountered with Railways undertakings can lead to the proceedings to withdraw their operating licence[2].

Rail Authority
The Rail Authority is an independent entity established by the State. Its Director is appointed by the Minister of Transport. The Rail Authority is responsible for:

- Safety on the railways and the issuing of Safety Certificates;
- Issuing permits for new railway infrastructure and rolling stock;

[2] **Track Act No 266/1994 Coll., Section 34a**

- Technical approval of vehicles and equipment and issues the certificates for train drivers;

Issuing the driving licence to the applicant who has proved his/her professional competence by passing an examination is provided by the Section of Electrical Devices.

The Rail Authority has the function of state administration in the matters of rail systems, except matters in which the Ministry of Transport or the municipalities are taking the decision. The Rail Authority is a special authority for the construction of rolling stock, and it decides on the issue of official permits for the operation of rail systems and on licensing to railway undertakings. It also issues safety certificates for carriers, for operating the rail transport on the nation-wide railways and regional railways, driving licences for driving rail vehicles, operability certificate of specified technological pressure, gas, electric, lifting and transport equipment, containers and swap bodies and rail vehicles, certificates of competence for performing revisions, inspections and tests of specified technological equipment in operation.

The Rail Authority coordinates national registers of the rail vehicles and rail systems. Furthermore, it imposes fines according to the Building Act and to the Act on rail systems. It also holds the state building supervision as well as the state supervision in the matters of rail systems.

3.4.4 Infrastructure Manager

SZDC Railway Infrastructure Administration
Under the **Transformation Act No 77/2002 Coll.**, as amended, Českе drahy (CD) was split into two organisations. The Railway Infrastructure Administration, a Government organisation, became responsible for the management of the rail infrastructure assets. It oversees the development and management of the infrastructure. However, it delegates its operational activities to CD under a three-year management contract.

In addition to CD, some regional parts of the Czech railway network are used by other Freight Railways Undertakings. Conditions of use have been set out in the **Track Act** including the requirement for an operating licence, certificate of forwarder (both issued by the Rail Authority), and a contract of exercise of railway transport that has to be drawn up between the railway undertaking and the infrastructure manager.

The infrastructure manager allocates train paths and capacity according to the operating licence conditions. Access charges are set by the Ministry of Finance on the basis of data provided by the infrastructure manager.

3.4.5 Railway Undertakings

Besides the biggest Czech company, Českе drahy, there are a small number of independent freight operators. An overview of the key industry stakeholders is summarized in Figure 1.

3.4.6 State of the art

The Second Railway Package for revitalisation of the EU railways is adapted in the amendment of the **Track Act** as amended by the **Act No. 103/2004 Coll.** that came

into force on May, 5th, 2004[3]. The Regulation of the Ministry of Transport **Regulation No. 101/1995 Coll.** on conditions for rail professions was amended in year 2005. Amongst other issues, it regulates the form of obtaining, assessment and maintaining qualifications of train drivers for Czech Republic's railways and private railways on the territory of the Czech Republic. A commission was established at the Ministry of Transport to prepare this amendment in order to bring the form of training and certification of train drivers in compliance with the EU.

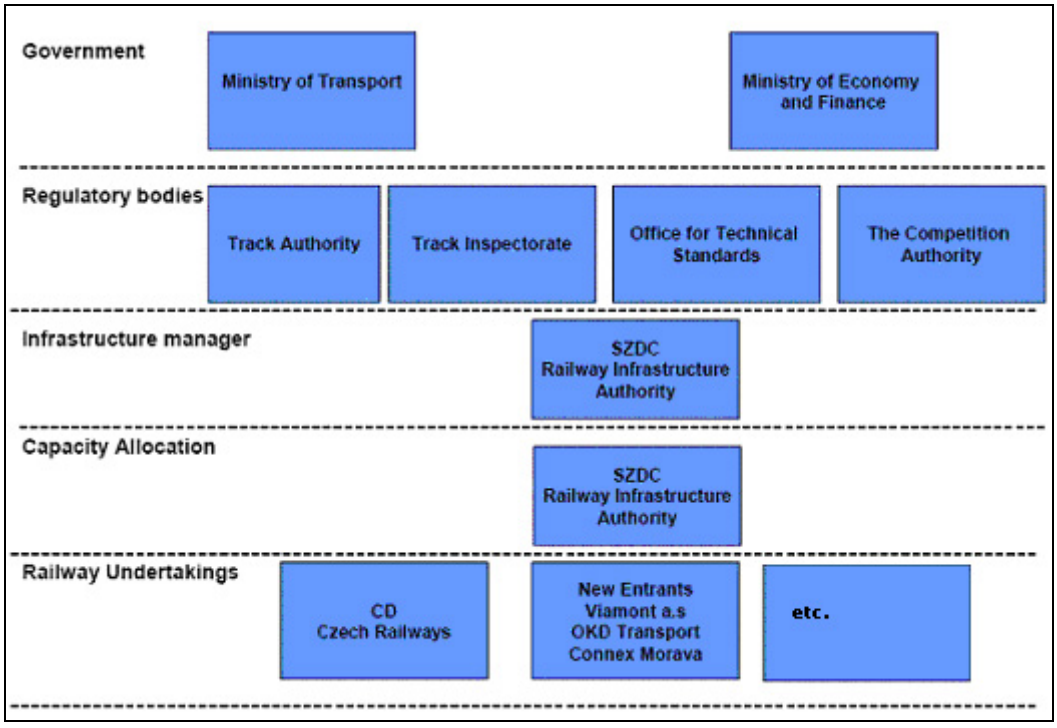


Figure 1: Overview of the key stakeholders in the rail sector in Czech Republic

3.4.7 Recent possibilities of entering of foreign carriers on the network of the Czech Republic

Since May, 1st, 2004, theoretically anybody, regardless of whether it concerns passenger transport or freight transport, can use the network of CD for its own trains driven by its own train drivers, even a foreign operator of railway undertakings. Such operator must meet following requirements:

- For its national safety certificate each operator must obtain a safety certificate for operating railway undertakings in the Czech Republic from a railway operator;
- For its national safety certificate each operator must hold a licence for operating railway undertakings on its own territory, for tracks on nation-wide railways or regional railways leading to the state boundary of the Czech Republic;
- For its national safety certificate each operator must prove that the operator is entitled to operate railway undertakings on the linking segment of the railway

[3] Czech Republic entered the EU

in the neighbouring state. Conditions for operating these undertakings are now being adapted by means of mutual border arrangement so that they are related to every authorized carrier to operate international undertakings in case it holds a valid licence, carrier certification, is allocated volume of rail traffic also on the neighbouring railways and has a contract to operate railway undertakings with a respective rail operator.

3.4.8 Competence for driving rail vehicles

The **Section 45** of the **Track Act** lines out that only those persons holding a valid driving licence shall be allowed to drive a rail vehicle. The Rail Administrative Authority shall issue the driving licence to the applicant who has proved his or her professional competence by passing an examination. An applicant can take the examination, if he/ she:

- Has reached the prescribed age and education,
- is reliable for driving[4],
- has proved his or her health fitness, and
- has completed the prescribed education and training program.

The conditions of health fitness, age, and education, the scope of the required professional knowledge, the manner of performing the education and training and the manner of carrying out the examinations shall be laid down by an implementing provision – i.e. the Regulation of the Ministry of Transport **Regulation 101/1995 Coll.**

The Rail Administrative Authority shall order a check of professional and health fitness for driving for persons showing driving shortcomings that may endanger the rail transport operation safety. According to the results of the check, the Rail Administrative Authority may take a decision to restrict or to cancel the respective driving licence. In case of cancellation of the driving licence, the Rail Administrative Authority shall withdraw the respective driving licence.

The Rail Administrative Authority shall order an examination in professional competence and health fitness of persons for driving if it has justified doubts regarding the health fitness or professional competence of such persons. In these cases, the Rail Administrative Authority shall suspend the driving licence until such time when the reasons for the suspension of the driving licence will have ceased.

Persons not holding a driving licence may drive a rail vehicle in the course of driving training or examination in rail vehicle driving. While operating a rail vehicle of a non-approved type for the purpose of trial runs and tests for type-approval or type-change, the rail vehicle may be driven by a supplier's employee not holding the respective driving licence only under the supervision of a railway undertaking's employee responsible for adhering to all principles of rail transport operation safety.

The overview of the legislation in the Czech Republic is very simple. The list of legislation acts can be split in two levels: national and company (see Figure 2).

[4] see **Section 46** of the **Track Act**

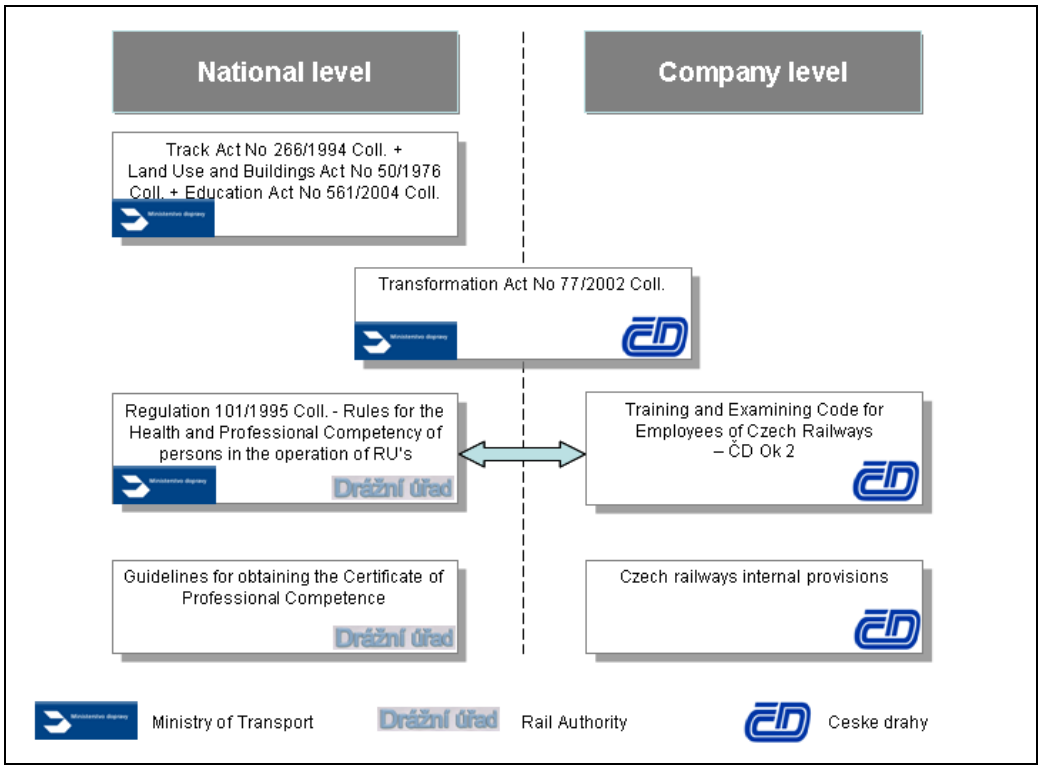


Figure 2: The overview of the legislation in the Czech Republic

3.4.9 Basic requirements for placing a candidate for training

The candidate must meet conditions for professional and health competence specified by the **Regulation No.101/1995 Coll.,** which issues rules for health and professional competence of persons operating railways and railway undertakings. Conditions for educational and professional competence of persons for driving electrical diesel vehicles on nation-wide railways, regional railways and sidings are:

a) complete secondary professional education specializing in electrical engineering,

b) professional competence in electrical engineering with a qualification of "person competent"[5],

c) completed schooling in professional theoretical knowledge according to the test content, specified in the **Attachment No. 4, Part A**, which is part of this regulation,

d) professional experience of repairing and maintenance of an electrical diesel vehicle in the duration of at least 20 weeks,

[5] Employees who perform any activity on CD electrified railway lines on specified technical equipment according to Track Act 266 (1994) and in its neighbourhood must meet qualification of electrical engineering, at least „person competent" according to **Regulation No. 100/1995 Coll.** To be a „person competent", it is considered a person, who was in extend of his or her activity demonstrably informed about technical rules related to activities on electrical equipments of respective type and voltage which shall perform or drive further with instruction of producer and provider of electrical equipment, was familiar with principles of first aid in electric current injury, was warned of possible danger of electrical equipment and was introduced into practice.

e) training in the service garage of electrical diesel vehicles specializing in knowledge of construction and maintenance of a vehicle in the duration of at least 20 weeks,

f) training in performing technical inspections of engine rail vehicles in the duration of at least two weeks,

g) driving training and operation of an electrical diesel vehicle under supervision in the duration of at least 24 weeks,

h) examination of professional theoretical and practical knowledge in front of the Rail Authority.

In case of a person already qualified for driving a diesel vehicle on nation-wide railways and on regional railways and on sidings, requirements for schooling and professional competence of a person to drive an electric diesel vehicle on nation-wide railways and regional railways and on sidings are

i) complete secondary professional education specializing in electrical engineering,

j) professional competence in electrical engineering with qualification of "person competent",

k) completed schooling in professional theoretical knowledge of construction, maintenance and driving of a respective type of diesel vehicle according to the test content, defined in the **Regulation, Attachment No. 4, Part A**, which is part of this regulation,

l) training in the service garage of electrical diesel vehicles specializing in knowledge of construction and maintenance of a vehicle in the duration of at least 10 weeks,

m) driving training and operation of an electrical motor vehicle under supervision in the duration of at least 12 weeks,

n) examination of professional theoretical and practical knowledge in front of the Rail Authority.

3.4.10 Normative and regulatory framework for training, maintenance of qualification

The **Regulation No.101/1995 Coll.** defines in **Chapter 9** types and length of training before assessment of competence for driving in front of the examining board of the Rail Authority. Issued „Certificate of Professional Competence for driving" is valid without restraint unless terms of validity are broken.

Further phase of training before taking up the post of a train driver is meeting requirements of professional competence specified in the **Training and Trial System for employees of CD** (**Ok 2**), including the requirements for maintaining the qualification obtained by professional assessment according to this regulation.

3.4.11 Requirements for obtaining state certificate („Certificate")

In compliance with the **Track Act, Section 45 & Section 46**, the **Regulation No. 101/1995 Coll.** stipulates requirements for obtaining the driving certificate:

- Driving rail vehicles, with the exception of a diesel vehicle and a special motor vehicle on special railways (e.g. metro) are allowed persons who reached the age of 21.
- Driving a diesel vehicle on special railways is allowed persons who reached the age of 18.

Preventive examinations are:

- Entrance examination where health competence is reviewed of candidates for the Certificate of Professional Competence for driving rail vehicles; check-up will be done before the beginning of training for obtaining the Certificate of Professional Competence for driving rail vehicles,
- Examination at the entrance check-up will also include ECG exam, neurological exam, including electroencephalograph exam, ear, nasal and neck exam, including audiometric examination, eye exam, including eye ground exam, stereoscopic vision and night blindness, psychiatric examination and
- Psychological exam (if necessary).

After successfully passing the examination at the Rail Authority, the candidate will obtain the certificate. The certificate is issued for motor vehicles of a certain type of a respective traction.

For driving a motor vehicle of a different type of the same traction, the competence for driving will be completed by an examination taken at the Rail authority from knowledge of construction, maintenance and driving of a respective motor vehicle. Conditions specified by the above cited regulation are valid for all the operators of railway undertakings on nation-wide railways, regional railways and sidings.

Organization, content and administration will be specified by **Chapter 18** of the **Regulation No.101/1995 Coll.,** together with details listed in **Annex 4** of this regulation. The whole process is in the exclusive competence of the Rail Authority. Theoretically, a driver of a rail vehicle must meet minimum requirements, which are required by the **Track Act**, subsequently amended.

3.4.12 Guidelines for obtaining the Certificate of Professional Competence[6]

The **Certificate of Professional Competence for driving rail vehicles on nation-wide railways, regional railways and sidings** and the **Certificate of Professional Competence for driving cableway installations** is certified by The Rail Authority (see Figure 3). The Rail Administrative authority shall issue the driving licence to the applicant who has proved his or her professional competence by passing an examination. An applicant can take an examination, if he or she

- reached the prescribed age,

[6] In compliance with the **Track Act, Section 45**, expressed in statutory texts and **Regulation No. 101/1995 - Rules for the Health and Professional Competency of persons in the operation of a Railway and Railway transport**, as amended.

