ERTMS/ETCS

System Requirements Specification

Chapter 1

Introduction

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1.1 Modification History

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2.3.0 24/02/06	Version number, no change since 2.2.2	Release version	HK
3.0.0 23/12/08	1.8.7	Release version Re-use of chapter 6, now dedicated to management of older system versions	AH

3.0.1 22/12/09		Including the results of the editorial review of the SRS 3.0.0	AH
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1.2 Table of Contents

1.3 Introduction

1.3.1.1 Train control is an important part of any railway operations management system. In the past a number of different Automatic Train Control (ATC) systems have evolved in different countries at different times. These systems are incompatible and not interoperable with each other. Only a few of these systems are used in more than one country, and even in those cases there have been differences in detailed development which have resulted in incompatible and not interoperable versions.

1.3.1.2 Many railways anticipate a significant increase in density of train traffic and are rethinking their infrastructure strategy, to accommodate high levels of traffic, in which ATC systems play an important part. Also many railways would like to introduce standardised systems to reduce system costs. In order to establish international standardisation of ATC systems, the following document specifies the European Rail Traffic Management System/European Train Control System (ERTMS/ETCS).

1.4 Advantages of an International Interoperable System

1.4.1.1 The advantages expected by the railways can be summarised as:

- Cross border interoperability.
- Improvement of the safety of national and international train traffic.
- Improvement of international passengers and freight train traffic management.
- Shorter headway on heavily trafficked lines, by driving on moving block, enabling exploitation of maximum track capacity.
- The possibility of step-by-step introduction of the new technology.
- Enabling Pan-European competition between the manufacturers of ERTMS/ETCS components. Strengthening the position of the European railway industry on the world market.
- Enabling preconditions for future harmonisation in other areas of rail traffic management.

1.5 About this Document

1.5.1.1 The purpose of this document is to specify the unified European Train Control System (ETCS) from a technical point of view.

1.5.1.2 Some parts of the system are only specified to allow a migration from existing train control systems to ETCS (e.g. STM's) over a transition period. They might be removed in a future edition of the standard.

1.5.1.3 To reach technical interoperability it is necessary not only that telegrams are generated and understood according to well specified rules but also that a train respectively trackside equipment reacts in a uniform way to information received. Technical interoperability requires specifications of a detailed level.

1.5.1.4 For operational interoperability it is necessary to add operating rules, engineering standards etc. to the system design. Reaching operational interoperability is outside the scope of the SRS.

1.6 How to Read and Use the SRS

1.6.1.1 The SRS covers 8 chapters, which are briefly described in the section following this introduction.

1.6.1.2 All readers may need to refer to the Glossary of terms and abbreviations (SUBSET-023).

1.7 Mandatory and Optional Requirements

1.7.1.1 This specification often offers multiple solutions on how to implement a specific function. It therefore contains both mandatory and optional requirements. Mandatory requirements are always referred to using the word “shall” where else optional requirements are referred to using the word “may”.

1.7.1.2 The ERTMS/ETCS on-board equipment shall implement all mandatory requirements, with the only exceptions and conditions explicitly stated in the Control-Command and Signalling TSI and in this SRS.

1.7.1.3 For ERTMS/ETCS trackside the implementation of functions has to be defined according to the characteristics of the specific lines and the related operational needs. In any case, the requirements of this SRS related to the implemented functions shall be respected.

1.7.1.4 Notes are added to the specification in some parts for clarification. They however never contain requirements.

1.7.1.5 Not specified requirements and solutions are only permitted as long as they do not generate any interoperability problems.

1.8 Contents of the SRS

1.8.1.1 The SRS defines the system requirements for the European Train Control System (ETCS) of ERTMS..

1.8.1.2 This sub-section is intended to give a rough overview of the contents of each chapter within the SRS so that readers interested only in specialised subjects can easily find the relevant chapters.

1.8.2 Chapter 1: Introduction

1.8.2.1 Chapter 1 (this chapter) gives a general introduction to the intention and structure of the SRS, including a brief overview of the contents of each chapter.

1.8.3 Chapter 2: Basic System Description

1.8.3.1 Chapter 2 gives an overview of the ERTMS/ETCS system structure.

1.8.3.2 Chapter 2 also contains a description of the basic application levels.

1.8.3.3 Chapter 2 does not contain technical requirements.

1.8.4 Chapter 3: Principles

1.8.4.1 Chapter 3 specifies the system principles of ETCS/ERTMS. These principles apply to onboard and trackside subsystems.

1.8.4.2 The principles define the behaviour of the system in general and functional terms.

1.8.5 Chapter 4: Modes and Transitions

1.8.5.1.1 Chapter 4 defines the modes of the ERTMS/ETCS onboard equipment and all transitions between modes.

1.8.6 Chapter 5: Procedures

1.8.6.1 Chapter 5 defines the dynamic behaviour of procedures that are necessary for interoperability. Procedures are presented by a state transition chart and a corresponding table, where all elements (States, events, transitions) of the chart are defined. The description of the procedures shows all states of the ERTMS/ETCS onboard unit and the conditions that must be fulfilled to switch from one state to another.

1.8.7 Chapter 6: Management of older System Versions

1.8.7.1.1 Chapter 6 defines the envelope of legally operated system versions and lists the exceptions that shall apply by derogation to the requirements listed in the other chapters of the SRS, when an older ERTMS/ETCS system version is used by the trackside subsystem.

1.8.8 Chapter 7: ERTMS/ETCS Language

1.8.8.1 Chapter 7 defines and describes the necessary variables to be used for the data flow over the air gap between track and train. The grouping of these into packets is described. The format of messages is given in Chapter 8.

1.8.9 Chapter 8: Messages

1.8.9.1 Chapter 8 defines the application protocol (format and content of messages, logical sequence for radio) necessary to achieve technical interoperability.

1.8.9.2 The scope of this chapter is limited to the application protocol and the content of messages.

ERTMS/ETCS

System Requirements Specification

Chapter 2

Basic System Description

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2.1 Modification History

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0.0.1 19 july 1999	All	First class 1 draft using new templates and including contributions from WPs	PZ
0.1.0 26 july 1999	System architecture figure § 2.3.1.2	Updating and introduction of Radio infill Reference to future class 1 deleted	PZ
1.0.0 29 July 1999	Document version, editorial changes, updating the architecture figure.	Finalisation in Stuttgart 990729	HE
1.2.0 990730	Version number	Release version	HE
1.2.1 991209	All	Draft for 2nd release	SAB
1.3.0 9912016	All	Review comments added	SAB
2.0.0 991222	Minor editing	Finalisation	SAB
2.0.1	All	Corrections after review	SAB
2.1.0	Minor editing	UNISIG release	SAB
2.2.0	Version number	UNISIG release	SAB
2.2.2 1.2.2002	Version number	Final edition	Ch. Frerichs
2.3.0 24/02/06	Version number No change since 2.2.2	Release version	HK
2.3.2 17/03/08	Including CRs that are in state “Analysis completed” according to ERA CCM	Working version	AH
3.0.0 23/12/08	Version number No change since 2.3.2	Release version	AH

3.0.1 22/12/09		Including the results of the editorial review of the SRS 3.0.0 and the other error CR's that are in state "Analysis completed" according to ERA CCM	AH
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2.2 Table of Contents

2.3 Introduction

2.3.1 Scope and purpose

2.3.1.1 The present chapter gives the basic description of the **ERTMS/ETCS system** proposed to achieve technical interoperability.

2.4 System structure

2.4.1.1 Due to the nature of the required functions, the **ERTMS/ETCS system** will have to be partly on the trackside and partly on board the trains.

2.4.1.2 This defines two sub-systems, the on-board sub-system and the trackside sub-system.

2.4.1.3 The environment of ERTMS/ETCS system is composed of:

a) the train, which will then be considered in the train interface specification;

b) the driver, which will then be considered via the driver interface specification;

c) other onboard interfaces (see architecture drawing in 2.5.3),

d) external trackside systems (interlockings, control centres, etc.), for which no interoperability requirement will be established.

2.5 Sub-systems

2.5.1 Trackside subsystem

2.5.1.1 Depending of the application level (see further sections), the trackside sub-system can be composed of:

a) balise

b) lineside electronic unit

c) the radio communication network (GSM-R)

d) the Radio Block Centre (RBC)

e) Euroloop

f) Radio infill unit

g) Key Management Centre (KMC)

2.5.1.2 Balise

2.5.1.2.1 The balise is a transmission device that can send telegrams to the on-board sub-system.

2.5.1.2.2 The balise is based on the existing Eurobalise specifications. These documents are included in the frame of the ERTMS/ETCS specifications.

2.5.1.2.3 The balises provides the up-link, i. e. the possibility to send messages from trackside to the on-board sub-system.

2.5.1.2.4 The balises can provide fixed messages or, when connected to a lineside electronic unit, messages that can be changed.

2.5.1.2.5 The balises will be organised in groups, each balise transmitting a telegram and the combination of all telegrams defining the message sent by the balise group.

2.5.1.3 Lineside electronic unit

2.5.1.3.1 The lineside electronic units are electronic devices, that generate telegrams to be sent by balises, on basis of information received from external trackside systems.

2.5.1.4 Trackside radio communication network (GSM-R)

2.5.1.4.1 The GSM-R radio communication network is used for the bi-directional exchange of messages between on-board sub-systems and RBC or radio infill units.

2.5.1.4.2 Intentionally deleted

2.5.1.5 RBC

2.5.1.5.1 The RBC is a computer-based system that elaborates messages to be sent to the train on basis of information received from external trackside systems and on basis of information exchanged with the on-board sub-systems.

2.5.1.5.2 The main objective of these messages is to provide movement authorities to allow the safe movement of trains on the Railway infrastructure area under the responsibility of the RBC.

2.5.1.5.3 The interoperability requirements for the RBC are mainly related to the data exchange between the RBC and the on-board sub-system.

2.5.1.6 Euroloop

2.5.1.6.1 The Euroloop subsystem operates on Level 1 lines, providing signalling information in advance as regard to the next main signal in the train running direction.

2.5.1.6.2 The Euroloop subsystem is composed of an on-board functionality and by one or more trackside parts.

2.5.1.7 Radio infill Unit

2.5.1.7.1 The RADIO INFILL subsystem operates on Level 1 lines, providing signalling information in advance as regard to the next main signal in the train running direction.

2.5.1.7.2 The RADIO INFILL subsystem is composed of an on-board functionality and by one or more trackside parts (named RADIO INFILL Unit).

2.5.1.8 KMC

2.5.1.8.1 The role of the KMC is to manage the cryptographic keys, which are used to secure the EURORADIO communications between the ERTMS/ETCS entities (ERTMS/ETCS on-board equipments, RBCs and RIUs).

2.5.2 On-board sub-system

2.5.2.1 Depending of the application level (see further sections), the on-board sub-system can be composed of:

a) the ERTMS/ETCS on-board equipment;

b) the on-board part of the GSM-R radio system;

2.5.2.2 ERTMS/ETCS on-board equipment

2.5.2.2.1 The ERTMS/ETCS on-board equipment is a computer-based system that supervises the movement of the train to which it belongs, on basis of information exchanged with the trackside sub-system.

2.5.2.2.2 The interoperability requirements for the ERTMS/ETCS on-board equipment are related to the functionality and the data exchange between the trackside sub-systems and the on-board sub-system and to the functional data exchange between the on-board sub-system and:

a) the driver;

b) the train;

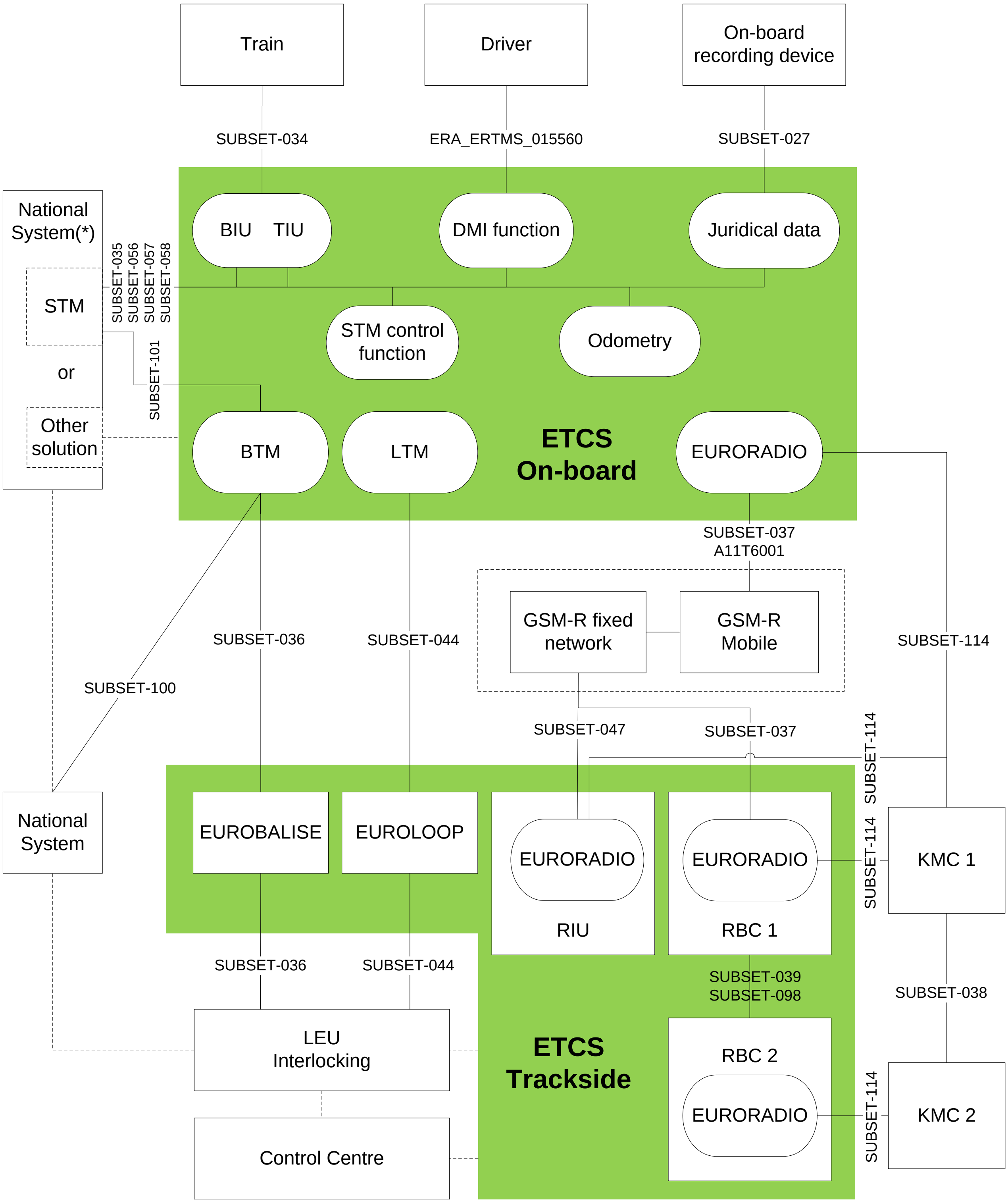
c) the onboard part of the existing national train control system(s).

2.5.2.3 Onboard radio communication system (GSM-R)

2.5.2.3.1 The GSM-R on-board radio system is used for the bi-directional exchange of messages between on-board sub-system and RBC or radio infill unit.

2.5.2.3.2 Intentionally deleted.

2.5.3 ERTMS/ETCS reference architecture



(*) Depending on its functionality and the desired configuration, the national system can be addressed either via an STM using the standard interface or via another national solution

Figure 1: ERTMS/ETCS system and its interfaces

2.5.3.1 Note: the entities inside the ERTMS/ETCS on-board equipment box are shown only to highlight the scope of the interfaces that are specified in the TSI CCS annex A.

2.6 Levels and transitions

2.6.1 Introduction

2.6.1.1 The different ERTMS/ETCS application levels (short: levels) are a way to express the possible operating relationships between track and train. Level definitions are related to the trackside equipment used, to the way trackside information reaches the on-board units and to which functions are processed in the trackside and in the on-board equipment respectively.

2.6.1.2 Different levels have been defined to allow each individual railway administration to select the appropriate ERTMS/ETCS application trackside, according to their strategies, to their trackside infrastructure and to the required performance. Furthermore, the different application levels permit the interfacing of individual signalling systems and train control systems to ERTMS/ETCS.

2.6.1.3 For the purpose of a consistent specification a level 0 has been defined. This level is used for operation on non-equipped (unfitted) lines or on lines equipped with train control system(s) but operation under their supervision is currently not possible.

2.6.2 Definitions

2.6.2.1 A train equipped with ERTMS/ETCS on-board equipment always co-operates with the ERTMS/ETCS trackside equipment in a defined ERTMS/ETCS level.

2.6.2.2 All transitions between levels are performed according to well-specified rules.

2.6.2.3 ERTMS/ETCS can be configured to operate in one of the following application levels:

- ERTMS/ETCS Level 0 (train equipped with ERTMS/ETCS operating on a line not equipped with any train control system (ERTMS/ETCS or national system) or on a line equipped with ERTMS/ETCS and/or national system(s) but operation under their supervision is currently not possible)
- ERTMS/ETCS Level NTC (train equipped with ERTMS/ETCS operating on a line equipped with a national system)
- ERTMS/ETCS Application Level 1 with or without infill transmission (train equipped with ERTMS/ETCS operating on a line equipped with Eurobalises and optionally Euroloop or Radio infill)
- ERTMS/ETCS Application Level 2 (train equipped with ERTMS/ETCS operating on a line controlled by a Radio Block Centre and equipped with Eurobalises and Euroradio) with train position and train integrity proving performed by the trackside

- ERTMS/ETCS Application Level 3 (similar to level 2 but with train position and train integrity supervision based on information received from the train)

2.6.2.4 It is possible to superimpose several application levels in parallel on the same track, for example to run trains without train integrity device in level 2 and in parallel trains equipped with train integrity device in level 3. Other examples might be a station which is shared by trains arriving over level 1 and level 2 lines (junctions) or parallel operation of a national system with ERTMS/ETCS. Mixed levels are supported.

2.6.2.5 Levels 1, 2 and 3 are downwards compatible. This means that:

- a level 3 equipped train is also able to operate in level 0, level 1 and level 2
- a level 2 equipped train is also able to operate in level 0 and level 1
- a level 1 equipped train is also able to operate in level 0

2.6.2.6 Note: Operation under level NTC is not part of the downward compatibility chain.

2.6.2.7 It is possible to transmit information not intended for ERTMS/ETCS but for other systems over the ERTMS/ETCS transmission channels. This information is not used by ERTMS/ETCS.

2.6.3 ERTMS/ETCS Application Level 0

2.6.3.1 General description

2.6.3.1.1 Level 0 covers operation of ETCS equipped trains on lines not equipped with ETCS or national systems or on lines where trackside ERTMS/ETCS infrastructure and/or national systems may exist but operation under their supervision is currently not possible (e.g. commissioning or on-board/trackside failed components).

2.6.3.1.2 In Level 0 it is authorized to operate trains without any train control system and therefore line side optical signals or other means of signalling are used to give movement authorities to the driver.

2.6.3.1.3 ERTMS/ETCS on-board equipment provides no supervision except of the maximum design speed of a train and maximum speed permitted in unfitted areas.

2.6.3.1.4 Train detection and train integrity supervision are performed by the trackside equipment of the underlying signalling system (interlocking, track circuits etc.) and are outside the scope of ERTMS/ETCS.

2.6.3.1.5 Level 0 uses no track-train transmission except Eurobalises to announce/command level transitions. Eurobalises therefore still have to be read. No balise data except certain special commands are interpreted.

2.6.3.1.6 No supervisory information is indicated on the DMI except the train speed. Train data has to be entered in order not to have to stop a train at a level transition to ERTMS/ETCS equipped area and to supervise maximum train speed.

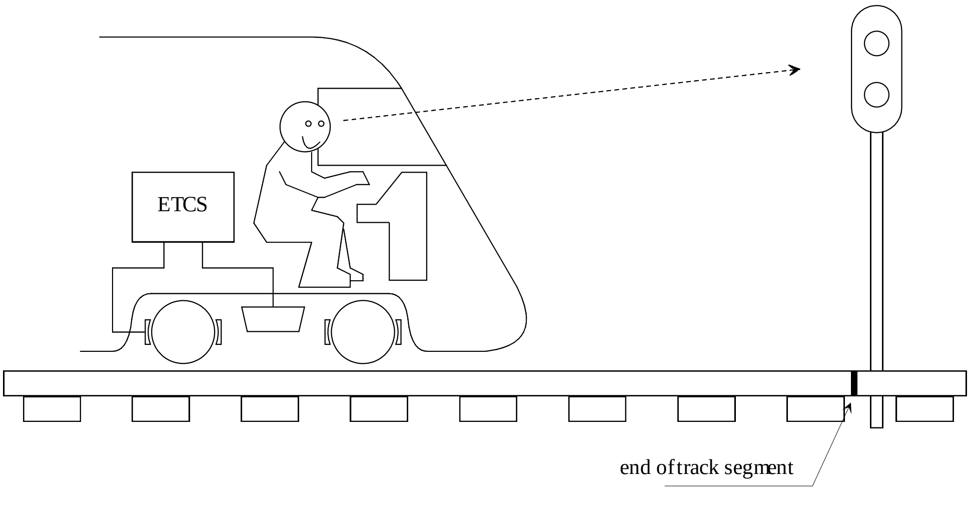


Figure 2: ERTMS/ETCS Application Level 0

2.6.3.2 Summary of characteristics of Application Level 0

2.6.3.2.1 Trackside equipment:

- No ERTMS/ETCS trackside equipment is used except for Eurobalises to announce level transitions and other specific commands.

2.6.3.2.2 Main ERTMS/ETCS trackside functions:

- None.

2.6.3.2.3 On-board equipment:

- Onboard equipment with Eurobalise transmission.

2.6.3.2.4 Main ERTMS/ETCS on-board functions:

- Supervision of maximum train speed.
- Supervision of maximum speed permitted in an unfitted area.
- Reading of Eurobalises to detect level transitions and certain special commands. All other messages are rejected.
- No cab signalling.

2.6.4 ERTMS/ETCS Application Level NTC

2.6.4.1 General description

2.6.4.1.1 Level NTC is used to run ERTMS/ETCS equipped trains on lines equipped with national train control and speed supervision systems.

2.6.4.1.2 Train control information generated trackside by the national train control system is transmitted to the train via the communication channels of the underlying national system.

2.6.4.1.3 Note: Lineside optical signals might be necessary or not, depending on the performance and functionality of the underlying systems.

2.6.4.1.4 Intentionally deleted.

2.6.4.1.5 The achievable level of supervision is similar to the one provided by the underlying national systems.

2.6.4.1.6 Train detection and train integrity supervision are performed by equipment external to ERTMS/ETCS.

2.6.4.1.7 Level NTC uses no ERTMS/ETCS track-train information except to announce/command level transitions and specific commands related to balise transmission. Eurobalises therefore still have to be read.

2.6.4.1.8 The information displayed to the driver depends on the functionality of the underlying national system. The active national system is indicated to the driver as part of that information. Full train data has to be entered in order not to have to stop a train at a level transition position and to supervise maximum train speed.

2.6.4.1.9 A combination of national systems can be regarded as one NTC level.

2.6.4.1.10 Depending on the functionality and the configuration of the specific national system installed onboard, the ERTMS/ETCS Onboard system may need to be interfaced to it, in order to perform the transitions from/to the national system and/or in order to give access to ERTMS/ETCS Onboard resources (e.g. DMI). This can be achieved through a device called an STM (Specific Transmission Module) using a standardised interface.

2.6.4.1.11 Intentionally deleted.

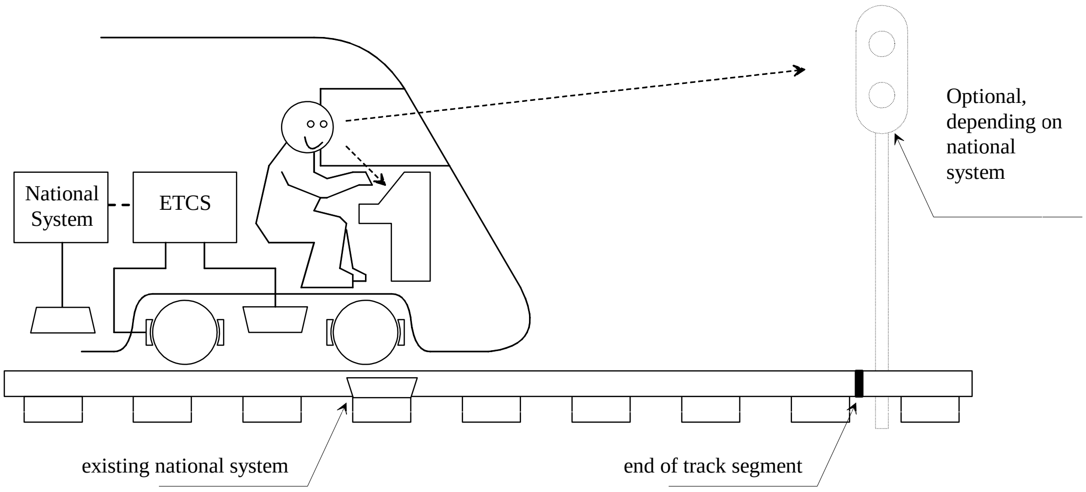


Figure 3: ERTMS/ETCS Application Level NTC

2.6.4.2 Summary of characteristics of Application Level NTC

2.6.4.2.1 Trackside equipment:

- Level NTC uses the track-train transmission system from an underlying national system, which is not part of ERTMS/ETCS.
- For level transition purposes Eurobalises are used.

2.6.4.2.2 Main ERTMS/ETCS trackside functions:

- None.

2.6.4.2.3 On-board equipment:

- Onboard equipment with Eurobalise transmission.
- Onboard part of the national system.

2.6.4.2.4 Main ERTMS/ETCS on-board function:

- No train supervision, it is fully handed over to the national system.
- Reading of Eurobalises to detect level transitions and certain special commands. All other messages are rejected.
- Management of the national system through STM, in case the ERTMS/ETCS on-board equipment is interfaced to the national system through an STM.

- No cab signalling.

2.6.5 ERTMS/ETCS Application Level 1

2.6.5.1 General description

2.6.5.1.1 ERTMS/ETCS Level 1 is a spot transmission based train control system to be used as an overlay on an underlying signalling system.

2.6.5.1.2 Movement authorities are generated trackside and are transmitted to the train via Eurobalises.

2.6.5.1.3 ERTMS/ETCS Level 1 provides a continuous speed supervision system, which also protects against overrun of the authority.

2.6.5.1.4 Train detection and train integrity supervision are performed by the trackside equipment of the underlying signalling system (interlocking, track circuits etc.) and are outside the scope of ERTMS/ETCS.

2.6.5.1.5 Level 1 is based on Eurobalises as spot transmission devices.

2.6.5.1.6 The trackside equipment does not know the train to which it sends information.

2.6.5.1.7 If in level 1 a lineside signal clears, an approaching train can not receive this information until it passes the Eurobalise group at that signal. The driver therefore has to observe the lineside signal to know when to proceed. The train has then to be permitted to approach the stopping location below a maximum permitted release speed.

2.6.5.1.8 Additional Eurobalises can be placed between distant and main signals to transmit infill information, the train will receive new information before reaching the signal.

2.6.5.1.9 Note: Lineside signals are required in level 1 applications, except if semi-continuous infill is provided.

2.6.5.1.10 Semi-continuous infill can be provided using Euroloop or radio infill. In this case, the on-board system will be able to show new information to the driver as soon as it is available and even at standstill.

2.6.5.1.11 Euroloop or radio infill can improve the safety of a level 1 system as they allow the operation without release speed.

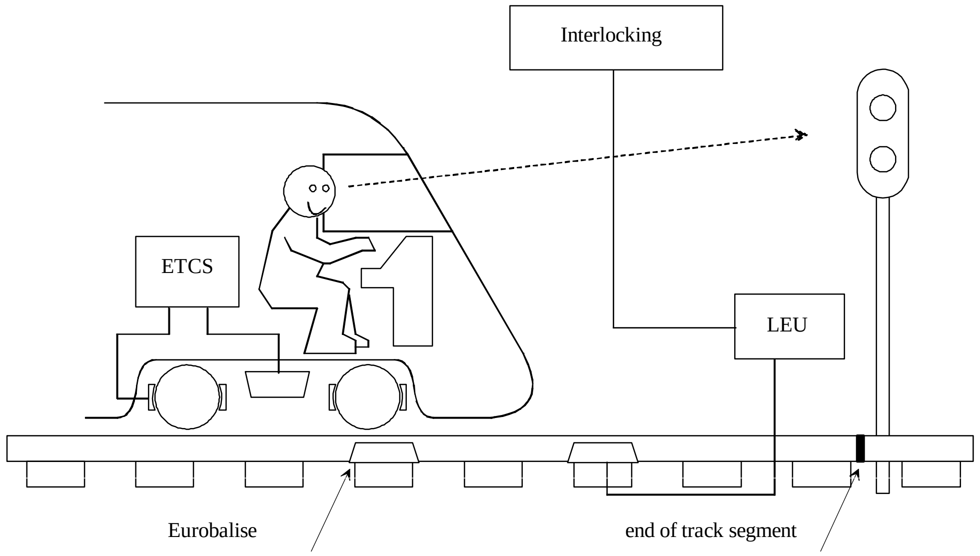


Figure 4: ERTMS/ETCS Application Level 1 without infill function

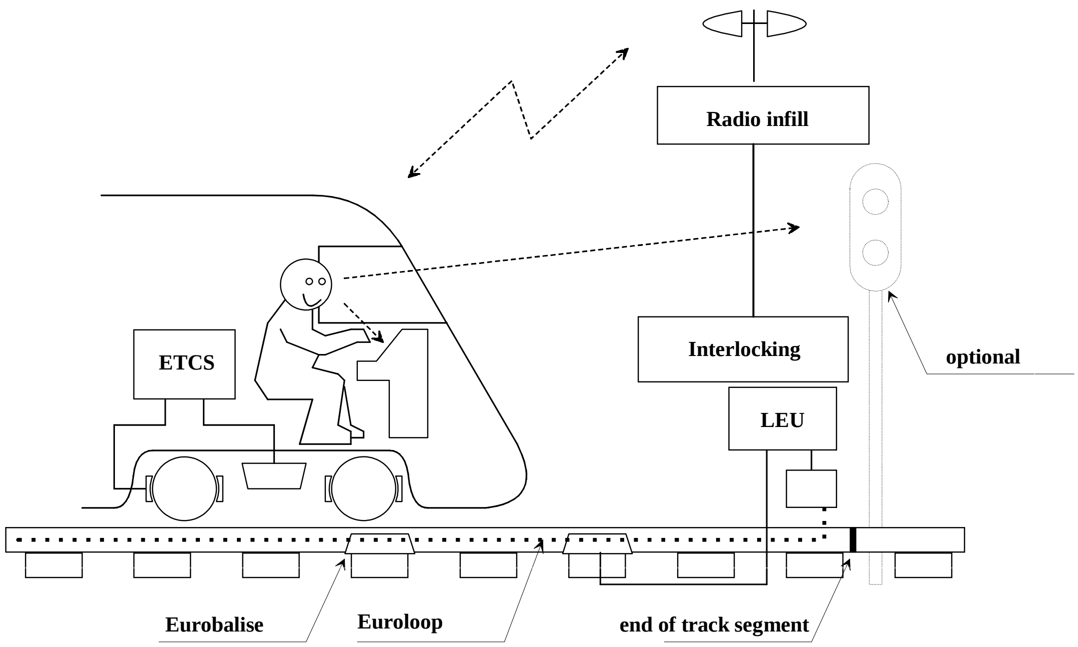


Figure 5: ERTMS/ETCS Application Level 1 with infill function by Euroloop or Radio infill

2.6.5.2 Summary of characteristics of Application Level 1

2.6.5.2.1 Trackside equipment:

- Eurobalises for spot transmission from track to train.
- Eurobalises must be able to transmit variable information.
- Semi continuous infill transmission by using Euroloop or radio infill is optional.

2.6.5.2.2 Main ERTMS/ETCS trackside function:

- Determine movement authorities according to the underlying signalling system.
- Transmit movement authorities and track description data to the train.

2.6.5.2.3 On-board equipment:

- Onboard equipment with Eurobalise transmission.
- Euroloop transmission if infill by Euroloop is required.
- Radio infill transmission if infill by radio is required.

2.6.5.2.4 Main ERTMS/ETCS on-board function:

- Reception of movement authority and track description related to the transmitting balise.
- Selection of the most restrictive value of the different speeds permitted at each location ahead.
- Calculation of a dynamic speed profile taking into account the train running/braking characteristics which are known on-board and the track description data.
- Comparison of the train speed with the permitted speed and commanding of the brake application if necessary.
- Cab signalling to the driver.

2.6.6 ERTMS/ETCS Application Level 2

2.6.6.1 General description

2.6.6.1.1 ERTMS/ETCS Level 2 is a radio based train control system which is used as an overlay on an underlying signalling system.

2.6.6.1.2 Movement authorities are generated trackside and are transmitted to the train via Euroradio.

2.6.6.1.3 ERTMS/ETCS Level 2 provides a continuous speed supervision system, which also protects against overrun of the authority.

2.6.6.1.4 Train detection and train integrity supervision are performed by the trackside equipment of the underlying signalling system (interlocking, track circuits etc.) and are outside the scope of ERTMS/ETCS.

2.6.6.1.5 Level 2 is based on Euroradio for track to train communication and on Eurobalises as spot transmission devices mainly for location referencing.

2.6.6.1.6 The trackside radio block centre which provides the information to the trains knows each ERTMS/ETCS controlled train individually by the ERTMS/ETCS identity of its leading ERTMS/ETCS on-board equipment.

2.6.6.1.7 Note: Lineside signals can be suppressed in Level 2.

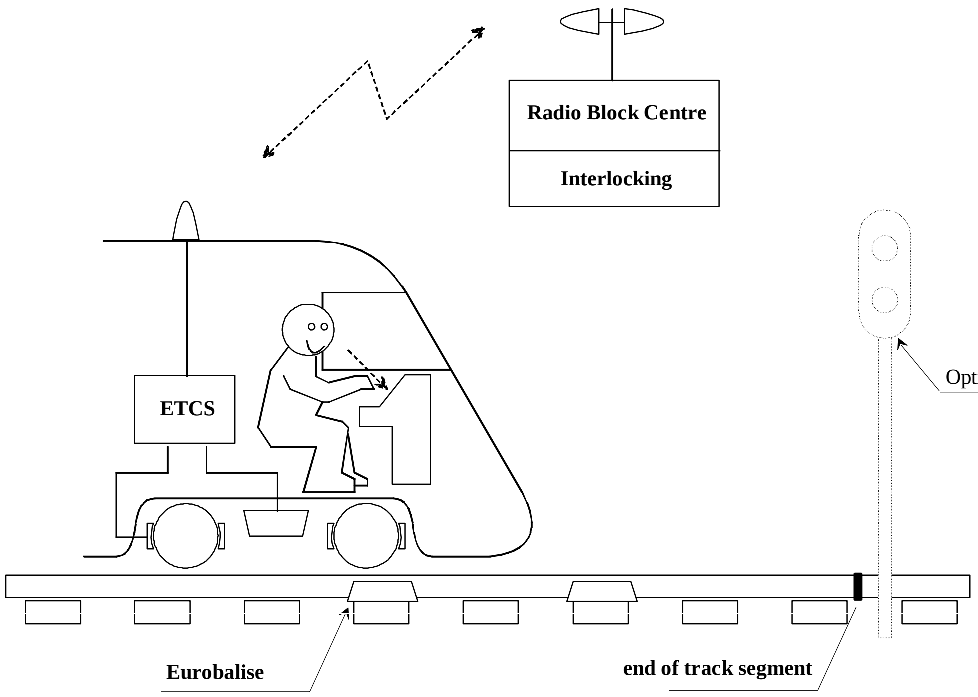


Figure 6: ERTMS/ETCS Application Level 2

2.6.6.2 Summary of characteristics of Application Level 2

2.6.6.2.1 Trackside equipment:

- Radio block centre.
- Euroradio for bi-directional track-train communication.
- Eurobalises mainly for location referencing.

2.6.6.2.2 Main ERTMS/ETCS trackside function:

- Knowing each train equipped with and running under ERTMS/ETCS within an RBC area by its ERTMS/ETCS identity.
- Following each ERTMS/ETCS controlled train's location within an RBC area.
- Determine movement authorities according to the underlying signalling system for each train individually.
- Transmit movement authorities and track description to each train individually.
- Handing over of train control between different RBC's at the RBC-RBC borders.

2.6.6.2.3 On-board equipment:

- Onboard equipment with Eurobalise and Euroradio transmissions.

2.6.6.2.4 Main ERTMS/ETCS on-board function:

- The train reads Eurobalises and sends its position relative to the detected balises to the radio block centre.
- The train receives a movement authority and the track description via Euroradio relating to a balise.
- Selection of the most restrictive value of the different speeds permitted at each location ahead.
- Calculation of a dynamic speed profile taking into account the train running/braking characteristics which are known on-board and the track description data.
- Comparison of the train speed with the permitted speed and commanding of the brake application if necessary.
- Cab signalling to the driver.

2.6.7 ERTMS/ETCS Application Level 3

2.6.7.1 General description

2.6.7.1.1 ERTMS/ETCS Level 3 is a radio based train control system.

2.6.7.1.2 Movement authorities are generated trackside and are transmitted to the train via Euroradio.

2.6.7.1.3 ERTMS/ETCS Level 3 provides a continuous speed supervision system, which also protects against overrun of the authority.

2.6.7.1.4 Train position and train integrity supervision are performed by the trackside radio block centre in co-operation with the train (which sends position reports and train integrity information).

2.6.7.1.5 Level 3 is based on Euroradio for track to train communication and on Eurobalises as spot transmission devices mainly for location referencing.

2.6.7.1.6 The trackside radio block centre which provides the information to the trains knows each train individually by the ERTMS/ETCS identity of its leading ERTMS/ETCS on-board equipment.

2.6.7.1.7 Note: Lineside signals are not foreseen to be used when operating in Level 3.

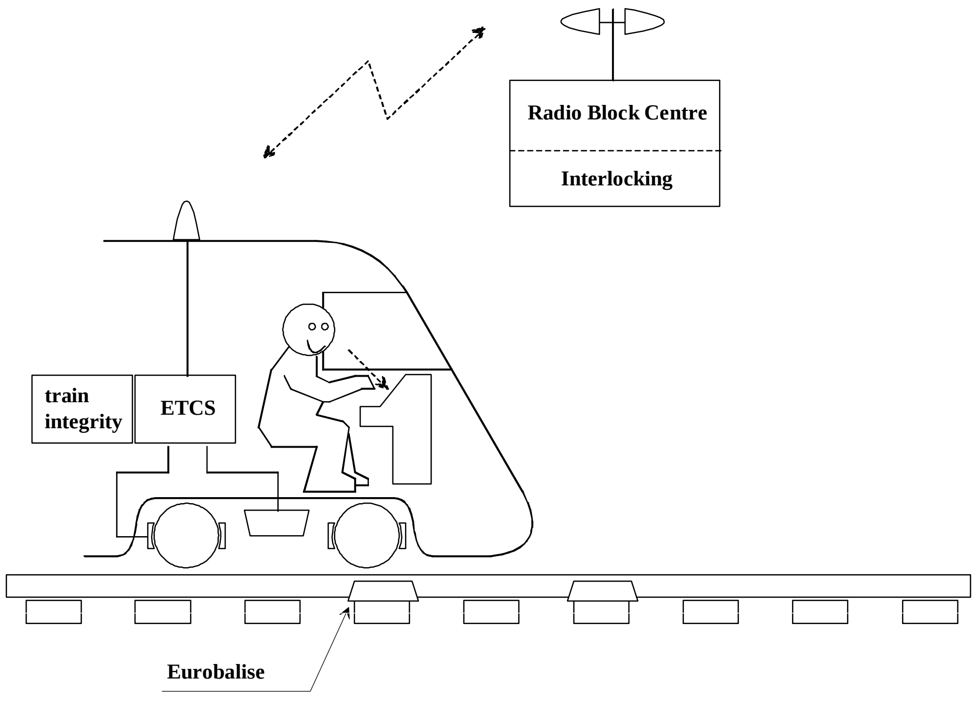


Figure 7: ERTMS/ETCS Application Level 3

2.6.7.2 Summary of characteristics of Application Level 3

2.6.7.2.1 Trackside equipment:

- Radio block centre.
- Euroradio for bi-directional track-train communication.
- Eurobalises for mainly location referencing.

2.6.7.2.2 Main ERTMS/ETCS trackside function:

- Knowing each train within an RBC area by its ERTMS/ETCS identity.
- Following each trains location within an RBC area.
- Route locking and route releasing based on information received from the trains.
- Determine movement authorities for each train individually.
- Transmit movement authorities and track description to each train individually.
- Handing over of train control between different RBC's at the RBC-RBC borders.

2.6.7.2.3 On-board equipment:

- Onboard equipment with Eurobalise and Euroradio transmissions.
- Train integrity proving system.

2.6.7.2.4 Main ERTMS/ETCS on-board functions:

- The train reads Eurobalises and sends its position relative to the detected balises to the radio block centre.
- The train monitors train integrity (external function, not part of ERTMS/ETCS) and sends this information to the radio block centre.
- The train receives a movement authority and the track description via Euroradio relating to a balise.
- Selection of the most restrictive value of the different speeds permitted at each location ahead.
- Calculation of a dynamic speed profile, taking into account the train running/braking characteristics which are known on-board and the track description data.
- Comparison of the train speed with the permitted speed and commanding of the brake application if necessary.
- Cab signalling to the driver.

2.6.8 Level transitions

2.6.8.1 An ERTMS/ETCS equipment which is not isolated always operates in one of the above described levels. All transitions between these levels are performed according to defined functions and procedures.

2.6.8.2 Additional national functions and rules which might be used by an individual railway to for example prevent not equipped trains from entering a level 2/3 area are not specified here and have to be implemented outside ERTMS/ETCS.

2.6.8.3 The following table shows all possible transitions (marked with Grey):

to from	0	NTC	1	2	3
0					
NTC		a)			
1					
2				b)	
3					b)

Table 1: Possible level transitions.

a) Transitions between level NTC and level NTC describe the switching from one national system to another national system.

b) Transitions between level 2 and level 2 respectively between level 3 and level 3 describe the handover between RBC's.

ERTMS/ETCS
System Requirements Specification **Chapter 3** **Principles**
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3.1 Modification History

Issue Number Date	Section Number	Modification / Description	Author/Editor
1.0.1 990307	All	Merge of Basic + Detailed Principles Removing redundant material, correcting text and adding proposals.	HE
1.1.0 990423	All	Class P Official Issue	HE
1.1.1 990521	All	Corrections after UNISIG review.	KL
1.1.2 990713	All	Additional functions for class 1 and changes related to these functions in other parts	KL
1.1.3 990722	All	Changes according to review of version 1.1.2	KL
1.1.4 990729	All	Editorial corrections, finalisation meeting Stuttgart 990729	HE
1.2.0 990730	Version number	Release version	HE
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1.3.1 991217	All	Corrections after UNISIG review 15 December 99	KL
2.0.0 991222	Minor editing	Release Version	Ch. Frerichs (ed.)
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2.2.0 010108	Section 3.18.4.6.6 – 3.18.4.6.8 removed	Changes as decided on Steering Committee meeting 13 December 2000 (changes from 2.0.0	KL

	marked)	
2.2.2 020201	Refer to document: SUBSET–026 Corrected Paragraphs, Issue 2.2.2	KL
2.2.4 SG checked 040528	Including all CLRs agreed with the EEIG (see “List of CLRs agreed with EEIG for SRS v2.2.4” dated 28/05/04) Affected clauses see change marks	H. Kast
2.2.5 210105	Incorporation of solution proposal for CLR 007 with EEIG users group comments Corrections according to erratum list agreed in SG meeting 170105	AH
2.2.6 050301	Including all CLRs being in state “EEIG pending” as per list of CLRs extracted on 28/01/05.	OG
2.2.7 220705	Including all CLRs extracted from “CR-Report_10.6.05-by number.rtf” and mentioned in column 2.2.7 in “CR status 13.6.05.xls” 22/07/05 Changes for CR 126 included (HK)	OG
2.2.8 211105	Change marks cleaned up and updated according to last CRs decisions (including split of CRs7&126)	OG
2.2.9 24/02/06	Including all CRs that are classified as “IN” as per SUBSET-108 version 1.0.0 Removal of all CRs that are not classified as “IN” as per SUBSET-108 version 1.0.0, with the exception of CRs 63,98,120,158,538	OG
2.3.0 24/02/06	Release version	HK
2.3.1 12/06/06		OG
2.3.2 17/03/08	Including all CRs that are classified as “IN” as per SUBSET-108 version 1.2.0 and all CRs that are in state “Analysis completed” according to ERA CCM	AH
2.9.1 06/10/08	Including all enhancement CR’s retained for baseline 3 and all other error CR’s For editorial reasons, the following CR’s are also included: CR656, CR804, CR821	AH
3.0.0 13/12/08	Release version	AH

3.0.1 22/12/09	Including the results of the editorial review of the SRS 3.0.0 and the other error CR's that are in state "Analysis completed" according to ERA CCM	AH
3.1.0 22/02/10	Release version	AH
3.1.1 08/11/10	Including all CR's that are in state "Analysis completed" according to ERA CCM, plus CR731, 972 and 1000.	AH
3.2.0 22/12/10	Release version	AH
3.2.1 13/12/11	Including all CR's that are in state "Analysis completed" according to ERA CCM, plus CR772	AH
3.3.0 07/03/12	Baseline 3 release version	AH

3.2 Table of Contents

3.3 Introduction

3.3.1 Scope and purpose

3.3.1.1 The chapter 3, Principles, specifies the system principles of ETCS/ERTMS. These principles apply to on-board and trackside subsystems and are mainly derived from FRS.

3.3.1.2 The principles define the operational and technical behaviour of the system in general and functional terms.

3.3.1.3 The chapter is divided into subchapters. In each subchapter normally several requirements are defined. Each requirement is identified with a unique identification number.

3.3.1.4 Notes, Justifications and Examples are only informative and shall not be regarded as requirements.

3.4 Balise configuration and linking

3.4.1 Balise Configurations – Balise Group Definition

3.4.1.1 A balise group shall consist of between one and eight balises.

3.4.1.2 In every balise shall at least be stored:

a) The internal number (from 1 to 8) of the balise

b) The number of balises inside the group

c) The balise group identity.

3.4.1.3 The internal number of the balise describes the relative position of the balise in the group.

3.4.2 Balise Co-ordinate System

3.4.2.1.1 Every balise group has its own co-ordinate system.

3.4.2.1.2 The orientation of the co-ordinate system of a balise group (i.e., nominal or reverse direction) is identified as balise group orientation.

3.4.2.2 Balise groups composed of two or more balises

3.4.2.2.1 The origin of the co-ordinate system for each balise group shall be given by the balise number 1 (called location reference) in the balise group.

3.4.2.2.2 The nominal direction of each balise group is defined by increasing internal balise numbers.

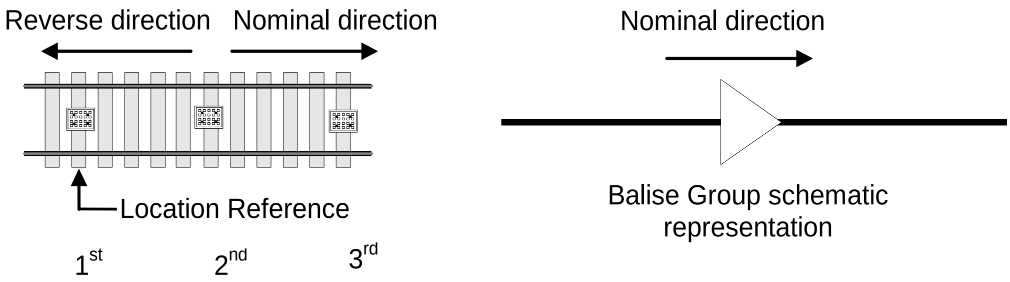


Figure 1: Orientation of the balise group

3.4.2.3 Balise groups composed of a single balise

3.4.2.3.1 Note: Balise groups consisting of only one single balise are referred to as "single balise groups" in the following.

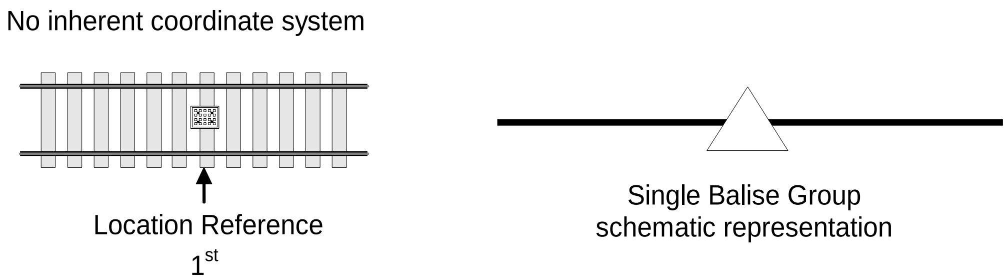


Figure 1a: Single balise group

3.4.2.3.2 Level 1:

3.4.2.3.2.1 The assignment of the co-ordinate system shall be by means of linking data.

3.4.2.3.2.2 For balise groups consisting of a single balise, the information "direction with which the linked balise group will be passed over" received from a previous balise group shall assign a co-ordinate system to the balise.

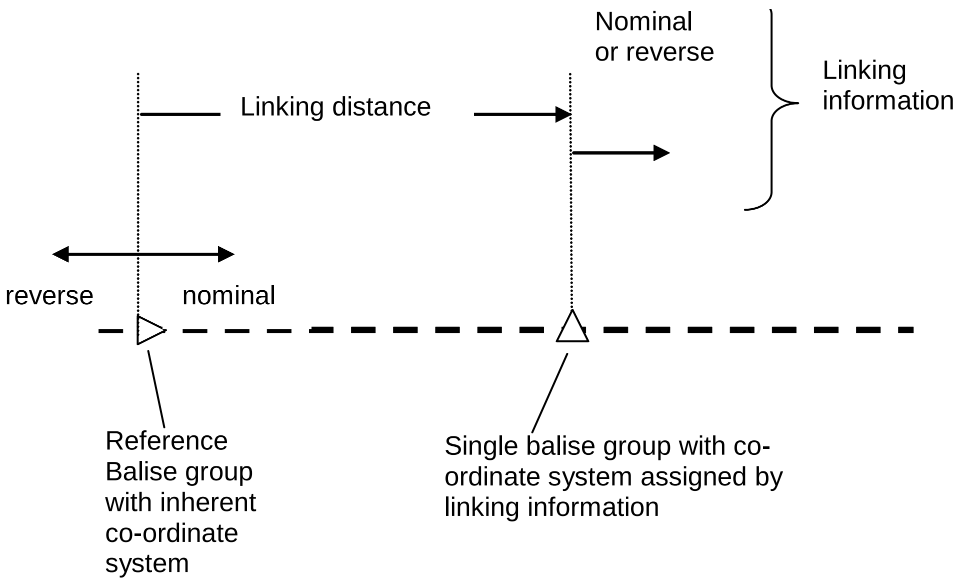


Figure 2: Assignment of a co-ordinate system to a single balise group by linking

3.4.2.3.2.3 The reference for the linking data shall be either a single balise group if a co-ordinate system has been assigned to it before, or a balise group consisting of two or more balises (with "inherent" co-ordinate system)

3.4.2.3.3 Level 2/3:

3.4.2.3.3.1 If the ERTMS/ETCS on-board equipment cannot evaluate the orientation of the last balise group detected, being a single balise group, i.e. no linking information is available to identify the orientation of the co-ordinate system of this single balise group, the ERTMS/ETCS on-board equipment shall report its position by means of a position report based on two balise groups reporting the train position in reference to the LRBG and the “previous LRBG”, if any.

3.4.2.3.3.1.1 Note: Receiving this type of position report advises the RBC of the need to assign a co-ordinate system to this single balise group.

3.4.2.3.3.2 When a single balise group is detected and the previous LRBG is known, the position report based on two balise groups shall use as direction reference a move from the “previous LRBG” towards this single balise group (being the new LRBG): directional information in the position report pointing in the same direction as the direction reference shall be reported as “nominal”, otherwise as “reverse”.

3.4.2.3.3.3 If the “previous LRBG “ is not known, the “previous LRBG” and all directional information of the position report based on two balise groups shall be reported as “unknown”.

3.4.2.3.3.4 If a new single balise group (BG2), different from the current LRBG (BG1), becomes LRBG while the running direction of the train is opposite to the running direction when this current LRBG (BG1) was last passed, the “previous LRBG” and all directional information of the position report based on two balise groups shall be reported as "unknown" (see Figure 2a).

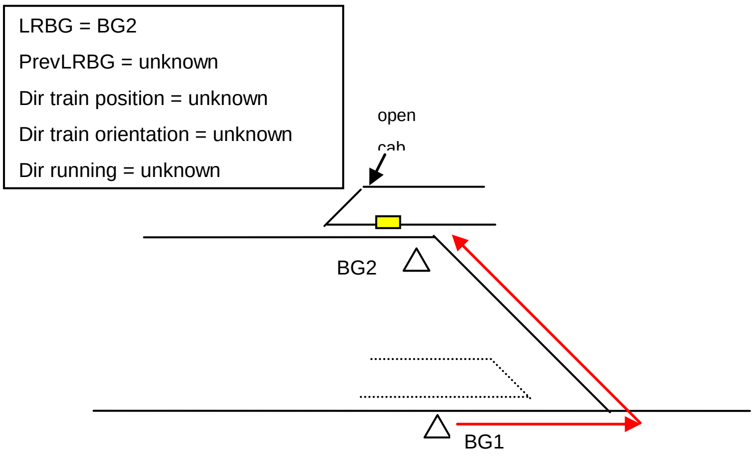


Figure 2a: Position report based on two balise groups versus train running direction

3.4.2.3.3.5 If a single balise group, being the LRBG, is detected again, the LRBG and the "previous LRBG" of the position report based on two balise groups shall remain unchanged.

3.4.2.3.3.6 The assignment of a co-ordinate system received from the RBC shall identify the balise group for which the assignment is given, and assign a balise group orientation "nominal" or "reverse" to this balise group

3.4.2.3.3.6.1 Note: From the sequence of reported balise groups, the RBC can derive the balise group orientation with which the balise group was passed.

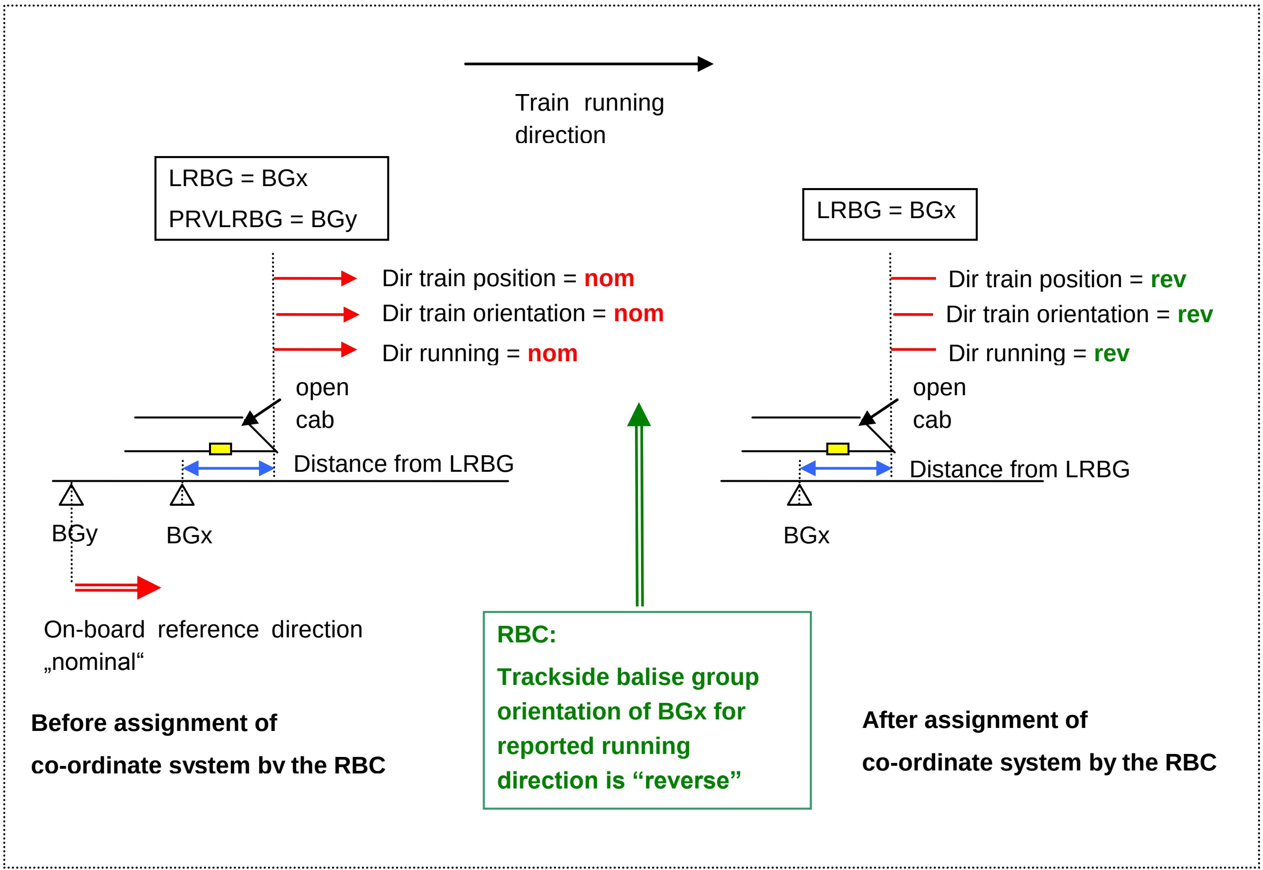


Figure 2b: Example for assigning a co-ordinate system

3.4.2.3.3.7 For single balise groups reported as LRBG and stored according to 3.6.2.2.2c, awaiting an assignment of a co-ordinate system, the ERTMS/ETCS on-board equipment shall be able to discriminate if a single balise has been reported more than once and with different “previous LRBGs” to the RBC.

3.4.2.3.3.7.1 Note: For a single balise group reported as LRBG awaiting the assignment of a co-ordinate system also the rules for LRBGs reported to the RBC (see 3.6.2.2.2) apply.

3.4.2.3.3.8 A co-ordinate system assignment received from trackside shall be rejected by the ERTMS/ETCS on-board equipment if the referred LRBG is memorised (see 3.6.2.2.2c) to have been reported more than once and with different “previous LRBGs”.

3.4.2.3.3.8.1 Note: If a single balise group is memorised, according to 3.6.2.2.2c, more than once, and with different “previous LRBGs”, the assignment of the co-ordinate system is ambiguous.

3.4.2.4 Balise groups composed of one pair of duplicated balises

3.4.2.4.1 A group of two balises duplicating each other shall be treated as a single balise group in case where only one balise is correctly read.

3.4.3 Balise Information Types and Usage

3.4.3.1 In level 1, all information to the on-board system is given from balise groups or additionally from EUROLOOPS or Radio Infill Units (see section 3.9). In level 2/3, balise groups are mostly used for location information.

3.4.3.2 A balise may contain directional information, i.e. valid either for nominal or for reverse direction, or may contain information valid for both directions. In level 1, this information can be of the following type (please refer to section 3.8.5):

a) Non-infill

b) Intentionally deleted

c) Infill.

3.4.3.2.1 Intentionally deleted.

3.4.3.2.2 Note: Infill information is referring to the location reference of an announced balise group.

3.4.3.3 Some information shall be read also in sleeping mode and when no linking information is available (see Chapter 4 Use of received information). If such information is transmitted by balises, and if the information is directional, balise groups consisting of at least two balises shall be used.

3.4.4 Linking

3.4.4.1 Introduction

3.4.4.1.1 Aim of linking:

- To determine whether a balise group has been missed or not found within the expectation window (see section 3.4.4.4) and take the appropriate action.
- To assign a co-ordinate system to balise groups consisting of a single balise.
- To correct the confidence interval due to odometer inaccuracy (see section 3.6.4).

3.4.4.1.2 A balise group is linked when its linking information (see section 3.4.4.2) is known in advance.

3.4.4.1.2.1 Note: In cases where a balise group contains repositioning information, the term linked also applies since the balise group is announced, marked as linked and contains repositioning information marked accordingly.

3.4.4.2 Content of linking information

3.4.4.2.1 Linking information shall be composed of:

a) The identity of the linked balise group.

b) Where the location reference of the group has to be found.

c) The accuracy of this location.
Note: If the reference balise is duplicated, it is the trackside responsibility to define the location accuracy to cover at least the location of the two duplicated balises.

d) The direction with which the linked balise group will be passed over (nominal or reverse).

e) The reaction required if a data consistency problem occurs with the expected balise group.

3.4.4.2.1.1 "Linking information is used" shall be interpreted as when balise group(s) are announced and the minimum safe antenna position has not yet passed the expectation window of the furthest announced balise group.

3.4.4.2.2 Instead of the identity of a linked balise group it shall be possible to identify a following linked balise group as unknown but containing repositioning information

3.4.4.2.2.1 Intentionally deleted.

3.4.4.2.2.2 Note 1: Regarding the repositioning information, see chapter 3.8.5.3.5 and 3.8.5.2.

3.4.4.2.2.3 Note 2: In case the identity of the next balise group is not unambiguously known because the route is not known by the trackside, this feature allows to link this balise group.

3.4.4.2.3 For each linked balise group, the trackside shall select one of the following reactions to be used in case of data inconsistencies:

a) Train trip (Trip mode, see Chapter 4)

b) Command service brake

c) No reaction

For further details see section 3.16.2.

3.4.4.3 Unlinked Balise Groups

3.4.4.3.1 A balise group, which contains information that must be considered even when the balise group is not announced by linking, is called an unlinked balise group.

3.4.4.3.2 Unlinked balise groups shall consist at minimum of two balises.

3.4.4.3.3 Unlinked balise groups shall always contain the unlinked balise group qualifier.

3.4.4.4 Rules related to linking

3.4.4.4.1 When no linking information is used on-board, all balise groups shall be taken into account.

3.4.4.4.2 When linking information is used on-board, only balise groups marked as linked and included in the linking information and balise groups marked as unlinked shall be taken into account.

3.4.4.4.2.1 When linking information is used on-board and the expected balise group is referred in the linking information with a balise group with ID “unknown”, a balise group marked as linked shall only be taken into account if:

a) the on-board equipment can determine the orientation of the linked balise group by information from the balise group itself (therefore excluding for example single balise groups), AND

b) the balise group contains repositioning information valid for the train orientation, AND

c) the balise group is crossed with the direction announced in the linking information.

3.4.4.4.3 The on-board equipment shall accept a balise group marked as linked and included in the linking information (i.e. the balise giving the location reference) from

- when the max safe front end of the train has passed the first possible location of the balise group

until

- the min safe front end of the train has passed the last possible location of the balise group

taking the offset between the front of the train and the balise antenna into account.

3.4.4.4.3.1 Note: The first possible location and the last possible location of the balise group are defined by the linking distance and the location accuracy.

3.4.4.4.3.2 Note: The interval between the outer limits to accept the balise group defines the expectation window.

3.4.4.4.4 In case of a balise group containing repositioning information, the first possible location shall start from the previously linked balise group.

3.4.4.4.5 The on-board equipment shall expect balise groups one by one (i.e., it shall supervise only one expectation window at a time) according to the order given by linking information.

3.4.4.4.6 The ERTMS/ETCS on-board equipment shall stop expecting a balise group and shall expect the next one announced in the linking information (if any) when:

a) the balise group is found inside its expectation window

b) a linking consistency error is found, see 3.16.2.3.1

3.4.4.4.6.1 Linking consistency error due to early reception of balise group expected later (see 3.16.2.3.1 c)): if the balise group found is the next one announced in the linking information, the ERTMS/ETCS on-board equipment shall check its linking consistency and apply again clause 3.4.4.4.6, i.e. it will immediately expect the further next balise group announced in the linking information.

3.5 Management of Radio Communication

3.5.1.1 Note: the following section refers to the behaviour of the user application interacting with Euroradio protocols. How the messages are actually transported from the sender to the receiver user application is not relevant for this description.

3.5.2 General

3.5.2.1 Each communication session managed by an entity shall allow the exchange of data with only one other entity.

3.5.2.2 Note: in the following sections reference is made to safe radio connections, whose definition and management is contained in Euroradio specification.

3.5.2.3 The information Initiation of a Communication Session and Version not Compatible (see sections 3.5.3 and 3.17) shall be the same in every system version.

3.5.3 Establishing a communication session

3.5.3.1 It shall be possible for ERTMS/ETCS on-board equipment and RBC to initiate a communication session.

3.5.3.2 A Radio Infill Unit (see section 3.9.3) shall never initiate a communication session.

3.5.3.3 Note: Only communication sessions between an ERTMS/ETCS on-board equipment and a trackside equipment (RBC or Radio Infill Unit) are considered here.

3.5.3.4 The on-board shall establish a communication session

a) At Start of Mission (only if level 2 or 3).

b) If ordered from trackside.

c) If a mode change, not considered as an End of Mission, has to be reported to the RBC (only if level 2 or 3)

d) If the driver has manually changed the level to 2 or 3

e) When the train front reaches the end of an announced radio hole

f) When the previous communication session is considered as terminated due to loss of safe radio connection (refer to 3.5.4.2.1)

g) When a Start of Mission procedure, during which no communication session could be established, is completed in level 2 or 3

3.5.3.4.1 In respect of a), b), c), d) and e) of 3.5.3.4, the on-board shall not establish a new communication session with an RBC/RIU in case a communication session is currently being established or is already established with this RBC/RIU.

3.5.3.5 The order to contact an RBC shall include

a) The identity of the RBC.

b) The telephone number of the RBC.

c) The action to be performed (establish/terminate the session).

d) Whether this applies also to Sleeping units.

3.5.3.5.1 See table at the end of section 3.5.3.

3.5.3.5.2 If the ERTMS/ETCS on-board equipment has to establish a communication session with an RBC whilst in session with another RBC, the existing communication session shall be terminated (see 3.5.5.2 for details) and the new one shall be established. Exception: the order to contact an Accepting RBC shall not terminate the communication session with the Handing Over RBC.

3.5.3.5.3 The order to contact an Accepting RBC shall be part of the RBC transition order and shall include:

a) The identity of the Accepting RBC.

b) The telephone number of the Accepting RBC.

c) Whether this applies also to Sleeping unit.

3.5.3.6 The order to contact a Radio Infill Unit shall include

a) The identity of the Radio Infill Unit

b) The telephone number of the Radio Infill Unit

c) The action to be performed (establish/terminate the session).

3.5.3.7 If the establishment of a communication session is initiated by the on-board, it shall be performed according to the following steps:

a) The on-board shall request the set-up of a safe radio connection with the trackside. If this request is part of an on-going Start of Mission procedure, it shall be repeated until successful or a defined number of times (see Appendix A3.1).

If this request is not part of an on-going Start of Mission procedure, it shall be repeated until at least one of the following conditions is met:

- Safe radio connection is set up
- End of Mission is performed
- Order to terminate communication session is received from trackside
- The train passes a level transition border (from level 2/3 to level 0, NTC, 1) with its front end.
- Order to establish communication session with a different RBC is received from trackside and the order does not request to contact an Accepting RBC.
- The train passes a RBC/RBC border with its front end.

- The train front passes the start of an announced radio hole
- Regards RIUs only: Level 1 is left

A request shall be repeated immediately after EURORADIO has indicated that setting up the safe radio connection has failed.

b) As soon as the safe radio connection is set-up, the on-board shall send the message Initiation of communication session to the trackside.

c) As soon as the trackside receives the information, it shall send the system version.

3.5.3.8 When the on-board receives the system version it shall consider the communication session established and:

a) If one of its supported system versions is compatible with the one sent by trackside, it shall send a session established report, including its telephone numbers, to the trackside.

b) If none of its supported system versions is compatible with the one sent by trackside, it shall send a version independent message indicating “No compatible version supported”. It shall inform the driver and shall terminate the communication session.

3.5.3.9 When the trackside receives the session established report or the information that no compatible system version is supported by the on-board, it shall consider the communication session established.

3.5.3.9.1 Intentionally deleted.

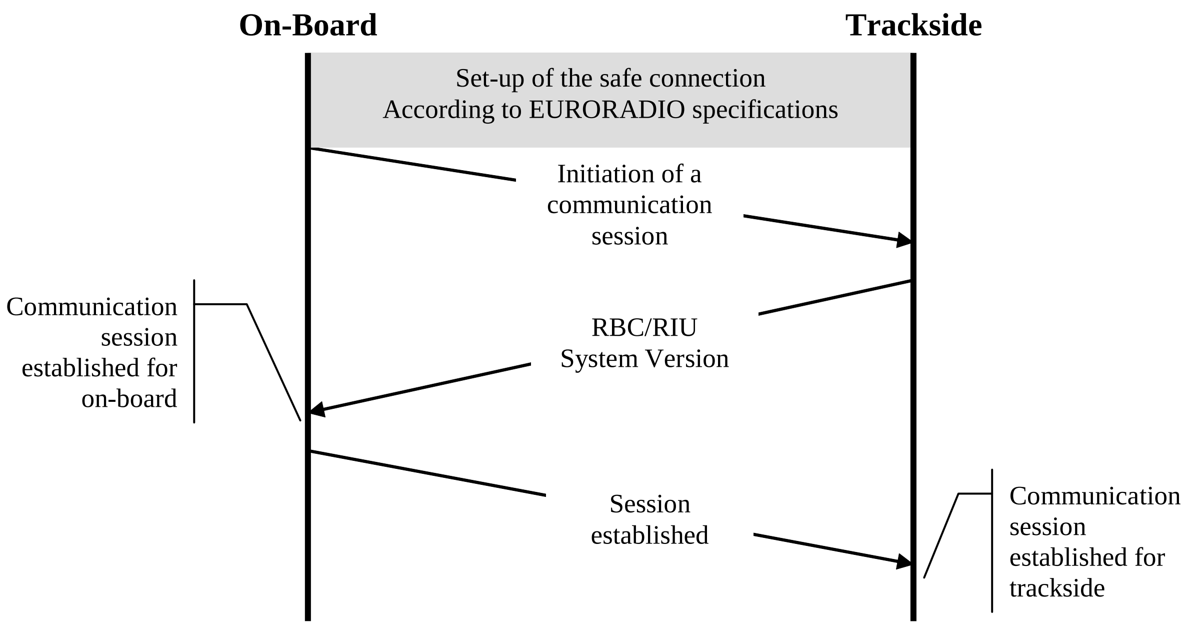


Figure 3: Establishment initiated by on-board

3.5.3.10 If the establishment of a communication session is initiated by the RBC, it shall be performed according to the following steps:

a) The trackside shall request the set-up of a safe radio connection with the on-board.

b) As soon as the safe radio connection is set-up, the trackside shall send the message Initiation of communication session to the on-board.

c) When the on-board receives the information, it shall consider the communication session established and send a session established report to the trackside.

d) When the trackside receives the session established report, it shall consider the communication session established.

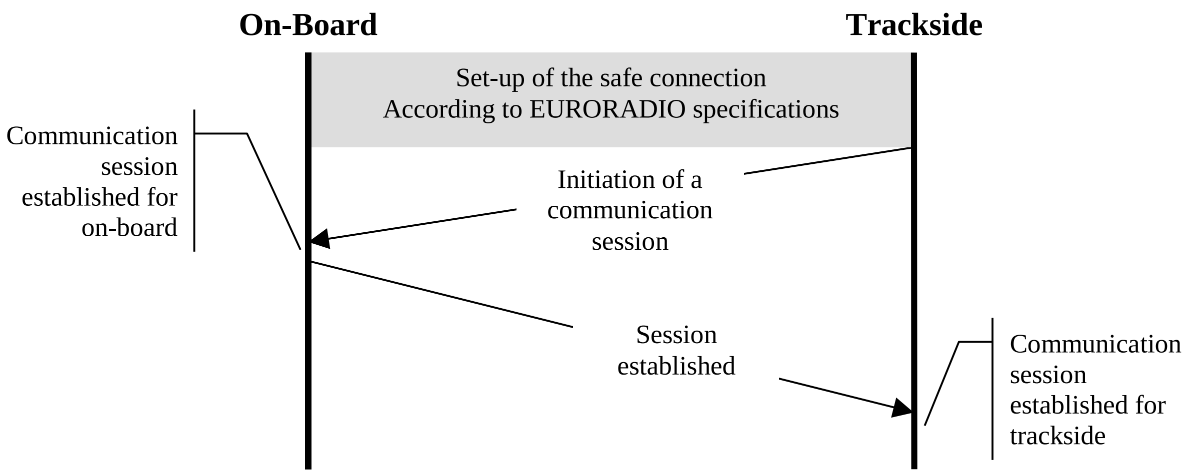


Figure 4: Establishment initiated by the RBC

3.5.3.11 In case the RBC is the initiator, the first message from RBC to on-board shall have the time-stamp and the LRBG identity set to "unknown".

3.5.3.12 Note: In the case the RBC is the initiator, there is no need to verify the compatibility of the system versions and for the on-board to send its telephone numbers, because the on-board is obviously already known to the RBC.

3.5.3.13 An order to contact the RBC may contain a special value for the RBC identity indicating that the on-board shall contact the last known RBC (i.e., using the stored RBC ID/phone number, if any); the phone number indicated in the order shall be ignored by the on-board equipment.

3.5.3.13.1 If there is no RBC ID/ phone number stored on-board, the order to contact the RBC shall be ignored.

3.5.3.14 Note: If a short number is used (considering trackside call routing), that number can be programmed into the balise instead of the normal phone number.

3.5.3.15 An order to contact the RBC may contain a special value for the RBC phone number indicating that the on-board shall use the on-board short number.

3.5.3.15.1 Note: The on-board stored short number for calling the RBC is defined by EIRENE.

3.5.3.16

Option	Balise data content	Train reaction
1	Order to contact RBC Special value for RBC ID: Contact last known RBC RBC Phone number irrelevant	Contact last known RBC (order is ignored in case no RBC ID/ phone number is stored on-board)
2	Order to contact RBC RBC ID Special value for RBC phone number: use on-board stored short number	Contact given RBC by using RBC ID and the on-board short number. Note: If the short number does not direct to the RBC with the given RBC ID, the connection will be terminated (EURORADIO functionality).
3	Order to contact RBC RBC ID + RBC phone number	Contact given RBC by using RBC ID and the RBC phone number

3.5.4 Maintaining a communication session

3.5.4.1 When a communication session is established, in case of a loss of the safe radio connection, i.e., if the disconnection has not been ordered (see 3.5.5.1), the involved entities shall consider the communication session still established for a defined time. The defined time shall start as soon as EURORADIO has indicated the loss of the safe radio connection.

3.5.4.2 When EURORADIO indicates the loss of the safe radio connection, the ERTMS/ETCS on-board equipment shall immediately try to set-up a new safe radio connection.

3.5.4.2.1 If the safe radio connection is not re-established after the defined time (as defined in A3.1), both, on-board equipment and trackside, shall consider the session as terminated.

3.5.4.3 The attempts shall be repeated, until at least one of the following conditions is met:

- The safe radio connection is set-up.
- The session is considered as terminated.
- The train passes the location indicated in the RIU order “Terminate the communication session”

3.5.4.3.1 Note: if the session is considered as terminated due to 3.5.4.2.1, the attempts will be resumed immediately according to 3.5.3.4 f).

3.5.4.4 Exception to 3.5.4.2 and 3.5.4.3: the on-board equipment shall not try to set up a new safe radio connection and shall stop any on-going attempts if the train front is inside an announced radio hole (see 3.12.1.3). The on-board equipment shall try to set it up again when the train front reaches the end of the radio hole.

3.5.4.5 In case a message has to be sent during the loss of the safe radio connection, this message shall be considered as sent.

3.5.5 Terminating a communication session

3.5.5.1 The termination of a communication session shall be initiated only by the on-board and in the following cases:

a) If an order is received from trackside (RBC, RIU or balise groups) (see sections 3.5.3.5 and 3.5.3.6 concerning the content of the order).

b) If an error condition requiring the termination of the communication session is detected on-board (e.g., not compatible system versions between on-board and trackside).

c) The train is rejected by RBC during Start of Mission.

d) If the driver closes the desk during Start of Mission.

e) In case the train has reported having exited from an RBC area and no order to terminate the session is received within a fixed waiting time (see Appendix A.3.1) from the time the position report was sent, the ERTMS/ETCS on-board equipment shall repeatedly send a position report with the fixed waiting time after each repetition, until the order to terminate the session is received, or the defined number of repetitions (see Appendix A.3.1) has been reached. If no reply is received within the fixed waiting time after the last repetition, the ERTMS/ETCS on-board equipment shall terminate the communication session.

f) In case of communication session with an RIU: the Level 1 is left, or, an End of Mission is executed.

3.5.5.2 In case a session is established, the on-board equipment shall terminate the communication session according to the following steps:

a) The on-board equipment shall send a Termination of communication session message.

b) As soon as this information is received, the trackside shall consider the communication session terminated and send an acknowledgement to the on-board.

c) When the acknowledgement is received the on-board shall consider the communication session terminated and request the release of the safe radio connection with trackside.

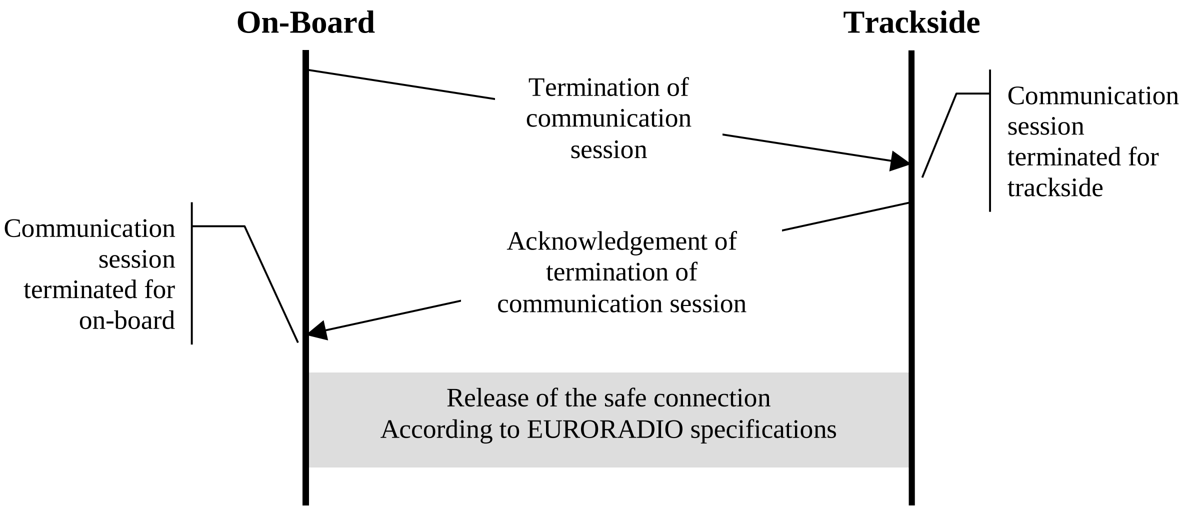


Figure 5: Termination of a communication session

3.5.5.3 No further message shall be sent by the on-board after the message Termination of communication session.

3.5.5.3.1 Exception: In case a communication session is established and no acknowledgement is received within a fixed waiting time (see Appendix A.3.1) after sending the “Termination of communication session” message, the message shall be repeated with the fixed waiting time after each repetition.

3.5.5.3.2 After a defined number of repetitions (see Appendix A.3.1), and if no acknowledgment is received within the fixed waiting time from the time of the last sending of “Termination of communication session”, the ERTMS/ETCS onboard equipment shall consider the communication session terminated.

3.5.5.4 No further message shall be sent by the trackside after the message Acknowledgement of the termination of communication session.

3.5.5.5 The information Termination of Communication Session and corresponding Acknowledgement shall be the same in every system version.

3.5.5.6 Messages from the RBC received onboard after the message “Termination of communication session” has been sent shall be ignored with the exception of the Acknowledgement of the termination of communication session.

3.5.5.7 In case an order to terminate the communication session is received, while the communication session is currently being established, the on-board shall abort the process of establishing it and shall release the safe radio connection.

3.5.6 Registering to the Radio Network

3.5.6.1 ERTMS/ETCS on-board equipment shall order the registration of its connected Mobile Terminal(s) to a Radio Network:

a) At power-up

b) Following driver entry of a new Radio Network identity (only if level 2 or 3)

c) If ordered from the trackside

3.5.6.2 When powered-off, ERTMS/ETCS on-board equipment shall memorize the last received Radio Network identity (from trackside or from driver) and shall use it when powered-up again.