- is reliable for driving (i.e. not a person who was lawfully sentenced for a criminal act in an action associated with the activities or for a criminal offence committed intentionally, provided that the driving requirements and the applicant's character raise fear that he or she might commit an identical or a similar act while driving or who was prohibited by a court sentence from driving),
- proved his or her health fitness,
- has completed the prescribed education and training program.

Figure 3: Sample of the Certificate of Professional Competence

Education and professional competence conditions for driving different kind of vehicles on different kind of tracks are stated in Chapter 9 of the **Regulation**.

Schooling for obtaining professional theoretical knowledge is carried out within the scope of examination content to demonstrate professional competence for driving according to the relevant part of the **Attachment No. 4** of the. Schooling, training, professional practice and training in driving of a rail vehicle is provided by an operator equipped with the respective rail vehicle. Professional competence for driving rail vehicles is demonstrated for (see Table 2):

- respective type of a motor vehicle
  - electrical motor vehicles of direct current system (E1),
  - electrical motor vehicles of alternating current system (E2),
  - multiple current system motor vehicles (E3),
  - motor vehicles (M),
  - steam motor vehicles (P),
  - special motor vehicles with operating speed of less than 40 km/h (SV1),
  - special motor vehicles with operating speed of more than 40 km/h (SV2).
- respective railway category
  - nation-wide railways, regional railways and sidings (C),
  - sidings (VL).

For driving a different type of motor vehicle in the same category of railways, professional competence will be demonstrated by supplementary examination in front of an examining board of the knowledge of construction, maintenance and driving of a re-

spective type of motor vehicle. To pass the supplementary examination on nation-wide railways, on regional railways and on sidings it is required:

- Training aimed at knowledge, maintenance and troubleshooting of a respective type of a motor vehicle in the duration of at least three weeks,
- Training in driving and operation of set type of motor vehicle under supervision in the duration of at least four weeks,

For driving the same type of a motor vehicle except for sidings also on nation-wide railways and regional railways, professional competence will be demonstrated by a differential test in front of an examining board from knowledge of rules for operating rails and railway transport and conditions for serviceability of rail. Conditions for passing differential tests are specified in **Chapter 16a** of the **Regulation**.

Every applicant submits his/her application for examination of professional competence as an individual, i.e. he or she is responsible for its accuracy and completeness. This does not eliminate certain cooperation of an applicant and employer, especially when submitting the application forms with necessary documents and when submitting bulk applications.

Documents which will be attached to the application are necessary to submit at the examination in original, attested duplicates or attested copies, in Czech language. With foreign-language documents applicant shall submit also its attested translation into Czech language.

The examining board should have at least three-members and at least one of these must hold the Certificate for driving a respective type of a rail vehicle if it concerns an examination of driving a rail vehicle. Or this person must hold the Certificate for driving rail vehicle for respective type of cableway installations, if it concerns an examination of driving cableway installations. The Rail Authority appoints an examining board and its chairperson who must be employed at The Rail Authority.

In case the applicant submits at the examination all the required documents and these documents are in compliance with the requirements prescribed by the regulation, the applicant will be told that he or she met prescribed requirements and will be allowed to take the exam. Proceedings with the actual exam are as follows:

- applicant will be introduced to the examine board,
- applicant will be acquainted with the system of the exam – examination is divided into two parts, i.e. a professional theoretical knowledge part and a practical knowledge part,
- part of the professional theoretical knowledge examination is done in the form of written tests
    - written exams and explains him or her how to complete them and its evaluation,
    - applicant will be provided with a time limit for answering the questions
    - during the professional theoretical knowledge examination, no working aids are allowed to be used.

First examination of professional competence (*101/95 §9 article 1, 2 ,3, 4, 5 paragraphs a - f (h)*)					
Type of motor vehicle	**Electric**	**Electric**	**Diesel**	**Diesel**	**Steam**
Type of track	**national**	**siding**	**national**	**siding**	**national**
Education - complete secondary professional	required	required	required	required	required
person competent	yes	yes	yes	yes	yes
Regulation 101/95 annexe no.	4 part A	4 part A	4 part AB	4 part AB	4 part C
training in the service garage of electrical motor	20 weeks	3 weeks	20 weeks	3 weeks	3 weeks
training in driving under supervision	24 weeks	4 weeks	24 weeks	4 weeks	4 weeks
examining board	yes	yes	yes	yes	yes

First examination of professional competence (*101/95 §9 article 6 a 7)*				
Type of motor vehicle	**SV1**	**SV2**	**SV1**	**SV2**
Type of track	**C**	**C**	**VL**	**VL**
Education - complete secondary professional education specializing in electrical engineering	required	required		
person competent	yes	yes	yes	yes
Regulation 101/95 annexe no.	4 part D	4 part D	4 part D	4 part D
training in the service garage of electrical motor vehicles	4/weeks	4/weeks	4/weeks (siding part)	4/weeks (siding part)
training in driving under supervision	4/weeks	4/weeks	4/weeks	4/weeks
examining board	yes			

Table 2: First examination of professional competence – type of track and motor vehicle

- part of the examination of practical knowledge consists of practical demonstration of a respective activity the examination is concerned
    - with the persons driving rail vehicle especially from driving a respective type of vehicle on rail of operation conditions and elimination of operation breakdown
    - during the practical knowledge examination, it is allowed to use also working aids, such as e.g. diagrams, manuals, etc.

The exam is considered successfully accomplished when graded passed at demonstrating theoretical and practical knowledge. Written examination tests are only attachments of the test record of the **Certificate of Professional Competence** which is part of the document the Rail Authority in the given matter.

Based on the submitted application The Rail Authority issues the applicant the certificate for driving. The certificate contains data according to the **Regulation, Chapter 20, Section 2**. The certificate can be picked up by the applicant in person at The Rail Authority. In exceptional cases it can be delivered to the applicant by post. When exchanging the old certificate for a new one, it is necessary to return the old one.

Applicant who did not pass the examination, can take a second examination from the parts of the examination he or she failed (i.e. from the part of the professional theoretical knowledge examination or from the part of the practical knowledge examina-

tion), within six months from the time when the examination was taken at the latest. It is not possible to retake the second examination (Table 3).

Second examination (*101/95 §16 article 3 paragraph a)*			
Track	**national**	**Siding**	**Note**
Construction of vehicles, maintenance	3 weeks	3 weeks	
training in driving under supervision	4 weeks	4 weeks	
examining board	yes	Yes	

Table 3: Second examination

Figure 4 summarises the way to pass the first exam.

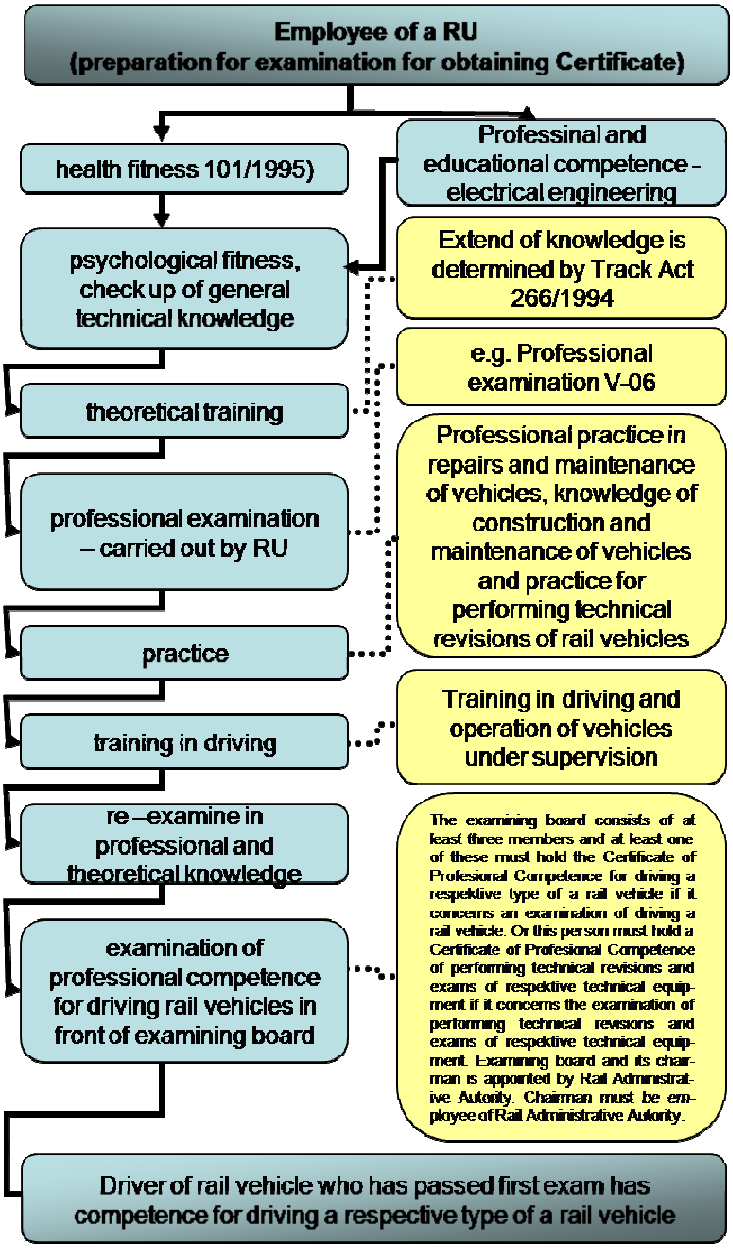


Figure 4: Summary of the way to pass the exam.

4 COMPANIES

4.1 Southern (UK)

Southern Railway Limited is a Train Operating Company (TOC) providing passenger carrying services in the Southern United Kingdom. Last year the franchise carried 120 million passengers. Southern's 3 500 staff manage 160 stations and operate and maintain a fleet of 300 new and refurbished trains.

4.1.1 Training system (content and driver assessment)

Driving different types of train at speeds of up to 100mph over a busy high density network, demonstrates the difficulties for training and licensing Train Drivers faced by Southern. There is a large amount to learn and Southern are committed to providing the best quality training for new drivers over a period of up to one year.

The training content for drivers at Southern is standardised to a modular concept. For every element of skill or knowledge that is required, there is a module of learning/development, the content of which is used to impart knowledge, skills experience and behaviour to the trainee. The product of these modules is to enable performance and understanding to be demonstrated and assessed, providing a competent driver at the completion of the programme.

Typical training media and delivery methods include;

- Classroom based theory training
- Practical training (i.e. on stock)
- Practical training in a learning environment
- Computer Based Training
- Simulator
- Handbooks

Typically, these training media cover;

- Initial Training; such as, Company induction, Depot induction & Personal Track Safety (PTS)
- Operations Training; Publications use, Sectional appendix, train regulation and signals, communications, driving policy, train dispatch, simulation experience, protection arrangements, route familiarisation
- Rolling Stock Specific Training; Train systems, Rolling stock familiarisation, communications, simulation, coupling / uncoupling,

A summary of the typical training programme and module duration for a new entrant Southern driver is provided as Table 4.1.

Module Name	No of Days
Company Induction	**5**
Depot Induction	**1**
Course Induction (Selhurst)	**1**
PTS	**1**
PTS Practical	**1**
Brand Values/Customer Service	**3**
Publication Use & G1	**3**
Sectional Appendix Theory	**1**
Sectional Appendix Practical / See Train Dispatch	**1**
Simulation Experience	**1**
Cab Experience Home Depot	**10**
Train Regulation & Signals	**3**
TPWS & Southern	**1**
Professional Driving/Comms	**1**
Detention of Trains/Comms	**1**
Passing Signals at Danger/Comms	**1**
SC SPAD Policy	**1**
Simulation Experience	**1**
Report writing, CIRAS/TW1/Dispatch & SigBox/ECO	**3**
Wrong Direction / Shunt Trains	**1**
Formative Assessment 1	**1**
Assessment Feedback	**1**
Single Line Over Double	**1**
Speed Restrictions	**1**
Simulation Experience	**2**
Train Systems	**20**
Practical Handling 1	**20**
Formative Assessment 2	**1**
Assessment Feedback	**1**
Route Learning Principles	**3**
Main Line Handling	**65**
Out of Course Situations	**2**
Protection Arrangements	**1**
Assistance Procedures	**1**
Simulation Experience CBA/T	**1**
Formative Assessment 3	**1**
Assessment Feedback	**1**
Depot Route Learning Brief	**1**
Summative Assessment	**3**
TOTAL	**158**

Table 4: Southern Railway Train Driver Programme

4.1.2 Examination at Southern

Southern adheres to the ROGS and RGS that are laid down as the requirements by the ORR and RSSB (see section 3.2.3) for drivers that undertake a safety critical role within the rail industry

As part of the safety case submitted to the ORR, Southern must demonstrate a robust safety management process. Part of this process is to show an appropriate level of training, assessment and resource has been allocated to the competency of the drivers within the company. As part of the Southern SMS, a competence programme

is in place to ensure continued workplace performance. Statements within the safety case indicate that;

- The training programme must be approved by the company's operations standards manager
- Content of the examination must be approved by the company's Operations standards manager
- The examiner must be a person that was not involved in the individuals training
- It is clearly defined, for which kind of skills an official examination according to the above mentioned points is needed, and for which ones a simple check of the knowledge is sufficient
- Performance can be judged by practical observation, simulation, written and oral examinations. Knowledge checks can be partly made by using a simulator

4.1.3 Competence Assessment and periodical training at Southern

Competence assessment and periodic update and review training takes place "in-the-line" within the company competence management process. The assessments can be either direct observation or indirect assessments;

- Direct assessment: Made at the driver's working place by accompanying him/her in the driver cab during a normal shift or by using a simulator.
- Indirect assessment: Made by written or oral examination or computer based assessment. This can be at a pre-determined time or at the end a cycle of training

Every driver must undergo a minimum of four assessments per year, of which two will be direct assessment and two as indirect assessment. Table 4.2 details the predicted assessment and monitoring activity that takes place over each two year period of a driver's competence cycle:

Start Date	Summary Assessment – 1 day
At month 3	OTMR Monitoring
At month 6	Practical Assessment – 60 min
At month 9	OTMR Monitoring
At month 12	Review Assessment - 1 day for drivers, as required for shunt drivers
At month 15	OTMR Monitoring
At month 18	Practical Assessment – 60 min
At month 21	OTMR Monitoring
At month 23	Summary Assessment – 1 day

Table 5: Competence Assessment Cycle (Southern Railway)

Simulator sessions are frequently used. The programme of the simulator activities is specifically developed to mirror as closely as possible the needs and environment in which the driver is likely to be involved and for every region or route is specifically prepared. If the driver fails the assessment ride on the simulator, the result is reported immediately to his/her home depot and driver manager. At this point, an action plan is put in place to facilitate appropriate re-training, re-assessment and re-

certification. As long as action remains in place the driver's competence and license will be removed for driving trains.

The periodical training at Southern generally covers operational and technical issues. This primarily involves classroom sessions and Computer Based Training. This update or review will be checked by assessment, either directly by observation or indirectly by examination, or by CBT assessment. The driver's competence is additionally monitored by a competence interview held with a Driver Standards Manager. This interview is intended to be informal and allows for comment from both parties. The interview generally consists of:

- Reviewing personal performance and achievements
- Identifying potential shortfalls in the driver's knowledge and skill base
- Identify any problems with this driver possibly based around recent incidents.
- Feedback on assessment and periodic training programmes development
- Additionally the driver can indicate any shortfalls in his/her competence.

The results of the competence interview can lead to an action plan being generated that is specifically tailored to the requirements of the individual.

4.1.4 Driving license

Southern issues a competence licence. This is issued every two years providing the driver meets all the competence and assessment criteria. This license can be withdrawn at anytime, by his/her Driver Manager. Figure 4.1 provides an example of the combined Train Driver Personal Track Safety (PTS) and Competence Licence.

<table>
<tr><td colspan="2">Personal Track Safety & Competence Licence</td><td colspan="5">The person named over is employed by Southern and has Proven Competence in their particular discipline. They have also proven competence in Personal Track Safety AC- DC
(Delete As Applicable)

Issued By:

Signature:

Grade:

The Holder of This Must Be In possession of A Southern SCWID</td></tr>
<tr><td colspan="7">Licence No.</td></tr>
<tr><td colspan="7">Name</td></tr>
<tr><td colspan="7">Grade</td></tr>
<tr><td colspan="7">Expiry Date</td></tr>
<tr><td colspan="7">The Holder of this Licence is Competent on the Following Stock:</td></tr>
<tr><td>377</td><td>319</td><td>455
456</td><td>421</td><td>200</td><td colspan="2">171</td></tr>
<tr><td colspan="5">Delete or Add to As Necessary
(Note: in “Grade” State if Train Dispatch Staff)</td><td colspan="2"></td></tr>
</table>

Figure 5: Train Driver Personal Track Safety (PTS) and Competence Licence

Assessors are also licensed in a similar way to drivers, and are themselves assessed as occupationally competent on specific rolling stock types and routes. The combined *Driver / Assessor PTS and Competence Licence* is provided as Figure 4.2.

<table>
<tr><td colspan="3">Licence to Assess Competence of Persons Undertaking Safety Critical Work</td><td colspan="4">Southern employs the person named over and they have Proven Competence in the disciplines indicated below,
Driver Guard Shunter Train Dispatch
(Delete / Add to the above list as necessary)
Issued By: Signature:
Grade:
The Holder of This Must Be In possession of A Southern SCWID and Competence Licence</td></tr>
<tr><td colspan="7">Licence No.</td></tr>
<tr><td colspan="7">Name.</td></tr>
<tr><td colspan="7">Grade.</td></tr>
<tr><td colspan="7">Expiry Date.</td></tr>
<tr><td colspan="7">The Holder of this Licence is Competent on the Following Stock</td></tr>
<tr><td>375/7</td><td>319</td><td>455
456</td><td>421</td><td>200</td><td colspan="2">170</td></tr>
<tr><td colspan="5">Delete or Add to As Necessary</td><td colspan="2"></td></tr>
</table>

Figure 6: Driver / Assessor Personal Track Safety (PTS) and Competence Licence

The license itself can be issued to two staff categories:

- Drivers who hold the competences for driving on Network Rail mainline infrastructure.
- Shunter drivers who are restricted to depot operations only, and are not permitted on Network Rail mainline infrastructure.

4.2 SNCF

4.2.1 Training content and driver assessment

At SNCF in general there are existing two different ways to become a train driver:

- Recruitment done in external
- Recruitment done in intern

To the SNCF three categories of drivers exist:

- the CRTT (drivers of tram trains)
- the CRML (drivers for shunting and local lines)
- the CRL therefore (drivers on classic lines or drivers of TGV) two types of initial formations. To be drivers TGV, it is necessary to be imperatively before drivers on classic lines.

The staff is susceptible to be authorized to driver's function receives an initial formation that answers a referential of expertises. These initial and continuous (other) formations (held of a first use, foreign procedures and formation to the lines to big speed) are dispensed either by a centre of formation traction (CPFT) production, ei-

ther on a site of production in the conditions fixed by a contract established between the CPFT and the establishments. The used media are:

- Class-room training
- Practical training at site
- Practical training in a learning environment
- CBT
- Handbooks
- Simulator

Formation of the CRTT (TT 0648)
Formation in establishment
52 days of generic formation and 15 days of formation of application (5 stages)

Formation of the CRML (TT 0660)
Formation in alternation (CPFT and establishment)
60 days of generic formation in CPFT and 20 days of formation of application in establishment (4 stages)

Formation of the CRL (TT 0627)
Formation in alternation (CPFT and establishment)
110 days of generic formation in CPFT and 80 days of formation of application in establishment (11 stages)

Formation of the TGV's driver (TT0032)
Formation in alternation (CPFT and establishment)
10 days of generic formation in CPFT and 15 days of formation of application in establishment

4.2.2 Examination at SNCF

An assessment of the attack of the educational objectives (level 2) must cover the understanding with the systems, the knowledge of the procedures and the mastery of the gestures professions. This assessment is achieved by the setting formative traction to every stage. The traceability is assured by the booklet of follow-up of the trainee.

Exam of CRTT 3 (ETT 1.1)
Tests successive written (1 hour), convenient (in the setting of one work day) and oral (1 hour about)

Exam of CRML 3 (ETT 1.2)
Tests successive written (1 hour), convenient (in the setting of one work day) and oral (1 hour about)

Exam of CRL 3 (ETT 2)
Written, convenient (in the setting of one work day) and oral (2 hours about) successive tests (1 hour 30)

4.2.3 Competence Assessment and periodical training at SNCF

An agent's empowerment to the function of driver security imposes to answer the conditions of physical, psychological faculties and professional expertises. Empowerment is registered on a register held by the employer and the driver receives an individual document of empowerment. The length of empowerment is fixed to three years. The first empowerment is gotten after success to the exam.

The renewal of empowerment rests on the setting in experienced eve on the professional capacities. The setting traction has the obligation to value on a cycle of three years the set of the observable professional practices in situation (PPOS) and those bound to the rare procedures (PR) to be used by a driver. A national list is established and counts the PPOS and the PR.

The empowerment of the drivers is valid for one period of 3 years. In this cycle of 3 years, the set of the observable professional practices in situation and the rare procedures must be valued. The used media are:

- Class-room training
- Practical training in a learning environment
- CBT
- Simulator

Figure 7 shows a template of a driver license at SNCF (without supplement sheets).


Photo d'identité

SNCF

M .....

Titre d'habilitation à la fonction de

Né(e).....

Etablissement de : .....

conducteur

A été habilité le ..... par.....

Titre délivré par.....

Date ..... *Visa*.....

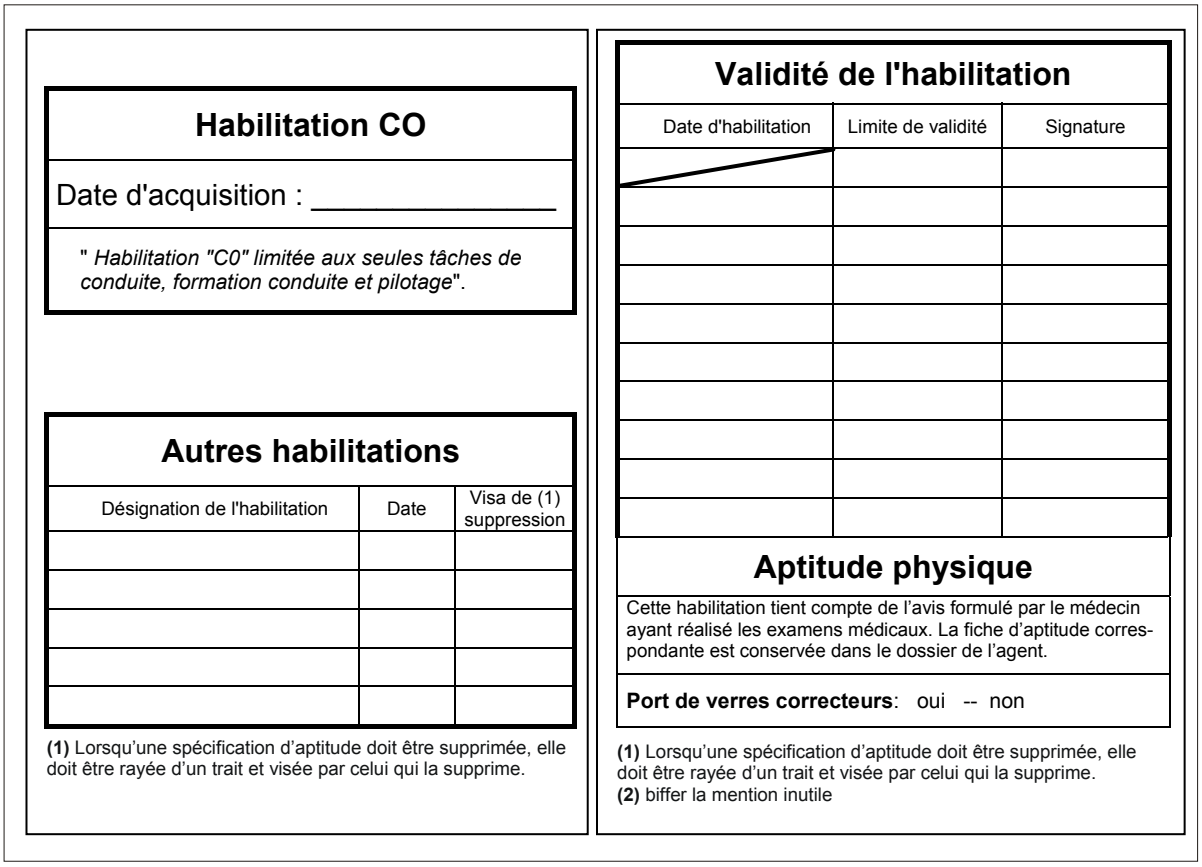
Signature de l'agent habilité :

Date ..... *Visa*.....

ATTENTION : La fonction de sécurité à laquelle vous êtes habilité ne peut s'exercer qu'en pleine possession de vos moyens.

En cas de traitement médical, vous êtes tenu d'informer votre médecin traitant sur le besoin de vigilance et de concentration que requiert l'exercice de votre fonction (Art. 34 de l'arrêté du 30/07/2003).

Application référentiel 77 0035



Habilitation CO

Date d'acquisition : _____

" *Habilitation "C0" limitée aux seules tâches de conduite, formation conduite et pilotage*".

Autres habilitations

Désignation de l'habilitation	Date	Visa de (1) suppression

(1) Lorsqu'une spécification d'aptitude doit être supprimée, elle doit être rayée d'un trait et visée par celui qui la supprime.

Validité de l'habilitation

Date d'habilitation	Limite de validité	Signature

Aptitude physique

Cette habilitation tient compte de l'avis formulé par le médecin ayant réalisé les examens médicaux. La fiche d'aptitude correspondante est conservée dans le dossier de l'agent.

Port de verres correcteurs: oui -- non

(1) Lorsqu'une spécification d'aptitude doit être supprimée, elle doit être rayée d'un trait et visée par celui qui la supprime.
(2) biffer la mention inutile

Figure 7: Driver License

4.3 Deutsche Bahn

4.3.1 Training content and driver assessment

At Deutsche Bahn AG in general there are existing two different ways to become a train driver:

- As part of the vocational training "Operational Railwayman"
- By a training to become only a train driver

The vocational training "Operational Railwayman" has total length of 3 ½ years. It is for young people who have finished the secondary school and is performed in cooperation with the local Chamber of Industry & Commerce. So within the German educational system it is an official job that requires training. Furthermore some of the training is performed at a municipal school, where beneath job typical school subjects also general issues like maths are trained. During the whole vocational training the trainees are learning issues of railway operation in general, but with a focus on train driving. After passing the final examination the trainees can start to work as a train driver. The only further things they will have to learn then are the specific issues (train or locomotive class, train protection systems, and so on) used at their future employer.

The second way to become a train driver at Deutsche Bahn AG is for persons who have already had a vocational training for any job (e.g. as a baker, electrician). The length of the training depends on the specific skills needed at their future employer. One part of the training are the operational basics, like signalling, operational rulebook and braking, the second part is consisting out of the courses for the rolling stock they will drive and on the train protection systems to be used. The typical overall length of this course is between 7 and 11 months.

The training content for driver training at Deutsche Bahn AG is standardised in a modular way. The whole package is called "Model of Train Driver's Competence" (DB company rule book no. 046.148). For every skill needed to be a train driver there exists a single module. Its content and the media used to impart it is part of the module's description and it is binding for performing the training module. The used media are:

- Class-room training
- Practical training at site
- Practical training in a learning environment
- CBT
- Handbooks
- Simulator

Modules exist for basics, like operational procedures up to absolutely specific skills, needed for example to drive a high speed train. In the following, one detailed module description is shown as an example:

Description of module

<table>
<tr><td>A1</td><td colspan="5">Organisation and objectives of the company</td></tr>
<tr><td>Learning objectives</td><td colspan="5">To know and to understand:
• To know the organisation, the most important tasks and aims of Deutsche Bahn AG
• To understand Deutsche Bahn AG as a service provider for fulfilling the customers' demands and expectations
• To know the duties of a train driver and his position within the organisation
• To understand a train as a 'product', made by a team</td></tr>
<tr><td>Content</td><td colspan="5">• Organisation and structure of the company
• Deutsche Bahn as a modern service provider in the transportation market - tasks, aims and products
• Tasks of a train driver according to the job qualification
• Dangers to operational safety resulting out of consuming addictive drugs
• Structure, tasks and main devices of the depot
• Collaboration of all persons involved into the train 'product'</td></tr>
<tr><td>Competencies</td><td colspan="5">• Representative of the company
• Cross-divisional collaboration</td></tr>
<tr><td rowspan="2">Additional information</td><td colspan="2" rowspan="2">• Training tour at the depot

• Further material to use: Organisational charts</td><td rowspan="2">Length</td><td>Theory (hrs)</td><td>Practical (hrs)</td></tr>
<tr><td>4</td><td>4</td></tr>
<tr><td>Certificate</td><td colspan="2">• Certificate of attendance</td><td>No. of trainees</td><td>• 12</td><td>• max 6</td></tr>
<tr><td>Methods / Media</td><td colspan="2">• Class-room training / training tour</td><td rowspan="4">Handbooks / Material</td><td colspan="2" rowspan="4"></td></tr>
<tr><td>Trainer</td><td colspan="2">• Theoretical trainer / practical trainer</td></tr>
<tr><td rowspan="3">Contact persons</td><td>Responsible departments</td><td>P.RBB 1/ P.TBZ 3/ L.RBS 2</td></tr>
<tr><td>Module description prepared by</td><td>Manfred Hoyer

Railion Deutschland</td></tr>
<tr><td>Revision</td><td>01 / 2004</td></tr>
</table>

*Figure 8:*Module description

For every course then a programme is designed, consisting out of the modules with the skills the driver needs at his future employer. So there doesn't exist any longer a "standard for everybody training". Every course has its own specifically designed

training agenda/programme. In the following and as an example, a training programme to become a driver for locomotive-hauled local passenger trains is shown.

Name of module	Description of module	Duration (hrs)	
		Theory	Practical
A	**Introduction into employment (1.5 days)**		
A1	Organisation and objectives of the company	4	4
A2	Basic legal issues and health/safety	4	0
G	**Basics of railway operation (4 days)**		
G1	The 'wheel/rail' system and special 'traffic rules' in railway operation	4	0
G2	The railway construction and operation regulations, catenary, occupational health and safety	10	0
G3	Devices for safety and communication	10	0
G4	Training run #1	0	8
V	**Modules for behaviour training (2.5 days)**		
V2	Service and communication	8	0
V3	Coping with stress successfully (incl. incidents/accidents)	12	0
B1	**Basics of operational rules (0.75 days)**		
B1.1	Terms of railroad properties and rolling stock	4	0
B1.2	Into railway operation involved persons	2	0
B2	**Shunting (4 days)**		
B2.1	Shunting, shunting signals	16	0
B2.3	Training run #2 (Shunting)	0	8
B2.4	Tour to a station/shunting yard	2	6
1st Competence check			
B3	**Marshalling and preparing of trains (1 day)**		
B3.1	Marshalling and preparing of locomotive-hauled passenger trains	8	0
B4	**Driving trains (7.75 days)**		
B4.1	Basics and preconditions for driving a train	8	0
B4.2	Time table needed for driving	10	0
B4.3.1	Signalling in normal operation (only for area of former Western Germany)	20	0
B4.4	Driving trains in normal operation	8	0
ES	**Additional modules on train protection systems (2 days)**		

Name of module	Description of module	Duration (hrs)	
ES10	Operating the train protection system 'PZB90'	12	4
B4.5	Training run #3 (train)	0	8
B4.5	Training run #4 (train)	0	8
2nd Competence check			
B5	**Driving trains under special conditions (3.75 days)**		
B5.1	Special operational situations occurring while driving a train	12	0
B5.2	Driving trains on the left track of double-track lines	18	0
B6	**Driving trains – Irregularities (6.5 days)**		
B6.1	Irregularities in railway operation	18	0
B6.2	Irregularities at technical equipment	18	0
B6.3	Training run #5 (train)	0	8
B6.4	Training run #6 (simulator)	0	4
1st Written test			
TG	**Technical basics of rolling stock (4 days)**		
TG1	Basic construction of locomotives and trains	8	0
TG2	Electric circuits and their components	4	0
TG3	Compressed air generation and distribution	4	0
TG4	Brakes on locomotives and trains, their operation and handling	8	0
TG5	Training tour	0	8
E BR	**Additional modules on brakes (4 days)**		
E BR1	Qualification to check brakes on passenger and freight cars	14	18
TE	**Mode of operation of electric locomotives and trains (4 days)**		
TE1	Basics of electric locomotives and trains	20	0
TE2	Requirements and specialities of operating electric trains	4	0
TE3	Training tour	0	8
EK	**Additional modules on communication (1 day)**		
EK1	Basics of train radio and GSM-R	4	4
ET	**Additional modules on technical issues (0.5 days)**		

Name of module	Description of module	Duration (hrs)	
ET2	Automatic door-locking system (Tb0)	0	4
EX	**Further additional modules (0.5 days)**		
EX5	Environmental driving (theoretical part)	3	0
EB	**Additional modules on train operation (0.5 days)**		
EB5	Preparation for driving trains	4	0
V			
V6	Training for customer-oriented announcements	6	4
	Special rolling stock technology (44 days)		
BR143.1	Training for the locomotive class 143 (theoretical and practical part)	32	40
2nd Written test			
BR143.2	**Learning to drive trains with the locomotive class 143 (35 shifts, part 1)**	**0**	**80**
E WT	**Additional modules on rail car technology (5 days)**		
E WT1	Passenger rail car technology	20	20
BR143.2	**Learning to drive trains with the locomotive class 143 (35 shifts, part 2)**	**0**	**120**
B7	**Exam preparation on railway operation (5 days)**		
B7.2	Handling technical/operational irregularities and special operational conditions on double-track lines	32	0
B7.3	Training run (simulator)	0	5
Written examination			
BR143.2	**Learning to drive trains with the locomotive class 143 (35 shifts, part 3)**	**0**	**80**
Oral examination			
Practical examination			

Table 6: Training programme to become a driver for locomotive-hauled local passenger trains

4.3.2 Examination at Deutsche Bahn AG

Deutsche Bahn AG is a member of the Association of German Train Operating Companies. This association has prepared a document with guidelines for the examination of train drivers (DB company rule book no. 492.0753). The guidelines are binding for every of the Association's members.