3.5.6.3 If no Radio Network identity received from trackside or from driver could have been memorized by ERTMS/ETCS on-board equipment (e.g. after a System Failure or at very first power-up), this latter shall nevertheless order the registration of its Mobile Terminal(s) to a default Radio Network.

3.5.6.3.1 Note 1: the source used to retrieve the default Radio Network identity (on-board equipment permanent storage, Mobile Terminal itself, or other external source) is implementation dependent.

3.5.6.3.2 Note 2: if ERTMS/ETCS on-board equipment is powered-up in an area not covered by the memorized or default Radio Network, attempts to register to this Radio Network will be repeated unconditionally by the Mobile Terminal(s) until either an attempt is successful or a new Radio Network identity is received from trackside or from driver, preventing Mobile Terminal(s) from registering to any unwanted Radio Network.

3.5.6.4 Note: for Radio Network identity data entry by driver during SoM, please refer to chapter 5 (Procedure Start of Mission).

3.5.6.5 On reception of the trackside order, ERTMS/ETCS on-board equipment shall immediately order the Radio Network registration of each Mobile Terminal that fulfils the following conditions:

a) it is not yet registered to the ordered Radio Network, AND

b) it is not used for an established communication session, AND

c) no safe radio connection is being set-up

3.5.6.6 If a Mobile Terminal is not currently registered to the Radio Network ordered by trackside and if one of the conditions b) or c) is not fulfilled, ERTMS/ETCS on-board equipment shall initiate the Radio Network registration once communication session is terminated and safe radio connection is released.

3.5.6.7 If no Mobile Terminal is duly registered to a Radio Network, any order to contact an RBC or an RIU received from trackside shall be rejected by ERTMS/ETCS on-board equipment.

3.5.7 Safe Radio Connection Indication

3.5.7.1 The ERTMS/ETCS on-board equipment shall inform the driver about the status of the safe radio connection. To that purpose, the following indication statuses of the safe radio connection are defined: “No Connection”, “Connection Lost/Set-Up failed”, “Connection Up”.

3.5.7.2 In addition, the ERTMS/ETCS on-board equipment shall use a “connection status” timer (see Appendix A.3.1), in order to manage properly the transitions to the indication status “Connection Lost/Set-Up failed”.

3.5.7.2.1 Note: The purpose of the “connection status” timer is to avoid distracting the driver for any short disturbance of the safe radio connection.

3.5.7.3 The ERTMS/ETCS on-board equipment shall start the “connection status” timer as soon as the first request to set-up a safe radio connection with the relevant RBC/RIU is sent:

a) for what regards the session establishment, see items b), c), d), e) in 3.5.3.4.

b) for what regards maintaining a communication session, see 3.5.4.2 and 3.5.4.4

3.5.7.4 If the “connection status” timer is ongoing, it shall be stopped if the requests to set-up a safe radio connection are stopped with the relevant RBC/RIU.

3.5.7.5 The ERTMS/ETCS on-board equipment shall execute the transitions between the different indication statuses of the safe radio connection with the relevant RBC/RIU as described in Table 1 according to the conditions in Table 2 (see section 4.6.1 for details about the symbols).

No Connection	< 3 -p2-	< 5, 6, 7 -p1-
1, 2 > -p2-	**Connection Lost / Set-Up failed**	<2 -p2-
4 > -p1-	4 > -p1-	**Connection Up**

Table 1: Transitions between the indication statuses of the safe radio connection

Condition Id	Content of the conditions
[1]	(a Start of mission procedure is on-going) AND (the final attempt to set-up the safe radio connection failed)
[2]	(the “connection status” timer expires)
[3]	(no Start of mission procedure is on-going) AND (the requests to set-up a safe radio connection are stopped with the relevant RBC/RIU for reason other than the successful set-up)
[4]	(the safe radio connection is set-up)
[5]	(the safe radio connection is released)
[6]	(the safe radio connection is lost) AND (the requests to set-up a safe radio connection are stopped with the relevant RBC/RIU for reason other than the successful set-up)
[7]	(the safe radio connection is lost) AND (the train front is inside an announced radio hole)

Table 2: Transition conditions for the indication statuses of the safe radio connection

3.5.7.6 For the case of an RBC/RBC transition, the safe radio connection indicated to the driver shall switch from the indication status of the safe radio connection with the Handing over RBC to the one with the Accepting RBC as soon as one of the following conditions is met:

a) the ERTMS/ETCS on-board equipment sends a position report directly to the Accepting RBC with its maximum safe front end having passed the border, see 3.15.1.3.5 (i.e. the Accepting RBC becomes the supervising RBC),

b) the safe radio connection is released with the Handing over RBC and the minimum safe rear end of the train has crossed the border, see 3.5.5.1 e) and 3.15.1.2.7.

3.5.7.6.1 Note: During an RBC/RBC handover procedure, an indication status transition table and a connection status timer might have to be managed at the same time, for each RBC.

3.5.7.7 For the case of safe radio connection with RIU’s, the safe radio connection indicated to the driver shall be the one related to the current infill area.

3.6 Location Principles, Train Position and Train Orientation

3.6.1 General

3.6.1.1 It shall be possible to identify:

a) Data that refers only to a given location, referred to as Location data (e.g. level transition orders, linking)

b) Data that remains valid for a certain distance, referred to as Profile data (e.g. SSP, gradient).

3.6.1.2 Note: Determination of the Train Position is always longitudinal along the route, even though the route might be set through a complex track layout.

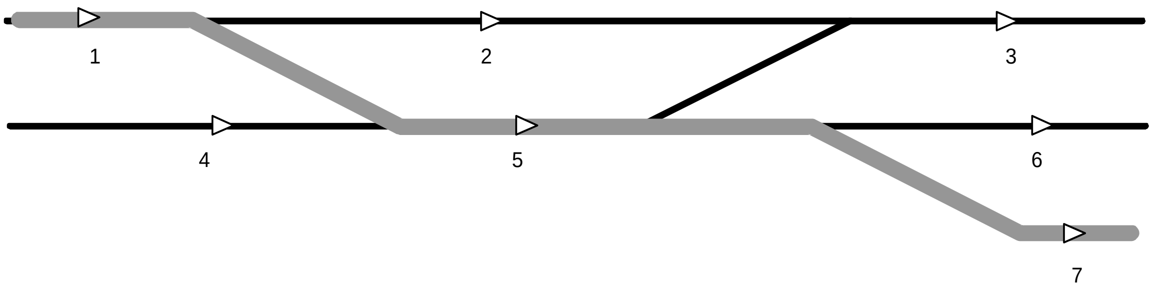


Figure 6: Actual route of the train

Figure 7: Route known by the train

3.6.1.3 The Train Position information defines the position of the train front in relation to a balise group, which is called LRBG (the Last Relevant Balise Group). It includes:

- The estimated train front end position, defined by the estimated distance between the LRBG and the front end of the train
- The train position confidence interval (see 3.6.4)
- Directional train position information in reference to the balise group orientation (see 3.4.2, also Figure 14) of the LRBG, regarding:
  - the position of the train front end (nominal or reverse side of the LRBG)
  - the train orientation
  - the train running direction

  In case of an LRBG being a single balise group with no co-ordinate system assigned, directional information is defined in reference to the pair of LRBG and “previous LRBG”, see 3.4.2.3.3
- A list of LRBGs, which may alternatively be used by trackside for referencing location dependent information (see 3.6.2.2.2 c)).

3.6.1.4 Balise groups, which are marked as unlinked, shall never be used as LRBG.

3.6.1.4.1 Justification: The location of an unlinked balise group, or the balise group itself, may not be known to the RBC.

3.6.1.5 If there is an active cab, this one defines the orientation of the train, i.e. the side of the active cab shall be considered as the front of the train. If no cab is active, the train orientation shall be as when a cab was last active.

3.6.1.6 The “train orientation relative to LRBG” is defined as the train orientation related to the orientation of the LRBG, see Figure 14. It can be either “nominal” or “reverse”.

3.6.1.6.1 Note: The train orientation cannot be affected by the direction controller position.

3.6.2 Location of Data Transmitted to the On-Board Equipment

3.6.2.1 Data Transmitted by Balises

3.6.2.1.1 All location and profile data transmitted by a balise shall refer to the location reference and orientation of the balise group to which the balise belongs.

3.6.2.1.2 Exception: Regarding infill information see section 3.6.2.3.1.

3.6.2.2 Data Transmitted by Radio from RBC

3.6.2.2.1 All location and profile data transmitted from the RBC shall refer to the location reference and orientation of the LRBG given in the same message.

3.6.2.2.2 For the LRBG the following requirements have to be met:

a) The on-board equipment shall use the last balise group passed as a reference when reporting its position to the RBC (in the following termed as $LRBG_{ONB}$). Only

- balise groups marked as linked and contained in the previously received linking information, if linking information is used on-board

or

- the last balise group not marked as unlinked, if no linking was used when this balise group was passed

shall be regarded.

b) The RBC shall use the last relevant balise group which was reported by the on-board equipment as a reference (in the following termed as $LRBG_{RBC}$). At a certain moment $LRBG_{RBC}$ and $LRBG_{ONB}$ can be different.

c) The on-board equipment shall be able to accept information referring to one of at least eight $LRBG_{ONB}$ last reported to the RBC.

3.6.2.2.2.1 Exception to a): When on-board position is unknown or when position data has been deleted during SoM procedure, the on-board equipment shall use an LRBG identifier set to "unknown" until the onboard has validated its position again by passing a balise group.

3.6.2.2.2.2 Exception to b): When the RBC has received from the onboard an unknown position, or an invalid position which it is not able to confirm during SoM procedure, the RBC shall use an LRBG identifier set to "unknown" until it receives a position report from the onboard having validated its position by passing a balise group.

3.6.2.2.2.3 Regarding c): From the time it has reported an unknown position, or an invalid position during SoM procedure, to the time it has received from the RBC a message with an LRBG not set to “unknown”, the on-board equipment shall also be able to accept messages from the RBC containing LRBG “unknown”.

3.6.2.2.3 Example: The following figure illustrates the on-board and RBC views of LRBGs:

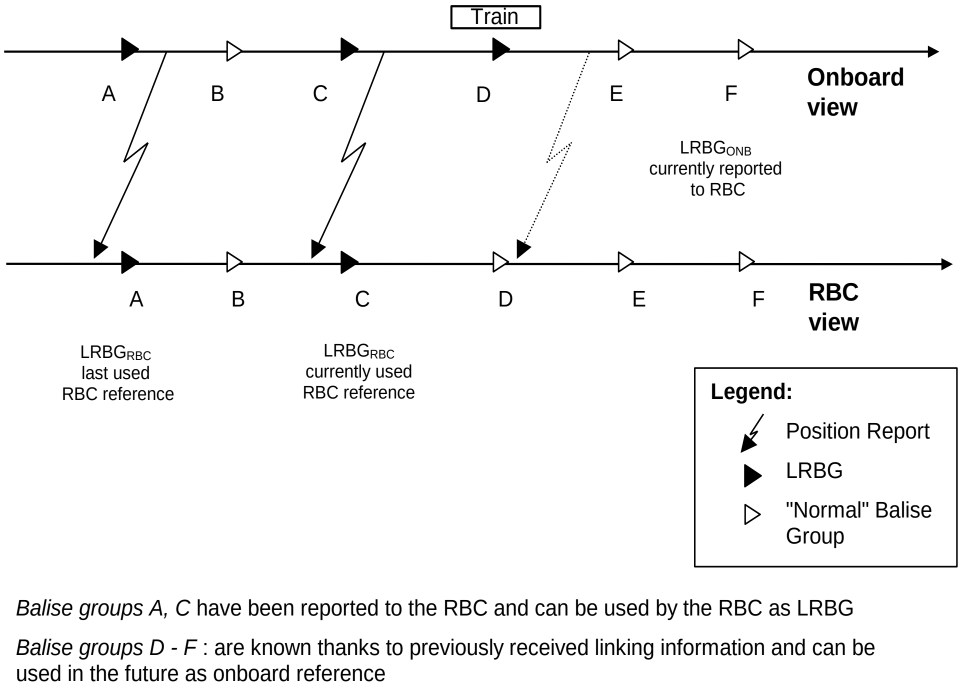


Figure 8: On-board and RBC views of LRBG when train is reporting new LRBG_{ONB} "D"

3.6.2.3 Data transmitted as Infill information

3.6.2.3.1 All location and profile data transmitted as infill information shall refer to the location reference of the balise group at the next main signal (identified by the infill information) and to the orientation given by the infill device. (See note after justification).

3.6.2.3.1.1 Justification:

- At locations where routes join: Infill information is the same for all routes, only linking information is different for different routes, see figure below (infill by means of balise group(s), loop or radio)

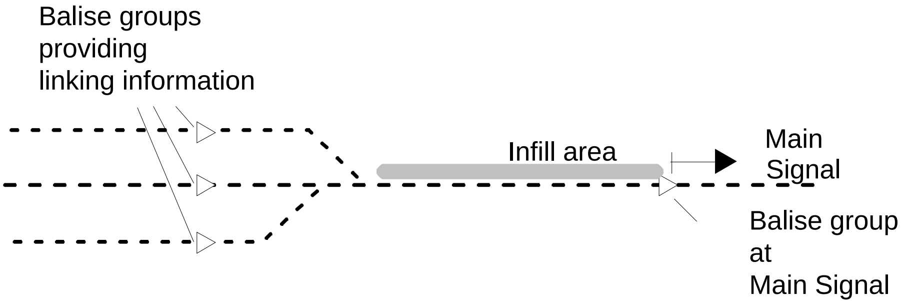


Figure 9: Routes Join in Rear of InFill Area

- In case of an infill area with multiple balise groups: all balise groups transmit identical information, as the information of all groups refers to the balise group at the main signal.

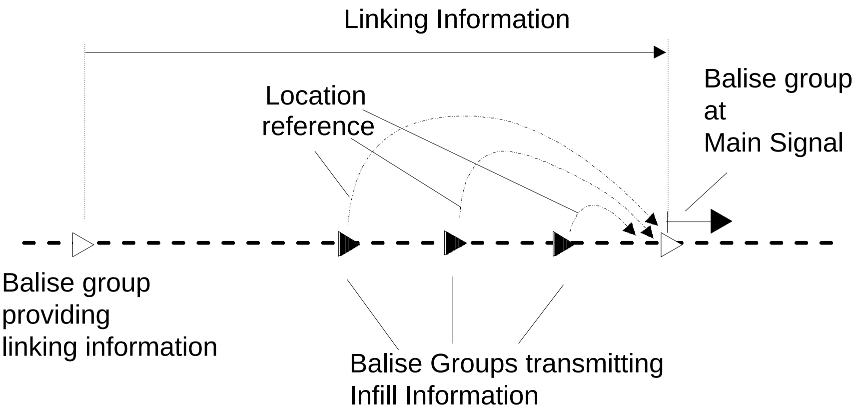


Figure 10: **Location referencing of infill information transmitted by balise groups**

3.6.2.3.1.2 Note: The orientation of infill information given by an infill device is defined in reference to (see also section 3.9):

- In case of a balise group, the orientation of the balise group sending the infill information
- In case of loop, the orientation indicated by the End Of Loop Marker
- In case of radio, the orientation of the LRBG indicated in the message

3.6.2.4 Data transmitted by Loop

3.6.2.4.1 It shall be possible to transmit non-infill location data by loop, which refers to a balise group as location reference.

3.6.2.4.1.1 Note: Regarding infill information see section 3.6.2.3.

3.6.2.4.2 The orientation of data transmitted by a loop is determined by the EOLM information which indicates how the directional information contained in loop messages is to be interpreted.

3.6.3 Validity direction of transmitted Information

3.6.3.1 General

3.6.3.1.1 The direction for which transmitted information is valid shall refer to:

a) the direction of the LRBG for information sent by radio

b) the direction of the balise group sending the information.

3.6.3.1.2 Data transmitted to the on-board equipment (by balise or radio) shall be identified as being valid for

a) both directions

b) the nominal direction

c) the reverse direction

of the referenced balise group.

3.6.3.1.2.1 Deleted.

3.6.3.1.3 When receiving information from any transmission medium, the ERTMS/ETCS on-board equipment shall only take into account information valid for its orientation. Other information shall be ignored. Exception: for SL, PS and SH engines, balise group crossing direction shall be considered.

3.6.3.1.3.1 If the train position is unknown, data received from any transmission medium valid for one direction only (nominal or reverse) shall be rejected by the onboard equipment. Data valid for both directions shall be evaluated (see section 4.8).

3.6.3.1.4 If no co-ordinate system has been assigned to a single balise group, data transmitted by trackside, which refers to that balise group requiring the co-ordinate system to be known (i.e. all data which are only valid for one direction (nominal or reverse)) shall be rejected by the ERTMS/ETCS on-board equipment. Data valid for both directions shall be evaluated (see section 4.8).

3.6.3.1.4.1 Exception: if not rejected due to balise group message consistency check (see 3.16.2.4.4.1 and 3.16.2.5.1.1), data to be forwarded to a National System (see section 3.15.6) shall be accepted. Justification: the co-ordinate system of the balise group might be known to the National System by other means inherent to the National System itself.

Figure 11: Intentionally deleted

3.6.3.2 Location, Continuous Profile Data and Non-continuous Profile Data

3.6.3.2.1 Location and profile data shall have the structure shown in Figure 12 below

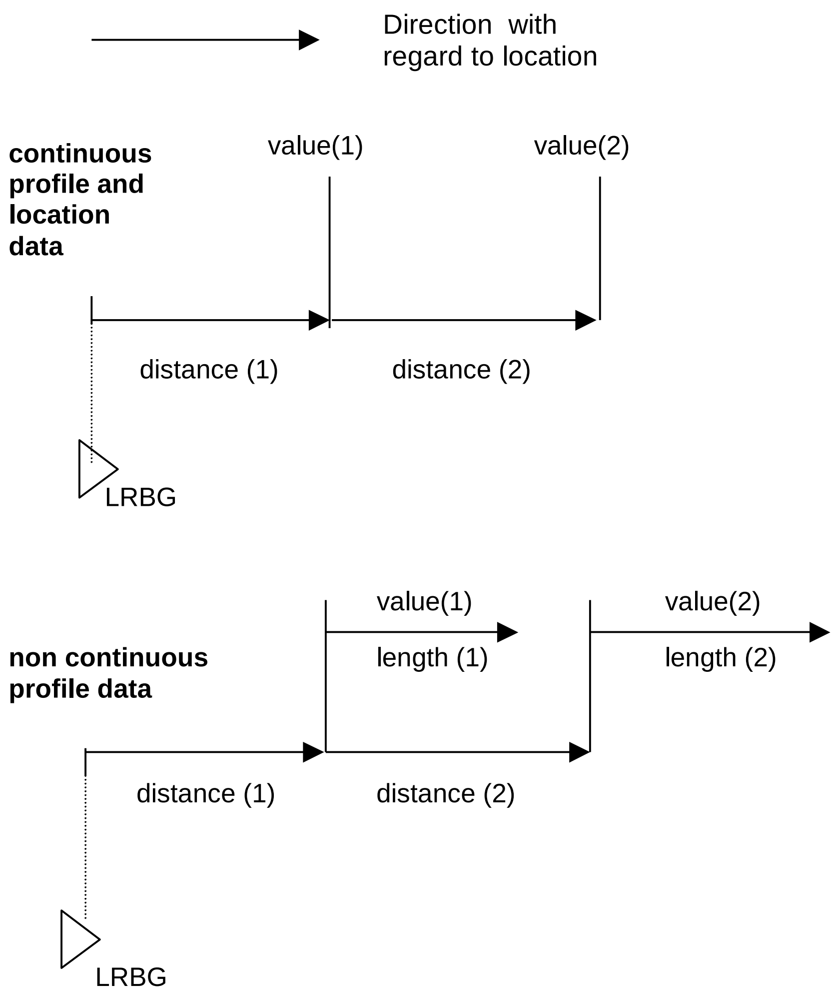


Figure 12: General Structure of location and profile data

3.6.3.2.2 With regard to Figure 12 the following applies to continuous profile data:

a) Value (n) shall be valid for distance (n+1)

b) For distance (1) the previously received data shall be used (in case of an SSP this includes train length delay, refer to 3.11.3.1.3).

c) Distances shall be given as unsigned incremental values representing the distance between value(n) and value(n-1).

d) The last value (n) transmitted shall be valid for an unlimited distance unless value(n) represents a special "end of profile" value.

e) If distance (n+1) = 0 then the corresponding profile value n shall still be taken into account.

3.6.3.2.3 With regard to Figure 12 the following shall apply to location data:

a) Distances shall be given as unsigned incremental values representing the distance between value(n) and value(n-1).

b) For distance (1) the previously received data shall be used.

c) Each value (n) may represent a single value or a set of data.

3.6.3.2.4 According to Figure 12 the structure for non-continuous profile data shall allow to contain multiple elements (value(n) for length(n)) inside the profile.

a) Distance to the start of each element (value(n) for length(n)) shall be given as unsigned incremental values, each increment representing the distance between starts of element (n) and element (n-1).

b) For distance (1) the previously received data (or initial data/default values, see section 3.7) shall be used.

c) Each value (n) may represent a single value or a set of data.

d) Note: There is no relationship between length of element (n-1) and distance (n), i.e., elements may overlap.

3.6.3.2.5 It shall be possible for the RBC to shift the location reference, e.g., after a change of train orientation or running direction.

3.6.3.2.5.1 Justification: Refer to Figure 13. To make it possible to shift the location reference if – due to the location of the LRBG and the start location – distance (1) would become a negative value.

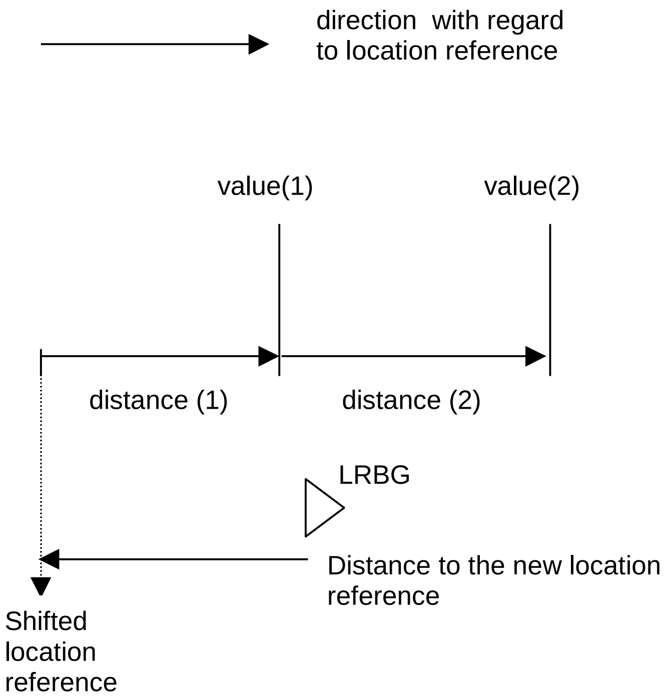


Figure 13: Shifted Location Reference (shown for continuous data /location profile, but also valid for non continuous data profile).

3.6.3.2.6 With regards to Figure 12 the following applies to linking information

a) The distance (1) shall be given to the first balise group included in the linking information

b) The distance (n) shall be given as the distance between two consecutive balise groups

c) Each value (n) shall represent the linking information related to that balise group.

3.6.4 Train Position Confidence Interval and Relocation

3.6.4.1 All location related information transmitted from trackside equipment shall be used by the on-board equipment taking into account the confidence interval to the train position, if required for safe operation.

3.6.4.2 The confidence interval to the train position shall refer to the distance to the LRBG and shall take into account

a) On-board over-reading amount and under-reading amount (odometer accuracy plus the error in detection of the balise group location reference)

b) The location accuracy of the LRBG.

3.6.4.2.1 Distance information received from trackside shall be evaluated on-board as nominal information (without taking into account any tolerances).

3.6.4.2.2 Note: The confidence interval increases in relation to the distance travelled from the LRBG depending on the accuracy of odometer equipment until it is reset when another balise group becomes the LRBG.

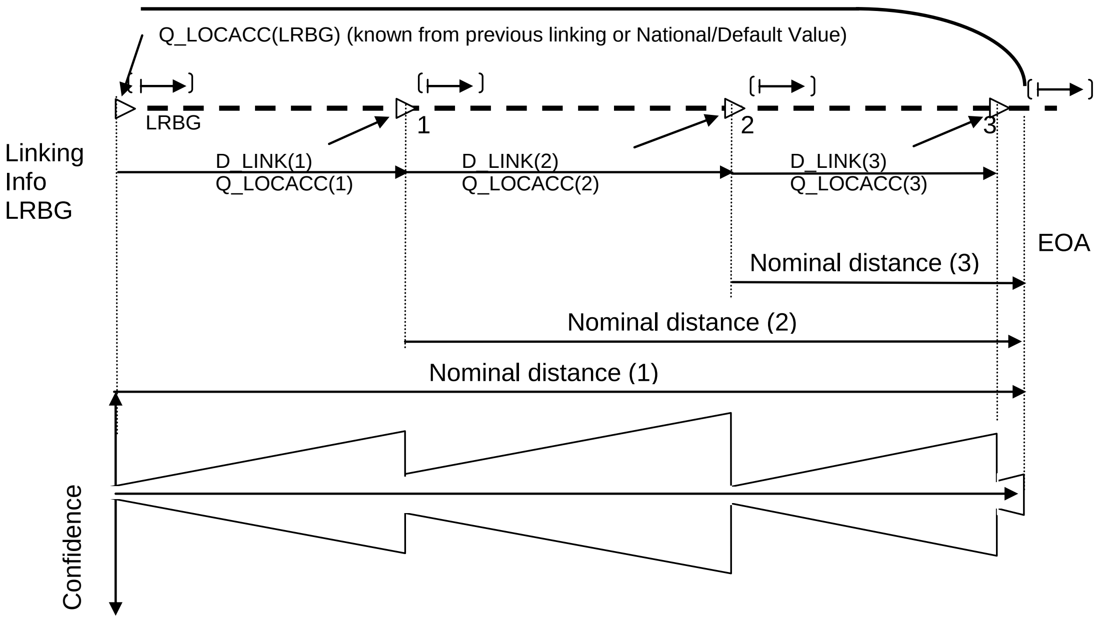
3.6.4.2.3 The value of the Location Accuracy shall be determined by Linking information if available, if not, by the corresponding National Value, or the corresponding Default Value if the National Value is not applicable.

3.6.4.3 When another balise group becomes the LRBG or when evaluating (see section 4.8) location related trackside information, which is referred to a previously received balise group different from the LRBG, all the location related information shall be relocated by subtracting from the distances that are counted from the reference balise group of the location related information:

a) the distance between the reference balise group of the location related information and the LRBG, retrieved from linking information if it is available and it includes both the reference balise group and the LRBG, OR

b) in all other cases, the estimated travelled distance between the reference balise group of the location related information and the LRBG.

3.6.4.3.1 Justification: it is always the trackside responsibility to provide linking in due course, knowing this rule; if the location related information is to be used in situations where linking is not provided (e.g. TSR transmitted by balise group marked as unlinked), the trackside can include provisions, if deemed necessary, when engineering the distance information.

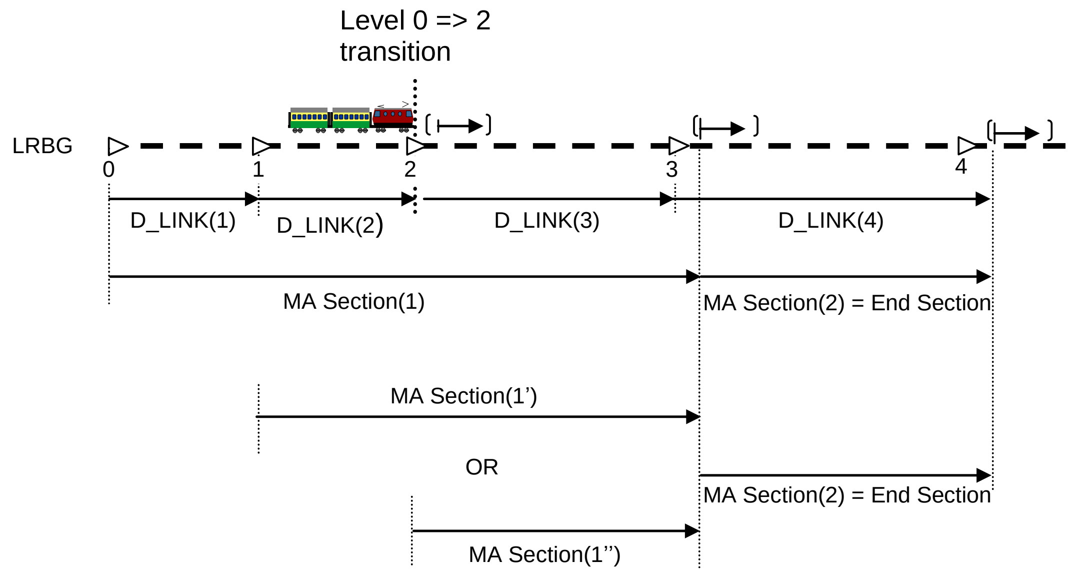


Confidence Interval = Function [Q_LOCACC; Odometer Error]

When the ERTMS/ETCS on-board has read the balise group 1

- the Confidence Interval is reset taking into account the location accuracy of balise group 1, and on-board tolerances when determining the reference location of the balise group,
- the nominal distance to EOA is relocated by subtracting D_LINK (1) from nominal distance (1), resulting in nominal distance (2). (Nominal distance (1) may be the distance to EOA received in the MA or the result of a previous relocation.)

Figure 13a: Reset of confidence interval and relocation, on change of LRBG



When the on-board performs the transition to level 2, the MA stored on-board (referred to balise group 0) is relocated prior to its evaluation:

- If balise group 1 is still the LRBG, the first MA Section distance is relocated by subtracting D_LINK (1) from MA Section (1), resulting in MA section (1')
- If balise group 2 is already the LRBG, the first MA Section distance is relocated by subtracting (D_LINK (1) + D_LINK (2)) from MA Section (1), resulting in MA section (1")
- MA Section (2) distance remains unchanged

Figure 13b: Relocation of trackside information referred to previously passed balise group, different from the current LRBG

3.6.4.4 The train front end position shall be identified in the following way

a) The estimated front end position.

b) The max(imum) safe front end position, differing from the estimated position by the under-reading amount in the distance measured from the LRBG plus the location accuracy of the LRBG.
I.e. in relation to the orientation of the train this position is in advance of the estimated position.

c) The min(imum) safe front end position, differing from the estimated position by the over-reading amount in the distance measured from the LRBG plus the location accuracy of the LRBG.
I.e. in relation to the orientation of the train this position is in rear of the estimated position.

3.6.4.4.1 Note: The rear end position is referenced in the same way. However min safe rear end is only safe if sent together with train integrity information.

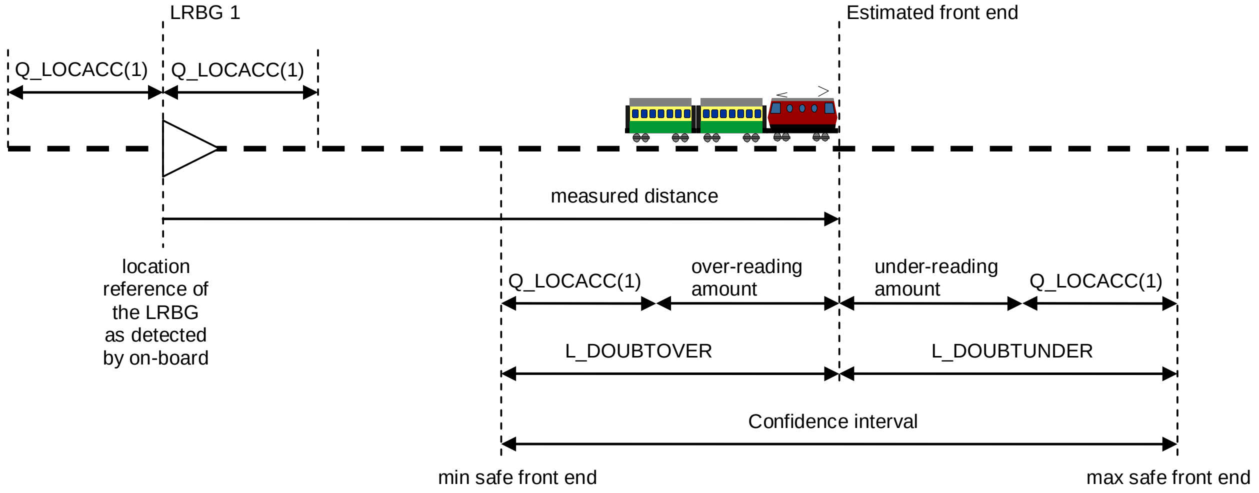


Figure 13c: Train confidence interval and train front end position

3.6.4.5 Intentionally deleted.

3.6.4.6 The estimated front end shall be used when supervising location information, unless stated otherwise.

3.6.4.7 <u>Supervision of location related information transmitted by a balise group marked as unlinked and referred to this balise group:</u>

3.6.4.7.1 By exception to clause 3.6.1.3, the train position is referred to this balise group marked as unlinked. The ERTMS/ETCS on-board equipment shall temporarily apply by analogy clauses 3.6.4.2, 3.6.4.2.1, 3.6.4.2.3 and 3.6.4.4 to determine an additional confidence interval, until a further received balise group becomes the LRBG or the location related information is deleted on-board.

3.6.4.7.2 If another balise group marked as unlinked is received before the additional confidence interval is deleted:

a) the additional confidence interval shall be reset in relation to this new balise group marked as unlinked

b) the location related information referred to the previous balise group marked as unlinked shall be relocated by subtracting the estimated travelled distance between both balise groups from the distances that are counted from this previous balise group marked as unlinked.

3.6.5 Position Reporting to the RBC

3.6.5.1 General

3.6.5.1.1 The position shall refer to the front end of the respective engine with regards to the train orientation.

3.6.5.1.1.1 Intentionally deleted.

3.6.5.1.2 The position report shall contain at least the following position and direction data

a) The distance between the LRBG and the estimated front end of the train.

b) The distance from the estimated front end position to the min safe front end position and the distance from the estimated front end position to the max safe front end position.

c) The identity of the location reference, the LRBG.

d) The orientation of the train in relation to the LRBG orientation.
Note: Driver selected running direction is only handled by the on-board system.

e) The position of the front end of the train in relation to the LRBG (nominal or reverse side of the LRBG).

f) The estimated speed

g) Train integrity information.

h) Direction of train movement in relation to the LRBG orientation

i) Optionally, the previous LRBG (see 3.4.2.3.3).

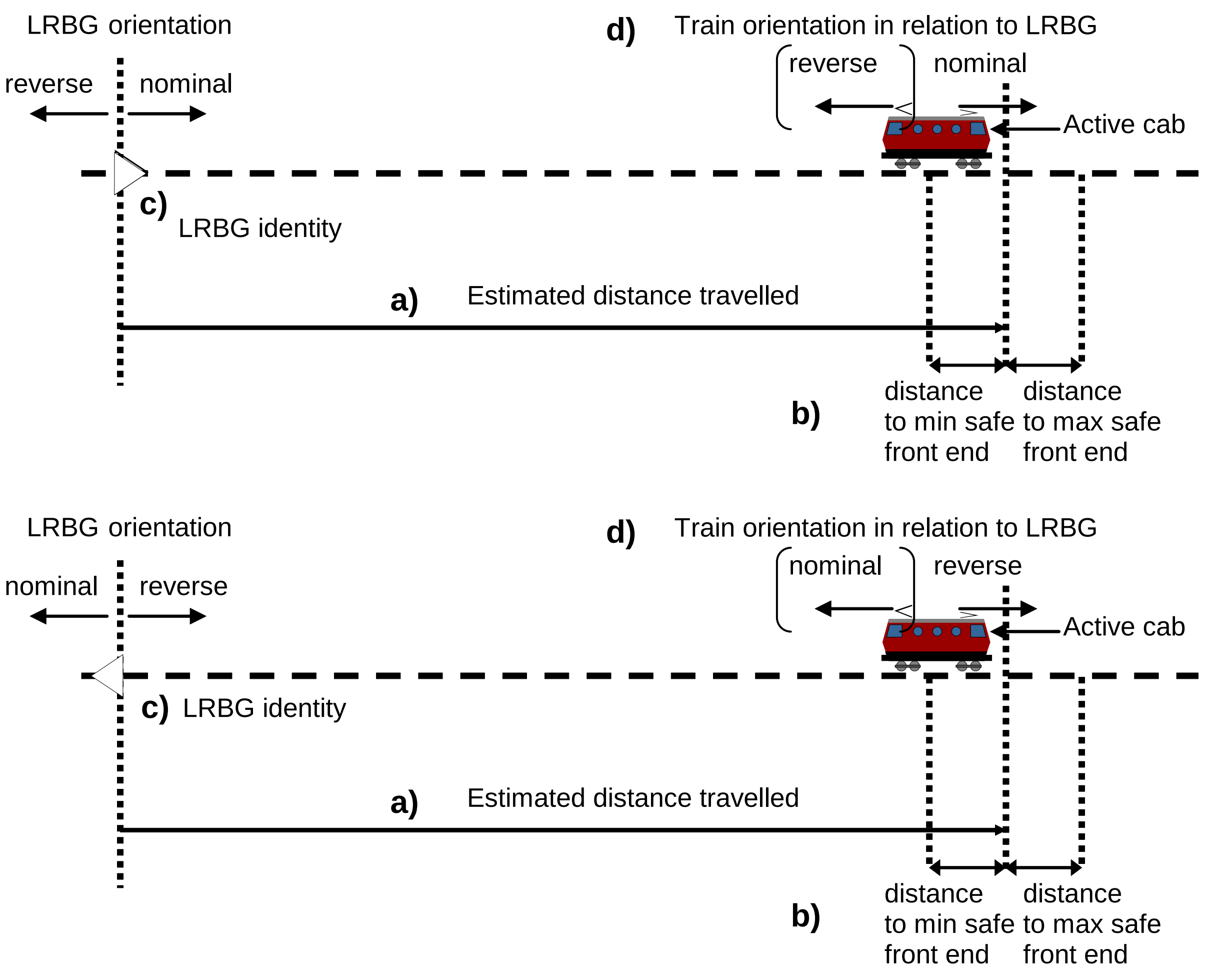


Figure 14: Information given in a position report (two examples to show the relation between LRBG and train orientation)

3.6.5.1.3 Intentionally deleted.

3.6.5.1.4 The on-board equipment shall send position reports as requested by the RBC in the position report parameters. In addition, it shall also send a position report if at least one of the events listed hereafter occurs:

a) The train reaches standstill, if applicable to the current mode.

b) The mode changes.

c) The driver confirms train integrity.

d) A loss of train integrity is detected.

e) The train passes a RBC/RBC border with its min safe rear end.

f) The train passes a level transition border (from level 2/3 to level 0, NTC, 1) with its min safe rear end.

g) The level changes.

h) A communication session is successfully established.

i) Intentionally moved.

j) The train passes an LRBG compliant balise group (see 3.6.2.2.2), if no position report parameters are stored on-board.

k) The train passes a RBC/RBC border with its max safe front end.

3.6.5.1.4.1 If the position report results from one or more events listed in 3.6.5.1.4, its content shall reflect the consequences of these events.

3.6.5.1.5 For the position report parameters requested by the RBC the following possibilities shall be available, individually or in combination

a) Periodically in time.

b) Periodically in space.

c) When the max safe front end or min safe rear end of the train has passed a specified location.

d) At every passage of an LRBG compliant balise group (see 3.6.2.2.2).

e) Immediately.

3.6.5.1.5.1 Note: d) and e) can not be combined.

3.6.5.1.6 Deleted.

3.6.5.1.7 The given position report parameters shall be valid until new parameters are given from the RBC.

3.6.5.1.8 The mode and level reported in a position report shall be consistent (e.g., no mode that relates to the previous level).

3.6.5.2 Report of Train Rear End Position for Level 3

3.6.5.2.1 Train integrity information shall be given by external device or by driver.

3.6.5.2.2 Driver input of train integrity shall only be permitted at standstill.

3.6.5.2.3 The train integrity information shall consist of

a) Train integrity status information

- No train integrity information
- Train integrity information confirmed by integrity monitoring device
- Train integrity information confirmed (entered) by driver
- Train integrity lost

b) Safe train length information (only valid if train integrity is confirmed at the same time).

3.6.5.2.4 The safe train length information shall represent the distance between the min safe rear end (by subtracting the train length from the min. safe front end position at the time when integrity was established last time) and the estimated position of the train front.

3.6.5.2.5 The safe train length information shall be re-calculated for every position report using the same last value of min safe rear end position until a new min safe rear end position is established on-board taking into account the time to detect train integrity.