The key principles are:

- Training programme must be approved by the company's Railway Chief Operating Officer
- Content of the examination must be approved by the company's Railway Chief Operating Officer
- The examiner must be a person, that was not involved into the examinees' training
- Before the examination starts the examiner must own a written document, signed by the company's Railway Chief Operating Officer, where is written that he/she is the examiner on that day
- It is clearly defined, for which kind of skills an official examination according to the above mentioned points is needed, and for which ones a simple check of the knowledge (made by one of the group's trainers) is sufficient. For example for the basic operational rules for driving trains an official examination is needed, for the course needed to drive a specific train or locomotive a simple competence check is sufficient.
- Examinations and knowledge checks can be partly or in total made by using a simulator

4.3.3 Competence Assessment and periodical training at Deutsche Bahn AG

One rulebook of Deutsche Bahn (company rulebook no. 408.1111) prescribes which periodical competence checks and assessments have to be made. There are direct and indirect assessments existing:

- Direct assessment: Made at the driver's working place by accompanying him/her on the driver cab during a normal shift (minimum 30 Minutes), or by using a simulator.
- Indirect assessment: Made by filling out a question form, e.g. at the end of a periodical training

Every driver must undergo a minimum of 4 assessments per year, 2 as direct and another 2 as indirect ones. For every driver employed at Deutsche Bahn a one hour simulator ride per year is mandatory. This simulator ride counts as 1 direct assessment.

The programme of the simulator rides is strongly standardised and specifically prepared for every transport division. At the end of every year the preparation of the assessment simulator rides for the coming year is done by a group of experts, based on incidents and irregularities recently occurred. If the driver fails the assessment ride on the simulator the result is reported immediately to his/her home depot and as long as no adequate action was taken to recover (and to check again) the driver's competence he/she will be removed from driving trains.

The periodical training for every driver at Deutsche Bahn AG must have a minimum of 18 hours per year and covers operational and technical issues. As media classroom training and CBT/WBT are used, both finished by a competence check which counts as an indirect assessment.

Some divisions of Deutsche Bahn are using also another part of the "Model of Train Driver's Competence". The driver's competence is then additionally monitored by a competence interview held by the train crew manager individually for each one of his/her drivers. The interview is consisting out of questions to find out potential lacks in the driver's knowledge and in the case of some problems occurred with this driver during the last period partly based on these incidents. Additionally the driver can tell lacks of his competence he is already aware of to his train crew manager. The results of the competence interview then lead to a specific class room and/or practical training (can also be held at the simulator) tailored to the specific requirements of every single driver. So the periodical training and competence assessment every year is as follows:

- Certain number of direct assessments by accompanying the driver on the cab during his/her shift – Minimum is 1
- 1 assessment run on the simulator – counts as 1 direct assessment
- CBT/WBT with competence check at its end – counts as 1 indirect assessment
- 1 class-room training with competence check at its end – counts as 1 indirect assessment
- Alternatively if the "Model of Train Driver's Competence" by the division is also applied for periodical training/assessment: 1 competence interview – counts as 1 indirect assessment, followed by a specific training programme for the driver

4.3.4 Driving license

There is no binding regulation existing by the government that prescribes to use driving licenses for train drivers. As already written under 3.1.6 every railway undertaking is responsible for the knowledge of their drivers. Additionally the results of examinations and competence checks must be kept and stored. In case of irregularities the company must then be able to present them to the authority.

The Association of German Train Operating Companies has developed a license system for train drivers and its usage is mandatory for the member railway undertakings. Deutsche Bahn applied this license system as a part of the company rule book 492.0753. The driving license consists out of two parts the driver has to carry with while doing his/her job:

- The license itself
- The supplementary sheet

Both documents must be signed by the Railway Chief Operating Officer of the issuing railway undertaking, or by a person officially authorised by him/her. The license itself can be issued in three categories:

- Category 1: The driver is allowed to drive trains with strongly restricted areas, e.g. only within a depot
- Category 2: The driver is allowed to drive trains on a restricted local network. The network is written on the supplementary sheet.

- Category 3: The driver is allowed to drive trains on the whole network, but maybe he/she is limited by missing additional qualifications needed for some operational procedures. The additional qualifications can be seen only on the supplementary sheet

Another principle is that a driving license of a higher Category always contains the lower ones. So a person who owns a license according to Category 3 also owns all of the qualifications needed for Category 1 and 2.

Figure 9: Driving License

The supplementary sheet must be carried and, if needed also shown, together with license. On the supplementary sheet can be seen for which operational procedures, train protection systems and train/locomotive classes the driver is qualified. Also further qualifications, e.g. the knowledge to check passenger or box-cars and their brakes are written on the supplementary sheet.

4.4 Česke drahy

Česke drahy was established on January, 1st, 1993, as a successor of the former Czechoslovak Railways (ČSD) in the territory of the Czech Republic under **Act No. 9/1993 Coll., Section 1**, as amended by **Act No. 212/1993 Coll.** Through December, 31st, 2002, the Company had the form of a join stock company, i.e. the government held a 100% interest in it. The principal subject of operations of CD was the operation of railway lines and railway transportation in compliance with **Act No. 266/1994 Coll.**, as subsequently amended. CD was primarily a transport company.

At the moment, the total number of CD train drivers is 6535. 114 of them have a professional knowledge at foreigner railway undertakings (DB, PKP, OBB or ZSR). The average age of CD train driver is more then 50 years, that's quite more then average of the whole CD.

4.4.1 Training and Trial System of Česke drahy

The Training and Trial system of CD (**Ok 2**) functions to determine professional competence of employees of CD as the railway operator and also the operator of railway undertakings (carrier).

Ok 2 specifies and constitutes conditions for an employee to obtain qualification in readiness for individual work activities. **Ok 2** also specifies a range of work activities, for which is required:

- Professional assessment (professional competence stipulated by the Track Act no. 266/1994 Coll. and implementing regulations for this act)
- Necessary requirements and qualification requirements for performance of this activity, specified from corporate level by the operator of railways and railway undertakings internal regulations of CD.
- Competence assessment stipulated by legal regulations which are related to work activities.

Ok 2 specifies theoretical and practical preparation with total time of training and apportion for respective periods, form of execution of the training, form of assessment of knowledge, skills and qualification requirements for performance of activities of employees who:

- Check, organize, and ensure operating railways and railway undertakings, professional competence is stipulated by course of track act and implementing regulations as amended;
- Do not directly affect safety of operation of railways and railway undertakings, do not organize maintenance of railways and operation of railway undertakings, do not perform and do not check defined technical parameters part of railways, ensure within the operation of CD activities for which no professional competence is stipulated by course of track act and implementing regulations.

Schooling and training system in accordance with **Ok 2** is valid for:

- All employees of CD;
- Employees of foreign legal subjects including subsidiary companies of CD, based on a contractual relation.

Within the framework of the regulation **Ok 2** the following types of examinations are specified:

- Professional examination – a test which examines professional knowledge of employees determined by working activity. This examination entitles employees to independent performance of respective working activity.
- Special examination – a test which an employee must take when new regulations are being issued or their substantial amendments, or for reasons defined by Ok 2, Article no. 82.
- Periodical examination – a test which will assess necessary level of knowledge in the scope of respective OZ and is taken regularly. This examination entitles employees to further individual performance of a respective working activity.

- Competence examination – entitles an employee to individual performance of one or more partial work activities.
- Examination of practical competence – examination which will assess practical skills of an employee for specified work placement or given work place. It can be taken separately or it can be part of examinations according to Ok 2, article no. 63 a), c).

If an employee fails the professional examination, special examination, periodical examination or competence examination, he/she must take a correction test within the time limit specified by the employer.

Ok 2 defines these types of examination for testing of train drivers[7]:

- Professional examination No. V-06 for train drivers - Train-driver in preparation
- Professional examination No. V-08 for train drivers
- Schooling for fulfilment of examination No. V-08

Professional examination No. V-06 for train drivers - Train-driver in preparation
Preconditions for fulfilment professional examination:

- Employee must reach the age of 18 and must meet the conditions for health competence specified by the Track Act 266/1994 Coll. and Regulation No. 101/1995 Coll. Employees accepted for this job performance must meet professional conditions for education according to the same regulation i.e. complete secondary education with A levels – Education Act 561/2004 Coll. (§ 58 article. (4)).
- Before the employee is passing the professional examination V-08, he/she must carry out the following practice and exams concerning only a respective type of vehicle according to the Regulation No. 101/1995 Coll. §15, article (1) on a nation-wide railways, regional railways and on sidings.

Required knowledge of CD provisions

- In general part V (e.g. Regulations on Safety and Health at Work)
- In operation part D (e.g. Railway Traffic Organization and Operation Rules)
- In technical part T (e.g. Rules for Operation and Service of Rolling Stock Braking Equipment)

Other required knowledge:

[7] Training programmes for these examinations is organized by the depot in charge. The training is being done by the trainers whose function is "inspector for training". The technical part of the training is done by them. The operational part is done by the trainers of Transport training institute. Transport training instate is a subsidiary company of CD founded to organize almost all the training for CD.

- D 3 (if required), local work place and occupation directions, Direction of first aid, Operating instructions, depot, Working regulations, D 17 - Emergency Reporting and Investigation Rules, T 100, V 62 - Technical and Operational Rules for Rolling Stock, Z 1 - Train Running Protection Equipment Provisions

Electrical motor vehicle: Contents of training	Duration
Familiarity with workplace of depot	1 week
Obtaining qualification of "person competent"	1 day
Study of professional theoretical knowledge of this regulation for professional examination V-06 (and passing this exam) and for examination of professional competence for driving rail vehicles in front of Rail Administrative Authority in compliance with Regulation of Ministry of transport No. 101/1995.	max 8 weeks
Professional practice in repairs and maintenance of electrical motor vehicles, training in car repair shop of electric motor vehicles focused on knowledge of construction and maintenance of vehicles and training for performing technical revisions of rail vehicles	min 20 weeks
Training in driving and operation of electrical motor vehicles under supervision	min 24 week
Professional and theoretical examination of professional competence for driving rail vehicles in front of examining board of Rail Administrative Authority	1 day

Figure 10: Practice and exams before passing professional examination V-08 – electrical motor vehicle

Motor vehicle: Contents of training	Duration
Familiarity with workplace of depot	1 week
Obtaining qualification of "person competent"	1 day
Study of professional theoretical knowledge of this regulation for professional examination V-06 (and passing this exam) and for examination of professional competence for driving rail vehicles in front of Rail Administrative Authority in compliance with Regulation of Ministry of transport No. 101/1995.	max 8 weeks
Professional practice in repairs and maintenance of motor vehicles, training in car repair shop of motor vehicles focused on knowledge of construction and maintenance of vehicles and training for performing technical revisions of rail vehicles	min 20 weeks
Training in driving and operation of motor vehicles under supervision	min 24 weeks
Professional and theoretical examination of professional competence for driving rail vehicles in front of examining board of Rail Administrative Authority	1 day

Figure 11: Practice and exams before passing professional examination V-08 – motor vehicle

Theoretical training for professional examination

- Preparation of driver of electrical motor vehicle - before passing the examination of professional competence of driving rail vehicle on nation-wide railways and regional railways and siding employee must complete an training course, which is organized by department of rail vehicles of general management or depot as well as training organization.

Hours	Training content
1	Introduction
10	Operation of rail and railway transport
12	Construction and operability of rail
8	Mechanics of electric traction
9	Energetic of electric traction
24	Electric and electronic circuits and its parts
max. 166	Construction of electrical motor vehicles
12	Operation and maintenance of vehicle
8	Technology of driving and operation of vehicle, emergency driving
8	Solving emergency and dangerous situations, ecology of operation
54	Regulation for professional examination V-06
8	Final examination
max. 320	**Total duration of training course**

Table 7: Content of theoretical training- electrical motor vehicle

- Preparation of driver of motor vehicle - before passing the examination of professional competence of driving rail vehicle on nation-wide railways and regional railways and siding employee must complete an training course, which is organized by department of rail vehicles of general management or depot as well as training organization.

Training in driving

- Training in driving is carried out on a respective type of rail vehicle which will be required for re-examine by depots before placing employee to his profession.
- Train-driver who supervises driving training must have at least 5 years´ experiences in driving rail vehicles.

Examining board

- Is instituted and organized by depot in charge

Professional examination No. V-08 for train drivers
This examination is common for both professions

- train driver for motor vehicle of infrastructure
- train driver for special motor vehicle

Hours	Training Content
1	Introduction
10	Operation of rail and railway transport
12	Construction and operability of rail
8	Mechanics of motor traction
25	Combustion engine
18	Electric and electronic circuits and its parts
20	Transfer of mechanical, hydrodynamic and combined output
32	Transfer of electric output
max. 100	Construction of motor vehicles
12	Operation and maintenance of vehicle
4	Fuel, oil, cooling liquid
8	Technology of driving and operation of vehicle, emergency driving
8	Solving emergency and dangerous situations, ecology of operation
54	Regulation for professional examination V-06
8	Final examination
max. 320	**Total duration of training course**

Table 8: Content of theoretical training- motor vehicle

Preconditions for fulfilment of professional examination

- professional examination No V-06
- Certificate of Professional Competence for driving rail vehicles (issued by Rail Authority)

Required knowledge of CD provisions

- In general part V (e.g. Regulations on Safety and Health at Work)
- In operation part D (e.g. Railway Traffic Organization and Operation Rules)
- In technical part T (e.g. Rules for Operation and Service of Rolling Stock Braking Equipment)

Other required knowledge

- D3 - local work place and occupational safety directions; Direction of first aid, operating instructions of the current depot, using the tools; Timetable, SR 49(V), TTP – Table of track banking, ZDD – The basic operation documenta-

tion; Z 1 - Train Running Protection Equipment Provisions,; V-04 - Provisions for Steam Boilers and Compressed Air Cans Supervision in the Railway Area

Theoretical training for professional examination

- 2 weeks of schooling of provisions – organized by depot

Training in driving

- 24 weeks of driving under supervision

Examining board

- is appointed by the department of rail vehicles of General management of CD

Other conditions of training after professional examination

After the accomplishing the professional examination No V-08 and before the assigning to the work position the employee is the knowledge tested by the employee set by the chief manager of depot. He is tested from the knowledge of construction and usage concreted series of motor vehicles specified in Certificate of Competence for driving rail vehicles. Positive result is recorded into his Examination report. After integrating the driver into his future working place he needs to go through 26 weeks long practise at station shunting. This amount can be increased by the main chief of the depot. After this station practise the driver is tested again from the provisions CD D2 - Railway Traffic Organization and Operation Rules, V8/I - Rules for Operation and Service of Speedometers, V15/I - Rules for Operation and Service of Rolling Stock Braking Equipment, T108 - Operating of the Continuous Automatic Train-Running Control. This test is supervised by the authorized person from rail vehicle department of the General management CD. The requirements to do individual work activities of the driver are:

- Valid Certificate of Professional Competence for driving a respective type of a rail vehicle
- Valid health check
- Valid examination according to Ok 2
- Obligatory training of operation provisions and technics

Continuous training has to be attended by the train drivers by the appropriate exams in this minimum year scope (Figure 17):

Employee with the exam on the position of	hours				
	Total	operation	operation foreign RU	services	technology
V-08 train driver	24	10			14
V-08,O-04a train driver with customer service	32	10		8	14
V-08 + train driver with professional knowledge at foreigner	44	10	20		14
V-08, D-101 až D-103 train driver in cross border operation	28	14			14

Table 9: Year scope of continuous training

The content of the continuous training is modified in accordance with the changes in provisions and with the new demands from the technical trainers in depots. Frame content of the technical and operational part of the training courses is set up always for six months in advance.

5 STANDARDS FROM THE PERSPECTIVE OF SCIENTIFIC RESEARCH

Scientific research publications in the fields of (a) railway research, (b) industrial psychology, and (c) cognitive ergonomics are important information sources for the compilation of existing standards for train drivers' competencies, training contents, training methods, assessment, and training models. In all of these three research domains great efforts have been made concerning safety relevant issues of the training of train drivers. Therefore, the inclusion of latest scientific research findings is mandatory as 2TRAIN puts to centre the handling of safety-critical situations and crisis-management.

The Health and Safety Executive (HSE, 2005) states in the document "Railway Safety Principles and Guidance" the following definitions of operational conditions or states in UK:[8]

- "'Normal conditions' means the conditions which a part of the railway is designed to accommodate. This would include the peaks, e.g. rush hours, and troughs in demand experienced during the day." (p. 12)
- "'Degraded conditions' means the state of the part of the railway system when it continues to operate in a restricted manner due to the failure of one or more components." (p. 13)
- "'Abnormal conditions' means extreme loading on a part of the railway system. For example, this may be the result of extended delays on one part of the service impinging on another." (p. 13)
- "'Emergency situation' means a current unforeseen or unplanned event which has life threatening or extreme loss implications and requires immediate attention, e.g. a fire." (p. 13)

5.1 Train driver's competencies

5.1.1 Train driving as a safety-critical working environment

The railway is an industry with high safety requirements. That is the reason why (1) technical systems and operational procedures are installed to reduce human error rate ("robust system"), (2) built-in protection systems ensure that individual errors and mistakes do not lead to accidents ("tolerant system") and (3) many efforts are taken in order to guarantee the adequate competence of every member of staff.

[8] For more definitions on operational conditions and states compare Hughes (2004).

This safety criticality is the reason why the European Commission stresses the development and improvement of railway safety in the European Community. In this context the Directive 2004/49/EC[9] has committed the infrastructure managers and railway undertakings to introduce safety management systems in order to obtain an operating licence. One of the ten basic elements that a safety management system according to the European Commission must incorporate is the "provision of programmes for training of staff and systems to ensure that the staff's competence is maintained and tasks carried out accordingly" (Directive 2004/49/EC). This means that highly capable and adequate trained staff is of special importance in the field of railway operation (cp. Directive 2001/14/EC[10] Article 32, Proposal for Directive COM(2004)0142[11])[12]. All these legal documents mention the necessity to put suitable arrangements in place to train staff involved in critical positions as e.g. drivers. Train drivers must have appropriate, knowledge, skills, experience, and fitness to discharge their responsibilities and tasks. A lack of, or inadequate, competence and experience reduces safety and can lead to incidents and accidents (Wright et al., 2003).

The content of the above mentioned directives on staff competence can be implemented in the railway undertakings by installing a sort of a competence management system. There is a wide variation amongst railway undertakings with regard to how they build up, monitor and assess competence of staff. The companies have to guarantee that no competence and experience erosion takes place (Wright et al., 2003). This implies the specification of the required qualifications, initial training and periodical re-training (and assessment; see Chapter 5.4) for train drivers during their career (Beck et al., 2004). The monitoring of the competence levels of the staff must be documented. Furthermore, training strategy, models and contents should be derived amongst other from cause analysis of railway accidents and incidents.

All in all, the competence management has to support the achievement of higher safety and efficiency in railway operations. The implementation of the trained knowledge, skills and safety commitment lies in the hands of the staff during daily operation.

It can be said that the management of staff competency is sort of a proactive safety measure. It has to be guaranteed that the competence of the train drivers does not erode over the time or that the daily work includes new requirements that are not covered by according competencies.

5.1.2 The system of train driving

Kecklund et al. (2001) describe the working environment and the train driver's job from a "Man-Technology-Organisation" perspective (Figure 12):

[9] Directive 2004/49/EC of the European Parliament and of the Council of 29 April 2004 on safety on the Community's railways and amending Council Directive 95/18/EC on the licensing of railway undertakings and Directive 2001/14/EC on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification (Railway Safety Directive)

[10] Directive 2001/14/EC of the European Parliament and of the Council of 26 February 2001 on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification

[11] COM(2004)0142: Proposal for a Directive of the European Parliament and of the Council on the certification of train crews operating locomotives and trains on the Community's rail network

[12] cp. IVE (2005); Shannon et al. (2004)

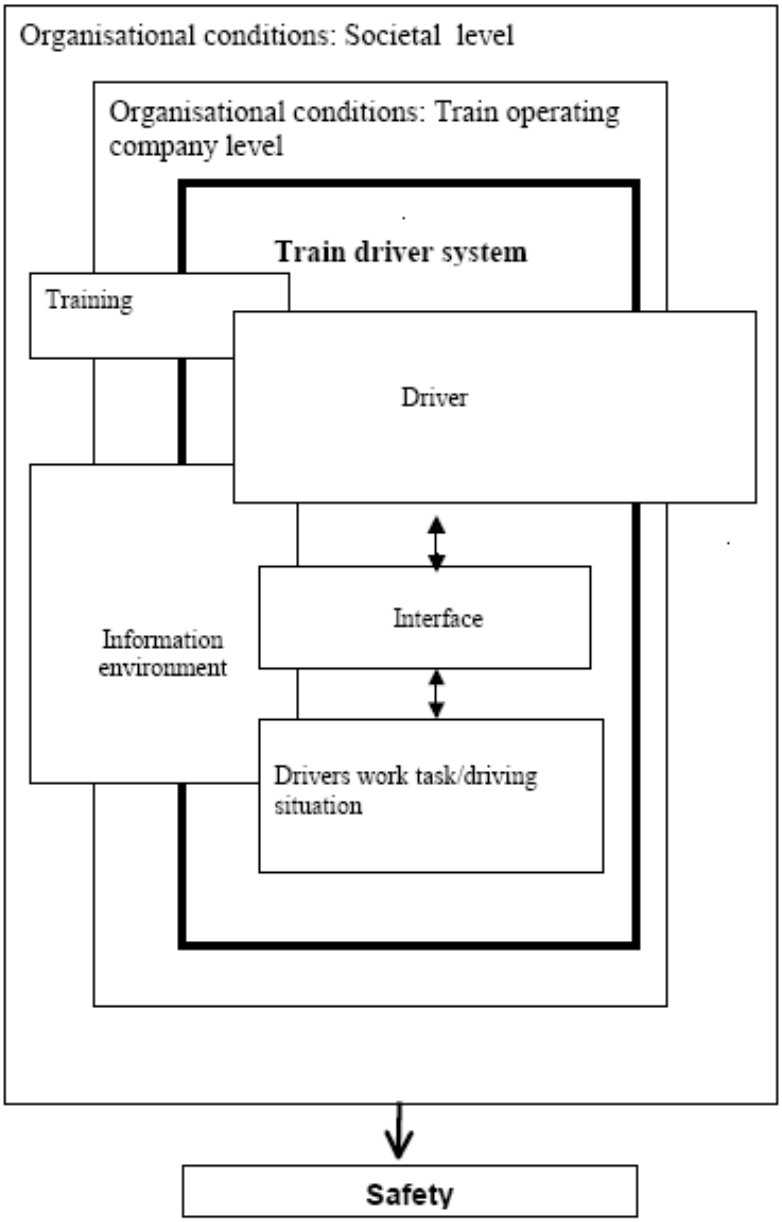


Figure 12: The Man-Technology-Organisation model of the train driver system (Lindberg et al., 2000; cited in Kecklund et al., 2001)

In this model (Lindberg et al., 2000; cited in Kecklund et al., 2001) the organisational conditions of the train driver system are divided into two different levels: Firstly, the societal level that is common to the whole rail traffic system and apply regardless of the train operator, and secondly, the level of the train operating company. The train driver system implies the function, technology, driver and organisation involved in the operation of an individual train. The interface contains the various in-cab displays as well as the different control devices. The information environment includes e.g. track-side signals, communication, and documents (timetable, rule-book, etc.). The driver's work task is the current driving situation and the train driver's actual behaviour. The training of train drivers has to consider the organisational conditions as well as specific conditions of the train driver system.

The train driver has to perform a number of different tasks: He must prepare for duty, get the train ready, drive the train in accordance with the timetable, and follow the safety guidelines, other written information, and the orders of the signaller. Furthermore, he must perceive and interpret signals and boards and operate the train control system (Kecklund et al., 2001).

These characteristics of the train driver's task imply that the integration of different information from several sources is a basic characteristic of the train driver's job (Kecklund et al., 2001):

- Train traffic control
- Information about the vehicle
- Track side signals and boards
- ATC panel
- Unexpected events along the track (objects, workers, etc.)
- Route book
- Written safety instructions
- Operational safety rules / rule book
- Radio communication

There exist some factors that modify the complexity of the train driver's task (Kecklund et al., 2001):

- Expected vs. non expected (planned vs. non planned)
- Preparation time (briefing: only events or also correct actions?)
- Number of required control actions
- Time restraints
- Frequency of situation/event (that means: experience of train driver)
- Interaction of several events
- Social pressure (e.g. delay and pressure by signaller)
- Environmental conditions (visibility, weather)

5.1.3 Behaviour levels and human error

Human error theory (Reason, 1990) provides an established classification of human error types. The identification of the error type that is linked with a specific incident is very important, because it can serve as an input for training measures.

Rasmussen (1983) describes three levels of behaviour that are based on the information sources feeding the behaviour of the operator (Figure 13):

- Skill-based behaviour: Sensor motor behaviour as automatic behaviour that takes place without conscious attention or control.

- Rule-based: Consciously controlled goal-oriented behaviour controlled by a stored rule or procedure.
- Knowledge-based: Goal-controlled behaviour used during unfamiliar situations. A plan is developed using knowledge and reasoning to predict the outcome of actions.

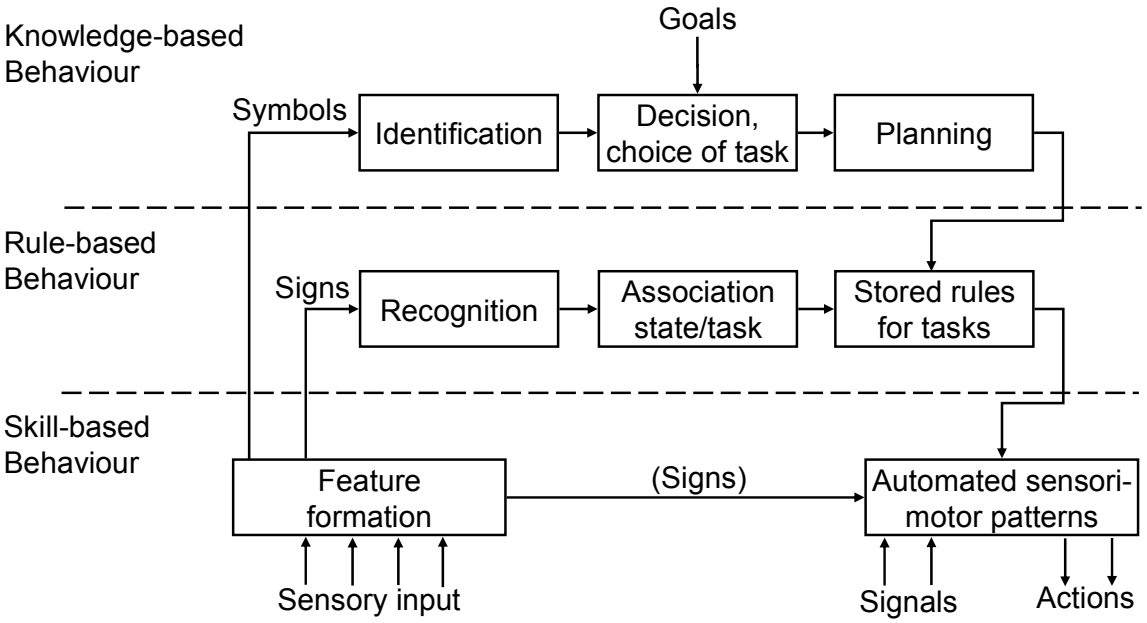


Figure 13: Levels of human behaviour (Rasmussen, 1983)

Reason (1990) describes the following types of human error (Figure 14) that are based upon Rasmussen's (1983) model of skill-, rule- and knowledge-based behaviour:

- Skill-based: lapse vs. slip
  Unintentional erroneous actions
  "Slips and lapses are errors which result from some failure in the execution and/or storage stage of an action sequence […]" (p. 9)
- Rule-based: mistake
  Appliance of wrong rules for the current situation or misinterpretation of situation
  "Mistakes may be defined as deficiencies or failures in the judgemental and/or inferential processes involved in the selection of an objective or in the specification of the means to achieve it […]" (p. 9)
- Knowledge-based: mistake
  Often a consequence of overconfidence, selectivity bias during information acquisition

Besides these error types the operator can also conduct deliberate and conscious rule violations.

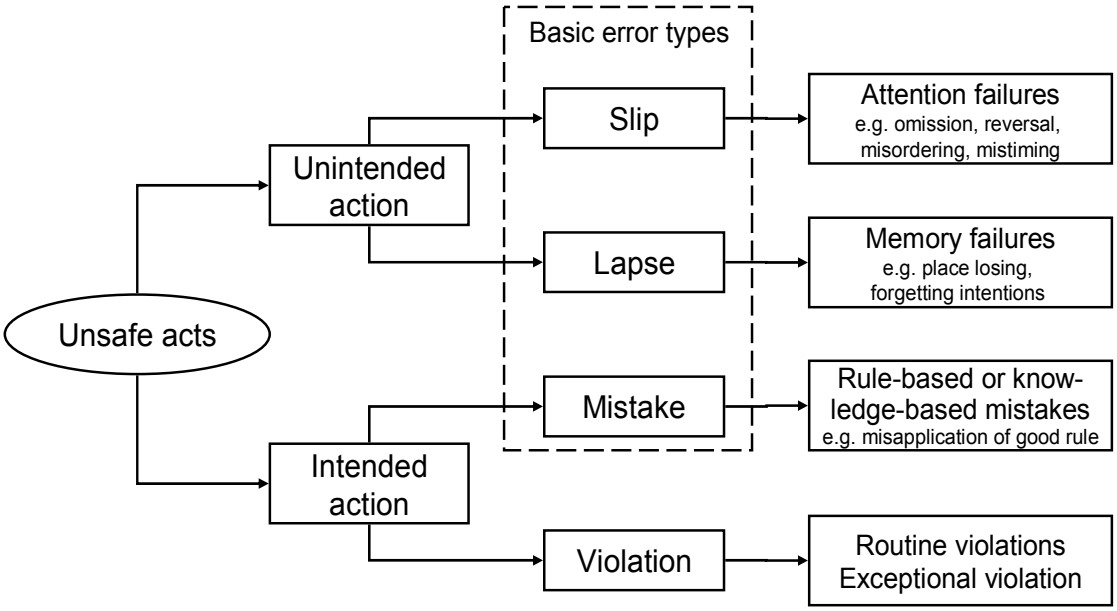


Figure 14: Classification of human error (Reason, 1990, p. 207)

5.1.4 Causes of incidents and accidents

Accidents and incidents rarely have one single cause. In fact a full understanding of such events requires the consideration of technological, organisational, and human factors. These three areas are interdependent: It is, for example, possible that a suboptimal design of the driver's cab facilitates operating errors of the train driver.