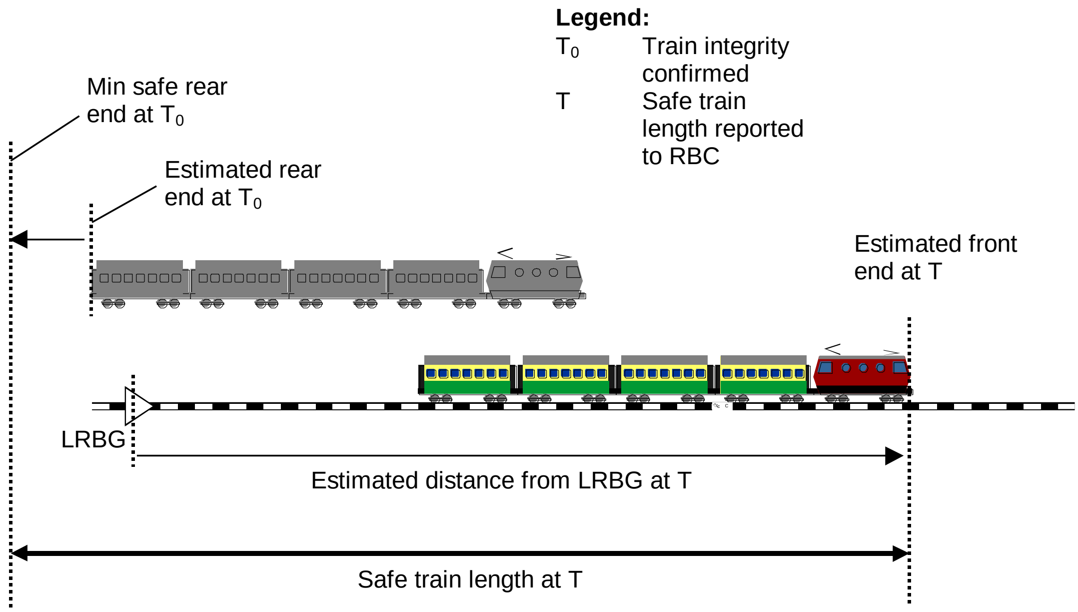


Figure 15: Calculation of Safe Train Length when train integrity was established

3.6.6 Geographical position reporting

3.6.6.1 The ERTMS/ETCS on-board equipment shall display, only on driver request, the geographical position of the estimated front end of the train in relation to the track kilometre. The display of the geographical position shall also be stopped on driver request.

3.6.6.2 The resolution of the position indication shall be 1 metre (sufficient to allow the driver to report the train position when communicating with the signalman).

3.6.6.3 When receiving new geographical position information (from radio or from balise group), the ERTMS/ETCS on-board equipment shall replace the currently stored geographical position information (if any) by this new received one, continuing the on-going geographical position calculation until at least one of the condition of 3.6.6.9 applies.

3.6.6.4 Geographical position information shall always use a balise group as geographical position reference balise group and if needed an offset from that balise group. A geographical position reference balise group shall be either:

a) part of the last reported balise groups memorised on-board, in case the information is received from radio, OR

b) the balise group transmitting the information, in case the information is received from balise group, OR

c) any balise group not yet passed at the time of reception of the information.

3.6.6.4.1 In case the information is received by radio and at least one of the announced geographical position reference balise group(s) is part of the last reported balise groups memorised on-board, the on-board equipment shall use the data related to the most recently reported balise group.

3.6.6.4.2 From the currently stored geographical position information, the track kilometre reference given for a geographical reference location shall become applicable if the train has detected the related geographical reference balise group and has travelled the offset distance from this reference balise group.

3.6.6.4.3 The announced and not applicable geographical references shall be deleted on-board if the train changes orientation.

3.6.6.5 The distance travelled from the geographical reference location shall be taken into account when calculating the geographical position.

3.6.6.6 In cases where the track kilometre is not incremental (jumps, changes in counting direction, scaling error) the reported position might be wrong between the point of irregularity and the next new reference.

3.6.6.7 In cases where single balise groups are used as a reference for geographical position information and where no linking information is available (and therefore no orientation can be assigned to the balise group), the on-board equipment shall ignore the geographical position information related to these single balise groups.

3.6.6.8 Intentionally deleted.

3.6.6.9 The on-board equipment shall continue calculating the position from a track kilometre reference (i.e. this track kilometre reference shall remain applicable) until:

a) a new track kilometre reference becomes applicable, OR

b) it is told not to do so, OR

c) the calculated geographical position becomes negative, OR

d) no more geographical position information is available (e.g., deleted according to conditions in SRS chapter 4)

3.6.6.9.1 Once a track kilometre reference is no longer applicable, it shall be deleted.

3.6.6.10 The following data shall be included in a message for geographical position (for every track kilometre reference):

- Identity of the geographical position reference balise group
- Distance from geographical position reference balise group to the track kilometre reference (offset)
- Value of the track kilometre reference
- Counting direction of the track kilometre in relation to the geographical position reference balise group orientation.

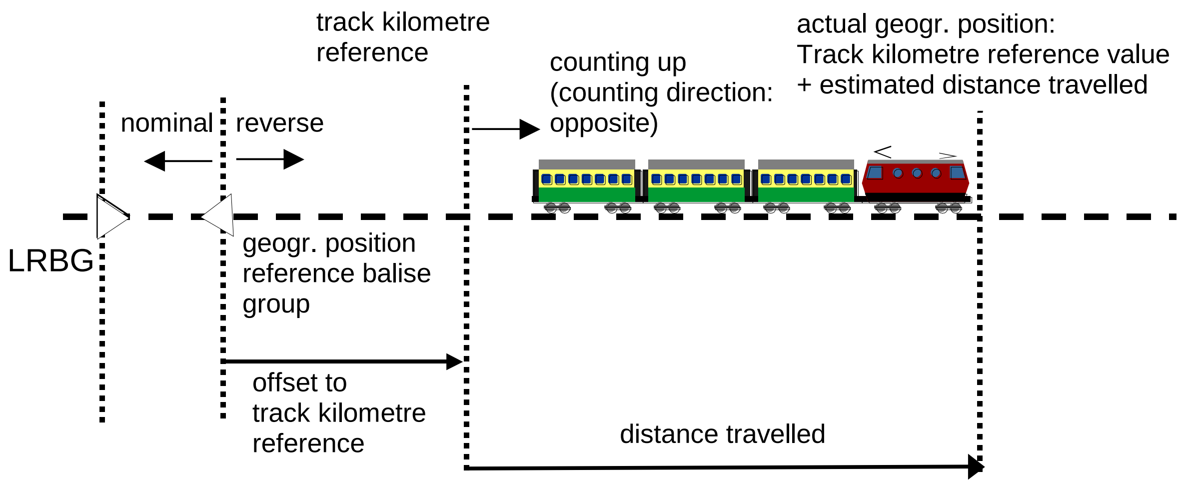


Figure 16: Geographical position example

3.7 Completeness of data for safe train movement

3.7.1 Completeness of data

3.7.1.1 To control the train movement in an ERTMS/ETCS based system the ERTMS/ETCS on-board equipment shall be given information from the trackside system both concerning the route set for the train and the track description for that route. The following information shall be given from the trackside

a) Permission and distance to run, the Movement Authority (MA) (see section 3.8)

b) When needed, limitations related to the movement authority, i.e. Mode profile for On Sight, Limited Supervision or Shunting and signalling related speed restriction (see sections 3.12.4 and 3.11.6). Mode profile and Signalling related Speed restriction shall always be sent together with the MA to which the information belongs

c) Track description covering as a minimum the whole distance defined by the MA. Track description includes the following information

- The Static Speed Profile (SSP) (see section 3.11.3).

- The gradient profile (see section 3.11.12).
- Optionally Axle load Speed Profile (ASP) (see section 3.11.4)
- Optionally Speed restriction to ensure a given permitted braking distance (see section 3.11.11)
- Optionally track conditions (see section 3.12.1).
- Optionally route suitability data (see section 3.12.2).
- Optionally areas where reversing is permitted (see section 3.15.4).
- Optionally changed adhesion factor (see section 3.18.4.6).

d) Linking information when available.

3.7.2 Responsibility for completeness of information

3.7.2.1 The Movement Authority (MA) shall be given to the on-board equipment

- Together with the other information (as listed in section 3.7.1.1 c) and d))
  or
- Separately, if the other information has already been correctly received by the on-board equipment.

3.7.2.2 The trackside shall be responsible for that the on-board equipment has received the information valid for the distance covered by the Movement Authority.

3.7.2.2.1 In case of LOA, trackside shall be responsible for including any track description beyond the LOA relevant for calculating safe supervision limits.

3.7.2.3 The MA and the related mode profile, if any, shall not be accepted by the on-board equipment if the SSP and gradient already available on-board or given together with the MA do not cover the full length of the MA.

3.7.2.3.1 Note: Full length means at least from the estimated front end of the train to the supervised location.

3.7.2.4 It shall be the responsibility of the trackside to send additional information when needed. The information referred to is

- Emergency messages (from RBC only)
- Request to stop earlier (from RBC only)
- Temporary speed restrictions
- National values
- Level transition information
- LX speed restrictions
- Inhibition of revocable TSRs from balises in L2/3 (from RBC only)
- Virtual Balise Cover orders

3.7.3 Extension, replacement of track description and linking information

3.7.3.1 New track description and linking information shall replace (in the ERTMS/ETCS on-board equipment) stored information as detailed below:

a) New Static Speed Profile information shall replace all stored Static Speed Profile information from the start location of the new information.

b) New Gradient Profile information shall replace all stored Gradient Profile information from the start location of the new information.

c) New Axle Load Speed Profile information shall replace all stored Axle Load Speed Profile information from the start location of the first element of the new information.

d) New Speed Restriction to ensure Permitted Braking Distance information shall replace all stored Speed Restriction to ensure Permitted Braking Distance information from the start location of the first element of the new information.

e) New track condition Change of Traction System information shall replace all stored Change of Traction System information.

f) New track condition Big Metal Masses information shall replace all stored Big Metal Masses information from the start location of the first element of the new information.

g) New track condition information of at least one of the types listed here, i.e., sound horn, non stopping area, tunnel stopping area, powerless section - lower pantograph, powerless section - switch off the main power switch, radio hole, air tightness, switch off regenerative brake, switch off eddy current brake for service brake, switch off eddy current brake for emergency brake, switch off magnetic shoe brake, shall replace all stored track condition information of the listed types from the start location of the first element of the new information.

h) New route suitability loading gauge information shall replace all stored route suitability loading gauge information.

i) New route suitability traction system information shall replace all stored route suitability traction system information.

j) New route suitability axle load information shall replace all stored route suitability axle load information.

k) New reversing area information shall replace all stored reversing area information.

l) New adhesion factor information shall replace all stored adhesion factor information from the start location of the new information.

m) New linking information received as non-infill information shall replace all stored linking information from the LRBG.

n) New linking information received as infill information shall replace all stored linking information from the reference location of the infill information (i.e. the balise group at next main signal).

3.7.3.1.1 Intentionally deleted.

3.7.3.1.2 Intentionally deleted.

3.7.3.2 When requested by trackside, the ERTMS/ETCS on-board equipment shall resume initial states beyond a given location individually:

a) for stored Speed Restriction to ensure Permitted Braking Distance information (for initial state, refer to 3.11.11.7)

b) for stored axle load speed profile information (for initial state, refer to 3.11.4.5)

c) through a single request, for all stored track condition information of the following types: sound horn, non stopping area, tunnel stopping area, powerless section – lower pantograph, powerless section – switch off the main power switch, radio hole, air tightness, switch off regenerative brake, switch off eddy current brake for service brake, switch off eddy current brake for emergency brake and switch off magnetic shoe brake (for initial states, refer to 3.12.1.3)

d) through a single request, for all stored route suitability information (for initial state, refer to 3.12.2.10).

3.7.3.3 In some situations, the track description and linking information shall be deleted (or initial state shall be resumed) by the on-board equipment. These various cases where the data is affected (e.g. the MA is shortened) are described in detail in Appendix A3.4.

3.7.3.4 Intentionally deleted.

3.7.3.5 Deleted.

3.7.3.6 Note: regarding the handling of Temporary Speed Restrictions and Level Crossings, see sections 3.11.5 and 3.12.5.

3.8 Movement authority

3.8.1 Characteristics of a MA

3.8.1.1 The following characteristics can be used in a Movement Authority (see Figure 17: Structure of an MA):

a) The End Of Authority (EOA) is the location to which the train is authorised to move.

b) The Target Speed at the EOA is the permitted speed at the EOA; when the target speed is not zero, the EOA is called the Limit of Authority (LOA). This target speed can be time limited.

c) If no overlap exists, the Danger Point is a location beyond the EOA that can be reached by the front end of the train without a risk for a hazardous situation.

d) The end of an overlap (if used in the existing interlocking system) is a location beyond the Danger Point that can be reached by the front end of the train without a risk for a hazardous situation. This additional distance is only valid for a defined time.

e) A release speed is a speed limit under which the train is allowed to run in the vicinity of the EOA, when the target speed is zero. One release speed can be associated with the Danger Point, and another one with the overlap. Release speed can also be calculated on-board the train (see section 3.13.9.4).

f) The MA can be split into several sections, The last one is called End Section.

- A first time-out value can be attached to each section. This value will be used for the revocation of the associated route when the train has not entered into it yet. It is called the Section time-out.
- In addition, a second time-out value can be attached to the End Section of the MA. This second time-out will be used for the revocation of the last section when it is occupied by the train; it is called the End Section time-out.

3.8.1.2 The values of the time-outs possibly given in an MA shall take into account the time elapsed from the start of validity of information to the sending of the message.

3.8.1.3 Note: A Danger Point can be (not exhaustive list):

- the entry point of an occupied block section (if the line is operated according to fixed block principles)
- the position of the safe rear end of a train (if the line is operated according to moving block principles)
- the fouling point of a switch, positioned for a route, conflicting with the current direction of movement of the train (both for fixed and moving block mode of operation)

3.8.1.4 Note: Traditionally the overlap is a piece of track (beyond the danger point), that is put at disposal of a train, to guarantee a non hazardous situation, also in case the driver should misjudge the stopping distance for the train. In ERTMS/ETCS the overlap can be used to improve the efficiency of the braking supervision.

3.8.1.5 Note: Time-out values can be given in the MA to cope with the following situations depending on the interlocking operations, i.e. the timers on-board will only reflect the situation trackside and when expired (on-board) the actions taken are restrictive:

a) Section time-out or time-out for the speed at the EOA/LOA: When a signalman requests a route release of a part of a route not yet entered by the approaching train.

b) End Section time-out: When the train has entered the last part of a route, the automatic route release can be delayed to make sure that the train has come to a standstill before any switches inside the route can be moved.

c) Time-out for an overlap: When the train has entered the last part of a route, the overlap associated with the route remains valid for a certain time to make sure that the train has successfully stopped before its end of authority. If the overlap is still unoccupied when the timer expires the interlocking revokes the overlap.

3.8.1.6 Note: If the trackside equipment does not have enough information to give the distance to End Of Authority (with target speed equal to zero) a target speed higher than zero can be given (speed at LOA, Limit Of Authority). It is the responsibility of the trackside to ensure that the safe distance beyond the EOA/LOA is long enough to brake the train from the target speed to a stand still without any hazardous situation. It is the responsibility of the on-board equipment to apply the brakes if no new information is received when the Limit of Authority is passed.

3.8.2 MA request to the RBC

3.8.2.1 It shall be possible for the on-board equipment to request a new Movement Authority from the RBC.

3.8.2.2 The parameters for requesting a new MA shall be given by the RBC.

3.8.2.3 In level 2/3, the following possibilities shall be available:

a) A defined time before the train reaches the pre-indication location (see section 3.13) for the EOA/LOA assuming it is running at the warning speed.

b) A defined time before the Section timer (not the End Section timer, not the Overlap timer) for any section of the MA expires, or before the LOA speed timer expires.

3.8.2.3.1 Regards to the above possibilities, the MA request shall be triggered when the train front has passed the resulting location (regards a)/ time (regards b)

3.8.2.4 It shall be possible to define whether the MA request shall be repeated until a new MA is received or not and if so, the time between each repetition.

3.8.2.5 The given data shall be valid until new MA request parameters are given from the RBC.

3.8.2.6 In case no MA request parameters are stored on-board and following an MA request no MA has been received, the request shall be repeated with a repetition cycle according to a fixed value (see appendix).

3.8.2.7 In level 2/3: an MA request shall be sent to the RBC when the driver selects start.

3.8.2.7.1 In level 0, 1, NTC: if a level 2/3 transition is announced and a communication session is already established, an MA request shall be sent to the RBC when the information "Track ahead free up to level 2/3 transition location" is received from balise group.

3.8.2.7.2 In level 0, 1, NTC: the ERTMS/ETCS on-board equipment shall also inform the RBC about the identity of the level 2/3 transition location balise group, as received through the information "Track ahead free up to level 2/3 transition location".

3.8.2.7.3 In level 2/3: An MA request shall be sent to the RBC when any part of the track description is deleted according to A3.4, except for situations a, b, f, k.

3.8.2.8 Together with the MA request the on-board shall inform the RBC about the reason(s) why the MA request is sent:

a) Start selection by driver,

b) Time before reaching pre-indication location for the EOA/LOA reached,

c) Time before a section timer or the LOA speed timer expires reached,

d) The track description has been deleted,

e) Track ahead free up to level 2/3 transition location.

3.8.3 Structure of a Movement Authority (MA)

3.8.3.1 The distance to End of Authority (EOA) can be composed of several sections.

3.8.3.2 For each section composing the MA the following information shall be given;

a) Length of the section

b) Optionally, Section time-out value and distance from beginning of section to Section timer stop location

3.8.3.3 In addition, the End Section of the MA may include;

a) End Section time-out value and distance from the End Section timer start location to the end of the last section

b) Danger point information (distance from end of section to danger point, release speed related to danger point)

c) Overlap information (distance from end of section to end of overlap, time-out, distance from Overlap timer start location to end of section, release speed related to overlap)

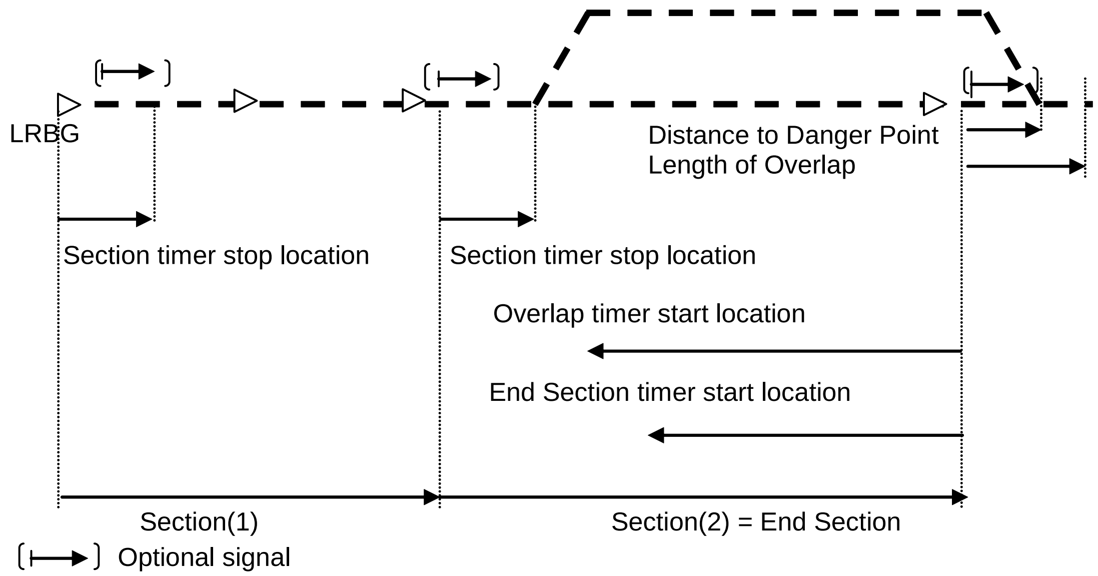


Figure 17: Structure of an MA

3.8.3.3.1 Note: If only one section is given in the MA it is regarded as the End Section.

3.8.3.4 The Section timer stop location shall be inside of the corresponding section.

3.8.3.4.1 Note: the End Section and Overlap timer start locations may be outside their corresponding section. One example can be seen referring to figure 22c: An infill MA towards a signal at stop will replace the previous End Section by a new short End Section starting at the infill location reference and ending at the next main signal, however the End Section and Overlap timer start locations still have to be consistent with the Interlocking timer start locations. Another example is when a timer start location is in rear of the LRBG.

3.8.3.5 In level 3, no time-outs shall be used.

3.8.3.5.1 Note: For level 3 functionality the split of responsibility between the RBC and the Interlocking has to be considered. Time-out of routes and related overlap can not be based on train position reports since the position report can be delayed compared to the real position of the train. The route release and revocation of routes can not be carried out by the interlocking until permitted by the RBC.

3.8.3.6 When an MA is transmitted by a balise group, the length of the first section shall refer to the balise co-ordinate system of that balise group.

3.8.3.7 In case a main signal is at danger in level 1, the first section shall give the distance from the balise group at the main signal to the location of the main signal, i.e. the distance to EOA is given. Where available, information concerning danger point and overlap for this EOA may also be given.

3.8.3.7.1 Justification: The balise group is not necessarily placed at the same location as the signal and thus an infill message (which includes the same information as the balise group at the main signal) could change the location of the EOA to a position closer to the train.

3.8.3.8 In case the main signal is at danger in level 1, the on-board shall supervise the given distance (specified in section 3.8.3.7) as the distance to EOA.

3.8.3.9 When an MA is transmitted by radio from the RBC, the length of the first section shall refer to the balise co-ordinate system of the LRBG given in the same message.

3.8.3.10 It shall be possible to give the length of a section to any location in the track.

3.8.3.10.1 Note: A section can cover several blocks and is not restricted to block ends (see figures).

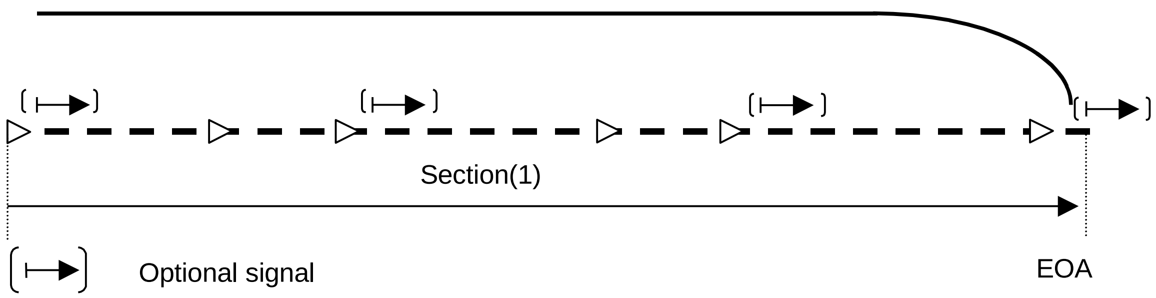


Figure 18: Distance to End Of Authority when no time-outs are needed

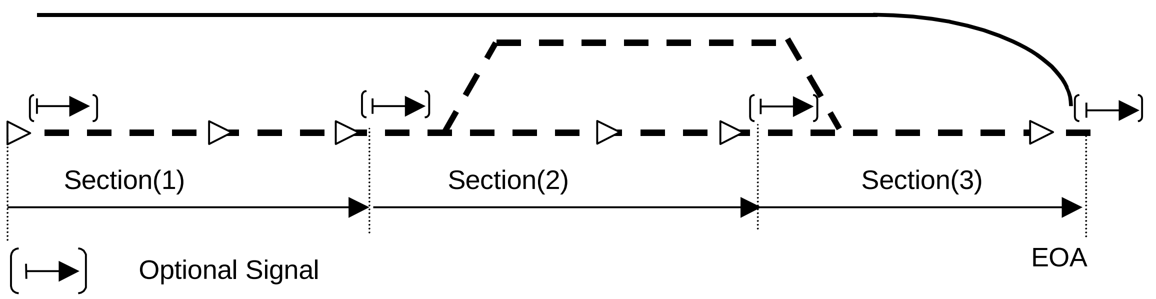


Figure 19 : Distance to End Of Authority when time-outs might be needed

3.8.3.11 In moving block operation the MA shall never exceed the min safe rear end of the preceding train.

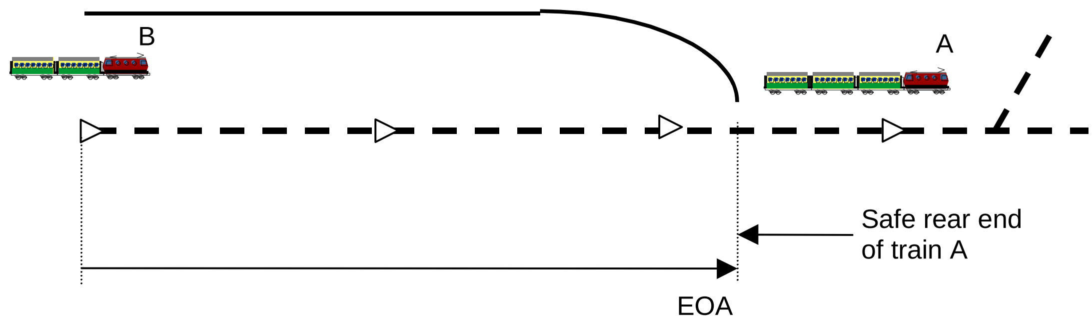


Figure 20: MA in moving block operation.

3.8.4 Use of the MA on board the train

3.8.4.1 End Section Time-Out

3.8.4.1.1 The End Section timer shall be started on-board when the train passes the End Section timer start location given by trackside with its max safe front end.

3.8.4.1.2 When the End Section timer value becomes greater than the time-out value given by trackside, the following shall apply:

a) The EOA/LOA shall be withdrawn to the current position of the train. Refer to appendix A.3.4 for the exhaustive list of location based information stored on-board, which shall be deleted accordingly;

b) if any, a non zero target speed value at the EOA/LOA shall be set to zero.

3.8.4.1.3 In case no End Section timer is running when the on-board receives a new MA with an End Section timer start location in rear of the max safe front end of the train, the on-board shall consider that the End Section timer value became greater than its time-out value and apply 3.8.4.1.2.

3.8.4.1.3.1 Justification: in this case the train is already beyond the timer start location, therefore it is impossible to determine when that location was crossed and so what share of the time-out value has elapsed since the crossing event. The safe assumption is to consider that the time-out value has been exceeded and therefore that the End Section will soon be released by the Interlocking.

3.8.4.1.4 In case an End Section timer is already running when the on-board receives a new MA with an End Section timer start location in rear of the max safe front end of the train, the on-board shall keep the End Section timer running but replace the time-out value with the value received with the new MA.

3.8.4.1.4.1 Justification: this allows repetition of the MA via RBC (e.g. acknowledgment of current MA was lost) without unintentionally affecting the End Section timer.

3.8.4.2 Section Time-Outs

3.8.4.2.1 The on-board shall start a Section timer for each section:

a) For Level 2: at the value of the time stamp of the message including the MA.

b) For Level 1: at the time of passage over the first encountered balise of the balise group giving the MA.

3.8.4.2.1.1 Justification for b): This is to ensure that the timer is always started before or at the same time as the related variable information is received. Thus the timer start is independent of in which balise the variable information is given.

3.8.4.2.2 When a Section timer value becomes greater than the time-out value given by trackside, the following shall apply:

a) the EOA/LOA and the SvL shall be withdrawn to the entry point of the revoked section. Refer to appendix A.3.4 for the exhaustive list of location based information stored on-board, which shall be deleted accordingly;

b) the National/ Default Value of the Release Speed shall apply ;

c) if any, a non zero target speed value at the EOA/LOA shall be set to zero.

3.8.4.2.2.1 Intentionally deleted.

3.8.4.2.3 The Section timer shall be stopped when the min safe front end of the train has passed the associated Section timer stop location.

3.8.4.3 Time-out of the speed associated with the EOA/LOA

3.8.4.3.1 The on-board shall start a timer for the speed at the EOA/LOA:

a) For Level 2: at the value of the time stamp of the message including the MA.

b) For Level 1: at the time of passage over the first encountered balise of the balise group giving the MA.

3.8.4.3.1.1 Justification for b): This is to ensure that the timer is always started before or at the same time as the related variable information is received. Thus the timer start is independent of in which balise the variable information is given.

3.8.4.3.2 When the LOA speed timer value becomes greater than the time-out value given by trackside, the speed associated with the EOA/LOA shall be set to zero (i.e. the Limit of Authority becomes an End of Authority and the SvL is defined on-board according to 3.8.4.5). Refer to appendix A.3.4 for the exhaustive list of location based information stored on-board, which shall be deleted accordingly.

3.8.4.4 Time-out of Overlap

3.8.4.4.1 The Overlap timer shall be started on-board when the train passes the Overlap timer start location given by trackside with its max safe front end. The timer shall be considered as started even if a time-out value “infinite” is given.

3.8.4.4.2 When the Overlap timer value becomes greater than the time-out value given by trackside, the following shall apply:

a) the overlap information shall be deleted, i.e. the Supervised Location shall be withdrawn to the Danger Point if there is any or else to the EOA. Refer to appendix A.3.4 for the exhaustive list of location based information stored on-board, which shall be deleted accordingly.

b) the release speed associated with the Overlap shall be deleted

c) if any, a non zero target speed value at the EOA/LOA shall be set to zero.

3.8.4.4.3 If the train comes to a standstill after the Overlap timer has been started, the on-board shall consider that the Overlap timer value became greater than its time-out value and shall apply 3.8.4.4.2.

3.8.4.4.4 In case no Overlap timer is running when the on-board receives a new MA with an Overlap timer start location in rear of the max safe front end of the train, the on-board shall consider that the Overlap timer value became greater than its time-out value and shall apply 3.8.4.4.2.

3.8.4.4.4.1 Justification: in this case the train is already beyond the timer start location, therefore it is impossible to determine when that location was crossed and so what share of the time-out value has elapsed since the crossing event. The safe assumption is to consider that the time-out value has been exceeded and therefore that the Overlap will soon be released by the Interlocking.

3.8.4.4.5 In case an Overlap timer is already running when the on-board receives a new MA with an Overlap timer start location in rear of the max safe front end of the train, the on-board shall keep the Overlap timer running but replace the Overlap time-out value with the value received with the new MA.

3.8.4.4.5.1 Justification: this allows repetition of the MA via RBC (e.g. acknowledgment of current MA was lost) without unintentionally affecting the Overlap timer.

3.8.4.5 Supervised Location

3.8.4.5.1 The Supervised Location (SvL) shall be defined on board as;

a) the end of overlap (if any and before time-out).

b) if not, the Danger Point (if any).

c) if not, the End Of Authority.

3.8.4.5.2 As long as a Limit of Authority is supervised, no SvL shall be defined on-board.

3.8.4.6 Infill MA (level 1 only)

3.8.4.6.1 An MA given by an infill device is called an infill MA.

3.8.4.6.2 An infill MA shall be evaluated on-board only if the on-board equipment is in FS or LS mode.

3.8.4.6.3 The infill information shall include the identity of the balise group at the next main signal i.e. the identity of the balise group giving the information that is transmitted in advance by the infill device.

3.8.4.6.4 An infill MA shall be evaluated on-board only if the linking information, regarding the main signal balise group to which it refers, is available.

3.8.4.6.5 The on-board shall start a Section timer for each section beyond the next main signal:

a) When the infill information is received from a balise group at the time of passing the first encountered balise of the infill balise group.

b) When the infill information is received from a loop at the time of receiving the loop message.

c) When the infill information is received from a radio infill unit at the value of the time stamp of the radio infill message including the MA.

3.8.5 MA Update

3.8.5.1 A new MA shall replace a previously received MA in the following ways:

a) When the new MA is given from a balise group at a main signal (i.e. not infill information) or from the RBC all data included in the previous MA shall be replaced by the new data.

b) When the new MA is given as infill information all data beyond the announced balise group at the next main signal shall be replaced.

3.8.5.1.1 Note: This refers to all information included in the MA as listed in section 3.8.1.1 and the Signalling related speed restriction (see section 3.11.6).

3.8.5.1.2 When an infill MA is received, the on-board shall start a new MA section at the infill location reference, i.e. the balise group at the next main signal (see 3.6.2.3.1).

3.8.5.1.3 If the SvL defined from the new MA is closer than the one supervised with the former MA, this shall be considered by the on-board equipment as an MA shortening. Refer to appendix A.3.4 for the exhaustive list of location based information stored on-board, which shall be deleted accordingly.

3.8.5.1.4 If a new MA defines an SvL while the on-board was supervising an LOA, this shall always be considered by the on-board equipment as an MA shortening regardless of the SvL location. Refer to appendix A.3.4 for the exhaustive list of location based information stored on-board, which shall be deleted accordingly.

3.8.5.2 It shall be possible to update the length of the current section by means of repositioning information (see section 3.8.5.3).

3.8.5.2.1 Note: The current section need not be the end section.

3.8.5.2.2 Repositioning information contained in a balise group message shall only be evaluated if linking information has announced a following balise group as unknown but containing repositioning information.

3.8.5.2.3 A balise group message containing a movement authority shall not contain repositioning information for the same direction.

3.8.5.2.3.1 Note: It is possible to combine repositioning with an infill MA.

3.8.5.2.4 The reception of repositioning information or of a new MA with an LOA shall not be considered as an MA shortening by the on-board equipment.

3.8.5.3 Examples of MA update

3.8.5.3.1 Note: In the following examples on how to update an MA are given. The examples are not exhaustive.

3.8.5.3.2 Example: Extension of MA via a main balise group in Level 1

- by giving a new longer section, see Figure 21a
- by giving a first section to the same location as in the previous MA and a second section, see Figure 21b

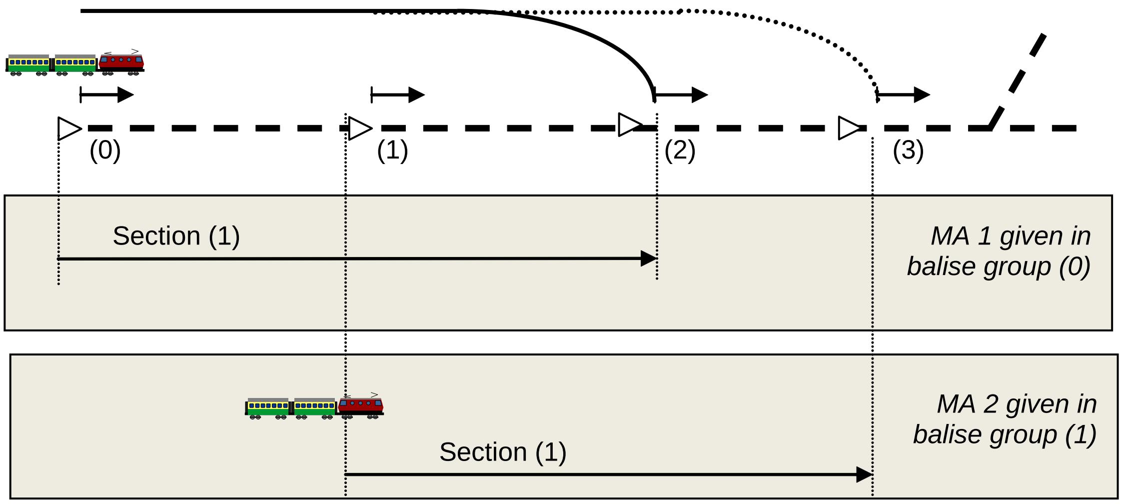


Figure 21a: Extension of an MA in Level 1, one section in the new MA

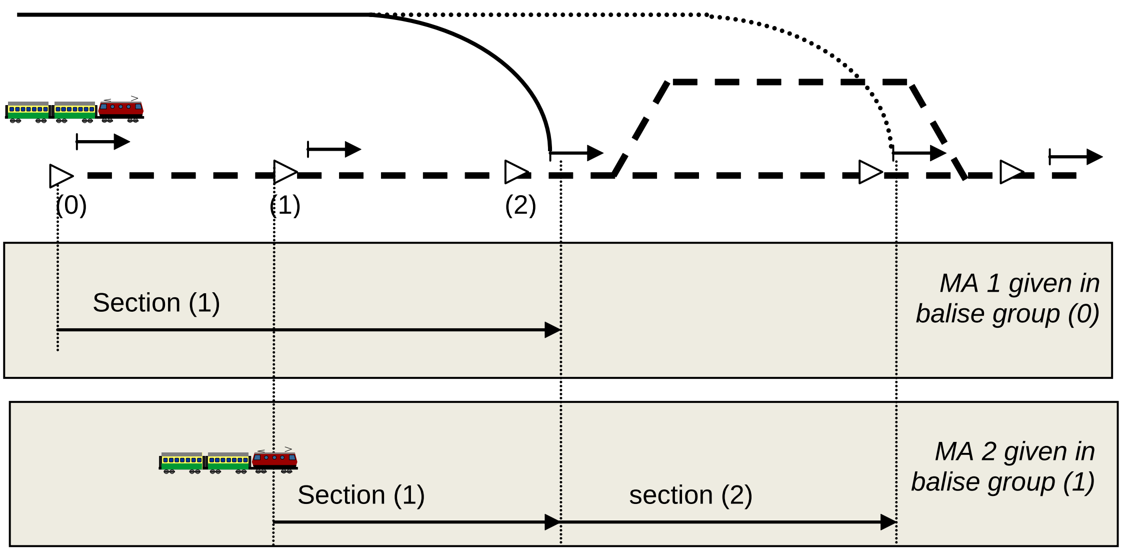


Figure 21b: Extension of an MA in level 1, two sections in the new MA

3.8.5.3.3 Example: MA update via infill information in Level 1. (Refer to section 3.6.2.3 for location reference of infill information)

- MA extension, by giving two new sections, see Figure 22a
- MA shortening, see Figure 22b
- MA repetition, see Figure 22c