Regarding railway incidents and accidents there is a large contribution of human error. Andersen (1999) investigated those incidents and accidents in the UK rail systems only the railway companies are responsible for (i.e. no suicides). He reports that approximately 70% of the railway accidents are caused by direct human error of staff members. Not all of these accidents are caused by a train driver error. For the period 1900-1997 the train driver is responsible for 40% of the accidents, for the period 1970-1997 for a proportion of 46%. The reasons for this development lie in the technical improvements concerning the signaller's task (track circuits, route interlocking) that have reduced the proportion of signaller error.

Hughes (2004) presents an analysis of signal passed at danger (SPAD) data. SPADs are one important precursor of train accidents in the UK. They account for 44% of the catastrophic risk of major injury and death on Network Rail. Approximately 15-20% of all SPADs in the UK are occurring during abnormal working. The train driver is responsible for 47% of these SPADs.

The SPAD-data analysed by Hughes (2004) can give information to the question to what extent a lack of competence is responsible for incidents and accidents. Table 10 gives an overview of the underlying causes of SPADs during abnormal conditions (Hughes, 2004):

Cause	*Description*	*Proportion*
Error inducing conditions	Distractions to the driver, e.g. track workers, or drivers having to work long shifts without adequate breaks	12%
Procedures	Inadequate procedures for the management of the abnormal condition or inadequate briefing of procedures	13%
Training	Inadequate training of staff on procedures to be followed and on route knowledge	14%
Communication	Wrong communication through inadequate briefings, miscommunication on site, etc.	39%
Incompatible goals	Pressures on staff, e.g. to complete a task on time and to do it safely	17%
Organisational weaknesses	Procedures that are not followed by the staff, inadequate publishing of notices	5%

Table 10: Causes of SPADs in the UK during abnormal conditions (Hughes, 2004)

A different point of view is stated by Hollnagel (2006). He states that accident analysis seems to work with a principle that can be called "WYLFIWYF: What you look for is what you find". It depends on the made assumptions, if the causes of accidents are found in (1) imperfect technology and materials, (2) careless or inexperienced staff or (3) complex organisations with unclear distribution of authority. As a consequence human error is an artefact of technological status and of accident models, rather than an objective phenomenon. Failures are an outcome of normal performance variability rather than a consequence of abnormal performance. People are expected to be both efficient and thorough at the same time – or rather to be thorough, when with hindsight it was wrong to be efficient (Hollnagel, 2006).

Nevertheless, human error is one important cause for railway incidents and accidents. That is the reason why human error elements should be integrated in the training of the railway staff, especially of train drivers.

5.1.5 Human factors perspective

The operation of the railway always involves human individuals and is an interactive process between human and machine – strongly influenced by human factors such as attention, workload, communication, and many more. Human operators are fundamental for safety in rail operation (Elms, 2001) but they are also fallible.

The awareness of human factor issues according to railways has increased in the last years and it is widely acknowledged that these issues have to be considered when safer, faster, more comfortable and more competitive rail systems should become reality. On the one hand, human error is at least partly responsible for a considerable portion of railway accidents. On the other hand behaviour-related training strategies can yield a good success in reducing human error and increasing safety by a relatively small financial cost.

Human factors research applies scientific knowledge about psychological and physiological processes to work activities. Key objectives of human factors research and application are

- the improvement of safety, performance and efficiency,
- the reduction of stress and workload, and
- a better match between the human and machine.

These objectives can be reached by

- improved working conditions,
- research and development on human machine interfaces,
- adequate operator capabilities (guaranteed by the selection, licensing, training and periodic performance checks of the operators), and
- improved organisational conditions (rules and regulations, control of operation).

A catalogue of driver's competencies and training contents is not complete as long as it is based on some results of human factor research. There are several aspects of railway operation that are significant from a human factor perspective:

- Workload: Operators have to deal with multiple tasks at the same time and have to work under specific time restraints.
- Limited information: Signals and other information input are mostly available only for restricted time-windows. Additionally, important information may be lacking. The operator has to deal with this.
- Automation: Today different protective and automatic control devices are implemented in the railway operation and have effects on safety and performance.
- Cross-border: Railway operation that passes over national borders is affected by new and perhaps unknown human factor issues.

Workload

As a consequence of specific timetable and operational requirements train drivers have – as other operators in railway traffic – to deal with time stress. The handling of multiple tasks and the problem of time restraints is especially noticeable during degraded situations.

Many sections of the railways' rule books describe the actions that have to be taken in response to irregularities and abnormal situations. If these situations only occur infrequently, it is possible that the train driver will be unfamiliar with the necessary actions and will make mistakes (Hughes, 2004). This is especially a problem, because degraded and abnormal conditions lead to an increase in workload. And this workload increase not only facilitates human error but in the long run also leads to

health problems and low job satisfaction (and as a consequence to higher absenteeism portions). Other degraded or abnormal events are so frequent that the train driver sees them as being 'normal' and can handle them without any problems or additional workload. But this can lead to another pitfall: The train driver may become inattentive and careless and may accept both intentional and unintentional risk.

On the contrary, an under-worked train driver also may react inadequately because of vigilance problems and inattentiveness. Also working hours, sleepiness and fatigue are important problems for train drivers.

Limited information

The behaviour of the train driver depends on the processing of information. However, the necessary information input for safe and efficient driving is not always available. For example, lineside signals are only visible for limited intervals. This is the reason why several protective devices have been developed in order to assist the train driver and to guarantee safety (Crick et al., 2004).

But these systems can cause confusion. Crick et al. (2004) lines out that 25% of the train drivers (of 651 surveyed) report confusion about visual warnings. Further 25% report confusing information from general cab systems and information from safety devices. 50% of the drivers admit making errors at some time during the data input into the automatic train protection (ATP) system. 20% state that they have difficulties with the information load they have to cope with and that they sometimes confuse warning tones of the different systems in the driver's cab. Another finding is that approximately 50% of the interviewed train drivers admit that they acknowledge warning signals without really realising them.

Kecklund et al. (2001) state that a major problem of the train drivers' task is the lack of complete information. This is not only the result of conflicts of attention and too much workload. Drivers report that they do not fully understand some functions of the train control system and the interaction of control systems, signals and the rule-book. As a consequence, the train driver has an inadequate and erroneous mental model of the train control system.

These findings suggest that the implementation of protective devices can have negative consequences on driver's performance. This is especially the case when more and more systems are integrated into the driver's cab without considering potential interferences. Therefore, human factors design issues (ergonomics) and training issues (for acquiring correct mental models) are very important and have to be considered.

Automation

Automation and the introduction of modern train control systems have changed train driving partly to a monitoring task. As a consequence, human manual control, planning and problem solving is replaced by automatic devices and computer systems.

Most of the time, the train driver has to monitor the largely automated driving. But railway traffic is a very complex system. The more complex a system is the higher is the probability of a failure. This in turn leads to a higher number of degraded or abnormal conditions. For example, when failures and irregularities occur in combination with a breakdown of the automatic mode, the train driver has to operate the train

manually. In such degraded and abnormal situations the train driver has to handle considerable amounts of information, perform multiple tasks, and use computer systems for the diagnosis of failures. Opposite to normal driving, in these cases the train driver has also to communicate a lot with other staff involved in railway operation.

If not handled sensitively the implementation of operator aids can lead to as many disadvantages as benefits. Trying to make the train driver's task easier can make it more difficult. A phenomenon that Bainbridge (1983) called "Ironies of automation". One crucial point could be the designer errors that are a major source of operating errors. The interface for the handling of the new device may require valuable cognitive resources that are also needed for the primary task of train driving. The second problem is that the operator is still responsible for all those tasks that can not be automated. And those tasks often include often the handling of abnormal (and sometimes unforeseeable) conditions and are for that reason rather difficult to cope with. This becomes a major problem because the train driver will lose practical experience to operate the train manually as a consequence of being restricted to monitor the status of the automated system most of the time. As a consequence, he is less able to respond immediately (because of vigilance problems) and correctly when the automated system fails (because of eroded experience) (Hughes, 2004). Additionally, there is the problem of reduced situational awareness. If the train driver only monitors the operation then he is not as deep involved in the situation and the current state of the railway (position, signal state, speed limit, etc.) as he would be when he drives the train manually. Consequently, when the assistance system fails it may take him longer to identify the crucial aspects of the situation and to respond adequately to the situation. Another problem in connection with the application of driver assistance features is a lack of driver's trust into these systems. When the train driver thinks that the system is unreliable he tries to switch it off – sometimes by breaking rules and regulations and with severe effects on safety (Crick et al., 2004). All these issues need to be addressed through training and competence management.

The change in work content is accompanied by a change in work conditions. They require less physical strength than in former times. But physical endurance is a major topic. Especially during long-haul trips at night the train driver has to handle severe vigilance problems and fatigue (cp. Edkins & Pollock, 1997). Additional, working environment is sometimes unpleasant because of heat, old rolling stock with poor ergonomic conditions, strong vibrations, and so on.

Cross-border

Cross-border operations have become important for railway undertakings because of good commercial and operational reasons. But until now, the country specific differences in rules and regulations are a huge obstacle for successful cross-border operations.

Different project groups (HUSARE-Consortium, 2000; Olsen et al., 2002) have noted that cross-border rail operation generates new human factors problems and associated risks that need to be addressed. When trains pass through national and infrastructure borders, the different technical systems, rules and procedures of operation, and languages have implications for efficiency and safety. This influence on safety is especially important in the case of degraded and abnormal situations when the train driver has to communicate and cooperate effectively with other railway agents.

Cross-border driving implies that the train driver has to learn the differences and similarities between railway operations in the different countries he passes. Human factor problems arise when in the different infrastructures the same information code is used in different meanings. It is possible that the train driver applies the new rules and regulations and behaves adequate. But in unfamiliar or stressful situations it is also possible that he switches back to his stereotype behaviour patterns.

A concrete example (de la Garza et al., 2004): In France, it may be possible that the train driver is allowed to pass a signal at danger with one red light by driving on sight that means with approximately 30 km/h. If the signal at danger has two red lights he must ask the signaller for the allowance to pass. In Germany, the train driver always has to ask the signaller for the permission to pass a signal at danger. The sticking point is that these circumstances can lead to wrong stereotype behaviour patterns: The German train driver in France waits in front of a signal at danger without necessity. The French train driver in Germany passes a signal at danger without having the permission to do so.

Concerning the training of language competencies the European railway undertakings and infrastructure managers have agreed that the train driver has to learn the language of the foreign country he is driving through (de la Garza, 2004). A common language like English in aviation is not realistic. Reasons for that are (1) translation problems regarding the country specific railway vocabulary, (2) a lot of potential communication partners in the foreign country that can not all be trained in speaking English, and (3) well practised regulations in today's bi-national cross-border operations. The train driver has to master technical, operational, and safety-relevant terms in the foreign language and be able to communicate adequately in normal as well as in degraded conditions.

5.1.6 Human factors training

There exist different countermeasures against human error: (1) The reduction of circumstances that facilitate human error (especially under degraded and abnormal conditions), (2) the monitoring/punishment in the case of the conscious breaking of rules, (3) training in the different fields of operational knowledge and skills and (4) human factors training. Human factors training covers such diverse contents like e.g.:

- Attention strategies
- Error detection
- Risk/hazard perception
- Situational awareness
- Decision making in complex and ambiguous situations
- Handling of multiple tasks
- Fatigue, monotony and boredom

Human factors training should also sensitise the train driver to human performance capabilities and their limitations.

Mistakes at the rule-based level (Chapter 5.1.3) can be influenced by enhancing the level of expertise of the operator and by motivating the operator to do regularly checks of the outcome of an action. The training should aim at the factual knowledge of the rules, knowing which rule is most suitable in a given situation, applying the rule and self-monitoring of the outcome. The training can be based on familiar events.

Mistakes at the knowledge-based level are made because the operator has insufficient knowledge of the whole problem area. That means that the plan the operator is acting upon is false. The operator has to detect that an action does not produce the anticipated result and has to adjust the action plan. The training is based on unfamiliar and unknown *events*. Mere applying of rules can not solve the situation. In fact the trainee has to combine different rules or has to 'invent' a new action plan. The train driver has to ask for additional information, communicate effectively, and schedule and plan his actions deliberately.

But not all types of human errors are susceptible to training. Human error on skill-based level (slips, lapses) can hardly be influenced by training because these integrated and automated actions are carried out without attention and mostly they are performed correctly. Only under specific circumstances (interruptions, distraction) slips or lapses happen. Training can only have the aim to limit the negative consequences of slips and lapses by recognising them at an early stage. This is the reason why all of these aspects have to be included in human factors trainings. In summary the objectives of simulator training in the field of human error are:

(1) Adequately diagnosis of the situation and application of the suitable rules and regulations

(2) Reduction of unfamiliar situations by the training of infrequent abnormal and degraded conditions ('teaching experience')

(3) Improvement of the knowledge-based reasoning process (general rules of problem solving and the handling of abnormal situations)

5.2 Training content

The training of the correct response in safety-critical situations and the training of crisis-management are very important for the overall safety of the railway system as there are a lot of causes that might lead from safety to safety-critical in the operating conditions of the railway (Hughes, 2004):

- Equipment failure (e.g. train protection system, communication system, signals)
- Temporary/emergency speed reductions
- Bad weather
- Overcrowding (holidays, big sport events)
- Timetable change (routine seasonal or unplanned)
- Trains running late

Changes of the operating conditions of the railway make the train driver's task more difficult, lead to more workload and increase the likelihood of human error and inadequate behaviour. In the German rule-book of Deutsche Bahn (DB, 2004) for example degraded and abnormal conditions are treated as special operational cases including the rules for the correct handling of such situations. Consequently, the main four sections contain rules about

- Running trains: normal operation of trains
- Specific situations: e.g. out-of-gauge trains, driving on adjacent tracks
- Operational irregularities: e.g. signal passed at danger, open door, driving on sight, driving backwards
- Technical irregularities: e.g. failure of signalling equipment, infrastructure or train equipment

The content of the initial training courses for train drivers are generally similar in the European countries. In general, they contain the following topics (Olsen et al., 2002):

- Introduction to the railway company and the basics of the job including health and safety at work
- Operational rules and traffic safety regulations
- Engineering (railway infrastructure and rolling stock) with emphasis on signalling, braking systems and train control systems
- Communications
- Acquisition of driving skills
- Local conditions and route knowledge acquisition

But Olson et al. (2002) also stress some national specifics concerning the training topics:

- Incidents and abnormal situations, including coping under stress
- Fire fighting
- Protection of the environment and green driving

For the training of the different human factor topics scientific research literature can give advice on which concrete behaviour patterns the training should focus. Maag et al. (2006) mention the handling of multiple tasks, safe decisions and control of action, situation-adequate communication and fatigue/optimal activation.

Frequent errors during safety critical communication between train driver and signaller are (Jones & Hickey, 2004):

- Failure to read back instruction or important message
- Pass on incomplete/ambiguous information (failure to identify self or location, failure to provide sufficient detail on a subject)

- Failure to use correct units of speech (use of slang, failure to use phonetic alphabet, failure to use standard phrases)
- Poor elocution / failure to speak clearly
- Do not listen
- Failure to reach clear mutual understanding (mishear, failure to ask for clarification where required, failure to confirm mutual understanding)
- Failure to follow recognised sequence for communication (interruption)

The most important precursors for communication errors are from the point of the train drivers: fatigue, lack of experience/competence and distraction (Jones & Hickey, 2004). Because of the fact that train drivers as well as signallers perceive errors to occur more frequently in the other's stage of communication, both joint basic and refresher training courses may be appropriate training measures for the improvement of safety critical communications. Important training topics (besides the fundamental basics of route knowledge and rolling stock) are:

- Driving under normal conditions (train preparation, driving, braking, signal system, operational rules, etc.)
- Basic technical knowledge (knowledge about technical systems and procedures: maintenance of engine, construction, technique of brakes, etc.)
- Irregularities during train operation (handling of irregularities in railway operations and in technical installations: driving backwards, driving on sight, malfunctions on the locomotive/train, etc.)
- Operation of train control systems (e.g. automatic train protection, automatic train control)
- Human factors (training of human behaviour topics: e.g. handling of multiple tasks, communication skills, decision making, activation and fatigue)
- Decreased adhesive circumstances (slippery rails)
- Emergency situations (handling of incidents/accidents: fire in train, derailment, collision)
- Energy saving driving (energy efficient driving, green driving)
- Customer oriented behaviour (e.g. announcements for customers)

Generally, it is very important that the scenarios are well constructed and as realistic as possible. Very experienced instructors have to develop and implement the scenarios. Furthermore, it is strongly recommended to test any scenario in a pilot study before being issued (de Jong, 1998).

5.3 Training methods

5.3.1 Overview of training methods

In order to ensure that staff is adequately trained it is necessary to think about the advantages and disadvantages of different training methods. Table 11 gives an overview of common training methods (Howells, 2000; RSSB, 2005):

Training method	***Description***
Lesson	'Chalk and talk'; traditional classroom-based instruction, supported by whiteboard, overhead projector, and/or slides.
Interactive electronic technical manual	Context browseable rule-book, route information, basic operating and maintenance procedures. Hand-held or in cab.
Computer aided/assisted instruction (CAI)	Instructor led classroom training using interactive technology (PC slides, video).
Computer/Web Based Training (CBT/WBT)	Self paced interactive learning environment, implemented on a PC in the form of interactive courseware. Training material (knowledge, application of knowledge – for example rule book training) is presented sequentially and often includes formative and summative testing to assess comprehension and competence.
Part task trainer	Shares software and visual display system with CBT/WBT, but with enhancement of additional functional and dummy (as required) hardware panels, switches and buttons to represent important cab interfaces and layout (fidelity is much lower than in a full simulator). Part task trainers focus on specific aspects of a role, e.g. principles of train driving, route knowledge.
Full simulator	High fidelity cab simulator (generic or realistic cab control layout), representing all real cab interfaces. Accurate presentation of external environment, with visual and performance effects represented. In a static full simulator motion cues are absent, or simulated by visual system effects. A dynamic simulator has a motion platform to give reasonably accurate acceleration and motion cues.
Real cab	Appropriate train cab dedicated to training function. A static cab (with or without power) can be distinguished from a dynamic cab that can be driven over representative track sections with support by a training instructor.
Scheduled service	Appropriate train cab, with power, being driven over representative track by trainee or instructor. Limited interaction between trainee and instructor possible due to workload/safety requirements.

Table 11: Overview of different training methods (Howells, 2000; RSSB, 2005)

Figure 15 shows examples of a real cab, a full simulator, a part task trainer, and a CBT/WBT:

Figure 15: Different training tools: Real cab (top left), full simulator (top right), part task trainer (bottom left) and computer based training (bottom right) (top right and bottom: RSSB, 2005).

Table 12 provides an overview of the benefits and drawbacks of the different training methods.

	Benefits	***Drawbacks***	***Useful Applications***
Classroom lesson	Least costly to procure Flexibility of training delivery Potential group processes	Central location and travel costs for trainees Quality depends on instructor Assessment often subjective Learning pace is not individually centred	Knowledge Social and emotional skills
CBT/WBT	Free time planning and self-paced learning Possibility of performance check High throughput at relatively low cost Less instructor intensive Distributed learning possible	Cost of initial courseware production No support or feedback from instructor/group	Knowledge and comprehension Preparation for simulator training

Part task trainer	Real time training of specific tasks or skills Less costly to procure and support High throughput Flexibility (different rolling stock) and mobility	Covers only part of the overall role	Driving under normal and degraded conditions Operational procedures
Full simulator	Simulation of out-of-course events and degraded conditions High fidelity Repeatability and controllability of situations Event recording and performance assessment High throughput	Cost of procurement and support Fixed location training centre leads to high travel costs for trainees Fidelity affects training efficiency Simulation sickness	Infrequent and highly safety relevant situations Aspects of driving dynamics (e.g. handling of slippery tracks) New procedures of rolling stock Practice and experience
Real vehicle	Nothing can be more realistic Optimal validity	Cost of using operational asset Low throughput Not all fault/out-of-course situations can be demonstrated	Driving skills Aspects of driving dynamics (e.g. handling of slippery tracks) Practice and experience

Table 12: Benefits and drawbacks of different training methods

It is common sense that the acquisition of different training contents requires different training methods. Table 13 shows a corresponding classification:

Training content \ Training method	Lesson	Interactive manual	CAI	CBT/WBT	Part task trainer	Full simulator	Real cab	Scheduled service
Knowledge	x	x	x	x				
Comprehension	x	x	x	x				
Application					x	x	x	x
Social skills	x		x			x	x	
Driving practice					(x)	x	x	x

Table 13: Classification of training contents and training methods

5.3.2 Simulation

The reason why simulator training becomes more and more common comes from its several benefits (RSSB, 2005):

- Suitability for the training of situations that are difficult or dangerous to reproduce in the real environment (e.g. out-of-course events, equipment failures)
- Repeatable, controllable and consistent reproduction – especially of infrequent – situations (e. g. adverse weather conditions) for training and assessment
- Performance recording and assessment facilities ensure an automatic and objective comparison of the trainee's performance against pre-set standards
- Improved throughput of trainees because of the permanent availability of the training environment
- High training efficiency because simulation allows the experience of a wide range of events in a relatively short time frame
- Training of the handling of new equipment and procedures to support their smooth introduction into service (e.g. new rolling stock, new operational rules)
- Cost saving potential because of increased trainee throughput and reduction of the use of operational asset
- Training of experience that means application of knowledge and skills
- Visible commitment to training and safety

Especially concerning the handling of degraded and abnormal operational conditions the usage of simulator training is recommended. As the frequency of these conditions is mostly low, this is the only way to guarantee that the train driver knows what to do during such an event.

Simulator training enables to train experience so that the train driver can respond quickly, correctly and effectively. The training of experience means (Wright et al., 2003).

- bringing training into practice (from theoretical knowledge to skill),
- expanding knowledge through experiential learning,
- enabling the improvement of skill through repeated practice, and
- giving opportunity to demonstrate and assess competence.

Some features of simulation as a training method are under discussion until now and cannot be answered definitely without looking at each individual case and training objective (Howells, 2000):

- Generic vs. type-specific simulator
- Static simulator vs. dynamic simulator with motion platform

In some application areas simulator training is appreciated so much that simulators are used for substituting training in the real environment. Besides aviation this is the case for maritime education and training. One day of training in a simulator is considered equivalent to five days in the real working environment (Zade, 2000). Nevertheless, until now the scientific research is working on the problem of quantifying trans-

fer-of-training from simulation to reality: How much is transferred, what is transferred, and what are the relevant factors that influence transfer (e.g. similarity of training and working environment, individual learner variables)?

This leads to the concept of fidelity that refers to the degree to which the simulator reproduces the characteristics of the real environment (Table 14). It is assumed that fidelity is very important for training efficiency. The key areas of fidelity are physical, functional, and environmental fidelity (cp. RSSB, 2002).

Fidelity category	***Sub-category***	***Definition***
Physical	Layout	Position of controls etc. relative to each other and the user
	Look	Shape, colour, and size of the interface
	Tactile	Feel and movement of the interface during use
Functional	Format	Format and characteristics of operational elements (e.g. signals, train control systems)
	Content	Proportion of real events that can be reproduced
	Response	Data change rates and display response times
Environ-mental	Sound	Background and engine noise, communication
	Motion	Movement cues
	Ambience	Heat, light, smell, etc.

Table 14: Definitions of fidelity elements (cp. RSSB, 2002)

Russell (2006) analyses the impact of individual learner variables on the effectiveness of simulator and computer-based training and assessment. The author concludes that the instructional design of training methods should take the potential effects of learners' cognitive style into account. Because cognitive style influences the processing and representing of information as well as the learning effect the structure and organisation of the training should be appropriate for different cognitive styles of the trainees.

In summary, from the scientific point of view the training in a simulator should be a fundamental part in the training of train drivers. This is valid for Initial and advanced training. The reasons are that simulator training (1) is efficient, (2) allows the training of experience during infrequent operational events, (4) allows the training of new rolling stock and new safety systems and (4) is widely accepted by the trainees. Additionally, the simulator can be used in the context of regular competence checks as an assessment tool that complements subjective ratings by the instructor with objective data from the simulation. Nevertheless, some principles of simulator usage have to be taken into account:

(1) Simulator training must be embedded in the whole training concept and curriculum of the company. The interfaces between different training methods have to be defined and a training needs analysis has to be carried out (training needs, standards and context; the options of different training solutions with their benefits and drawbacks; the training design and the definition of the training and assessment methods).

(2) Simulation should mainly be used for the purpose of training and not for hiring decisions. Simulation can be used for initial training, advanced training, conversion training and performance checks.

(3) Companies who want to purchase new training technology should contact other stakeholders in an early stage in order to gain acceptance (trade unions) and to buy tailor-made solutions (manufacturer, training department, consultancy).

(4) The employees that are operating the simulator have to be adequately trained. In cases where purchasing own simulators is too expensive for a railway undertaking there should be the possibility to use the simulator facilities of an external training institute.

An effective and efficient training system should include several training methods. Howells (2000) suggests the following training equipment for initial training:

- Classroom environment, equipped with networked computers running computer-aided learning materials, supported with instructors able to observe trainee progress and present comment and support
- Trainees are given an early opportunity to experience riding in a cab with an instructor on a scheduled service
- Rules and equipment knowledge training is interspersed with practical elements, applying the newly acquired knowledge on the simulator, stationary train, or in a dedicated training train
- Basic driving and communication skills are taught in the simulator, then practised on a training train
- Trainees are trained in working in sub-optimal conditions, managing degraded systems, emergency situations and out-of-course events using computer aided learning and simulation
- Assessments of knowledge, basic and complex skills (including communication and handling of degraded and emergency conditions) are performed during the whole course
- After examination, ongoing monitoring of novice and experienced drivers is performed regularly by observation on the job, analysis of train data and reassessment of knowledge and skills (especially concerning activities that are rarely performed) in classroom and simulator

5.4 Assessment

Competence assessment is a fundamental part of a competence management system (Chapter 5.1.1). Every company has to guarantee adequate competence of every staff member. That means that the competence and performance of train drivers must be monitored and assessed in a regular manner. If discrepancies are identified an appropriate training programme has to be put in place in order to close these gaps. The train driver can acquire the knowledge and skills he needs for doing his job

safely and effectively. After the initial training the regular monitoring of the overall competence must continue.

The RSSB (2002) recommends using assessment in order to ensure that the trainees have achieved the minimum competence standards. An examination is therefore conducted at the end of the initial training whereas on-the-job assessment should be performed regularly in order to monitor the trainees' performance during their whole working life. During the implementation of new training courses the collected data can also be used for the evaluation of the training and its efficiency. Basically, there are two different assessment approaches (cp. Bommer et al., 1995):

- Subjective assessment by the instructor/trainer
- Objective assessment by using simulator data

Both assessment approaches have advantages and disadvantages (Table 15):

	Benefits	***Drawbacks***
Subjective assessment	Overall assessment possible No technical tools necessary Accepted by trainee	Instructor training mandatory Rater training mandatory in order to guarantee interrater reliability
Objective assessment	Assessment is based on reliable data	Assessment criteria and thresholds have to be developed

Table 15: Comparison of subjective and objective assessment

Many human factors training objectives can only be assessed by subjective ratings of the observing instructor. This is e.g. the case for communication, decision making, and dealing with stress. In order to get an optimal subjective assessment a check list specially tuned to the simulator trip has to be developed. This list consists of questions/statements with regard to specific manifest behaviour patterns of the train driver. Only at the end of the document some more general questions can be asked (e.g. on handling with stress, workload, and overall performance).

For the assessment of the trainee it is crucial to weight possible deviations from the target behaviour. If the mandatory behaviour is highly relevant for the immediate safety it has to be weighted seriously.

The RSSB (2005) points out in its "Good Practice Guide on Simulation as a Tool for Training and Assessment" that data and statistics from simulation should be used in order to review the effectiveness of simulation applications. With the analysis of the statistics the quality of training and assessment programmes could be improved. In order to make this possible before purchasing a simulator the company has to specify the requirements for the simulator, its scoring and database. Often this specification is done incompletely or even not at all. Because of the fact that the use of simulators, design of scenarios and measurement of performance are broadly consistent across different train operating companies, not every company has to start from the beginning.

5.5 Training and assessment models

5.5.1 Frequency and duration of training and assessment

There are significant differences in the training systems in the different European countries (Olsen et al., 2002). This refers to the balance of theoretical and practical training, the training methods (classroom, computer-based and simulator) as well as the measures for periodical competence checks. For example, due to several reasons simulators are used in some countries quite extensive but in other countries not at all. In the different European countries the duration of train driver training is quite different. It ranges between 18 and 84 weeks. As an example, Figure 16 presents the duration of train driver training in different countries (Olsen et al., 2002):

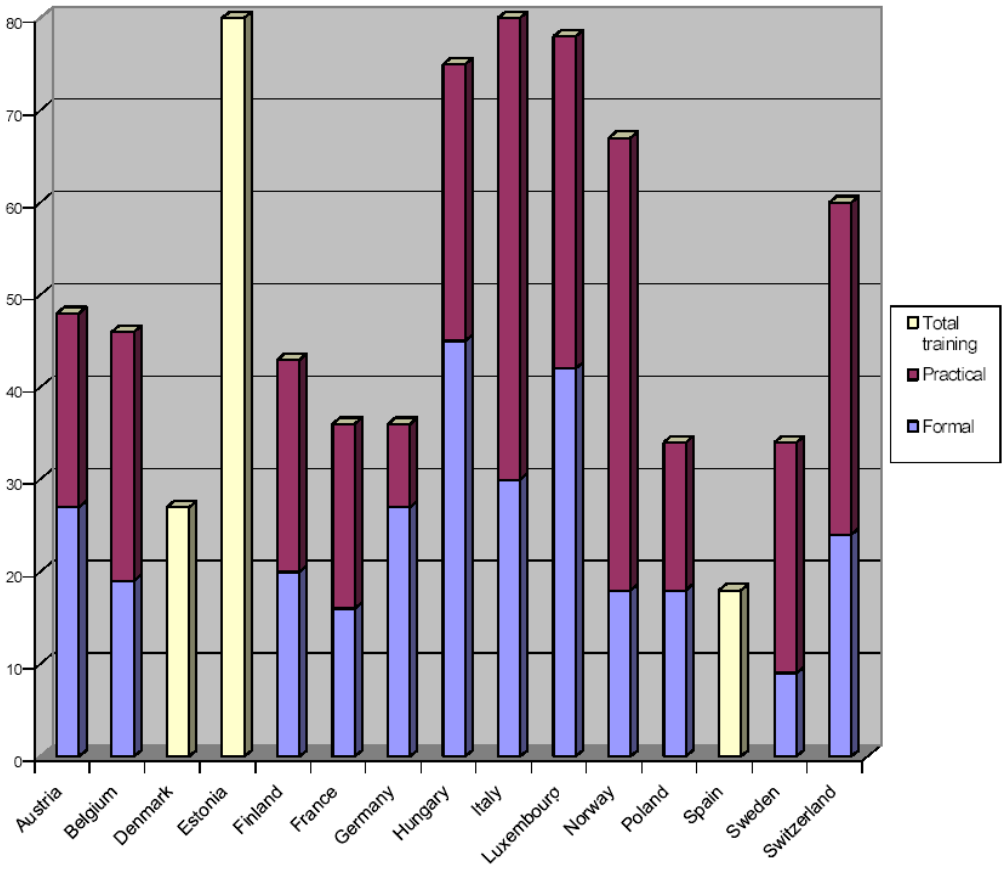


Figure 16: Duration of the train driver training in different European countries in weeks (Olsen et al., 2002)

Furthermore, the quantity of the periodical refresher training varies in the European countries but is usually restricted to a few days each year (Olsen et al., 2002). The continuous monitoring of competence varies also and includes measures as automatic recordings of train driving behaviour (speed, braking, incident analysis), on-the-job assessment (by the superior of the train driver), assessment of theoretical knowledge, and assessment of practical performance (simulator).

5.5.2 Different training stages

The levels of training should go from the training of factual knowledge and basic skills, over the study of practical examples to the appliance of the learned knowledge and skills in simulator and reality (de Jong, 1998). Realism and complexity increase with experience to prevent overload and maximise the learning effect (Table 16).

Training stage	***Training method***	***Comments***
Basic training	Background reading	Reading list, specific text, prepared folder
	Lectures	Given by experienced people
	Video films	Training films
	Exercises	Small group exercises
	Case studies	Analysis of complex cases
Practical but technically oriented training	Computer-based training	Individual knowledge training
	Basic exercises	Low-fidelity exercises
	Advanced exercises	Exercises with higher fidelity (e.g. by using models)
Full integration of skills in realistic setting	Simulators	High-fidelity simulation
	Exercises (on site)	In situ training
	Full scale interagency exercises	Multiple events scenario

Table 16: Stages of training and related training methods (cp. de Jong, 1998)

The trainee conducts his/her initial training by using part-task trainers and learns to apply his/her knowledge and skills in the full-mission simulator. For the refresher and advanced training the fidelity of the simulator is for reasons of acceptance and realism more important than for beginners.