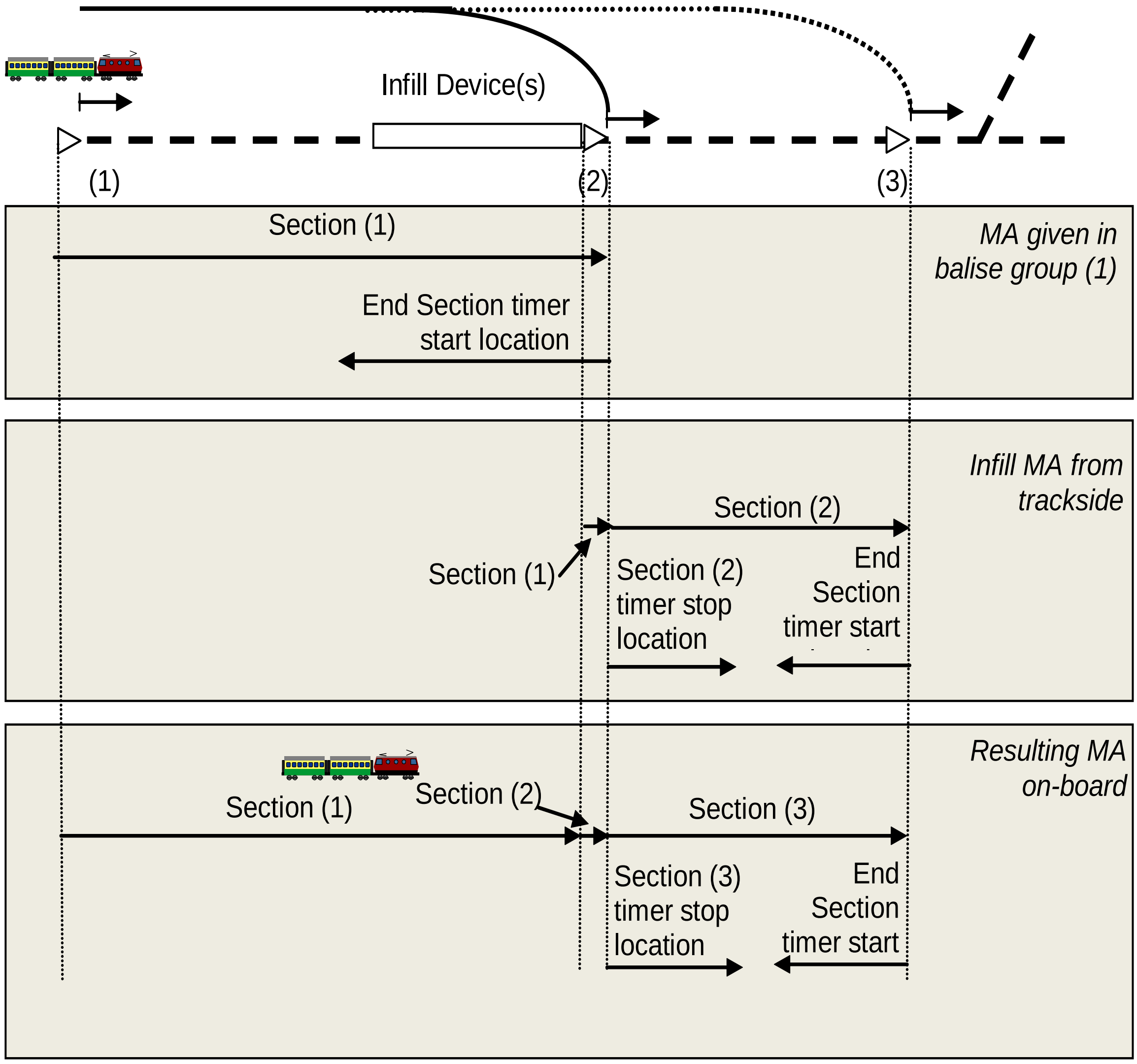


Figure 22a: Extension of an MA with Infill information

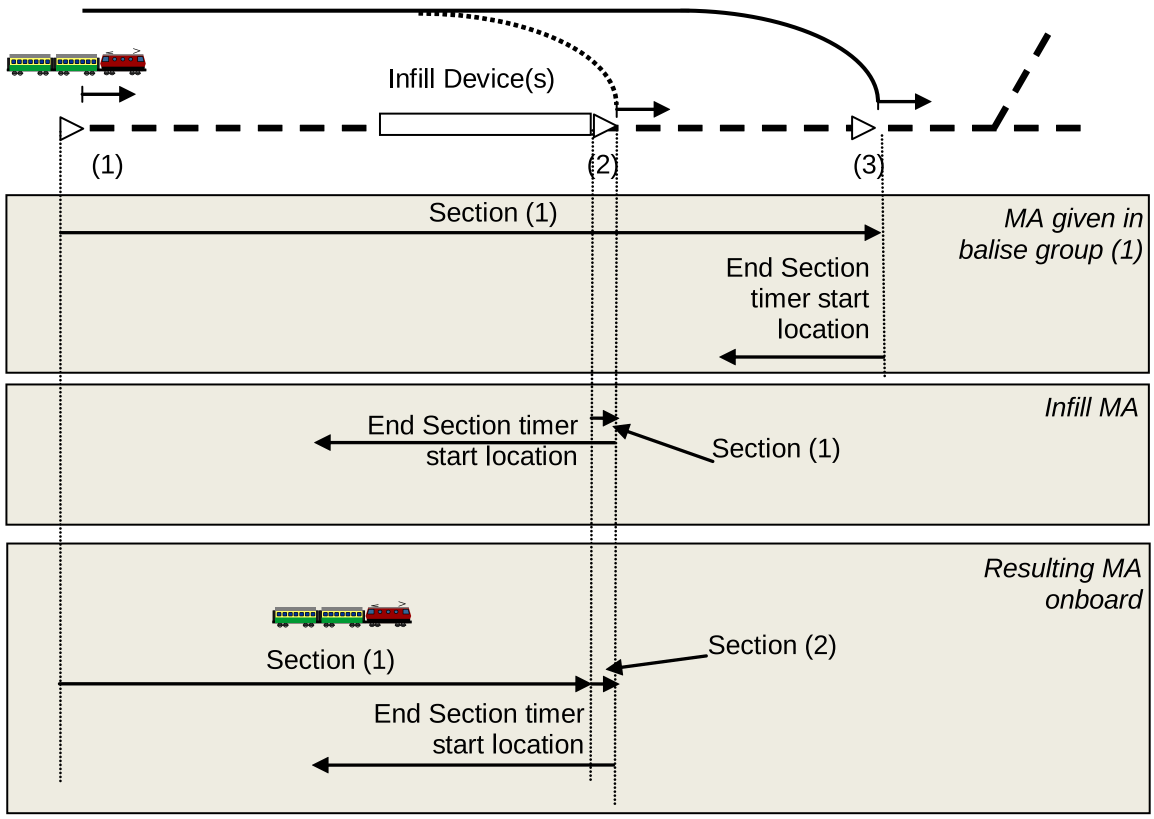


Figure 22b: Shortening of an MA with Infill information

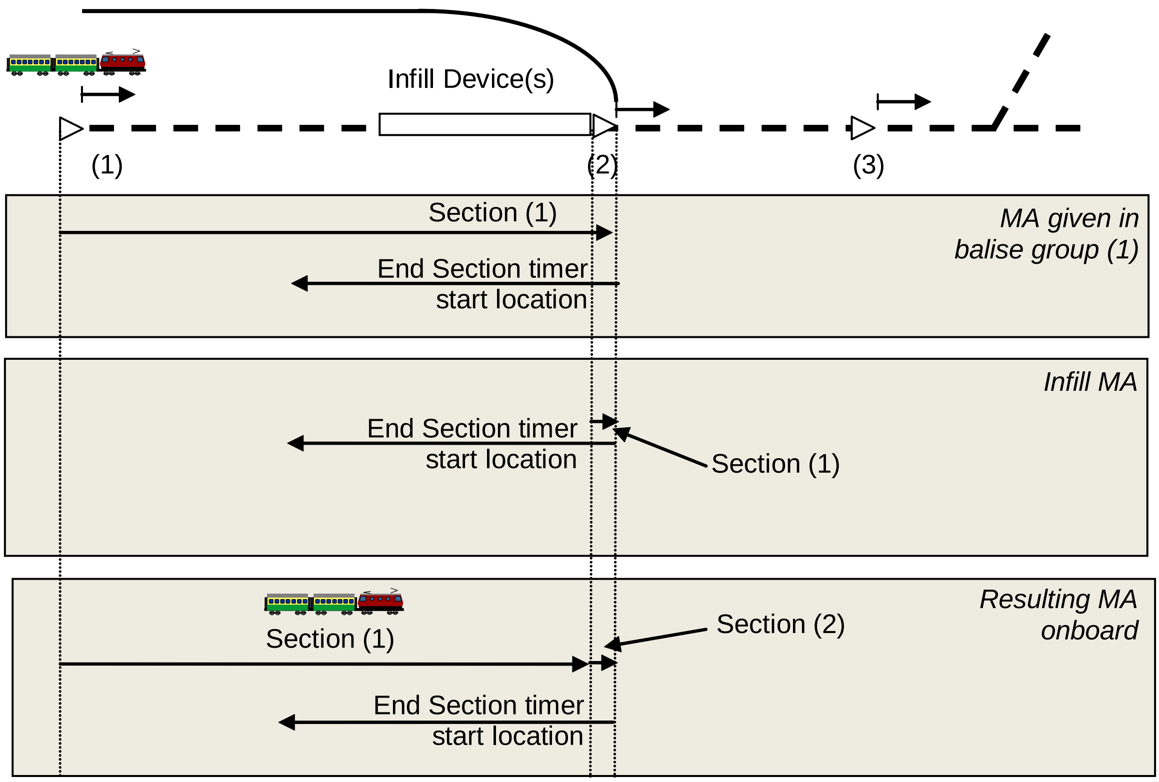


Figure 22c: Repetition of an MA with Infill information

3.8.5.3.4 Example: Extension of MA in Levels 2 and 3

- by using the same LRBG as in previous MA, see Figure 23a
- by using a new LRBG, see Figure 23b

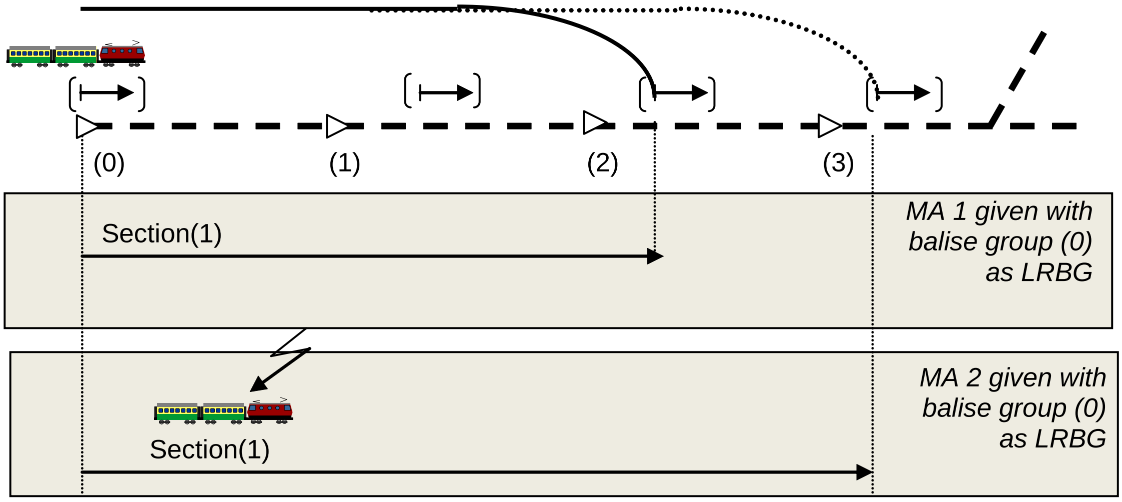


Figure 23a: Extension of an MA in level 2/3, using same LRBG

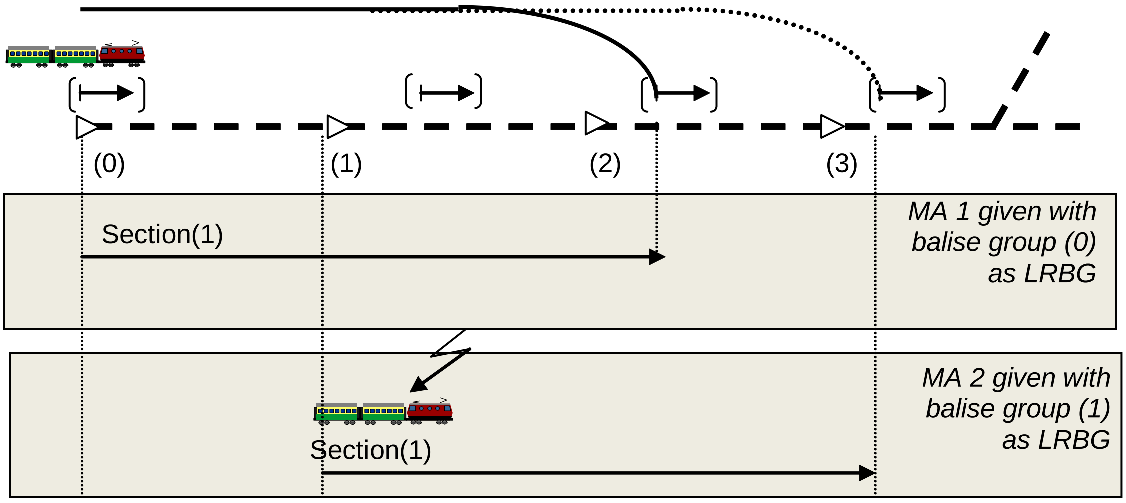


Figure 23b: Extension of an MA in Level 2/3, using a new LRBG

3.8.5.3.5 Example: Extension of MA in level 1 using a balise group containing repositioning information.

3.8.5.3.5.1 Note: In some existing systems, information about the locked route is not complete.

3.8.5.3.5.2 History of the situation (refer to the figure below):

a) Signal A gives an aspect to proceed up to signal Cx because it has received information about the locked route.

b) Signal A can determine whether track 3 or track 1 / 2 is locked but is unable to distinguish between track 1 and 2.

c) In the situation described the route is set to track 1 or 2.

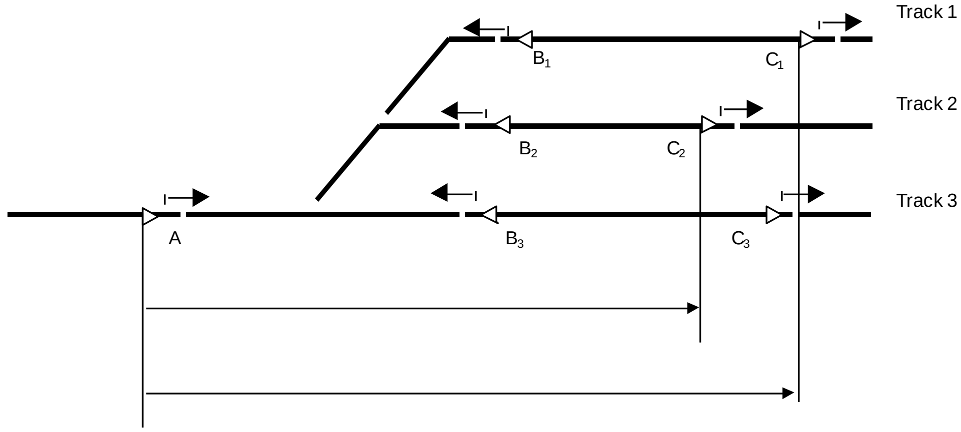


Figure 24: Information on set route not complete at signal A

3.8.5.3.5.3 In balise group A the following information is given:

a) The most restrictive track description from all routes (which could be a combination from the routes);

b) The linking distance given to the farthest balise group containing repositioning information, the identification of the repositioning balise group is not known;

c) For a given aspect of signal A, the most restrictive MA from all routes (the shortest sections from the routes and the lowest target speed at the End Of Authority);

d) If some sections are time limited, the most restrictive timer.

3.8.5.3.5.4 Balise groups B (B_1 or B_2) give the following static information:

a) This is repositioning information

b) Linking to the next balise group C

c) The distance to the end of the current section (i.e. the distance to the end of section B1 - C1, or the distance to the end of section B2 - C2)

d) The track description related to this track.

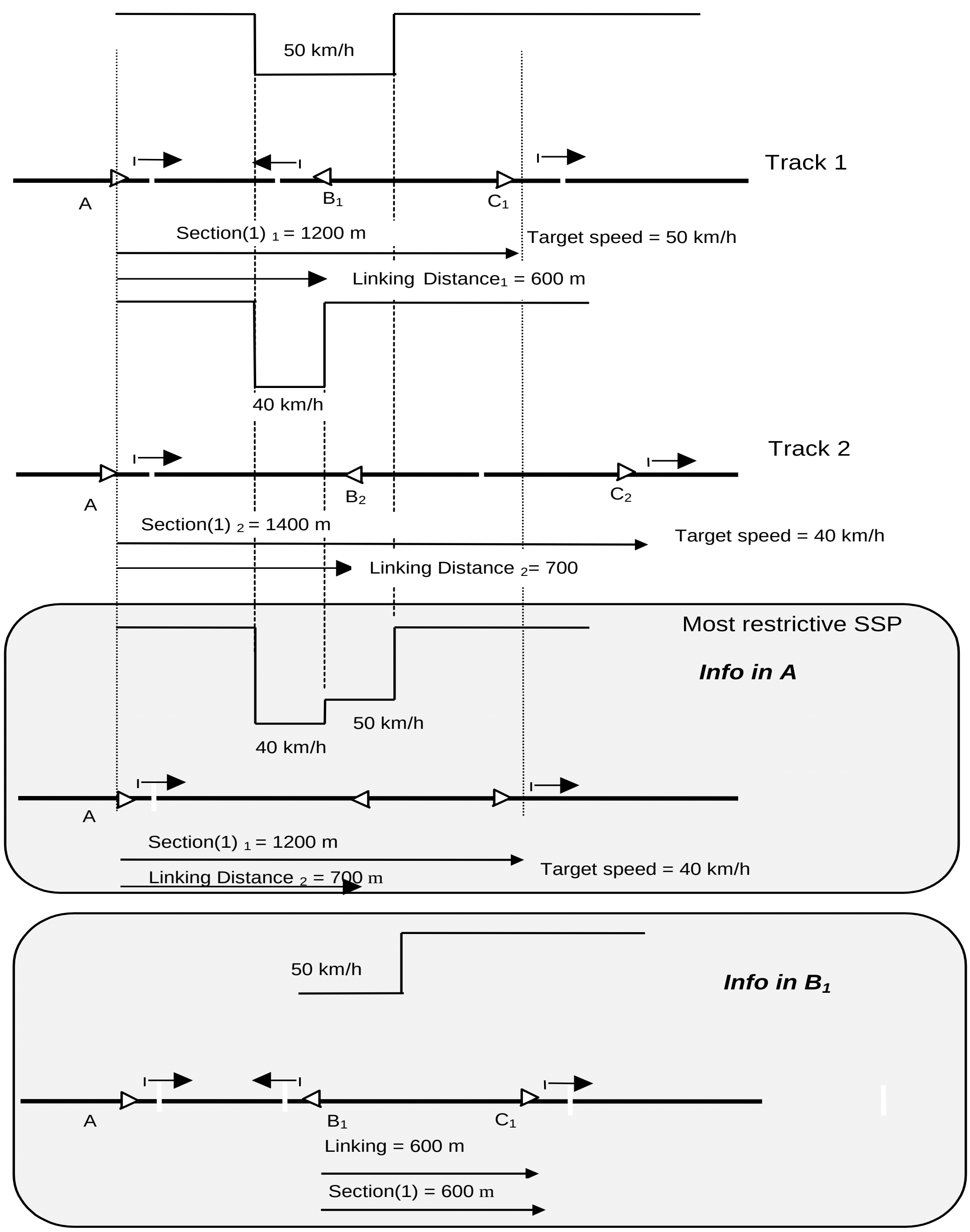


Figure 25: Information contained in A and B_1 (for clarity purposes, only SSPs are drawn but the procedure has to be applied for all track description)

3.8.6 Co-operative shortening of MA (Level 2 and 3 only)

3.8.6.1 It shall be possible to shorten a given MA using a special procedure between on-board equipment and RBC. The procedure is as follows:

a) The RBC proposes a new MA with an EOA closer to the train than the current EOA, optionally with a mode profile.

b) The ERTMS/ETCS on-board equipment shall check the train front end position versus the Indication supervision limit of the proposed shortened MA.

- If it is in rear, the on-board equipment shall accept the new MA.
- If it is in advance, the request shall be rejected and the previously received MA remains valid

c) The RBC shall be informed about the decision.

3.8.6.2 If the request from the RBC is granted by the on-board, refer to appendix A.3.4 for the exhaustive list of location based information, which shall be deleted accordingly.

3.9 Means to transmit Infill information (Level 1 only)

3.9.1 General

3.9.1.1 It shall be possible to transmit infill information to the on-board equipment using

a) Balise groups

b) Euroloops

c) Radio infill units.

3.9.1.1.1 Note: If the information transmitted by Balise groups, Euroloops, and Radio includes infill information, those devices are also identified as infill devices.

3.9.1.2 The principle used for the infill information shall be the same independent of transmission media.

3.9.1.3 If the on-board system is not equipped with the infill transmission media as requested by the announcement balise group, the announcement information shall be ignored by the on-board equipment and the train shall proceed according to the previously received information.

3.9.1.4 Note: No additional description is needed for infill by balise group (other than already covered in previous chapters).

3.9.2 Infill by loop

3.9.2.1 An End Of Loop Marker (EOLM) is by definition a device to mark the beginning or the end of a loop. When receiving this information, the on-board equipment knows that it is entering/leaving a track equipped with a loop. In unidirectional applications it shall be possible to have an EOLM only at the entry side of a loop.

3.9.2.2 Balise groups shall be used as EOLMs. They act as an EOLM by sending the EOLM information to the passing train.

3.9.2.3 EOLMs have an orientation that is identical to the balise group orientation. The general rules for balise orientation therefore also apply to EOLMs.

3.9.2.4 EOLM information might be contained in a balise group that contains other information.

3.9.2.5 The EOLM shall send the identity of the announced loop.

3.9.2.6 The on-board shall only accept information coming from the loop with the announced identity.

3.9.2.7 Deleted.

3.9.2.8 Deleted.

3.9.2.9 The following information shall be sent in advance by the EOLM to prepare for reception of the loop information:

- Loop identity used to identify the loop.
- Key to select the spread spectrum key necessary to receive the loop telegrams.
- Distance to the loop giving the distance from the EOLM to the location from where on loop messages can be received.
- Length of the loop giving the length of the loop over which messages can be received.
- Indicator telling the on-board whether the orientation of the loop is identical or reverse to the orientation of the announcing EOLM.

3.9.2.10 The on-board shall be prepared to receive messages from the Euroloop after passing the EOLM.

3.9.2.11 When the on-board equipment reads the next main signal balise group or when it detects that the next main signal balise group was missed, new infill information possibly received from the loop shall be ignored.

3.9.2.12 The distances given in an EOLM (distance to loop, length of loop) are used for diagnostic purpose only. They shall therefore not be used to restrict reception of loop telegrams to specific locations.

3.9.3 Infill by radio

3.9.3.1 In level 1 areas it shall be possible to send to the on-board equipment orders to establish/terminate a communication session with a radio infill unit.

3.9.3.2 The orders shall be sent via balise groups or via Radio Infill units.

3.9.3.3 The order to establish a communication session shall be ignored:

a) Intentionally deleted.

b) If the on-board equipment does not include radio.

3.9.3.4 If the on-board equipment includes radio, the communication session shall be established using the same protocols and interfaces as for Level 2/3 operations.

3.9.3.5 If the order to establish a communication session with a radio infill unit sent via balise groups is received by an on-board equipment, connected with another radio infill unit(s), two cases may arise:

3.9.3.5.1 Case 1: the on-board can handle only one communication session at a time. In this case, the onboard shall (unless §3.9.3.5.1.1 applies):

a) terminate the existing communication session at the location indicated in the order

b) establish a communication session with the RIU indicated in the order as soon as action a) is completed.

3.9.3.5.1.1 The order shall be ignored in case it refers to an RIU with which a session is currently being established or is already established.

3.9.3.5.2 Case 2: the on-board can handle more than one communication session at a time. In this case, at the location indicated in the order the on-board shall:

a) terminate any communication session existing with RIU(s) not indicated in the order

b) as soon as a new communication session can be handled, establish a communication session with the RIU indicated in the order, unless currently being established or already established with the said RIU.

3.9.3.6 If the order to establish a communication session with a radio infill unit sent via Radio Infill unit is received by an on-board equipment:

a) If the on-board can handle only one communication session, the order shall be ignored.

b) If the on-board can handle two communication sessions simultaneously and only one session is ongoing, the existing communication session shall be maintained and the new one shall be established.

c) If the on-board can handle two communication sessions simultaneously and two sessions are ongoing, then the communication session related to the current infill area shall be maintained, the other one shall be terminated and the new one shall be established.

3.9.3.7 A Radio Infill Unit shall not initiate a communication session with an on-board equipment.

3.9.3.8 The order to establish/terminate a communication session sent via balise groups shall be sent together with the following radio infill area information:

a) Location where to perform the action (referred to the balise group containing the order).Note: if the action is to establish a communication session, this location marks the beginning of the Radio Infill Area.

b) Next main signal balise group identifier (ignored by the on-board if the action is Terminate communication session).Note: the reference location of this balise group marks the end of the Radio Infill Area.

3.9.3.8.1 The order to establish/terminate a communication session sent via Radio Infill units (see 3.5.3.6) shall not be sent together with any radio infill area information.

3.9.3.9 The establishment of a communication session for radio infill shall not change the operational level of the on-board i.e. the information in the balise group shall be taken into account as usual in level 1.

3.9.3.10 The on-board equipment shall inform the radio infill unit

a) As soon as the location indicated in the order sent via balise groups is passed (i.e. entry of the train in the infill area)

b) As soon as the next main signal balise group indicated in the order sent via balise groups is read or the on-board equipment detects that it was missed.

3.9.3.11 The information sent to the radio infill unit by the on-board equipment shall include

a) Train identity (ETCS-ID of the on-board equipment)

b) Position report

c) Identifier of the next main signal balise group

d) Time stamp

3.9.3.11.1 Justification:

a) The train identity is used for conformity with other train to track messages

b) The identifier of the next main signal balise group allows the radio infill unit to identify safely where the train is going, even in the case of a points area

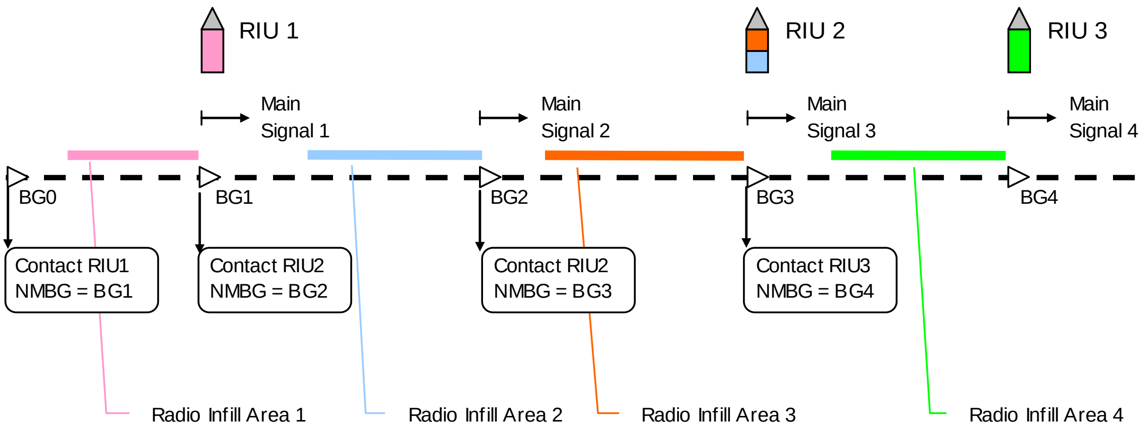
3.9.3.12 As soon as the radio infill unit is informed that a train has entered an infill area under its responsibility, it shall

a) Terminate a possible previous sending of infill information to the on-board equipment, AND

b) Send cyclically the infill information corresponding to the message currently sent by the next main signal balise group indicated in the information from the on-board equipment.

3.9.3.12.1 Justification: case a) refers to the possibility that a report from the on-board equipment, after having passed the previous main signal, was lost.

3.9.3.12.2 Note: A Radio infill unit may manage several signals, thus several Radio Infill Areas (see Figure 25a)



- NMBG = Next Main signal Balise Group
- RIU1 manages Radio Infill Area 1
- RIU2 manages Radio Infill Area 2 and 3
- RIU3 manages Radio Infill Area 4

Figure 25a: Line equipped with radio infill. Example of radio infill area information transmitted by balise.

3.9.3.13 The radio infill unit shall terminate the sending of infill information as soon as information is received, that the on-board equipment has read the next main signal balise group indicated in the order or that the on-board equipment has detected that it was missed.

3.9.3.14 The radio infill unit shall evaluate the time stamp according to the principles of section 3.16.3.2.
The on-board equipment shall check the consistency of radio infill data, according to the principles of section 3.16.3.1 and 3.16.3.3.

3.9.3.15 When the on-board equipment reads the next main signal balise group or when it detects that the next main signal balise group was missed, new infill information related to this balise group possibly received shall be ignored.

3.9.3.16 The on-board equipment shall terminate the communication session according to the orders received from the trackside (balise group or Radio Infill units).

3.9.3.17 Intentionally deleted.

3.10 Emergency Messages

3.10.1 General

3.10.1.1 Emergency messages shall be sent individually to each on-board equipment, either as high priority data or as normal priority data of the same radio connection, as described in Euroradio specification. Only emergency messages can be sent as high priority data, not their acknowledgement or their revocation.

3.10.1.1.1 Justification: In case of hazardous events, it is possible to use high priority data in the radio connection between RBC and on-board equipment to get a quick reaction.

3.10.1.2 An emergency message shall contain an identifier decided by the trackside.

3.10.1.3 The same identifier shall be used in case the emergency message is repeated.

3.10.1.3.1 If the on-board receives a new message with the same identifier it shall replace the previous one.

3.10.1.4 Each emergency message to an on-board equipment shall be acknowledged, using the corresponding emergency message identification number.

3.10.1.4.1 Note: This acknowledgement informs the RBC about the use of the emergency message by on-board equipment and is independent from the general acknowledgement for track-to-train messages, as specified in section 3.16.3.5.

3.10.2 Emergency Stop

3.10.2.1 It shall be possible to stop a train with a conditional or an unconditional emergency stop message.

3.10.2.2 A conditional emergency stop message shall contain the information of a new stop location, referred to the LRBG. In case, when receiving this message

- the train has already passed with its min safe front end the new stop location, the emergency stop message shall be rejected and the RBC shall be informed.
- the train has not yet passed with its min safe front end the new stop location, the emergency stop message shall be accepted, however this location shall be used by the onboard to define the new EOA and SvL only if not beyond the current EOA. Refer to appendix A.3.4 for the exhaustive list of location based information stored on-board, which shall be deleted accordingly.

3.10.2.3 When receiving an unconditional emergency stop message the train shall be tripped immediately.

3.10.2.4 New movement authority received after any accepted emergency stop message and before the emergency message has been revoked, shall be rejected.

3.10.2.5 Intentionally deleted.

3.10.2.6 The driver shall be informed when emergency stop(s) have been accepted and are not yet revoked.

3.10.3 Revocation of an Emergency Message

3.10.3.1 The revocation message shall refer to the identity of the concerned emergency message.

3.10.3.2 The revocation messages shall be acknowledged by the on-board equipment, according to the general acknowledgement procedure (see section 3.16.3.5)

3.10.3.3 The revocation of an emergency message shall have no effect on the management of other emergency messages possibly received.

3.10.3.4 Intentionally deleted.

3.11 Static Speed Restrictions and Gradients

3.11.1 Introduction

3.11.1.1 The permitted speed at which the train is allowed to travel shall be limited to different kinds of Static Speed Restrictions and considering the End of Authority/Limit Of Authority.

3.11.1.2 A Static Speed Restriction shall be handled in the same way independent of ETCS level.

3.11.2 Definition of Static Speed Restriction

3.11.2.1 Static Speed Restrictions are imposed by the trackside infrastructure, the train characteristics, the signalling and the mode of the on-board equipment.

3.11.2.2 There are eleven categories of Static Speed Restrictions:

a) Static Speed Profile (SSP)

b) Axle load Speed Profile (ASP)

c) Temporary Speed Restrictions (TSR)

d) Maximum Train Speed

e) Signalling related speed restriction (only level 1)

f) Mode related Speed Restriction.

g) STM Max speed (for details refer to Subset-035)

h) STM System speed (for details refer to Subset-035)

i) Level Crossing speed restriction (LX SR)

j) Override function related Speed Restriction

k) Speed restriction to ensure a given permitted braking distance (PBD SR) (see 3.11.11)

3.11.2.3 The Static Speed Restriction categories shall be independent of each other. This means that one speed restriction category shall not affect, nor be affected by, any other category of Static Speed Restrictions.

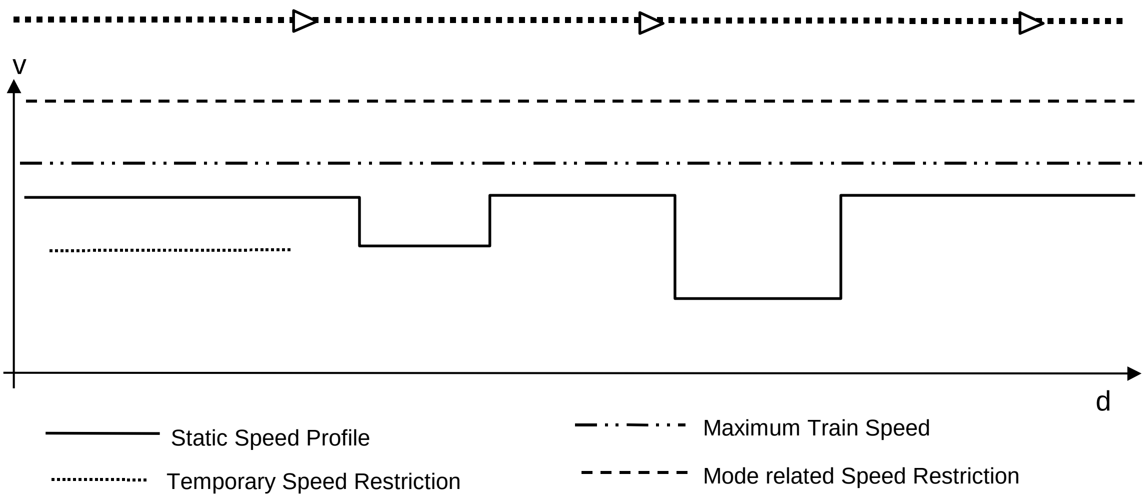


Figure 26: Example of Static Speed Restriction categories on a piece of track.

3.11.2.4 Depending on the type of Static Speed Restriction train length may have to be used to ensure that the full length of the train has passed a Static Speed Restriction discontinuity before a speed increase shall be taken into account.

3.11.2.5 Intentionally deleted.

3.11.2.6 Intentionally deleted.

3.11.3 Static Speed Profile (SSP)

3.11.3.1.1 The Static Speed Profile (SSP) is a description of the fixed speed restrictions of a given piece of track. The speed restrictions can be related to e.g. maximum line speed, curves, points, tunnel profiles, bridges.

3.11.3.1.2 The Static Speed Profile is based on factors, which are both track and train dependent. The relationship between track and train characteristics determine the individual Static Speed Profile for each train.

3.11.3.1.3 It shall be possible for every element (distance between two discontinuities) of a static speed profile to define, if a transition to a higher speed limit than the speed limit specified for this element is permitted before the complete train has left the element.

3.11.3.2 Static Speed Profile Categories

3.11.3.2.1 It shall be possible to transmit several Static Speed Profile Categories; one Basic SSP category and specific SSP categories related to the international train categories.

3.11.3.2.1.1 The specific SSP categories are decomposed into two types:

a) The “Cant Deficiency” SSP categories: the cant deficiency value assigned to one category shall define the maximum speed, determined by suspension design, at which a particular train can traverse a curve and thus can be used to set a specific speed limit in a curve with regards to this category.

b) The “other specific” SSP categories: it groups all other specific SSP categories corresponding to the other international train categories

3.11.3.2.1.2 Whenever the type of specific SSP category is not explicitly specified in the following requirements, it shall be interpreted as being applicable for both types of specific SSP categories.

3.11.3.2.2 For each part of the Static Speed Profile, the ERTMS/ETCS trackside shall:

a) always give the Basic SSP, which shall be considered as the default “Cant Deficiency” SSP

b) optionally give one or more specific SSPs

c) specify, for each “other specific” SSP, whether it replaces or not the “Cant Deficiency” SSP as selected by the ERTMS/ETCS on-board equipment according to 3.11.3.2.3

3.11.3.2.3 For each part of the Static Speed Profile, the ERTMS/ETCS on-board equipment shall select the SSP best suiting its “Cant Deficiency” train category, according to the following order of preference:

a) if available, the “Cant Deficiency” SSP matching its “Cant Deficiency” train category, OR

b) if available, the “Cant Deficiency” SSP with the highest Cant Deficiency value below the value of its “Cant Deficiency” train category, OR

c) the Basic SSP

3.11.3.2.3.1 Intentionally deleted.

3.11.3.2.4 Intentionally deleted.

3.11.3.2.5 “Other Specific” SSP categories not relevant to the current train shall be ignored.

3.11.3.2.6 For each part of the Static Speed Profile, the ERTMS/ETCS on-board equipment in a train belonging to at least one or more “other international” train categories shall use the most restrictive speed amongst:

a) the ” Cant Deficiency” SSP as selected in 3.11.3.2.3, only if none of the “other specific” SSP categories matching the train categories replaces the ” Cant Deficiency” SSP, AND

b) all the “other specific” SSP categories matching the “other international” train categories.

3.11.3.3 Train categories

3.11.3.3.1 A maximum of 31 train categories shall be defined to match the SSP categories. 16 “Cant Deficiency” train categories and 15 “other international” train categories.

3.11.3.3.2 A train shall always belong to one and only one “Cant Deficiency” train category and may optionally belong to one or more “other international” train categories.

3.11.3.3.3 The train category(ies) to which a train belongs shall be a part of its Train Data.

3.11.4 Axle load Speed Profile

3.11.4.1 It shall be possible to define an Axle load Speed Profile as a non-continuous profile.

3.11.4.2 For each section with a speed restriction due to axle load, the different speed value(s) and for which minimum axle load category this speed value(s) applies shall be specified.

3.11.4.2.1 Note: Different speed restrictions depending on the axle load category can be applicable to the same distance.

3.11.4.3 The ERTMS/ETCS on-board equipment shall consider the most restrictive speed restriction that is associated with any axle load category lower than, or equal to that of the train.

3.11.4.4 For trains with an axle load category lower than the minimum axle load category given in the profile, the ERTMS/ETCS on-board equipment shall not consider any speed restriction due to axle load.

3.11.4.5 The initial state for Axle load Speed Profile shall be “no restriction due to axle load”.

3.11.4.6 Whether a speed increase after the axle load speed restriction shall be delayed with train length, shall be determined by the axle load speed profile information sent to the on-board equipment.

3.11.5 Temporary Speed Restrictions

3.11.5.1 The temporary speed restriction is defined in order to enable a separate category of track infrastructure speed restriction, which can be used for working areas etc.

3.11.5.2 All Temporary Speed Restrictions shall be independent of each other. This means that an individual Temporary Speed Restriction shall not affect, nor be affected by, any other individual Temporary Speed Restriction.

3.11.5.3 Whether a speed increase after the temporary speed restriction shall be delayed with train length, shall be determined by the temporary speed restriction information sent to the on-board equipment.

3.11.5.4 When two or more temporary speed restrictions overlap, the most restrictive speed of the overlapping temporary speed restrictions shall be used in the area of overlap.

3.11.5.5 Each Temporary Speed Restriction shall have an identity to make it possible to revoke the Temporary Speed Restriction using its identity. The speed restriction shall be revoked immediately when revocation is received from trackside, without delay for the train length.

3.11.5.6 It shall be possible to identify whether a Temporary Speed Restriction is possible to revoke or not.

3.11.5.7 A new Temporary Speed Restriction shall not replace a previously received Temporary Speed Restriction with another identity.

3.11.5.8 Temporary Speed Restrictions shall only be revoked on request from the trackside.

3.11.5.9 If the on-board equipment receives a new Temporary Speed Restriction (TSR) with the same identity as an already received TSR, the new Temporary Speed Restriction shall replace the previous one, except when the Temporary Speed Restriction is identified as non revocable in which case this shall be considered as an additional TSR.

3.11.5.10 In case the train has changed its orientation any Temporary Speed Restriction shall be deleted (operational requirement: will be executed due to the mode change).

3.11.5.11 Intentionally deleted.

3.11.5.12 It shall be possible for the RBC to order an ERTMS/ETCS on-board equipment in Level 2 or 3 to reject revocable TSRs from balises.

3.11.5.13 When ERTMS/ETCS on-board equipment has accepted an order to reject revocable TSRs from balises, this inhibition shall be stored and shall be effective immediately, but only for revocable TSRs received from balises thereafter.

3.11.5.14 The inhibition of revocable TSRs from balises shall be deleted if any of the following occurs:

- the communication session established with the RBC that ordered the inhibition is terminated, OR
- in case of RBC/RBC handover, the train front end crosses the RBC/RBC border.

3.11.5.15 Note: this inhibition may be useful in Level 1 / Level 2 mixed signalling applications when the RBC has more precise information about restrictions than can be given from balises. The RBC may then order inhibition of revocable TSRs from balises and instead send more precise TSRs to the train.

3.11.6 Signalling related speed restrictions

3.11.6.1 In level 1, it shall be possible to send to the on-board equipment a speed restriction with a value depending on the current state of signalling.

3.11.6.2 This speed value shall be taken into account by the on-board equipment as soon as it is received on-board, with the exception of a signalling related speed restriction from an infill device. In case of infill information the speed restriction shall be taken into account from the location reference of the balise group at the next main signal.

3.11.6.3 The speed restriction shall be valid until a new signalling related speed restriction is received.

3.11.6.3.1 If the ERTMS/ETCS on-board equipment switches from level 1 to level 2/3, the signalling related speed restriction shall remain valid until a L2/3 MA is accepted by the ERTMS/ETCS on-board equipment

3.11.6.4 In case of a signal at danger the signalling related speed restriction shall have value zero, which shall be evaluated by the ERTMS/ETCS on-board equipment not as a speed limit but as a train trip order.

3.11.6.5 In case of infill information the signalling related speed restriction at zero shall be ignored.

3.11.6.5.1 Note: The infill information will also include an EOA at the next main signal that will be supervised according to the normal rules.

3.11.7 Mode related speed restrictions

3.11.7.1 The value of the mode related speed restriction shall be determined by the corresponding national value or the corresponding default values if the national values are not applicable.

3.11.7.1.1 Exception 1: For the modes On-sight, Limited Supervision and Shunting the speed limit can also be given from the trackside. The speed limit given from the trackside shall prevail over the National value and the default value.

3.11.7.1.2 Exception 2: For the mode Reversing there is no National/Default value. The speed limit is always given from trackside.

3.11.7.1.3 Exception 3: For the mode Staff Responsible the speed limit can also be entered by the driver. The speed limit given by the driver shall prevail over the National/Default value.

3.11.8 Train related speed restriction

3.11.8.1 It shall be possible to define the maximum train speed related to the actual performance and configuration of the train.

3.11.9 LX speed restriction

3.11.9.1 It shall be possible to define a LX speed restriction when the train has to pass a non protected Level Crossing.

3.11.10 Override function related Speed Restriction

3.11.10.1 While the “override” function is active, the override speed limit (national /default value) shall be taken into account.

3.11.11 Speed restriction to ensure permitted braking distance

3.11.11.1 It shall be possible for trackside to request on-board to calculate a speed restriction which ensures that the train stops within a given permitted braking distance.

3.11.11.2 The order shall be given by means of a non-continuous profile defining:

- The start and end location for the speed restriction
- The permitted braking distance used to calculate the speed restriction value
- Whether the permitted braking distance is to be achieved with the Service Brake or Emergency Brake
- A single gradient value applicable for the calculation

3.11.11.3 The speed restriction shall be calculated when ERTMS/ETCS on-board receives the permitted braking distance information from trackside, and shall be re-calculated only if the brake characteristics of the train taken into account for the calculation of the speed restriction changes.

3.11.11.4 The calculation of the speed restriction by the on-board shall be executed as follows:

- The gradient value received from trackside shall be applied for EBD and/or SBD calculation.
- For the calculation of the EBI limit: the estimated acceleration shall be set to “zero”, the compensation of the speed measurement inaccuracy, if not inhibited, shall be set to a Fixed Value (see Appendix A3.1).
- If the permitted braking distance is to be achieved with the emergency brake, the EBI limit shall be calculated like the EBI limit for an SvL in a target speed supervision towards an EOA.
- If the permitted braking distance is to be achieved with the service brake, the FLOI limit shall be calculated like the FLOI limit of the target speed supervision for a combined EOA/SvL location.

The result of the calculation is an EBI, or FLOI, target speed supervision value at the permitted braking distance in rear of the stop location.

3.11.11.5 The derived EBI, or FLOI, target speed supervision value shall be used as the SB ceiling speed intervention limit for the speed restriction.

3.11.11.6 From the SB ceiling speed intervention limit according to the previous clause, the Permitted Speed limit inside the speed restriction shall be calculated by:

- Subtracting the applicable speed interval between Permitted Speed limit and SB intervention (see 3.13.9.2.5). The speed interval shall be approximated by using the SB ceiling speed intervention limit instead of the MRSP speed limit in the formula.
- Rounding the result down to the next lower multiple of 5km/h.

3.11.11.7 The initial state for Speed Restrictions to Ensure Permitted Braking Distance shall be "no speed restriction".

3.11.12 Gradients

3.11.12.1 The gradient information for a given piece of track shall be transmitted to the on-board equipment in form of a gradient profile.

3.11.12.2 The gradient profile shall be continuous, i.e., give a gradient value for each location within the piece of track covered by the profile.

3.11.12.3 A gradient value shall be identified as a positive value for an uphill slope, and with a negative value for a downhill slope.

3.11.12.4 The gradient profile shall contain the gradient information as a sequence of gradient values, constant between two defined locations each, see Figure 27.

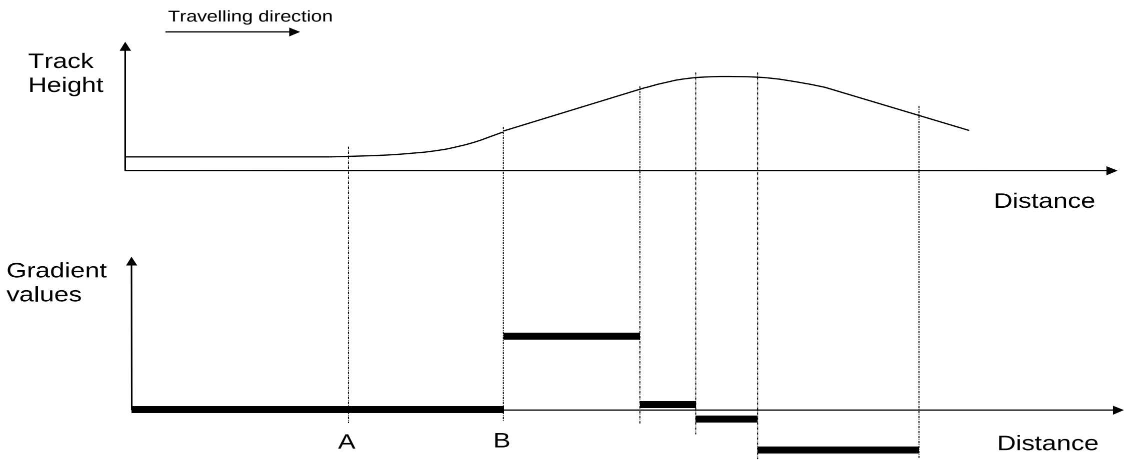


Figure 27: Gradient profile

3.11.12.4.1 Note: The figure above symbolises the engineering process to provide the values of gradients. Following the track height, the track must be split in segments giving for each segment a gradient value.

3.11.12.5 It shall be possible via balise groups to send to the on-board equipment a default gradient for TSR supervision, to be used for the parts of the track not covered by the gradient profile.

3.11.12.6 The Default Gradient for TSR stored on-board shall be valid until a new Default Gradient for TSR is received.

3.12 Other Profiles

3.12.1 Track Conditions

3.12.1.1 The Track Condition function is used to inform the driver and/or the train of a condition in front of the train.

3.12.1.2 A Track Condition shall be given as profile data (e.g. non-stopping area), i.e. start and end of the data is given, or location data (e.g. change of traction system) i.e. start location given, depending on the type of track condition.

3.12.1.2.1 The starting point of a profile type track condition shall be evaluated taking into account the max safe front end of the train, the end of the profile taking into account the min safe rear end of the train. Location type data shall be evaluated taking into account the max safe front of the train.

3.12.1.2.1.1 Note: The timing of output data to control train equipment (e.g. pantograph) is application specific.

3.12.1.2.1.2 Exception 1: The starting point of a Big Metal Mass type track condition shall be evaluated taking into account the max safe <u>antenna</u> position, the end of the profile taking into account the min safe <u>antenna</u> position.

3.12.1.2.1.3 Exception 2: The end of the Powerless section shall be evaluated taking into account the min safe front end of the train.

3.12.1.2.1.4 Exception 3: The start and end of a tunnel stopping area and of a sound horn track condition shall be evaluated taking into account the estimated front end of the train.

3.12.1.3 The types of track conditions to be covered by this function are:

- Powerless section, lower pantograph (initial state: no powerless section, i.e. pantograph not to be lowered)
- Powerless section, switch off main power switch (initial state: no powerless section, i.e. main power switch not to be switched off)
- Air tightness (initial state: no request for air tightness)
- Sound horn (initial state: no request for sound horn)
- Non stopping area (initial state: stopping permitted)
- Tunnel stopping area (initial state: no tunnel stopping area)
- Change of traction system, switch traction system on-board, used for train capable of handling several traction systems (initial state: no initial state – keep the current setting)

- Change of allowed current consumption, limit current consumed by the train, used to adapt the maximum current consumption of the train to the maximum current allowed by the trackside (initial state: no initial state – keep the current setting)
- Big metal masses, ignore onboard integrity check alarms of balise transmission. (initial state: alarms not ignored)
- Radio hole, stop supervision of the loss of safe radio connection (initial state: loss of safe radio connection supervised)
- Switch off regenerative brake (initial state: regenerative brake on)
- Switch off eddy current brake for service brake (initial state: eddy current brake on for service brake)
- Switch off eddy current brake for emergency brake (initial state: eddy current brake on for emergency brake)
- Switch off magnetic shoe brake (initial state: magnetic shoe brake on).
- Station platforms, enable passenger doors with or without steps according to platform location, side and height (initial state: not enabled).

3.12.1.3.1 Note: In case of regenerative brake switch off or magnetic shoe brake switch off, the deceleration of the emergency brake might be affected if the effect of these brakes was included in the calculation of the deceleration value.

3.12.1.3.2 Note: In case of eddy current brake switch off the deceleration of the service brake or emergency brake might be affected if the effect of these brakes was included in the calculation of the deceleration value.

3.12.1.3.3 Note: in case of powerless section the deceleration of the service brake or emergency brake might be affected if the effect of a regenerative brake not independent from the presence of voltage in the catenary was included in the calculation of the deceleration value.

3.12.1.4 Intentionally deleted.

3.12.1.5 The following actions shall be performed at receiving a track condition:

a) Indicate on DMI (see chapter 5, procedure “Indication of track conditions”), except “Station platforms”, “Change of allowed current consumption” and “Big metal masses”.

b) Send information with the remaining distance to an ERTMS/ETCS external function, with the exception of big metal mass track condition, sound horn track condition, non stopping area, tunnel stopping area and supervision of radio transmission which are handled inside the ERTMS/ETCS on-board equipment.

3.12.1.5.1 Note: Whether some information shall be filtered (not shown to the driver or not sent to an ERTMS/ETCS external function) is outside the scope of ERTMS/ETCS.

3.12.1.5.2 Note: The ERTMS/ETCS external function must be able to handle new track condition of the same type as previously received and covering the same distance.

3.12.1.6 The train is permitted to run without any track condition information given from the trackside. The initial state shall then be used by the on-board equipment.

3.12.2 Route Suitability

3.12.2.1 Route suitability data defines which values concerning loading gauge, traction system and axle load category a train must meet to be allowed to enter the route.

3.12.2.2 The route suitability data is sent as location data from the trackside when needed.

3.12.2.3 On reception of route suitability data, the ERTMS/ETCS on-board equipment shall compare it with the corresponding Train Data stored on-board. Unsuitability exists if:

a) The loading gauge profile of the train is not included in the list of loading gauges accepted by trackside

b) The list of traction systems accepted by the engine does not include the one received from trackside

c) The axle load category of the train is higher than the permitted one received from trackside

3.12.2.4 If at least one unsuitability exists, the closest location corresponding to the unsuitability(ies) shall be considered as both the EOA and SvL (instead of the EOA and SvL given by the MA), with no Release Speed. The driver shall be informed about all unsuitabilities.

3.12.2.5 Intentionally deleted.

3.12.2.5.1 Intentionally deleted.

3.12.2.6 Intentionally deleted.

3.12.2.7 Intentionally deleted.

3.12.2.8 If, for any reasons, the train overpasses the location of the first route suitability where incompatibility occurs, it shall be tripped.

3.12.2.9 The Train Data concerning route suitability is part of the Train Data sent to the RBC.

3.12.2.9.1 Note: This allows for route suitability supervision to be used in systems external to the ERTMS/ETCS system.

3.12.2.10 The train is permitted to run without any route suitability data given from the track. No default values shall be used or supervised by the on-board equipment, i.e. the initial state is that no restrictions related to route suitability exists.

3.12.3 Text Transmission

3.12.3.1 General Rules

3.12.3.1.1 It shall be possible to transmit information to be displayed to the driver from the trackside to the on-board equipment in the form of text messages.

3.12.3.1.2 Text messages shall always be supplemented by conditions on when and where they are to be displayed, and whether any acknowledgement is requested from the driver. These parameters shall be transmitted individually for each message.

3.12.3.1.3 Text messages and the supplementary information shall always be transmitted in one message.

3.12.3.1.4 Text messages can contain the text to be displayed in plain text or a number selecting a fixed message.

3.12.3.1.4.1 Note: In case of plain text messages the trackside selects the language in which the message is displayed.

3.12.3.1.5 Intentionally deleted.

3.12.3.1.6 Intentionally deleted.

3.12.3.1.7 Intentionally deleted.

3.12.3.1.8 Intentionally deleted.

3.12.3.1.9 The following data shall be included in a text message:

- Class of message
- Plain text message or fixed message number
- Conditions for start of indication
- Conditions for end of indication
- If driver acknowledgement is requested or not

3.12.3.1.10 The appearance of a message shall depend on the class and on whether a driver acknowledgement is requested.

3.12.3.1.11 A text message from trackside may be sent with a request to report driver acknowledgement, if any, to an RBC.

3.12.3.2 Text Message Classes

3.12.3.2.1 Text messages shall be classified according to the following scheme:

Class	Characteristics/Appearance	Use
Auxiliary Information	Displayed and deleted when specified conditions are met. May be hidden behind a	Auxiliary operational information (e.g. station announcement etc.)

Class	Characteristics/Appearance	Use
	message of another class.	
Important Information	Displayed and deleted when specified conditions are met. Shall never be hidden behind a message of another class.	Important operational information (e.g. information about workers on the line etc.).

3.12.3.3 Fixed text messages

3.12.3.3.1 Fixed text messages shall be stored on-board in all languages that can be selected by the driver.

3.12.3.3.2 Intentionally deleted.

3.12.3.3.3 Intentionally deleted.

3.12.3.3.4 Intentionally deleted.

3.12.3.3.5 Intentionally deleted.

3.12.3.4 Conditions for Start/End of Indication

3.12.3.4.1 It shall be possible to specify individual events for start/end condition of indication.

3.12.3.4.2 The following events can be used to define the start condition:

- Location
- Mode (start display as soon as in mode)
- Level (start display as soon as in level)

3.12.3.4.3 The following events can be used to define the end condition:

- Location
- Time
- Mode (stop display when leaving mode)
- Level (stop display when leaving level)

3.12.3.4.3.1 It shall be possible to define whether one or all of the events used from the list in 3.12.3.4.2/3.12.3.4.3 have to be fulfilled to define the start/end condition. This definition shall apply to both start and end conditions.

3.12.3.4.3.2 In case a confirmation of the text message is requested, it shall be possible to define whether the driver acknowledgement is considered:

a) As always ending the text display, regardless of the end condition defined in 3.12.3.4.3.1

b) As a necessary condition to end the text display, in addition to the end condition defined in 3.12.3.4.3.1.

3.12.3.4.4 The end condition shall be evaluated as soon as the start condition is fulfilled. No display shall take place if the end condition is immediately fulfilled.

3.12.3.4.5 Once the text message is displayed and the end condition is fulfilled, the start condition shall not be re-evaluated.

3.12.3.4.6 When the end event "location" is used, the length on which the text is displayed shall refer to the location used for the start condition, independently from other start events.

3.12.3.4.7 In case a confirmation of the text message is requested, it shall be possible to define whether the service brake or emergency brake application shall be commanded if the driver does not acknowledge before the end condition is fulfilled..

3.12.3.4.7.1 If the driver does not acknowledge before the end condition is fulfilled, the text message shall remain displayed until acknowledged by driver.

3.12.3.4.7.2 If the driver acknowledges before the end condition is fulfilled, the on-board equipment shall consider the driver acknowledgement as requested by trackside (see 3.12.3.4.3.2).

3.12.3.4.8 Intentionally deleted.

3.12.3.5 Report of driver acknowledgement to RBC

3.12.3.5.1 If trackside requests a report of driver acknowledgement, then it shall include:

- a text message identifier
- the identity of the RBC to which the driver acknowledgement report is to be sent.

3.12.3.5.2 When the driver has acknowledged a text message with a request to report driver acknowledgement, the driver acknowledgement report, including the text message identifier, shall be sent to the RBC referenced in the request.

3.12.3.5.3 A new text message with request for report of driver acknowledgement shall be rejected by the ERTMS/ETCS on-board equipment if it has the same text message identifier as a previously received text message, which the driver has not yet acknowledged.

3.12.4 Mode profile

3.12.4.1 The Mode Profile can request On Sight mode, Limited Supervision mode and Shunting mode.

3.12.4.2 For OS and LS mode the mode profile shall define the entry and the length of the On Sight/Limited Supervision area. For SH mode the mode profile only defines the entry location to SH mode, any length given shall be ignored by the on-board.

3.12.4.3 On reception of a new MA (with or without Mode Profile) the on-board equipment shall delete the currently supervised Mode Profile.

3.12.4.3.1 Exception: When receiving a new MA by infill, any currently supervised Mode Profile shall be deleted only beyond the reference location of the infill information.

3.12.4.4 In case the mode profile information for shunting is overwritten by a new shunting profile, before the on-board equipment switches to SH mode, a previous list of balise groups for SH area shall be deleted or replaced by a new list of balise groups for SH area.

3.12.4.5 The beginning of the Mode Profile relates to the max safe front end of the train.

3.12.4.6 The end of the mode profile relates to the min safe front end of the train.

3.12.5 Level Crossings

3.12.5.1 It shall be possible for trackside to inform the ERTMS/ETCS on-board equipment about the conditions under which a Level Crossing (LX) must be passed.

3.12.5.2 Each Level Crossing shall have an identity, so that all LX information shall be independent of each other. This means that an individual LX information shall not affect, nor be affected by, any other individual LX information.

3.12.5.3 If the ERTMS/ETCS on-board equipment receives a new LX information with the same identity as an already received LX information, the new LX information shall replace the previous one.

3.12.5.4 Level Crossing information shall be given as profile data, corresponding to the LX start location and the length of the LX area.

3.12.5.5 Level Crossing information shall indicate whether the LX is protected or not.

3.12.5.6 In case the LX is not protected, ERTMS/ETCS on-board equipment shall be informed:

a) at which speed the LX is allowed to be passed

b) whether the stopping of the train in rear of the LX start location is required or not

3.12.5.7 In case stopping in rear of the non protected LX is required, a stopping area in rear of the LX start location shall be defined.

3.13 Speed and distance monitoring

3.13.1 Introduction

3.13.1.1 The speed and distance monitoring is the supervision of the speed of the train versus its position, in order to assure that the train remains within the given speed and distance limits.

3.13.1.1.1 Note: The speed and distance monitoring of the on-board can only assure this when the following necessary conditions are fulfilled:

- Brake system of the train functions as specified
- wheel/rail adhesion is sufficient for the required safe deceleration

- Brake characteristics (and other Train Data) are correctly entered into the on-board (automatic or by driver)

3.13.1.2 Note: The ERTMS/ETCS on-board equipment triggers brake commands and revokes them, it may also receive status information if the brakes are applied or released. However, it cannot be made responsible if brake control circuits outside the equipment fail. Also the way the brakes are released by the driver after a revocation of a brake command is an implementation issue.

3.13.1.3 Figure 28 gives an overview of the main elements contributing to the speed and distance monitoring. These elements (inputs, functions and outputs) are detailed in the following chapters.

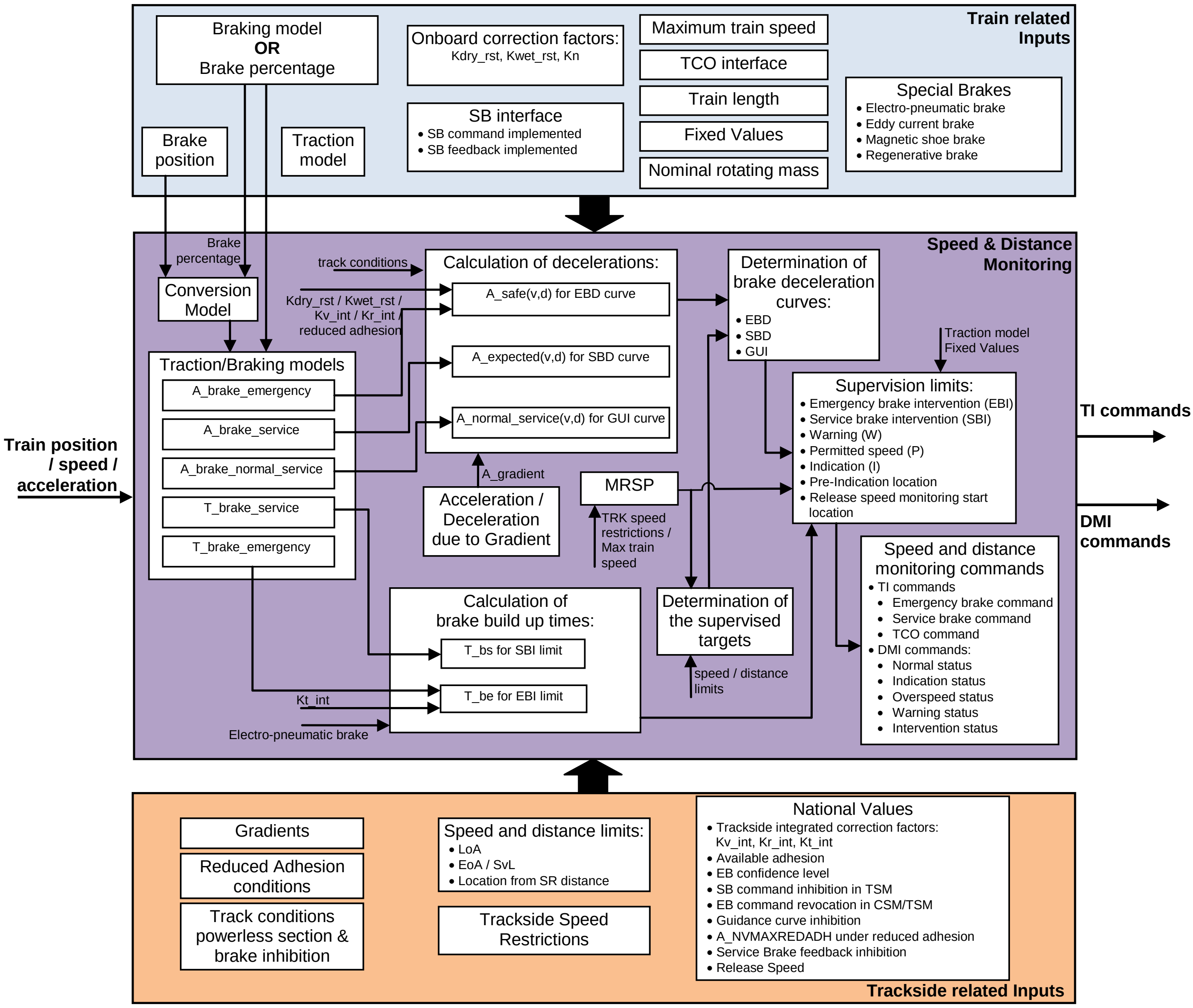


Figure 28: Speed and distance monitoring overview

3.13.1.4 Throughout the following sections, all the distances marked with “d” (lower case), which are referred in parameters, formulas and figures, are counted from the current reference location of the on-board equipment (e.g. the LRBG).

3.13.2 Inputs for speed and distance monitoring

3.13.2.1 Introduction

3.13.2.1.1 The traction / braking models, the brake position / brake percentage are used for the definition of the kinematic behaviour of the train after a service brake command or an emergency brake command has been initiated.

3.13.2.1.2 However, railway brakes have a statistical behaviour and braking distances vary within the typical distribution for a given condition. Correction factors are therefore incorporated for the speed and distance monitoring.

3.13.2.1.3 The correction factors will allow obtaining, from the nominal emergency braking performance of the train, the minimum emergency braking performances that are required for reference conditions set by trackside.

3.13.2.2 Train related inputs

3.13.2.2.1 Introduction

3.13.2.2.1.1 The train related inputs to be considered for the speed and distance monitoring are:

a) Traction model

b) Braking models (brake build up time and speed dependent deceleration) or brake percentage

c) Brake position

d) Special brakes

e) Service brake interface

f) Traction cut-off interface

g) On-board correction factors

h) Nominal rotating mass

i) Train length

j) Fixed values related to speed and distance monitoring

k) Train related speed restriction (i.e. the maximum train speed)

3.13.2.2.1.2 All train related inputs except the fixed values are acquired as Train Data (see 3.18.3.2 items b) c) and d)).

3.13.2.2.1.3 The speed and distance monitoring shall use braking models acquired as Train Data, unless the brake percentage is acquired as Train Data and the conversion model is applicable (see 3.13.3.2 for its validity limits).

3.13.2.2.2 Traction model

3.13.2.2.2.1 The traction model shall be given as a step function as indicated in Figure 29. It shall describe the time delay T_traction_cut_off from the traction cut-off command by the on-board (t0) to the moment the acceleration due to traction (A_traction) is guaranteed to be zero (t1). The estimated acceleration value of the train shall be considered during this time delay.

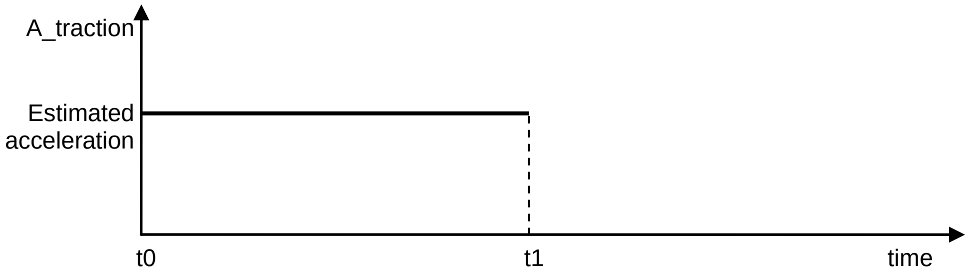


Figure 29: Traction Model

3.13.2.2.2.2 Note: The current value of A_traction is not known directly by the on-board. It is implicitly known as a contribution to the estimated acceleration, together with the acceleration due to gradient.

3.13.2.2.3 Braking Models

3.13.2.2.3.1 Speed Dependent Deceleration

3.13.2.2.3.1.1 The deceleration due to braking shall be given as a step function of the speed.

3.13.2.2.3.1.2 It shall be possible to define up to seven steps for each speed dependent deceleration model.

3.13.2.2.3.1.3 Note: An example with 4 steps is given in Figure 30. A_brake(V) is calculated as follows:

- A_brake = AD_0 when 0 ≤ speed ≤ V1
- A_brake = AD_1 when V1 < speed ≤ V2
- A_brake = AD_2 when V2 < speed ≤ V3
- A_brake = AD_3 when V3 < speed

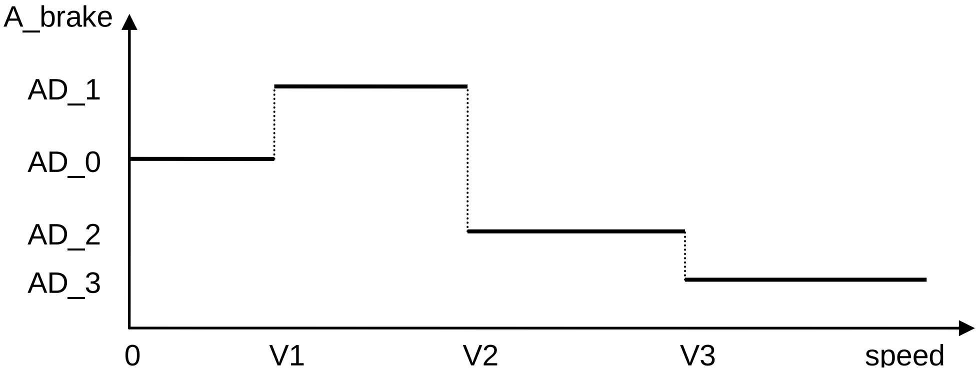


Figure 30: Speed Dependent Deceleration Model

3.13.2.2.3.1.4 The last step of A_brake(V) shall by definition be considered as open ended, i.e. it has no upper speed limit.

3.13.2.2.3.1.5 The model shall be applicable only after full build up of the braking effort (see a_full in Figure 31)

3.13.2.2.3.1.6 The model shall be used for the emergency brake nominal deceleration (A_brake_emergency(V)), for the full service brake deceleration (A_brake_service(V)) and for the normal service brake deceleration (A_brake_normal_service(V)).

3.13.2.2.3.1.7 It shall be possible to define individual speed dependent deceleration models of A_brake_emergency(V) and A_brake_service(V) for each combination of use of regenerative brake, eddy current brake and magnetic shoe brake.

3.13.2.2.3.1.8 Note: Individual deceleration models may be equal, thereby avoiding the influence of a specific brake on A_brake_emergency(V) or A_brake_service(V). However, the choice to take into account or not the contribution of a specific brake for A_brake_emergency(V) or A_brake_service(V) is only rolling stock dependent, not an ETCS implementation issue.

3.13.2.2.3.1.9 It shall be possible to define up to two sets of three models of A_brake_normal_service(V):

a) one set applicable when the brake position is in “Freight train in G”

b) one set applicable when the brake position is in “Passenger train in P” or “Freight train in P”

3.13.2.2.3.1.10 A set of A_brake_normal_service(V) shall be defined as a function of the full service brake deceleration at zero speed, A_brake_service(V=0):

If A_brake_service(V = 0) ≤ A_SB01

A_brake_normal_service(V) = A_brake_normal_service_0(V) if A_SB01 < A_brake_service(V = 0) ≤ A_SB12

A_brake_normal_service(V) = A_brake_normal_service_1(V)

if A_SB12 < A_brake_service (V = 0)

A_brake_normal_service(V) = A_brake_normal_service_2(V)

3.13.2.2.3.1.11 Note: the two pivot values A_SB01 and A_SB12 are part of the A_brake_normal_service model, i.e. they are train related input data for the speed and distance monitoring function.

3.13.2.2.3.2 Brake build up time

3.13.2.2.3.2.1 The deceleration A_brake is not available immediately after the on-board commands the brake. There is a time lag between brake command and the start of the brake force build-up. There is also time needed to build up the full brake force.

3.13.2.2.3.2.2 The model for the brake build up time shall be given as a step function as explained in Figure 31.

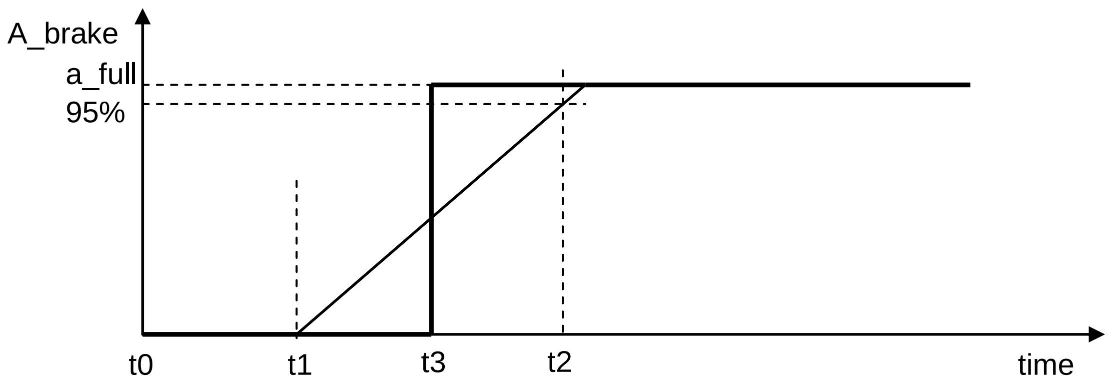


Figure 31: Brake Build Up Time Model

3.13.2.2.3.2.3 In Figure 31, the following time intervals are defined:

a) T_brake_react (t0…t1) is the interval between the command of the brake by the on-board and the moment the brake force starts to build up.

b) T_brake_increase (t1...t2) is the interval in which the brake force increases from the zero to the moment when 95% of full brake power is reached.

c) T_brake_build_up (t0...t3) is the equivalent brake build up time.

3.13.2.2.3.2.4 The equivalent brake build up time (T_brake_build_up) is defined as T_brake_build_up = T_brake_react + 0.5*T_brake_increase.

3.13.2.2.3.2.5 This model for T_brake_build_up shall be used for the emergency brake (T_brake_emergency) and for the full service brake (T_brake_service).

3.13.2.2.3.2.6 Note: The equivalent brake build up time is a safe approximation. In the beginning of the build-up time the model assumes a smaller deceleration, in the later part this is compensated by a higher deceleration.

3.13.2.2.3.2.7 Note: T_brake_react and T_brake_increase are indicated in Figure 31 for completeness reasons; only T_brake_build_up is to be considered as an input for the speed and distance monitoring function.

3.13.2.2.3.2.8 It shall be possible to define individual values of T_brake_emergency and T_brake_service for each combination of use of regenerative brake, eddy current brake, magnetic shoe brake and Ep brake.

3.13.2.2.3.2.9 Note: Individual values of T_brake_emergency and T_brake_service may be equal, thereby avoiding the influence of a specific brake. However, the choice to take into account or not the contribution of a specific brake for T_brake_emergency and T_brake_service is only rolling stock dependent, not an ETCS implementation issue.

3.13.2.2.3.2.10 Note: In general, T_brake_emergency and T_brake_service are determined by the pneumatic brake therefore avoiding to take into account of the influence of the regenerative brake, eddy current brake or magnetic shoe brake. However, if the Electro-pneumatic brake system is used, it is possible that T_brake_emergency and T_brake_service are determined by another special brake.

3.13.2.2.4 Brake Position

3.13.2.2.4.1 The brake position shall be set to one of the following three values:

a) Passenger train in P

b) Freight train in P

c) Freight train in G

3.13.2.2.4.2 Note: The brake position defines the behaviour of the brake for specific train types.

3.13.2.2.5 Brake Percentage

3.13.2.2.5.1 If the brake percentage is captured as Train Data and the conversion model is applicable (see 3.13.3.2), they are used to derive A_brake_emergency(V), A_brake_service(V), T_brake_emergency and T_brake_service.

3.13.2.2.5.2 Note: the conversion model has been designed assuming that all the provisions laid down in the UIC leaflet 544-1, with the exception of sections 9.1.2 and 9.2.2, apply for the acquired brake percentage.

3.13.2.2.6 Special Brakes

3.13.2.2.6.1 For each special brake (regenerative brake, eddy current brake, magnetic shoe brake and electro-pneumatic brake), it shall be possible to configure the on-board to one of the following possibilities marked with an "X" in Table 3

		configuration possibilities			
		No interface exists	*Interface exists and status affects the emergency brake model only*	*Interface exists and status affects the service brake model only*	*Interface exists and status affects both emergency and service brake models*
Special brake	regenerative brake	x	x	x	x
	eddy current brake	x	x	x	x
	magnetic shoe brake	x	x		
	Ep brake	x		x	x

Table 3: On-board Configuration in relation to special brakes

3.13.2.2.6.2 When an interface exists with the regenerative brake, eddy current brake, magnetic shoe brake system and/or the Ep brake on-board system and depending whether their status affects the concerned brake parameter(s), the speed and distance monitoring shall take into account their status "active" or "not active" to select the appropriate brake parameter(s) captured as Train Data, according to Table 4:

		When interface exists and if status affects the brake parameter, selection of brake parameter according to status of:			
		regenerative brake	eddy current brake	magnetic shoe brake	Ep brake
Brake parameter	A_brake_emergency(V)	x	x	x	
	T_brake_emergency	x	x	x	x
	A_brake_service(V)	x	x		
	T_brake_service	x	x		x

Table 4: Selection of brake parameters according to status of special brakes

3.13.2.2.6.3 When the brake percentage is captured as Train Data and the conversion model is applicable, A_brake_emergency(V), T_brake_emergency and A_brake_service(V) shall not be influenced by the status of a special brake. However, the conversion model offers the possibility that T_brake_service can be affected by the status of the regenerative brake, eddy current brake or Ep brake (see A.3.9).

3.13.2.2.6.4 The on-board equipment shall be configured to define whether it is allowed to take into account the contribution of a special/additional brake, which is independent from wheel/rail adhesion, for the selection of the maximum emergency brake deceleration under reduced adhesion conditions (see 3.13.6.2.1.6).

3.13.2.2.6.5 Note: the choice to set to “allowed” the contribution of such special/additional brake in the selection of the maximum emergency braking effort, is rolling stock dependent.

3.13.2.2.6.6 If it is allowed to take into account the contribution of a special/additional brake, which is independent from wheel/rail adhesion, the speed and monitoring function shall take into account the status “active” or “not active” of the special/additional brake to select the appropriate National Value under reduced adhesion conditions (see 3.13.2.3.7.7).

3.13.2.2.7 Service brake interface

3.13.2.2.7.1 The on-board shall be configured to define whether the service brake command is implemented or not, i.e. whether a service brake interface is implemented to command a full service brake effort.

3.13.2.2.7.2 The on-board shall be configured to define whether the service brake feedback is implemented or not, i.e. whether it is able to acquire from the service brake interface the information that the service brake is currently applied (e.g. from the main brake pipe pressure or brake cylinder pressure).

3.13.2.2.8 Traction cut-off interface

3.13.2.2.8.1 The on-board shall be configured to define whether the traction cut-off command is implemented, i.e. whether the interface to the traction system is implemented or not.

3.13.2.2.9 On-board Correction Factors

3.13.2.2.9.1 Correction factors for the emergency deceleration

3.13.2.2.9.1.1 If the braking models are captured as Train Data, rolling stock correction factors shall be defined in the ETCS on-board equipment. If the brake percentage is captured as Train Data and the conversion model is used (see 3.13.3.2 for its validity limits), no rolling stock correction factor shall apply.

3.13.2.2.9.1.2 For each defined individual speed dependent deceleration model of A_brake_emergency(V) (i.e. corresponding to each combination of use of regenerative brake, eddy current brake and magnetic shoe brake), one set of rolling stock correction factors Kdry_rst(V, EBCL) and Kwet_rst(V) shall be defined in the on-board equipment.

3.13.2.2.9.1.3 For a given confidence level on emergency brake safe deceleration (EBCL), the rolling stock correction factor Kdry_rst(V) shall be given as a step function of speed, with the same steps as the ones of A_brake_emergency(V).

3.13.2.2.9.1.4 The confidence level on emergency brake safe deceleration represents the probability of the following individual event: the rolling stock emergency brake subsystem of the train does ensure a deceleration at least equal to A_brake_emergency(V) * Kdry_rst(V), when the emergency brake is commanded on dry rails.

3.13.2.2.9.1.5 The rolling stock correction factor Kwet_rst(V) shall be given as a step function of speed, with the same steps as the ones of A_brake_emergency(V). It represents the loss of deceleration with regards to emergency braking on dry rails, when the emergency brake is commanded on wet rails, according to wheel/rail adhesion reference conditions.

3.13.2.2.9.2 Correction factor for gradient on normal service deceleration

3.13.2.2.9.2.1 The speed dependent correction factors for gradient on the normal service brake, Kn+(V) and Kn-(V), shall be given as step functions in the range from 0 to 10 m/s2.

3.13.2.2.9.2.2 It shall be possible to define up to five steps for Kn+(V) and for Kn-(V), respectively.

3.13.2.2.9.2.3 Note: An example with 4 steps is given in Figure 32. Kn is calculated as follows:

- Kn = Kn_0 when 0 ≤ speed ≤ V1
- Kn = Kn_1 when V1 < speed ≤ V2
- Kn = Kn_2 when V2 < speed ≤ V3
- Kn = Kn_3 when V3 < speed

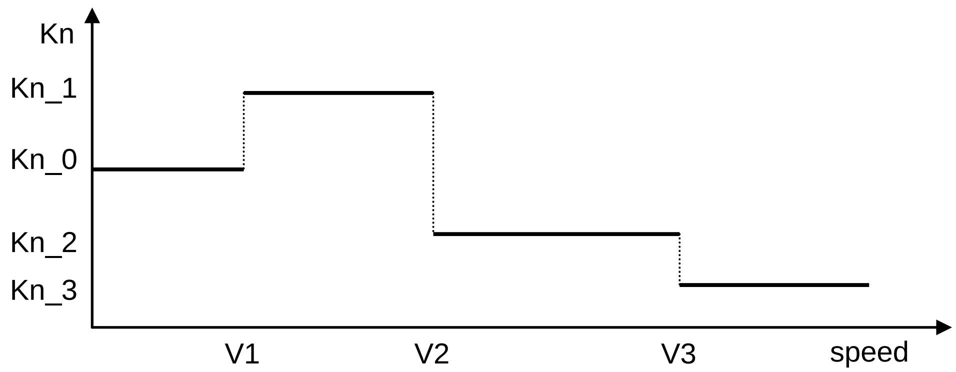


Figure 32 Speed dependent correction factor for normal service brake (Kn)

3.13.2.2.9.2.4 Kn+(V) shall be applicable for positive gradients.

3.13.2.2.9.2.5 Kn-(V) shall be applicable for negative gradients.

3.13.2.2.9.2.6 The last step of the Kn+(V) or Kn-(V) shall by definition be considered as open ended, i.e. it has no upper speed limit.

3.13.2.2.10 Nominal Rotating mass

3.13.2.2.10.1 It shall be possible to define the nominal rotating mass to be used for compensating the gradient, instead of the two related fixed values defined in A3.1.

3.13.2.2.11 Train length

3.13.2.2.11.1 The speed and distance monitoring shall take into account the train length acquired as part of Train Data (see section 3.18.3).