5.5.3 Training development

Figure 17 shows a cyclic concept of the management of staff training (cp. Beck et al., 2005). At first, the contents and objectives of the training have to be planned and specified according to target competencies and human error analysis. After that the adequate training method (classroom, self-study, computer-based, simulation, real environment) and training model (duration, number of sessions, assessment) have to be chosen and didactical questions answered. Thereafter, the training can be implemented and put into practice. The practice period always has to be evaluated. That means conclusions have to be drawn if the set of intended training objectives could be achieved and the training is accepted as well as effective. The results of the evaluation phase should again feed the planning phase and improve the whole process. At any time new target competencies (e.g. for cross-border traffic) and findings from human error analysis can alter the training content and training model.

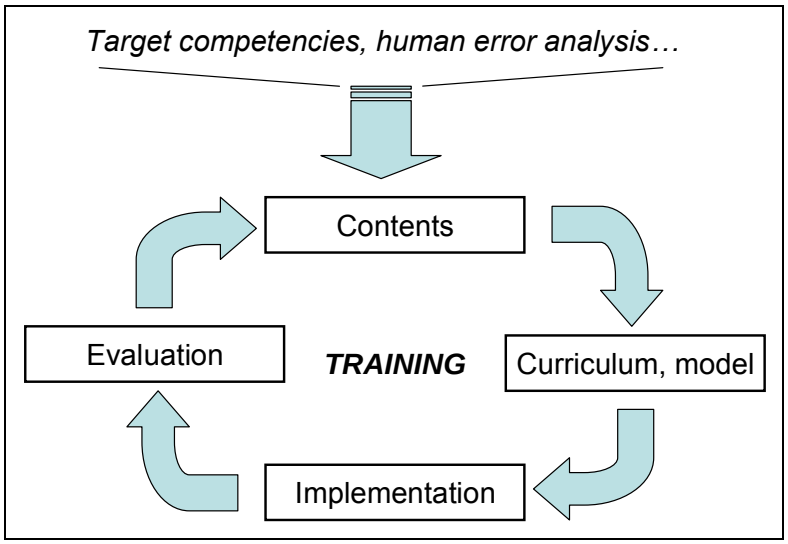


Figure 17: Basic steps of the development and evaluation of training measures

Figure 18 gives a somewhat more detailed overview on the steps of the development of simulator trainings (de Jong, 1998):

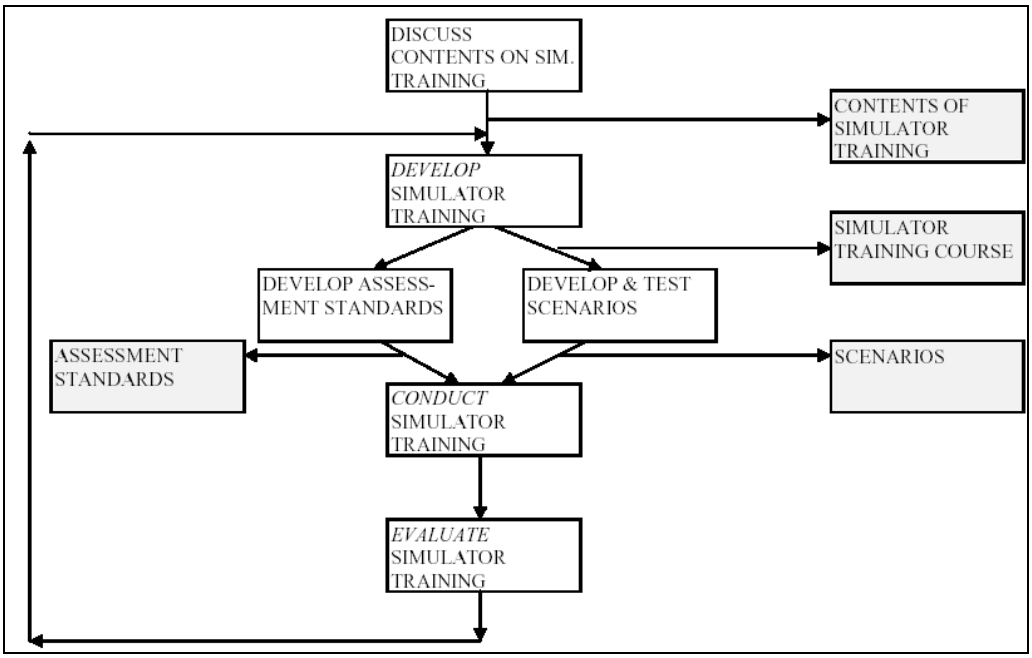


Figure 18: Simulator training development (de Jong, 1998; shaded boxes: documents; other boxes: certain processes)

After the decision on training content, different scenarios have to be developed (event-based approach to training; Fowlkes et al., 1998). Scenario scripts have to be generated and give a detailed picture of the events, the target behaviour, and the communication between the several members of railway staff that are affected. Furthermore, the detailed script ensures standardisation of training and makes the evaluation and assessment of the trainee easier. For this, different assessment standards have to be put into place. For each training objective there should be one or more assessment parameters.

6 SUMMARY

Table 1717 gives an overview of the scientific research findings concerning the standards for drivers' competencies, training content, training method, competence assessment, and training/assessment models. These findings will feed the benchmarking process: The existing characteristics of train driver training should be compared with these scientific criteria.

Scope of 2TRAIN Task 1.2		Competencies	Training contents	Training methods	Assessment	Training models
Legislation	European	Traffic Operation & Management TSI Commission Decision (2006/920/EC) Driver Licence Directive	Traffic Operation & Management TSI Commission Decision (2006/920/EC) Driver Licence Directive	Traffic Operation & Management TSI Commission Decision (2006/920/EC) Driver Licence Directive	Traffic Operation & Management TSI Commission Decision (2006/920/EC) Driver Licence Directive	
	National (only consortium members)	Rail Authority - Regulation No. 101/1995 - Rules for the Health and Professional Competency of persons in the operation of a Railway (CD) EBO - Railway operating and construction regulation. The drivers must be trained properly. Para 54 (1)(DB)	Rail Authority - Regulation 101/1995 - Rules for the Health and Professional Competency of persons in the operation of a Railway (CD) EBO - Railway operating and construction regulation. The drivers must be trained properly. Para 54 (1) (DB)	Nothing currently in existence (CD) Nothing currently in existence (DB)	Rail Authority - Guidelines for obtaining the Certificate of Professional Competence for driving rail vehicles or cableway installations (2005) (CD) EBO – Train Operating Companies (TOCs) must check by using examinations or by other suitable methods if their staff or personnel have the knowledge and abilities needed. Records must be kept Para 54 (2)(DB)	Nothing currently in existence (CD) Nothing currently in existence (DB)

Scope of 2TRAIN Task 1.2		Competencies	Training contents	Training methods	Assessment	Training models
Legislation	National (only consortium members)	Etablissement publique de Sécurité Ferroviaire - EPSF (SNCF) Railway Group Standard GO/RT3251: Train Driving p14 Issue 4, October 2002 (RSSB, UK) Railway Group Standard Train Working: Competence & Fitness, GO/RT3255, Issue 2, October 2000 (RSSB.UK) Railway Group Standard GO/RT3260, Issue 2, August 1998 (RSSB, UK)	Nothing currently in existence (SNCF) Railway Group Standard GO/RT3251: Train Driving pp10-13 Issue 4, October 2002 (RSSB, UK) Railway Group Standard Train Working: Competence & Fitness, GO/RT3255, Issue 2, October 2000 (RSSB.UK)	Nothing currently in existence (SNCF) Railway Group Standard GO/RT3251: Train Driving pp10-13 Issue 4, October 2002 (RSSB, UK)	EBO – Train Operating Companies (TOCs) must check by using examinations or by other suitable methods if their staff or personnel have the knowledge and abilities needed. Records must be kept Para 54 (2)(DB) Nothing currently in existence (SNCF) Railway Group Standard GO/RT3251: Train Driving p 14 (RSSB, UK) Code of Practice GO/RC3560, Issue 1, August 1998 (RSSB, UK)	Nothing currently in existence (SNCF) Railway Group Standard GO/RT3251: Train Driving pp10-13 Issue 4, October 2002 (RSSB, UK) Good Practice Guide on Simulation as a Tool for Training & Assessment RS/501 Issue 1 April 2005 (RSSB/501 Issue 1) Good Practice in Training RS/220, Issue 1, October 2002 (RSSB, UK)
Companies	Rules & Directives (only consortium members)	Training and Trial System for employees of ČD, ČD Ok 2. (CD) Rail Authority - Regulation 101/1995 - Rules for the Health and Professional Competency of persons in the operation of a Railway (CD)	Training and Trial System for employees of ČD, ČD Ok 2. (CD) Rail Authority - Regulation 101/1995 - Rules for the Health and Professional Competency of persons in the operation of a Railway (CD)	Training and Trial System for employees of ČD, ČD Ok 2 (CD)	Training and Trial System for employees of ČD, ČD Ok 2 (CD) Professional examination No. V-06 for train drivers - Train-driver in preparation. (CD)	Professional examination No. V-06 for train drivers - Train-driver in preparation. (CD) Professional examination No. V-08 for train drivers (CD)

Scope of 2TRAIN Task 1.2		Competencies	Training contents	Training methods	Assessment	Training models
Companies	Rules & Directives (only consortium members)	Track Act č. 266/1994 and Regulation of Ministry of transport No. 101/1995. (CD) Education Act 561/2004 (CD) 046.148 – Driver recruitment and qualification; Guideline on train driver training (DB) TT0032 Cahier des Charges national des conducteurs (SNCF) TT0875 Cahier des Charges de la formation initiale des conducteurs TGV (SNCF) TT0660 Cahier des Charges national – Formation des CRML (SNCF) TT0627 Cahier des Charges national – Formation des CRL	Framework content of the Educational module: I. Operation of railways and railway undertakings, II. Construction, maintenance and operation of the vehicle, III. Construction of vehicles – mechanical, electric and hydraulic part (CD) 046.148 – Driver recruitment and qualification; Guideline on train driver training (DB) TT0032 Cahier des Charges national des conducteurs (SNCF) TT0875 Cahier des Charges de la formation initiale des conducteurs TGV (SNCF) TT0660 Cahier des Charges national – Formation des CRML TT0627 Cahier des Charges national – Formation des CRL ATOC Guidance Note: The Training of On-Train Staff in On-Train Emergency Procedures, Issue 3, May 2004 (ATOC, UK)	046.148 – Driver recruitment and qualification; Guideline on train driver training (DB) 408.1111 Operating and shunting of trains.–(DB) TT0032 Cahier des Charges national des conducteurs (SNCF) TT0875 Cahier des Charges de la formation initiale des conducteurs TGV (SNCF) TT0660 Cahier des Charges national – Formation des CRML (SNCF) TT0627 Cahier des Charges national – Formation des CRL (SNCF)	Professional examination No. V-08 for train drivers, Check up of knowledge of ČD regulations: D2, V8/I, V15/I, T108 - ČD Department of rail vehicles (CD) 046.148 – Driver recruitment and qualification; Guideline on train driver training (DB) 408.1111 Operating and shunting of trains. 492.0753 Driving trains - regulations on train driving license (DB) TT0032 Cahier des Charges national des conducteurs (SNCF) TT0875 Cahier des Charges de la formation initiale des conducteurs TGV (SNCF) TT0660 Cahier des Charges national – Formation des CRML TT0627 Cahier des Charges national – Formation des CRL	046.148 – Driver recruitment and qualification; Guideline on train driver training. 82 modules (DB) TT0032 Cahier des Charges national des conducteurs (SNCF) TT0875 Cahier des Charges de la formation initiale des conducteurs TGV (SNCF) TT0660 Cahier des Charges national – Formation des CRML (SNCF) TT0627 Cahier des Charges national – Formation des CRL (SNCF)

Scope of 2TRAIN Task 1.2	Competencies	Training contents	Training methods	Assessment	Training models
Scientific research	Adequate competence level concerning knowledge, application, skills and experience Basics of human performance and human error Human factors (concerning automation, limited information, multiple task) Handling of train in normal, degraded, and abnormal conditions	Driving under normal conditions Basic technical knowledge Irregularities during train operation Operation of train control systems Human factors (e.g. handling of multiple tasks, communication skills, decision making, activation and fatigue) Decreased adhesive circumstances Emergency situations Energy saving driving Customer oriented behaviour	Overall training concept that considers the benefits and drawbacks of the individual training methods Concerning the handling of degraded and abnormal operational conditions the usage of simulator training is recommended Taking into account the relevant factors that influence transfer of training (e.g. fidelity, individual learner variables)	Examination at the end of initial training and regular performance check in order to monitor the trainees' performance during their whole working life Usage of subjective assessment by the instructor/trainer and objective assessment by using simulator data Assessment on a behavioural basis (deviations from target behaviour)	Contents and objectives of the training have to be planned and specified according to target competencies and human error analysis Evaluation of the training (e.g. acceptance, efficiency) Scenario scripts in order to guarantee the standardisation of training execution and performance assessment Realism and complexity of training content and training method should increase training progress

Table 17: Summary of the scientific research findings concerning 2TRAIN Task 1.2 "Standards for drivers' competencies and training contents in Europe"

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APPENDIX 1 CONTENT OF THE THEORETICAL PREPARATION FOR EXAMINATION AT ČESKE DRAHY

Theoretical part of the preparation is divided into hereinafter specified areas I., II., and III. The system is compiled into modules, both for drivers on nation-wide railways, regional railways and for sidings. Within the framework, it is possible to use the module also for drivers of special motor vehicles. Framework content of the educational module:

I. Operation of railways and railway undertakings

- Introductory provisions, basic concepts, requirements for ensuring safety and smooth running
- operation of railways and railway undertakings
- timetable - content and usage
- conditions for touching the lines
- requirements for operation of railways and railway undertakings – management of railway undertakings according to synchronous time, passenger safety, access for handicapped people, passenger service, accidents and emergencies, fire safety, first aid
- Requirements for operation of nation-wide railways, regional railways and sidings, - depots and stations, sidings operation and safety devices, signal system, signal colours, signals, visibility of semaphores, braking distance
- Management of railway undertakings – train driving and shunting
- Operational management of railway undertakings
- Requirements for operating railway undertakings on nation-wide railways, regional railways and sidings – driving a rail vehicle, train escort, train composition and train braking, train labelling, rail protective device, train radio communication
- railway traffic road and its parts, basic parameters and concepts – track signals, clearance, track speed, caducity of vehicles, propensity and directional proportion, gauge and others
- stations and stops
- communication equipment
- crossing of rails with land communication
- conditions for rail serviceability
- basic concepts regarding nation-wide railways, regional railways and sidings

- technical condition of a rail vehicle – requirements for operation of a rail vehicle, responsibility for the state of the vehicle, vehicle check

II. Construction, maintenance and operation of the vehicle:

- Mechanics of electric, motor and hydraulic traction, development and importance of electric, motor and hydraulic traction, supply systems, adhesive features, traction characteristics, tachograph of driving
- Power engineering of electric, motor and hydraulic traction, transmission and distribution of electrical energy, types of trolley lines, communication of two voltage systems
- electric and electronic circuits and their parts, passive and active elements of electric circuits, semiconductors, their characteristics,

III. Construction of vehicles – mechanical, electric and hydraulic part:

- carriages, storage of traction motors, transmission of tractive force, spring loading, wheel set conducting, frame, body, layout of machines and devices
- electrical machines and devices, rotating and non rotating electrical machines, contactors, circuit breakers, relay, switches, measuring and securing installation, circuits of electric motor vehicles, traction circuits, control circuits, speed regulation
- combustion engines
- braking equipment of vehicles, compressors, brake valves, switch boards, conditioners, garrotters, brake reservoirs and their safety piping, brake units, mechanical parts of brakes, compressed air schemes, cooperation of different types of brakes, magnetic brake, shifters on vehicles, brake releasers, anti-slip device
- operation and maintenance, effect of electric and motor traction on the machinery, operational handling, maintenance and repairs, ecology of operation of electric and motor engine vehicles
- technology of driving and operating of a motor vehicle target braking