3.13.2.2.12 Fixed values

3.13.2.2.12.1 The speed and distance monitoring shall take into account the fixed values defined in A3.1 that are related to speed and distance monitoring.

3.13.2.2.13 Maximum train speed

3.13.2.2.13.1 The speed and distance monitoring shall take into account the maximum train speed defined as part of Train Data (see section 3.18.3).

3.13.2.3 Trackside related inputs

3.13.2.3.1 Introduction

3.13.2.3.1.1 The trackside related inputs to be considered for the speed and distance monitoring are:

a) Trackside related speed restrictions

b) Gradients

c) Track conditions related to brake inhibition

d) Track conditions related to powerless section

e) Reduced adhesion conditions

f) Specific speed and distance limits (e.g. EOA/SvL)

g) National Values

3.13.2.3.2 Trackside related speed restrictions

3.13.2.3.2.1 The speed and distance monitoring shall take into account the trackside related speed restrictions composed of all speed restrictions mentioned in 3.11.2 except the maximum train speed.

3.13.2.3.3 Gradients

3.13.2.3.3.1 The speed and distance monitoring shall take into account the gradient profile and the default gradient for TSR (see section 3.11.12).

3.13.2.3.4 Track conditions

3.13.2.3.4.1 The speed and distance monitoring shall take into account the following types of track condition received from trackside (see section 3.12.1): powerless section, inhibition of regenerative brake, eddy current brake and magnetic shoe brake.

3.13.2.3.5 Reduced adhesion conditions

3.13.2.3.5.1 The speed and distance monitoring shall take into account the track reduced adhesion received from trackside or selected by the driver (see section 3.18.4.6).

3.13.2.3.6 Specific speed / distance limits

3.13.2.3.6.1 The speed and distance monitoring shall take into account the following limits:

a) the Limit of Authority (LOA), the End of Authority (EOA), the Supervised Location (SvL) and its associated release speed, if any.

b) the maximum permitted distance to run in Staff Responsible

3.13.2.3.7 National Values for speed and distance monitoring

3.13.2.3.7.1 It shall be possible by means of a National Value to inhibit the use of the service brake command in target speed monitoring.

3.13.2.3.7.2 It shall be possible to state by means of a National Value whether an emergency brake command has to be revoked, both in ceiling speed and target speed monitoring, when:

a) the Permitted Speed supervision limit is no longer exceeded, or

b) the train is at standstill.

3.13.2.3.7.3 It shall be possible by means of a National Value to inhibit the guidance curve (GUI).

3.13.2.3.7.4 It shall be possible by means of a National Value to inhibit the service brake feedback function.

3.13.2.3.7.5 It shall be possible by means of National Values to indicate to the on-board equipment the required confidence level on the emergency brake safe deceleration, when the emergency brake is commanded on dry rails (see 3.13.2.2.9.1.4).

3.13.2.3.7.6 It shall be possible by means of a National Value to indicate to the on-board equipment the available wheel/rail adhesion, weighted between the wheel/rail adhesion for dry rails and the wheel/rail adhesion for wet rails according to reference conditions.

3.13.2.3.7.7 In order to adapt the train behaviour under reduced adhesion conditions, it shall be possible by means of National Values to limit to a maximum value the speed dependent deceleration for the emergency brake. Three values shall be applicable for a given combination of the brake position and of the type of brakes:

a) the first value shall be used for “Passenger train in P” with special/additional brakes independent from wheel/rail adhesion;

b) the second value shall be used for “Passenger train in P” without special/additional brakes independent from wheel/rail adhesion;

c) the third value shall be used for “Freight train in P” or “Freight train in G”.

3.13.2.3.7.8 It shall be possible by means of a National Value to specify a release speed.

3.13.2.3.7.9 It shall be possible by means of a National Value to inhibit the compensation of the speed measurement inaccuracy.

3.13.2.3.7.10 It shall be possible by means of National Values to define integrated correction factors, namely Kv_int(V), Kr_int(l) and Kt_int. The integrated correction factors only apply to the on-board equipment when the conversion model is used.

3.13.2.3.7.11 The speed dependent correction factor, Kv_int(V), shall be given as a step function.

3.13.2.3.7.11.1 It shall be possible to define up to five steps for Kv_int(V).

3.13.2.3.7.11.2 Note: An example with 4 steps is given in Figure 33. Kv_int is calculated as follows:

- Kv_int = Kv_int_0 when 0 ≤ speed ≤ V1
- Kv_int = Kv_int_1 when V1 < speed ≤ V2
- Kv_int = Kv_int_2 when V2 < speed ≤ V3
- Kv_int = Kv_int_3 when V3 < speed

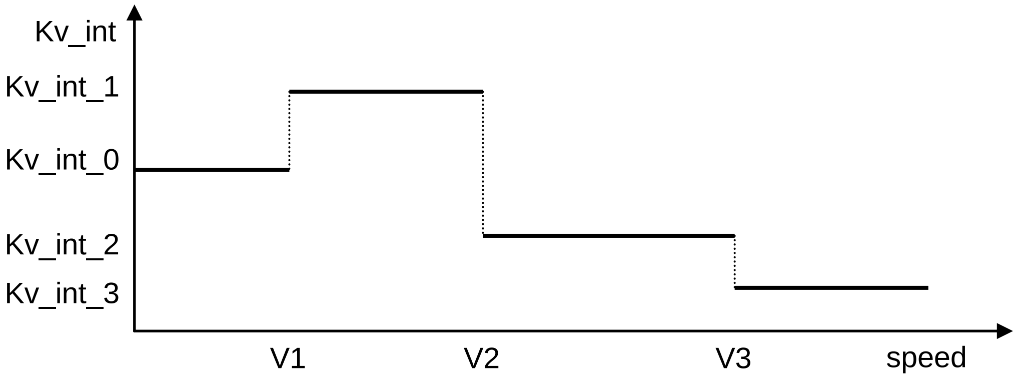


Figure 33 Speed dependent correction factor Kv_int

3.13.2.3.7.11.3 It shall be possible to define up to 2 sets of Kv_int with separate speed limits V1, V2, .. for each set. The sets of Kv_int relate to the following train types:

1) Freight trains
2) Conventional passenger trains

3.13.2.3.7.11.3.1 Note: Different sets of Kv_int are needed for different types of trains in order to compensate the absence of the rolling stock related correction factors when the conversion model is used.

3.13.2.3.7.11.4 The set of Kv_int for conventional passenger trains shall be divided into two sub sets Kv_int_x_a and Kv_int_x_b, with identical speed limits V1, V2, ...

3.13.2.3.7.11.5 Subset Kv_int_x_a shall be applicable for maximum emergency brake deceleration lower or equal to a deceleration limit, defined as a National Value.

3.13.2.3.7.11.6 Subset Kv_int_x_b shall be applicable for maximum emergency brake deceleration greater or equal to a deceleration limit, defined as a National Value.

3.13.2.3.7.12 The train length dependent correction factor, Kr_int(l), shall be given as a step function.

3.13.2.3.7.12.1 It shall be possible to define up to five steps for Kr_int(l).

3.13.2.3.7.12.2 Note: An example with 4 steps is given in Figure 34. Kr_int is calculated as follows:

- Kr_int = Kr_int_0 when 0 ≤ train length ≤ L1
- Kr_int = Kr_int_1 when L1 < train length ≤ L2
- Kr_int = Kr_int_2 when L2 < train length ≤ L3
- Kr_int = Kr_int_3 when L3 < train length

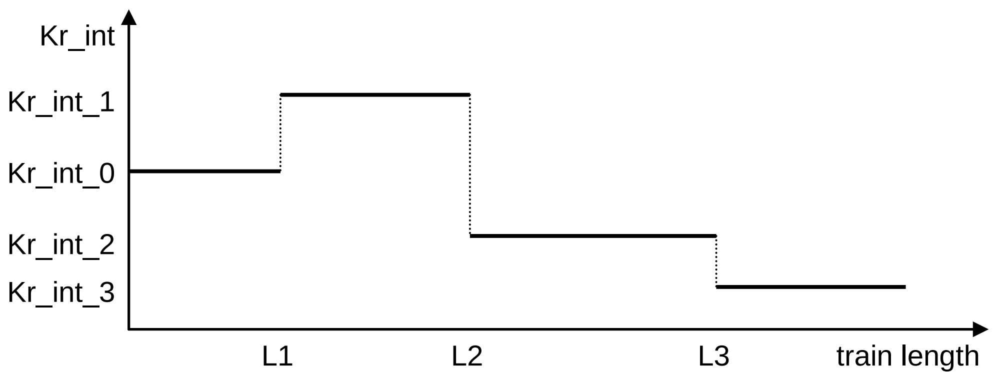


Figure 34 Train length dependent correction factor Kr_int

3.13.2.3.7.13 The last step of the Kv_int(V) and Kr_int(l) shall by definition be considered as open ended, i.e. it has no upper speed and train length limit, respectively.

3.13.2.3.7.14 The correction factor for brake build up time (Kt_int) shall be a single parameter.

3.13.3 Conversion Models

3.13.3.1 Introduction

3.13.3.1.1 For trains with variable composition (loco hauled trains), the brake characteristics can vary together with the composition of the train. In this case, it is not convenient to pre-program the brake parameters necessary to calculate the braking curves. The only practical way to obtain the correct values for the current train composition is to include them into the data entry process by the driver. However, it cannot be expected from the driver to know deceleration values and brake build up times. Conversion models are therefore defined to convert the parameters entered by the driver (brake percentage and brake position) into the parameters of the corresponding brake model.

3.13.3.1.2 Note: The process for defining the input parameters for the conversion model (brake percentage and brake position) is outside the scope of the ERTMS/ETCS specifications.

3.13.3.2 Applicability of the conversion models

3.13.3.2.1 The conversion models shall be used by the on-board equipment if the brake percentage is acquired as part of Train Data, and if the maximum train speed, the brake percentage and the train length are all within the following validity limits of the conversion models:

a) $0 \le V \le 200$, where V is the maximum train speed in km/h

b) $30 \le \lambda \le 250$, where λ is the brake percentage in %

c) $0 \le L \le Lmax$, where L is the train length in m and where Lmax = 900 m if the brake position is “Passenger train in P” or Lmax = 1500 m if the brake position is “Freight train in P” or “Freight train in G”

3.13.3.2.1.1 Note: The overspeed above the maximum train speed which may occur due to the ceiling speed margins is taken into account in the definition of the conversion model.

3.13.3.2.2 For trains not fitting into at least one of those validity limits, it is still possible to acquire the brake percentage as Train Data, but the conversion models are not applicable, which means that braking models (i.e. pre-programmed deceleration profiles and brake build up times) shall be used by the speed and distance monitoring function.

3.13.3.3 Brake percentage conversion model

3.13.3.3.1 Input parameters

3.13.3.3.1.1 The input for the model shall be the brake percentage of the train as defined in 3.13.2.2.5.

3.13.3.3.2 Calculation of the basic deceleration

3.13.3.3.2.1 The basic deceleration A_basic(V) shall be given as a step function of the speed using the algorithm defined in Appendix A3.7.

3.13.3.3.3 Output parameters

3.13.3.3.3.1 The output of the brake percentage conversion model shall consist of two speed dependent deceleration brake models, A_brake_emergency(V) for the emergency brake and A_brake_service(V) for the service brake.

3.13.3.4 Brake position conversion model

3.13.3.4.1 Input parameters

3.13.3.4.1.1 The input for the model shall consist of the brake position of the train as defined in 3.13.2.2.4, the train length and the target speed.

3.13.3.4.2 Calculation of the emergency brake equivalent time

3.13.3.4.2.1 The equivalent brake build up time for the emergency brake shall be determined as specified in Appendix A3.8.

3.13.3.4.3 Calculation of the full service brake equivalent time

3.13.3.4.3.1 The equivalent brake build up time for the full service brake shall be determined as specified in Appendix A3.9.

3.13.3.4.4 Output parameters

3.13.3.4.4.1 The outputs of the brake position conversion model shall consist of:

a) two values of the equivalent brake build up time to be used when the target speed (V_target) is equal to zero, one value for the emergency brake and one for the full service brake:

   T_brake_emergency_cm0 as defined for emergency brake in A3.8

   T_brake_service_cm0 as defined for service brake in A3.9

b) two values of the equivalent brake build up time to be used when the target speed (V_target) is different from zero, one value for the emergency brake and one for the full service brake:

   T_brake_emergency_cmt as defined for emergency brake in A3.8

   T_brake_service_cmt as defined for service brake in A3.9

3.13.4 Acceleration / Deceleration due to gradient

3.13.4.1 Introduction

3.13.4.1.1 The elements of the gradient profile given from trackside shall be compensated:

a) in location according to the train length as defined in 3.13.4.2

b) in value according to the rotating mass as defined in 3.13.4.3 in order to derive the corresponding acceleration/deceleration.

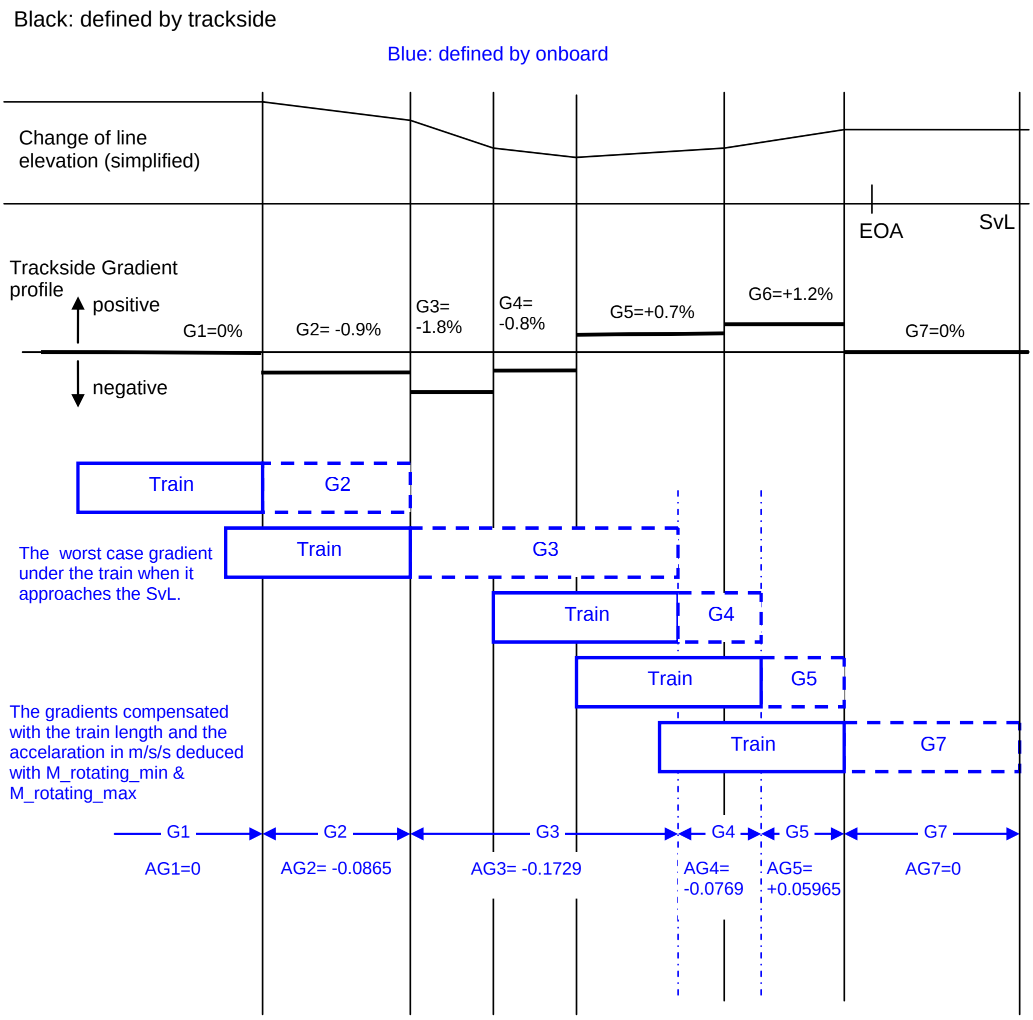


Figure 35: Compensation on the gradient profile

3.13.4.1.2 The default gradient for TSR shall be compensated in value according to the rotating mass as defined in 3.13.4.3.

3.13.4.1.3 For all locations not covered by the gradient profile, the on-board shall consider the gradient value as:

a) the default gradient for TSR, if available and if the concerned target is due to a TSR

b) zero, for other cases.

3.13.4.2 Train length compensation

3.13.4.2.1 Assuming that a fictive train front end would be at any location between the current (actual) train front end location and the SvL, the acceleration due to the gradient shall be determined using the lowest (taking the sign into account) gradient value given by the gradient profile between the location of the fictive train front end and the location of the fictive train rear end (see Figure 35).

3.13.4.3 Rotating mass

3.13.4.3.1 The influence of gradients shall be compensated for the rotating mass of the train (see Figure 35).

3.13.4.3.1.1 Note: Since the rotating mass works like a flywheel (rotating inertia), the effect of the gradient is reduced. Assume for instance a (theoretical) train without any rotating mass, not braking, on a downhill gradient from height 1 to height 2. All the energy added to the train when it goes from H1 to H2 is converted into linear forward motion. This can be observed as an acceleration due to the gradient. Now assume the same train with part of the weight rotating. If this train travels the same distance from H1 to H2, the same amount of energy is added to the train. But now a part of that energy is converted into rotational motion and only the remaining part is converted into linear forward motion. The latter can be observed as an acceleration which is less than for the train without rotating mass.

3.13.4.3.1.2 Note: For the influence of the rotating mass on the deceleration due to the brake, it is already taken into account in the values for the brake parameters.

3.13.4.3.2 The following formulas shall be used:

a) If M_rotating_nom is unknown:

- Uphill: A_gradient = g * grad / (1000+10*M_rotating_max)
- Downhill: A_gradient = g * grad / (1000+10*M_rotating_min)

b) If M_rotating_nom is known:

- Uphill: A_gradient = g * grad / (1000+10*M_rotating_nom)
- Downhill: A_gradient = g * grad / (1000+10*M_rotating_nom)

Legend:

A_gradient = acceleration/deceleration due to gradient

g = 9.81 m/s^2 - acceleration of gravity in m/s^2

grad = gradient values in ‰ (positive = uphill)

M_rotating_nom = nominal rotating mass (part of train data) as a percentage of the total train weight

M_rotating_max = maximum possible rotating mass (see A3.1) as a percentage of the total train weight

M_rotating_min = minimum possible rotating mass (see A3.1) as a percentage of the total train weight

3.13.5 Determination of locations without special brake contribution and with reduced adhesion conditions

3.13.5.1 As long as it uses a track condition profile given by trackside, the on-board shall consider locations without special brake contribution over a distance going from the start location of the profile to the foot of the deceleration curve (EBD, SBD or GUI, see sections 3.13.8.3, 3.13.8.4 and 3.13.8.5).

3.13.5.2 If the status of a special brake is “not active”, all locations shall be considered without the contribution of this special brake.

3.13.5.2.1 Note: in such case, a track condition profile implying the inhibition of this special brake will have no effect.

3.13.5.3 From the adhesion profile given by trackside, the on-board shall consider locations with reduced adhesion conditions over a distance going from the start location of the profile to the location derived by adding the train length to the end location of the profile.

3.13.5.4 When slippery rail is selected by the driver, all locations shall be considered with reduced adhesion conditions.

3.13.5.5 The speed and distance monitoring shall use, as resulting reduced adhesion conditions, the most restrictive value of the adhesion conditions selected by the driver and the adhesion conditions calculated from the trackside profile.

3.13.6 Calculation of the deceleration and brake build up time

3.13.6.1 Introduction

3.13.6.1.1 This chapter describes how the safe emergency brake, the expected and the normal service brake decelerations and the time intervals due to brake build up time are calculated.

3.13.6.2 Emergency brake

3.13.6.2.1 Safe deceleration

3.13.6.2.1.1 The safe deceleration, A_safe(V,d), is safety relevant. This means that for the calculation of the safe deceleration, all necessary track and train characteristics shall be taken into account.

3.13.6.2.1.2 The train and track related characteristics to be considered are:

a) The speed dependent deceleration model(s) for the emergency brake either acquired as part of Train Data (see 3.13.2.2.3.1) or derived from the brake percentage using the conversion model (see 3.13.3.3)

b) The acceleration/deceleration due to gradient i.e. A_gradient(d) (see 3.13.4)

c) The locations with reduced adhesion conditions (see 3.13.5)

d) The National Values for reduced adhesion condition (see 3.13.2.3.7.7)

e) The locations without special brake contribution (see 3.13.5), only if the speed dependent deceleration model(s) for the emergency brake are acquired as part of Train Data

f) The rolling stock correction factors Kdry_rst(V, EBCL) and Kwet_rst(V) (see 3.13.2.2.9.1), only if the speed dependent deceleration model(s) for the emergency brake are acquired as part of Train Data

g) The National Values for confidence level on emergency brake safe deceleration and for the available wheel/rail adhesion (see 3.13.2.3.7.5 & 3.13.2.3.7.6), only if the speed dependent deceleration model(s) for the emergency brake are acquired as part of Train Data

h) The integrated correction factors Kv_int(V) (with the two pivot deceleration values for passenger trains) and Kr_int(l) (see 3.13.2.3.7), only if the conversion model is used

i) The brake position (see 3.13.2.2.4)

j) The acquired train length L_TRAIN (see 3.13.2.2.11), only if the conversion model is used

3.13.6.2.1.3 A_safe(V,d) shall be equal to:

For locations with normal adhesion conditions:

A_safe(V,d) = A_brake_safe(V,d) + A_gradient(d)

For locations with reduced adhesion conditions:

A_safe(V,d) = MIN(A_brake_safe(V,d) , A_MAXREDADH) + A_gradient(d)

3.13.6.2.1.4 A_brake_safe(V,d) shall be the safe emergency brake deceleration. A_brake_safe(V,d) shall be equal to:

If the speed dependent deceleration model(s) for the emergency brake are acquired as part of Train Data:

A_brake_safe(V,d) = Kdry_rst(V, M_NVEBCL) * (Kwet_rst(V) + M_NVAVADH *(1- Kwet_rst(V))) * A_brake_emergency(V,d)

If the conversion model is used:

A_brake_safe(V) = Kv_int(V) * Kr_int(L_TRAIN) * A_brake_emergency(V)

3.13.6.2.1.5 A_brake_emergency(V,d) shall be the emergency brake deceleration as a function of the speed, of the locations with change of special brake(s) contribution encountered between the train front and the foot of the EBD curve. A_brake_emergency(V,d) shall be equal to:

A_brake_emergency$_1$(V) when $d_{estfront} \le d \le d_1$

A_brake_emergency$_2$(V) when $d_1 < d \le d_2$

A_brake_emergency$_3$(V) when $d_2 < d \le d_3$

....

Where

d_1, d_2, d_3,... are the locations with change of special brake(s) contribution

$A\_brake\_emergency_x(V)$ is equal to the emergency brake model, A_brake_emergency, applicable for the concerned combination of brake.

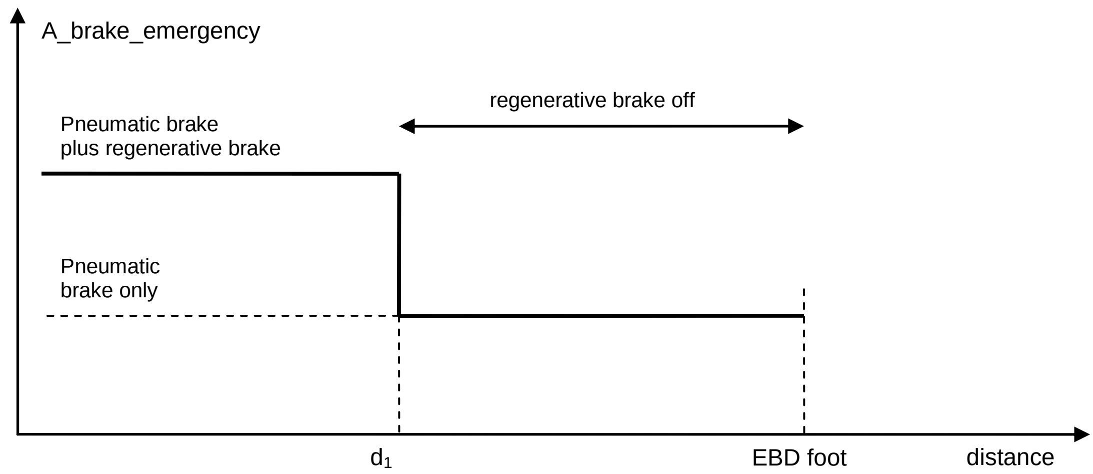


Figure 36: Influence of track conditions on A_brake_emergency(V,d)

3.13.6.2.1.6 A_MAXREDADH shall be the deceleration value, out of the three related National Values, applicable for this train according to:

a) its brake position

b) whether special/additional brakes independent from wheel/rail adhesion are active and it is allowed to take into account their contribution to the emergency braking effort.

3.13.6.2.1.7 Kdry_rst(V, M_NVEBCL) shall be the rolling stock correction factor, as a function of speed (with speed steps identical with the ones of A_brake_emergency(V)), corresponding to the confidence level on emergency brake safe deceleration required by trackside (National Value).

3.13.6.2.1.8 Kv_int(V) shall be the integrated correction factor applicable for the train, selected according to the brake position.

3.13.6.2.1.8.1 If the brake position is “Passenger train in P”, the set of Kv_int shall be calculated as a function of the maximum emergency brake deceleration (A_ebmax) in the following way (see also figure 10):

Kv_int_x = Kv_int_x_a when A_ebmax ≤ A_P12.

Kv_int_x = Kv_int_x_b when A_ebmax ≥ A_P23.

Kv_int_x = Kv_int_x_a + (A_ebmax - A_P12)/(A_P23 - A_P12) * (Kv_int_x_b - Kv_int_x_a) when A_P12 < A_ebmax < A_P23.”

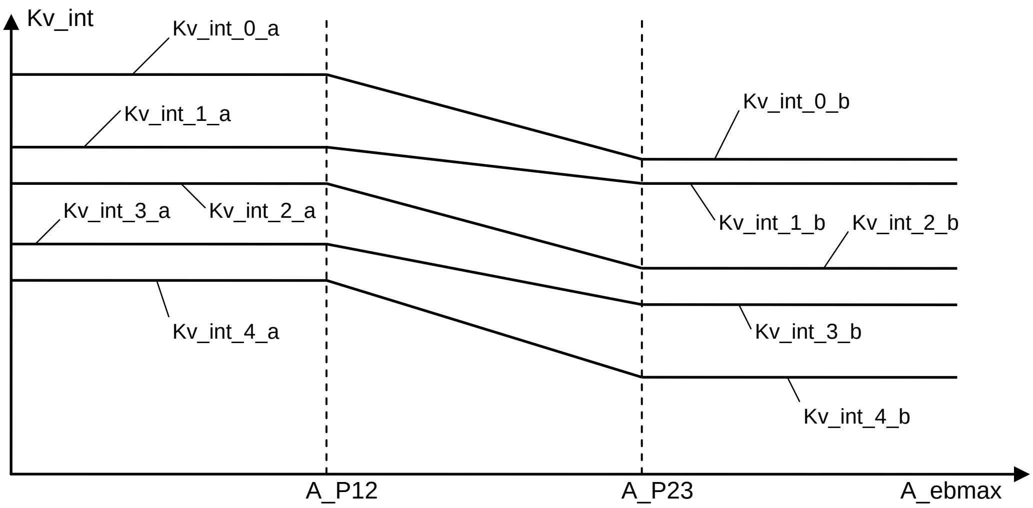


Figure 37: Kv_int structure for conventional passenger trains

3.13.6.2.1.8.2 The maximum EB deceleration A_ebmax shall be the maximum of A_brake_emergency between 0 km/h and the maximum speed of the train.

3.13.6.2.1.9 Note: Figure 38 gives an example of the influence of the various track/train characteristics on A_safe(V,d) and consequently on the EBD curve (see 3.13.8.3).

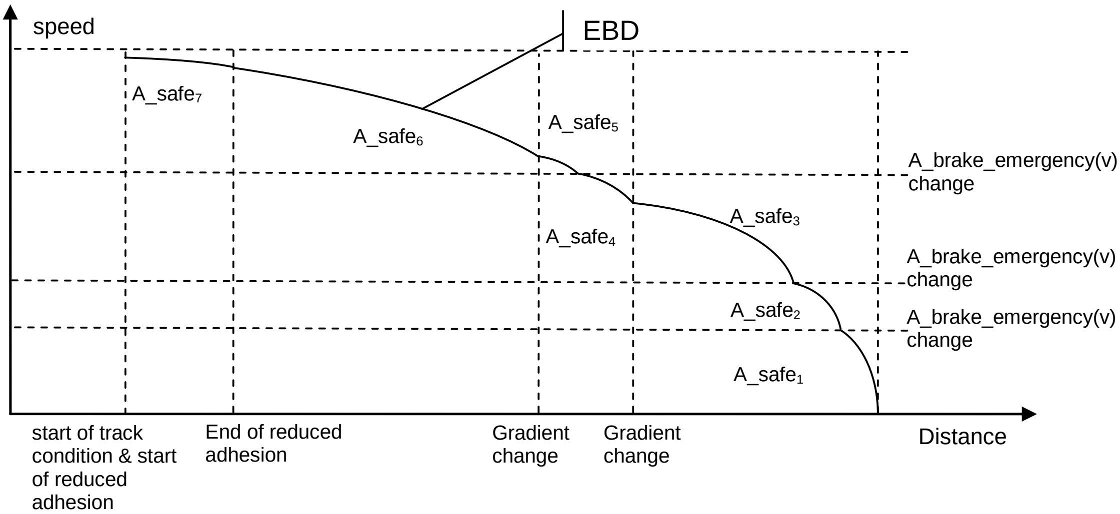


Figure 38: Influence of track/train characteristics on A_safe

3.13.6.2.2 Safe brake build up time

3.13.6.2.2.1 The safe brake build up time, T_be, is safety relevant. This means that for the calculation of the safe brake build up time, all necessary track and train characteristics shall be taken into account.

3.13.6.2.2.2 The train and track related characteristics to be considered are:

a) The values of T_brake_emergency acquired as part of Train Data (see 3.13.2.2.3.2.8) or the value of T_brake_emergency derived from the conversion model (see 3.13.3.4) using the brake position and train length acquired as Train Data.

b) The integrated correction factor Kt_int, only if the conversion model is used (see 3.13.2.3.7)

c) The status of the regenerative brake, eddy current brake, magnetic shoe brake and Ep brake system (see 3.13.2.2.6), only if the values of T_brake_emergency are acquired as part of Train Data

3.13.6.2.2.3 The safe brake build up time T_be shall be equal to:

If values of T_brake_emergency are acquired as part of Train Data:

T_be = T_brake_emergency, with T_brake_emergency corresponding to the combination of special brakes currently in use

If the conversion model is used:

T_be = Kt_int * T_brake_emergency

3.13.6.3 Service brake

3.13.6.3.1 Expected deceleration

3.13.6.3.1.1 Since the expected deceleration is not safety relevant, no worst case conditions (e.g. correction factors, adhesion conditions) need to be taken into account for its calculation.

3.13.6.3.1.2 The train and track related characteristics to be considered are:

a) The speed dependent deceleration model(s) for the full service brake either acquired as part of Train Data (see 3.13.2.2.3.1) or derived from the brake percentage using the conversion model (see 3.13.3.3)

b) The acceleration/deceleration due to gradient i.e. A_gradient(d) (see 3.13.4)

c) The locations without special brake contribution (see 3.13.5)

3.13.6.3.1.3 A_expected(V,d) shall be equal to:

A_expected(V,d) = A_brake_service(V,d) +A_gradient(d)

3.13.6.3.1.4 A_brake_service(V,d) shall be the full deceleration of the service brake as a function of the speed, of the locations with change of special brake(s) contribution encountered between the train front and the foot of the SBD curve. A_brake_service(V,d) shall be equal to:

$A\_brake\_service_1(V)$ when $d_{estfront} \le d \le d_1$

$A\_brake\_service_2(V)$ when $d_1 < d \le d_2$

$A\_brake\_service_3(V)$ when $d_2 < d \le d_3$

....

Where

d_1, d_2, d_3,... are the locations with change of special brake(s) contribution

$A\_brake\_service_x(V)$ is equal to the full service brake model, A_brake_service, applicable for the concerned combination of brake.

3.13.6.3.2 Expected brake build up time

3.13.6.3.2.1 Since the expected brake build up time is not safety relevant, no worst case conditions (e.g. correction factors, adhesion conditions) need to be taken into account for its calculation.

3.13.6.3.2.2 No track related characteristics are to be considered for the expected brake build up time.

3.13.6.3.2.3 The train related characteristics to be considered are:

a) The values of T_brake_service acquired as part of Train Data (see 3.13.2.2.3.2.8) or the value(s) of T_brake_service derived from the conversion model (see 3.13.3.4) using the brake position and train length acquired as Train Data)

b) The status of the regenerative brake, eddy current brake and Ep brake system (see 3.13.2.2.6)

3.13.6.3.2.4 The expected brake build up time T_bs shall be equal to the brake build up time of the full service brake:

T_bs = T_brake_service, with T_brake_service corresponding to the combination of special brakes currently in use

3.13.6.4 Normal service brake deceleration

3.13.6.4.1 Since the normal service brake deceleration is not safety relevant, no worst case conditions (e.g. correction factors, adhesion conditions) need to be taken into account for its calculation.

3.13.6.4.2 The train and track related characteristics to be considered are:

a) The speed dependent deceleration model(s) for the full service brake either acquired as part of Train Data (see 3.13.2.2.3.1) or derived from the brake percentage using the conversion model (see 3.13.3.3)

b) The speed dependent deceleration model(s) for the normal service brake acquired as part of Train Data (see 3.13.2.2.3.1)

c) The acceleration/deceleration due to gradient i.e. A_gradient(d) (see 3.13.4)

d) The brake position (see 3.13.2.2.4)

e) The on-board correction factors Kn+(V) and Kn-(V) (see 3.13.2.2.9.2)

f) The locations without special brake contribution (see 3.13.5)

3.13.6.4.3 The normal service brake deceleration shall be equal to:

For positive gradient values (uphill):

A_normal_service(V,d) = A_brake_normal_service(V,d) + A_gradient(d) – Kn+(V)*grad

For negative gradient values (downhill):

A_normal_service(V,d) = A_brake_normal_service(V,d) + A_gradient(d) – Kn-(V)*grad

Where

grad = gradient values in ‰ (positive = uphill)

3.13.6.4.4 A_brake_normal_service(V,d) shall be the normal deceleration of the service brake as a function of the speed, of the locations with change of special brake(s) contribution encountered between the train front and the foot of the GUI curve. A_brake_normal_service(V,d) shall be equal to:

A_brake_normal_service$_1$(V) when $d_{estfront} \leq d \leq d_1$

A_brake_normal_service$_2$(V) when $d_1 < d \leq d_2$

A_brake_normal_service$_3$(V) when $d_2 < d \leq d_3$

....

Where

d_1, d_2, d_3,... are the locations with change of special brake(s) contribution

A_brake_normal_service$_x$(V) is equal to the normal service brake model applicable for the concerned combination of brake position and of the value of A_brake_service(V=0) between d_{x-1} and d_x (see 3.13.2.2.3.1.9 and 3.13.2.2.3.1.10).

3.13.7 Determination of Most Restrictive Speed Profile (MRSP)

3.13.7.1 The Most Restrictive Speed Profile (MRSP) is a description of the most restrictive speed restrictions the train shall obey on a given piece of track.

3.13.7.2 The Most Restrictive Speed Profile shall be computed from all speed restrictions (see 3.13.2.2.13 & 3.13.2.3.2) by selecting the most restrictive parts of each element, some elements being compensated by the train length if requested by trackside (see 3.11.3.1.3 for SSP, 3.11.4.6 for ASP and 3.11.5.3 for TSR).

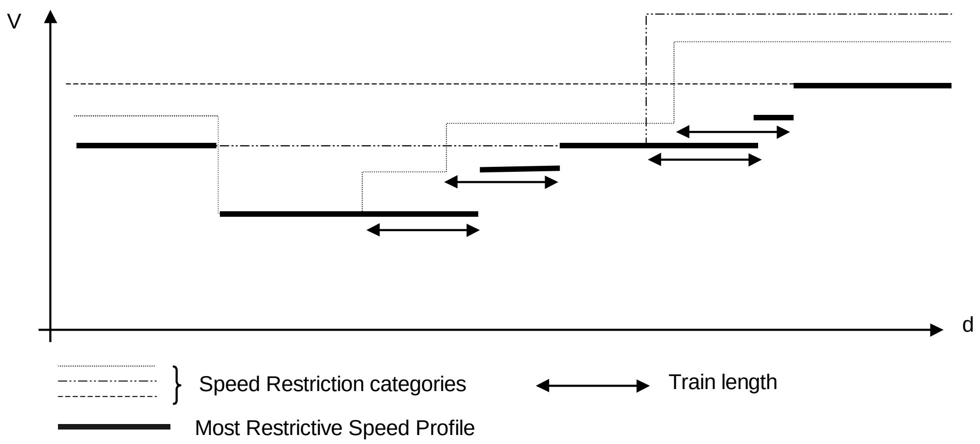


Figure 39: Most Restrictive Speed Profile selection

3.13.7.3 The Most Restrictive Speed Profile shall be recalculated when any of the elements it is built of is changed.

3.13.8 Determination of targets and brake deceleration curves

3.13.8.1 Introduction

3.13.8.1.1 A target is defined by a target location and a target speed, to which the train must decelerate before reaching the target location.

3.13.8.1.2 For that purpose, the on-board equipment shall use brake deceleration curves related to the supervised targets, from the deceleration values as specified in sections 3.13.6.2.1, 3.13.6.3.1and 3.13.6.4.

3.13.8.1.3 These deceleration values being speed and distance dependent, a brake deceleration curve shall be calculated piecewise, i.e. it shall be composed of interconnected arcs of parabola, each one being based on one of the speed/distance dependent deceleration values (see Figure 38).

3.13.8.2 Determination of the supervised targets

3.13.8.2.1 The on-board shall continuously supervise a list of targets, which may include the following types of target:

a) the locations corresponding to a speed decrease of the MRSP (if any), which are in advance of the max safe front end of the train

b) the Limit of Authority (LOA), if the target speed at the EOA/LOA is not equal to zero

c) the End of Authority (EOA) and the Supervised Location (SvL), if the target speed at the EOA is equal to zero

d) the location deduced from the maximum permitted distance to run in Staff Responsible, with a target speed zero

3.13.8.2.1.1 Note: depending on the information received from trackside and the position of the train, the list of supervised targets may be empty.

3.13.8.2.2 The list of supervised targets shall be re-evaluated when any of the elements it is built of is changed (e.g. new MA and/or track description accepted on-board, EOA and/or SvL temporarily supervised at the start location of a mode profile, update of stored information in specific situations (see sections A.3.4 and 4.10)).

3.13.8.2.3 A target corresponding to a speed decrease of the MRSP shall be removed from the list of supervised targets when the max safe front end of the train has passed the target location.

3.13.8.3 Emergency Brake Deceleration curves (EBD)

3.13.8.3.1 If a target belongs to the MRSP or is an LOA, the on-board shall calculate an EBD curve based on the safe deceleration A_safe(V,d), that crosses the ceiling speed EBI supervision limit (see 3.13.9.2) at the target location, and that extends up to the location where the target speed is reached (EBD foot).

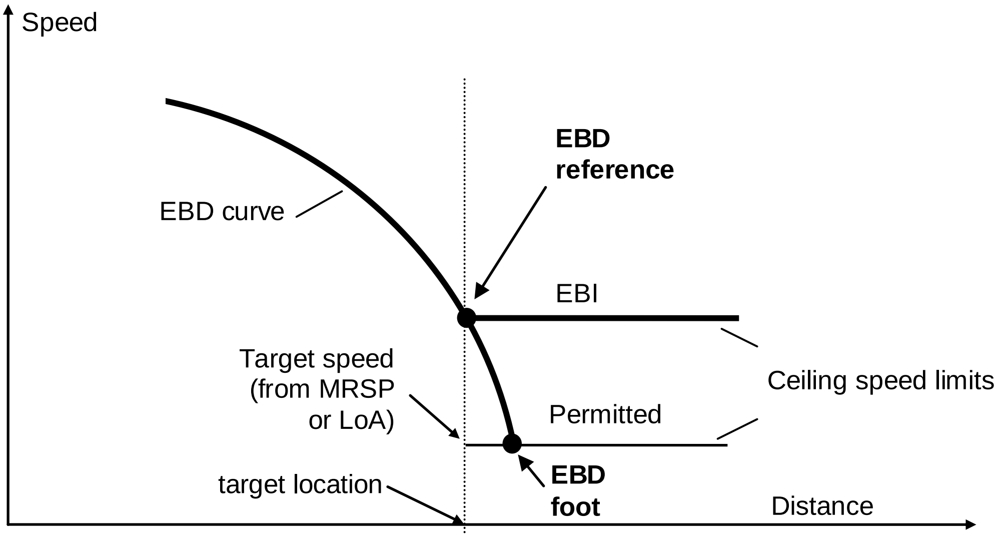


Figure 40: Calculation of the EBD curve with regards to MRSP or LOA target

3.13.8.3.2 If a target is an SvL, the on-board shall calculate an Emergency Brake Deceleration (EBD) curve based on the safe deceleration A_safe(V,d) and that reaches zero speed at the SvL.

3.13.8.3.3 If a target is the location at the end of the maximum permitted distance to run in Staff Responsible, the on-board shall calculate an Emergency Brake Deceleration (EBD) curve based on the safe deceleration A_safe(V,d) and that reaches zero speed at this staff responsible end location.

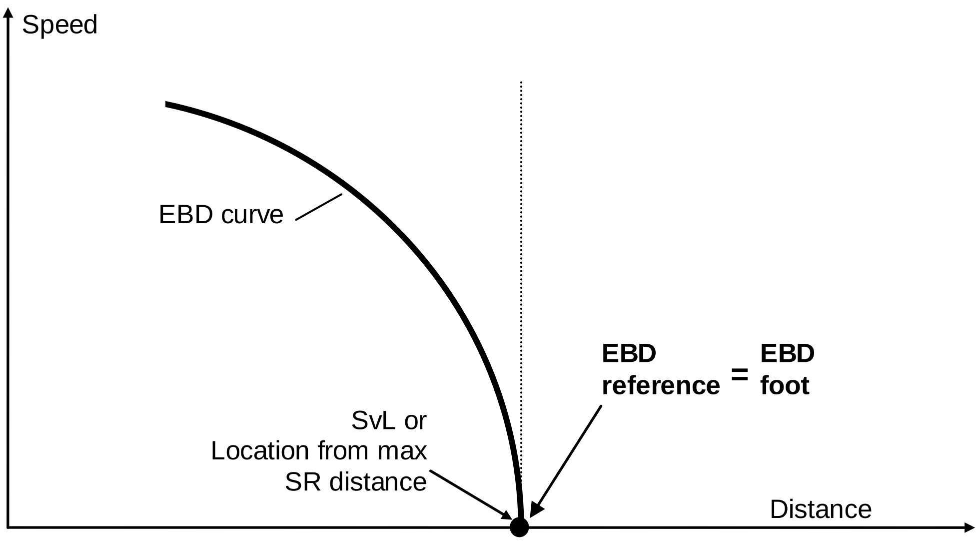


Figure 41: Calculation of the EBD curve with regards to SvL or SR distance

3.13.8.4 Service Brake Deceleration curves (SBD)

3.13.8.4.1 If a target is an EOA, the on-board shall calculate an Service Brake Deceleration (SBD) curve based on the expected deceleration A_expected(V,d) and that reaches zero speed at this EOA location.

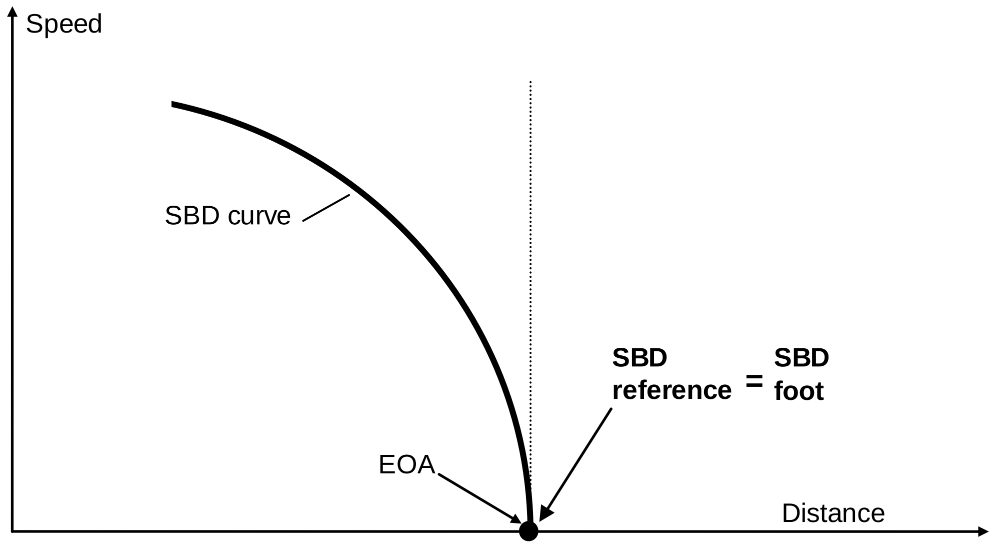


Figure 42: Calculation of the SBD curve with regards to EOA

3.13.8.5 Guidance curves (GUI)

3.13.8.5.1 The purpose of the guidance curve (GUI) is to provide a comfortable way of braking for the driver, to avoid excessive wear of the brakes and to save traction energy.

3.13.8.5.2 If the National Value does not inhibit them, the on-board shall calculate a guidance curve (GUI) for each supervised target, based on the normal service brake deceleration A_normal_service(V,d). The foot of a GUI curve (i.e. the location where the GUI speed is equal to the target speed) shall be:

a) the target location, in case of EOA/SvL

b) the location defined in 3.13.9.3.5.9, for others targets

3.13.9 Supervision limits

3.13.9.1 Overview

3.13.9.1.1 In this chapter the following supervision limits are defined:

- Emergency brake intervention (EBI)
- Service brake intervention (SBI)
- Warning (W)
- Permitted speed (P)

- Indication (I)
- Pre-Indication location
- Release speed monitoring start location

3.13.9.1.2 The purpose of the emergency brake intervention supervision limit is to assure that the train will remain within the various limits (in distance/speed) imposed by the trackside.

3.13.9.1.3 The purpose of all other supervision limits is to assist the driver in preventing an emergency brake intervention by maintaining the speed of the train within the appropriate limits.

3.13.9.2 Ceiling supervision limits

3.13.9.2.1 The ceiling supervision limits are derived from the MRSP elements, where the speed is constant (refer to 3.13.7) or from the LOA.

3.13.9.2.2 From an MRSP element or from the LOA, the Permitted speed, Warning, Service brake intervention and Emergency brake intervention supervision limits are defined (see Figure 43).

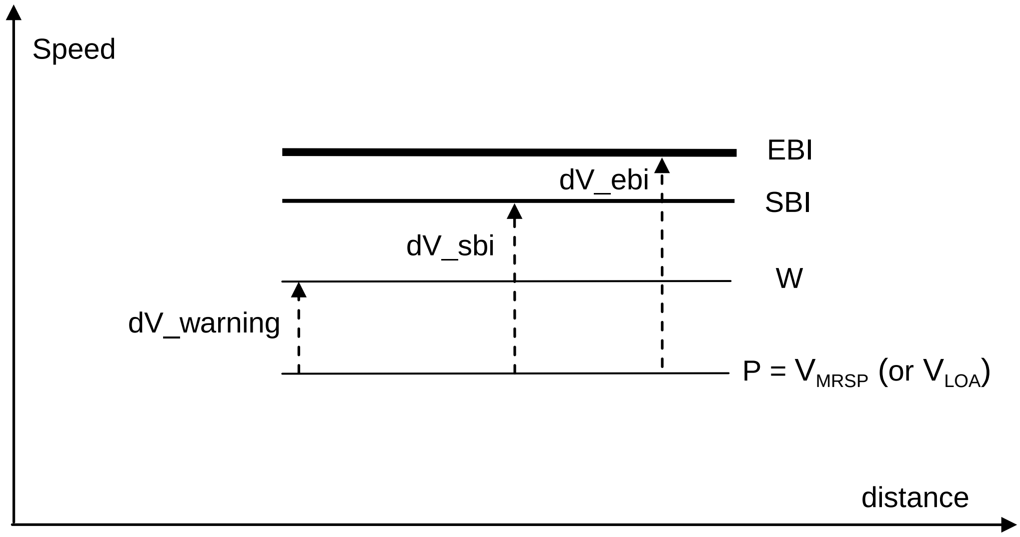


Figure 43: Ceiling supervision limits

3.13.9.2.3 For dv_ebi, the following formula shall be applied:

when $V_{MRSP} > V_{ebi\min}$:

$$dV_{ebi} = \min\left\{dV_{ebi\min} + C_{ebi} \cdot \left(V_{MRSP} - V_{ebi\min}\right), dV_{ebi\max}\right\}$$

with $C_{ebi} = \dfrac{\left(dV_{ebi\max} - dV_{ebi\min}\right)}{\left(V_{ebi\max} - V_{ebi\min}\right)}$

when $V_{MRSP} \leq V_{ebi\min} : dV_{ebi} = dV_{ebi\min}$

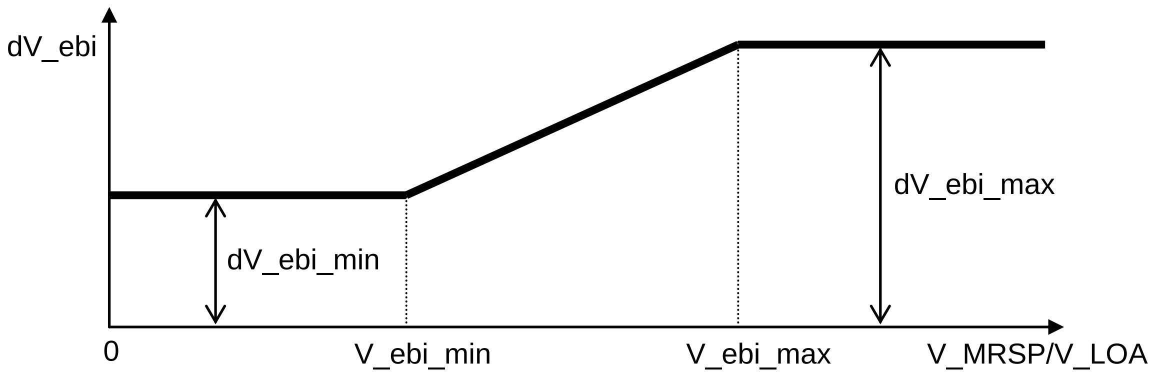


Figure 44: Definition of dV_ebi

3.13.9.2.4 dV_ebi_min, dV_ebi_max, V_ebi_min and V_ebi_max are defined as fixed values (See Appendix A3.1)

3.13.9.2.5 For dV_sbi, the same formula as for dV_ebi shall apply, dV_sbi_min, dV_sbi_max, V_sbi_min and V_sbi_max being also defined as fixed values (See Appendix A3.1)

3.13.9.2.6 For dV_warning, the same formula as for dV_ebi shall apply, dV_warning_min, dV_warning_max, V_warning_min and V_warning_max being also defined as fixed values (See Appendix A3.1)

3.13.9.2.7 For LOA, the same formulas shall apply, by substituting V_MRSP with V_LOA.

3.13.9.2.8 The SBI supervision limit is also referred as the FLOI (First Line Of Intervention) supervision limit.

3.13.9.3 Braking to target supervision limits

3.13.9.3.1 Overview

3.13.9.3.1.1 The braking to target supervision limits are derived from the EBD, SBD and GUI curves.

3.13.9.3.1.2 From an EBD curve, the Emergency brake intervention (EBI), Service brake intervention (SBI2), Warning (W), Permitted speed (P) and Indication (I) supervision limits, valid for the estimated speed, are defined as follows(see Figure 45):

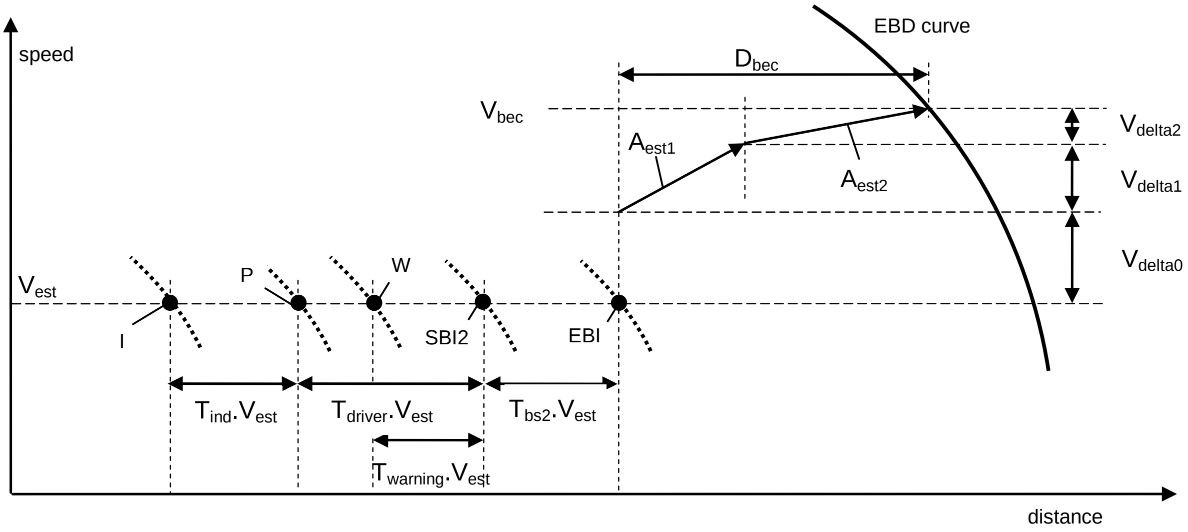


Figure 45: Braking to target supervision limits from EBD curve

3.13.9.3.1.3 From the SBD curve, Service brake intervention (SBI1), Warning (W), Permitted speed (P) and Indication (I) supervision limits, valid for the estimated speed, are defined as follows (see Figure 46):

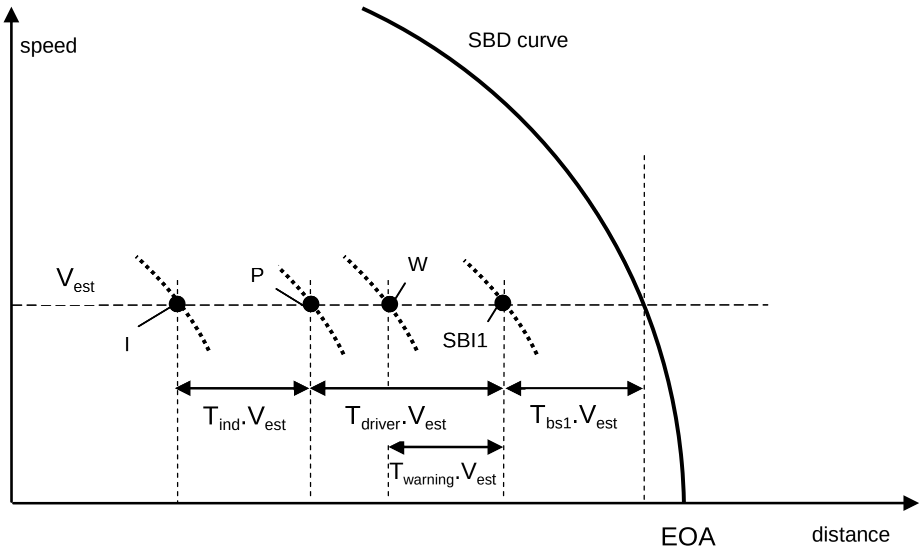


Figure 46: Braking to target supervision limits from SBD curve

3.13.9.3.1.4 No specific supervision limit is calculated from the GUI curve: it is only used to adjust the Permitted speed (P) supervision limit, which is obtained either from the EBD or the SBD curve.

3.13.9.3.2 EBI supervision limit

3.13.9.3.2.1 If not inhibited by National Value, the ERTMS/ETCS on-board equipment shall compensate the inaccuracy of the speed measurement by taking into account the speed under reading amount (V_ura) at the moment when the calculation is made: V_delta0 = V_ura (see Figure 45).

3.13.9.3.2.2 The time elapsed between the Emergency brake intervention and the full application of the braking effort is reached (EBD) shall be split into two parts:

a) Time during which the traction effort is still present: T_traction

b) Remaining time during which the traction effort is not present: T_berem

3.13.9.3.2.3 The traction time (T_Traction) shall be defined as follows:

a) when the traction cut-off is implemented:

T_traction = MAX((T_traction_cut_off - (T_warning + T_bs2)) ; 0).

b) when the traction cut-off is not implemented: T_traction = T_traction_cut_off

3.13.9.3.2.4 Note: When the traction cut-off is implemented, the traction cut-off command is triggered when passing the warning limit. The term (T_warning + T_bs2) in the equation above takes this into account, assuming that the warning limit is derived from the EBD.

3.13.9.3.2.5 T_bs2 and T_warning are defined in sections 3.13.9.3.3 and 3.13.9.3.4.

3.13.9.3.2.6 The remaining time with no traction (T_berem) shall be equal to MAX(T_be - T_traction ; 0).

3.13.9.3.2.7 Note: T_Traction exceeding T_be is rather a theoretical case, but is nevertheless included to make the specifications complete.

3.13.9.3.2.8 During T_traction, the estimated acceleration/deceleration (A_est1), which is measured at the moment when the calculation is made, shall be taken into account.

3.13.9.3.2.9 If T_be > T_traction, the estimated acceleration during T_berem (A_est2) shall be the one measured at the moment when the calculation is made, but limited to values between 0 and +0.4m/s^2.

3.13.9.3.2.10 The compensated speed and the distance travelled during the time elapsed between the Emergency brake intervention and the full application of the braking effort is reached shall be derived as follows (see Figure 45):

$$V_{bec} = \max\left\{(V_{est} + V_{delta0} + V_{delta1}), V_{target}\right\} + V_{delta2}$$

$$D_{bec} = \max\left\{(V_{est} + V_{delta0} + \frac{V_{delta1}}{2}), V_{target}\right\} \cdot T_{traction}$$

$$+ \left(\max\left\{(V_{est} + V_{delta0} + V_{delta1}), V_{target}\right\} + \frac{V_{delta2}}{2}\right) \cdot T_{berem}$$

with $V_{delta0} = V_{ura}$ or $V_{delta0} = 0$ (if compensation of speed inaccuracy is inhibited by National Value)

with $V_{delta1} = A_{est1} \cdot T_{traction}$ and $V_{delta2} = A_{est2} \cdot T_{berem}$

3.13.9.3.2.11 Note: The formula avoids that, in case A_est1 < 0, V_bec would become lower than V_target.

3.13.9.3.2.12 For the estimated speed V_est, the location of the EBI supervision limit shall be:

$$d_{EBI}(V_{est}) = d_{EBD}(V_{bec}) - D_{bec}$$

3.13.9.3.3 SBI supervision limit

3.13.9.3.3.1 For the EOA, the on-board shall calculate the location of the SBI supervision limit (SBI1) valid for the estimated speed, assuming that this latter remains constant during the interval T_bs1, until the SBD curve is reached.

$$d_{SBI1}(V_{est}) = d_{SBD}(V_{est}) - V_{est} \cdot T_{bs1}$$

3.13.9.3.3.2 For an EBD based target, the on-board shall calculate the location of the SBI supervision limit (SBI2) valid for the estimated speed, assuming that this latter remains constant during the interval T_bs2, until the location of the EBI supervision limit is reached.

$$d_{SBI2}(V_{est}) = d_{EBI}(V_{est}) - V_{est} \cdot T_{bs2}$$

3.13.9.3.3.3 If the service brake command is available for use and the service brake feedback is not available for use, T_bs1 and T_bs2 shall be equal to T_bs.

3.13.9.3.3.4 If both the service brake command and the service brake feedback are available for use, T_bs1 and T_bs2 shall be firstly set to T_bs. When the service brake is used by the driver, they shall then be reduced progressively and possibly locked to the respective fixed values of 0s and T_bs2_locked, until the target location is passed or until the target speed monitoring is left; they are then reset again to T_bs (see detailed algorithm in Appendix A3.10).

3.13.9.3.3.4.1 In case T_bs < T_bs2_locked then T_bs2 shall be equal to T_bs2_locked.

3.13.9.3.3.5 If the service brake command is not available for use, T_bs1 and T_bs2 shall be set to zero.

3.13.9.3.3.6 Note: The values T_bs1 and T_bs2 = 0s are defined to achieve the maximum performance when service brake command is not used.

3.13.9.3.3.7 For display purpose only, the SBI1 speed for the estimated train front end, shall be calculated as follows (see Figure 47):

$$V_{SBI1}(d_{estfront}) = V_{SBD}\left(d_{estfront} + V_{est} \cdot T_{bs1}\right)$$

$V_{SBI1}(d_{estfront}) = 0$ if $d_{estfront} + V_{est} \cdot T_{bs1} \geq d_{EoA}$

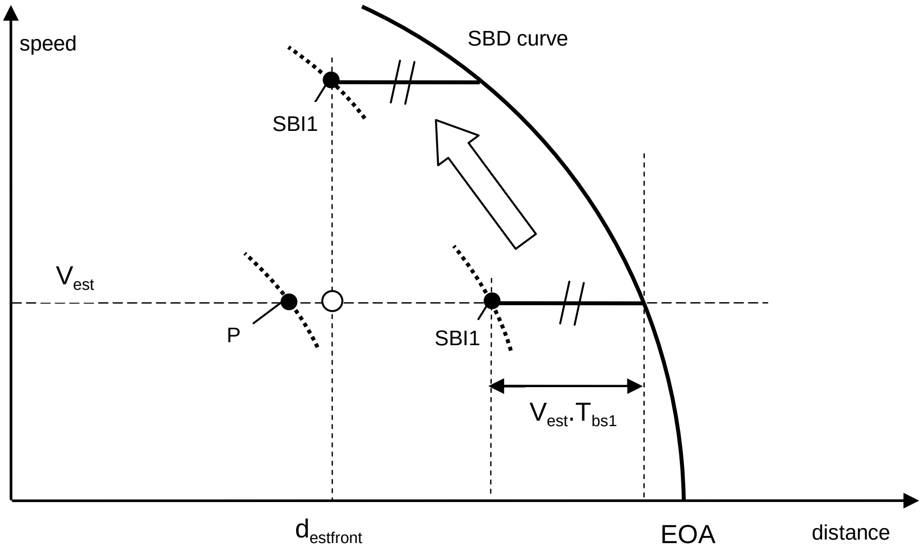


Figure 47: Calculation of SBI1 speed displayed to the driver

3.13.9.3.3.8 For display purpose only, the SBI2 speed for the max safe front end of the train shall be calculated as follows (see Figure 48):

$$V_{SBI2}(d_{\max safefront}) = V_{EBD}\left(d_{\max safefront} + V_{est} \cdot T_{bs2} + D_{bec}\right) - \left(V_{bec} - V_{est}\right)$$

$V_{SBI2}(d_{\max safefront}) = V_{t\arg et}$ if $d_{\max safefront} + V_{est} \cdot T_{bs2} + D_{bec} \geq d_{EBD}(V_{t\arg et})$

With D_bec and V_bec calculated according to 3.13.9.3.2.10

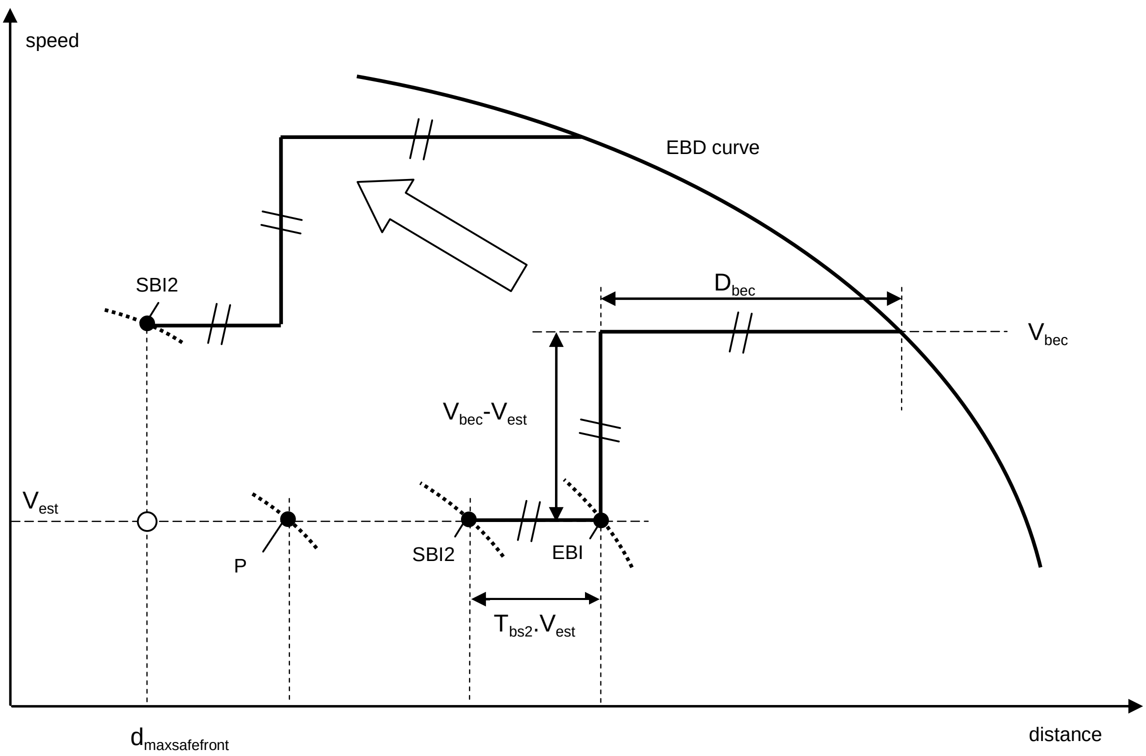


Figure 48: Calculation of SBI2 speed displayed to the driver

3.13.9.3.3.8.1 Note: the re-use of the same distance travelled and speed increase between the SBI2 supervision limit and the EBD, as for the estimated speed (see Figure 48), leads to an overestimation/underestimation of the SBI2 speed to be displayed to the driver. This simplification, which avoids the need of an iterated calculation, is however acceptable and necessary since the error made tends to zero when the train reaches the SBI2 supervision limit.

3.13.9.3.3.9 The FLOI (First Line Of Intervention) supervision limit, valid for estimated speed, shall be defined as the SBI supervision limit, of which the location is the closest to the train front, taking into account the max safe train front end for the SBI2 supervision limit(s) and the estimated train front end for the SBI1.

$$d_{FLOI}(V_{est}) = d_{SBI1}(V_{est}) \text{ if } d_{SBI1}(V_{est}) - d_{estfront} \le \underset{MREBDT}{d_{SBI2}}(V_{est}) - d_{\max safefront}$$

$$d_{FLOI}(V_{est}) = \underset{MREBDT}{d_{SBI2}}(V_{est}) \text{ if } \underset{MREBDT}{d_{SBI2}}(V_{est}) - d_{\max safefront} < d_{SBI1}(V_{est}) - d_{estfront}$$

With $\underset{MREBDT}{d_{SBI2}}(V_{est}) = \min\left\{ \underset{Target\_1}{d_{SBI2}}(V_{est}), \ldots, \underset{Target\_n}{d_{SBI2}}(V_{est}) \right\}$

MREBDT = Most Restrictive Target amongst the EBD based targets

3.13.9.3.4 Warning supervision limit (W)

3.13.9.3.4.1 The on-board shall calculate the location of the Warning supervision limit valid for the estimated speed, assuming that this latter remains constant during the interval T_warning until the location of the FLOI supervision limit is reached.

$$d_W(V_{est}) = d_{FLOI}(V_{est}) - V_{est} \cdot T_{warning}$$

3.13.9.3.4.2 T_warning is defined as a fixed value (refer to A3.1).

3.13.9.3.5 Permitted speed supervision limit (P)

3.13.9.3.5.1 In case the calculation of the GUI curve is inhibited, the on-board shall calculate the location of the Permitted speed supervision limit valid for the estimated speed, assuming that this latter remains constant during the interval T_driver until the location of the FLOI supervision limit is reached.

$$d_P(V_{est}) = d_{FLOI}(V_{est}) - V_{est} \cdot T_{driver}$$

3.13.9.3.5.2 T_driver is defined as a fixed value (refer to A3.1).

3.13.9.3.5.3 Note: The reference for the Permitted speed supervision limit is the FLOI supervision limit and not the Warning supervision limit. As a result the permitted and warning supervision limits are clearly separated and do not affect each other. In this way it is clear that the warning is not part of the critical performance interval.

3.13.9.3.5.4 In case the calculation of the Guidance curve is enabled, the on-board shall calculate the location of the Permitted speed supervision limit valid for the estimated speed, as follows:

$$d_P(V_{est}) = \min\left\{\left(d_{FLOI}(V_{est}) - V_{est} \cdot T_{driver}\right), d_{\substack{GUI \\ FLOI}}(V_{est})\right\}$$

3.13.9.3.5.5 In case the calculation of the GUI curve is inhibited, for display purpose only, the P speed related to SBD shall be calculated for the estimated train front end as follows:

$$V_{\substack{P \\ EOA}}(d_{estfront}) = V_{SBD}\left(d_{estfront} + V_{est} \cdot (T_{driver} + T_{bs1})\right)$$

$$V_{\substack{P \\ EOA}}(d_{estfront}) = 0 \text{ if } d_{estfront} + V_{est} \cdot (T_{driver} + T_{bs1}) \geq d_{EoA}$$

3.13.9.3.5.6 In case the calculation of the GUI curve is enabled, for display purpose only, the P speed related to SBD shall be calculated for the estimated train front end as follows:

$$V_{\substack{P \\ EOA}}(d_{estfront}) = \min\left\{V_{SBD}\left(d_{estfront} + V_{est} \cdot (T_{driver} + T_{bs1})\right), V_{\substack{GUI \\ EOA}}\left(d_{estfront}\right)\right\}$$

$$V_{\substack{P \\ EOA}}(d_{estfront}) = 0 \text{ if } d_{estfront} + V_{est} \cdot (T_{driver} + T_{bs1}) \geq d_{EoA}$$

3.13.9.3.5.7 In case the calculation of the GUI curve is inhibited, for display purpose only, the P speed related to EBD, shall be calculated for the max safe front end of the train as follows (see Figure 49):

$$V_{\substack{P \\ EBD\_Target}}(d_{\max safefront}) = V_{EBD}\left(d_{\max safefront} + V_{est}\cdot(T_{driver}+T_{bs2}) + D_{bec}\right) - \left(V_{bec} - V_{est}\right)$$

$$V_{\substack{P \\ EBD\_Target}}(d_{\max safefront}) = V_{target} \text{ if } d_{\max safefront} + V_{est}\cdot(T_{driver}+T_{bs2}) + D_{bec} \geq d_{EBD}(V_{target})$$

With D_bec and V_bec calculated according to 3.13.9.3.2.10

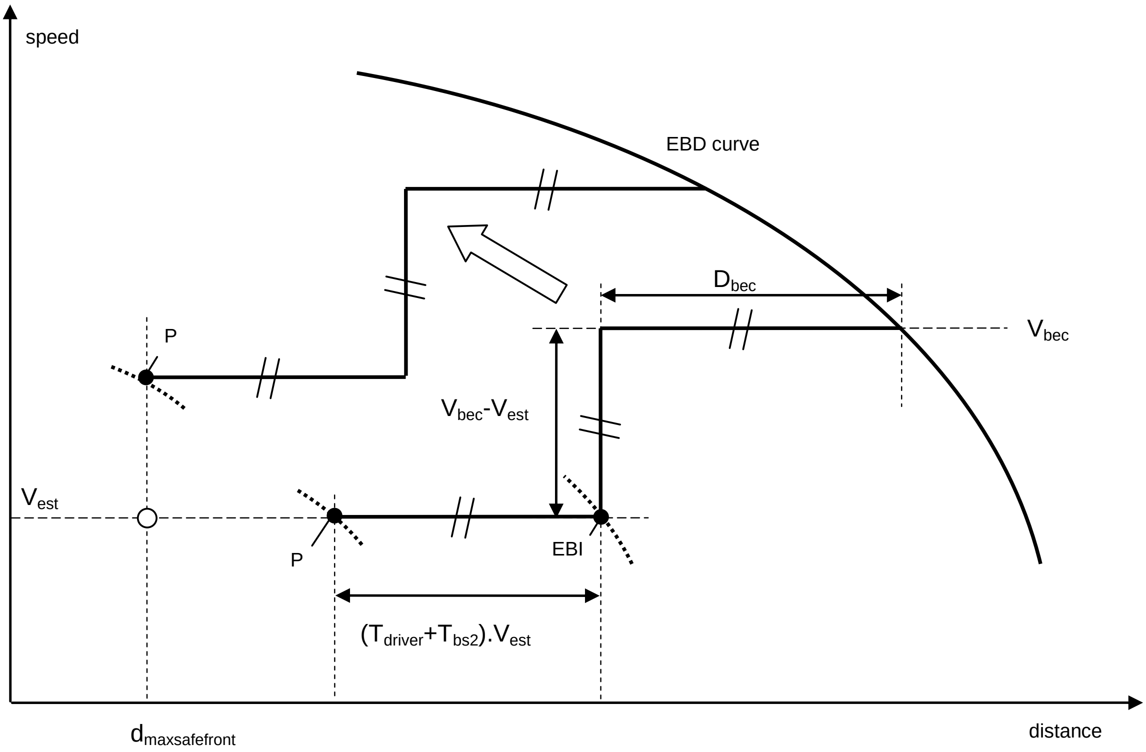


Figure 49: Calculation of Permitted speed displayed to the driver

3.13.9.3.5.7.1 Note: the re-use of the same distance travelled and speed increase between the Permitted speed supervision limit and the EBD, as for the estimated speed (see Figure 49), leads to an overestimation/underestimation of the Permitted speed to be displayed to the driver. This simplification, which avoids the need of an iterated calculation, is however acceptable and necessary since the error made tends to zero when the train reaches the Permitted speed supervision limit.

3.13.9.3.5.8 In case the calculation of the GUI curve is enabled, for display purpose only, the P speed related to EBD, shall be calculated for the max safe front end of the train as follows:

$$V_P\,(\underset{EBD\_target}{d_{\max safefront}}) =$$

$$\min\left\{\left(V_{EBD}\left(d_{\max safefront}+V_{est}\cdot(T_{driver}+T_{bs2})+D_{bec}\right)-\left(V_{bec}-V_{est}\right)\right), V_{GUI}\left(\underset{EBD\_target}{d_{\max safefront}}\right)\right\}$$

$$V_P\,(\underset{EBD\_target}{d_{\max safefront}}) = V_{target} \text{ if } d_{\max safefront}+V_{est}\cdot(T_{driver}+T_{bs2})+D_{bec}\geq d_{EBD}(V_{target})$$

or if $d_{\max safefront}\geq d_{GUI}(V_{target})$

With D_bec and V_bec calculated according to 3.13.9.3.2.10

3.13.9.3.5.9 In order to determine the reference location of the target distance displayed to the driver and in order to determine the foot of the GUI curve (only if it is enabled) in case of target different from EOA/SvL, the location of the Permitted speed supervision limit, valid for the target speed, shall be calculated from the EBD, taking into account the following assumptions:

a) the estimated acceleration shall be set to "zero"

b) if not inhibited by National Value, the compensation of the inaccuracy of the speed measurement shall be set to a value calculated from the target speed, as defined in SUBSET-041 § 5.3.1.2: V_delta0t = f_{41}(V_target)

3.13.9.3.5.10 To do so, the same formulas defined above with V_est and V_delta0 shall be applied, by substituting V_est with V_target and V_delta0 with V_delta0t.

$$d_{EBI}\left(V_{target}\right)=d_{EBD}\left(V_{target}+V_{delta0t}\right)-\left(V_{target}+V_{delta0t}\right)\cdot\left(T_{berem}+T_{traction}\right)$$

$$d_{P}\left(V_{target}\right)=d_{EBI}\left(V_{target}\right)-V_{target}\cdot\left(T_{driver}+T_{bs2}\right)$$

3.13.9.3.5.10.1 Justification: these assumptions are intended to avoid fluctuations of the target distance displayed to the driver. Moreover the foot of the GUI curve may influence the pre-indication location, which must be fully predictable for trackside engineering reasons.

3.13.9.3.5.11 In case a non protected LX start location is supervised as both the EOA and SvL and the stopping in rear of LX is not required, the location of the Permitted speed supervision limit, valid for the LX speed shall be used in order to determine the location where the supervision of the LX start location is substituted by the supervision of the LX speed (see section 5.16.3). This location shall be calculated taking into account the following assumptions:

a) the estimated acceleration shall be set to "zero"

b) if not inhibited by National Value, the compensation of the inaccuracy of the speed measurement shall be set to a value calculated from the LX speed, as defined in SUBSET-041 § 5.3.1.2: V_delta0lx = f_{41}(V_LX)

3.13.9.3.5.12 To do so, the same formulas defined above with V_est and V_delta0 shall be applied, by substituting V_est with V_LX and V_delta0 with V_delta0lx.

$$d_{SBI1}(V_{LX}) = d_{SBD}(V_{LX}) - V_{LX} \cdot T_{bs1}$$

$$d_{SBI2}(V_{LX}) = d_{EBI}(V_{LX}) - V_{LX} \cdot T_{bs2}$$

with $d_{EBI}(V_{LX}) = d_{EBD}(V_{LX} + V_{delta0lx}) - (V_{LX} + V_{delta0lx}) \cdot (T_{berem} + T_{traction})$

$d_{FLOI}(V_{LX}) = d_{SBI1}(V_{LX})$ if $d_{SBI2}(V_{LX}) - d_{SBI1}(V_{LX}) \geq d_{\max safefront} - d_{estfront}$

Or $d_{FLOI}(V_{LX}) = d_{SBI2}(V_{LX})$ if $d_{SBI2}(V_{LX}) - d_{SBI1}(V_{LX}) < d_{\max safefront} - d_{estfront}$

In case the GUI curve is inhibited: $d_P(V_{LX}) = d_{FLOI}(V_{LX}) - V_{LX} \cdot T_{driver}$

In case the GUI curve is enabled: $d_P(V_{LX}) = \min\left\{(d_{FLOI}(V_{LX}) - V_{LX} \cdot T_{driver}), d_{\substack{GUI \\ FLOI}}(V_{LX})\right\}$

3.13.9.3.6 Indication supervision limit (I)

3.13.9.3.6.1 The on-board shall calculate the location of the Indication supervision limit valid for the estimated speed, assuming that this latter remains constant during the interval T_indication until the location of the Permitted speed supervision limit is reached.

$$d_I(V_{est}) = d_P(V_{est}) - V_{est} \cdot T_{indication}$$

3.13.9.3.6.2 If the service brake feedback interface is not available for use, then

$$T_{indication} = \max\{(0.8 \cdot T_{bs}), 5s\}$$

3.13.9.3.6.3 Note: The reduction of T_indication by a factor is intended to improve performance and the feasibility of this reduction is based on experience with real implementations. To avoid very low values when T_bs is small, a minimum is defined for T_indication, giving the driver always enough time to operate the brake.

3.13.9.3.6.4 If the service brake feedback interface is available for use then T_indication = 5s.

3.13.9.4 Release speed supervision limits

3.13.9.4.1 The release speed is a special ceiling speed limit, applicable in the vicinity of the EOA. The EBI supervision limit shall be equal to the release speed. There is no SBI, W, P, I supervision limit associated to the release speed.

3.13.9.4.2 Note: The release speed may be necessary for two reasons. One is that a train has to be able to approach the EOA where the permitted speed reaches zero and might be too restrictive to permit acceptable driving due to inaccuracy of the measured distance. The other reason is that in a level 1 application the train has to be able to overpass the balise when the signal clears. For these two reasons a (low) release speed may be given from trackside or may be calculated on board, based on the distance from the EOA to the Supervised Location.

3.13.9.4.3 With each MA, it shall be possible for the trackside to:

a) Give the value of the release speed directly to the on-board, OR

b) Instruct the on-board to calculate the release speed, OR

c) Instruct the on-board to use the national value.

3.13.9.4.4 In case the MA does not identify the variant to be used or in case of LOA, no release speed shall be supervised.

3.13.9.4.5 Note: When the release speed is given as a fixed value from trackside, the ERTMS/ETCS system cannot be responsible for stopping the train in rear of the Supervised Location. In this case, it is the full responsibility of the infrastructure manager to set the appropriate release speed with regard to the risk of passing the Supervised Location.

3.13.9.4.6 The start location of the release speed monitoring (i.e. where the EBI supervision limit related to EBD is replaced with an EBI supervision limit equal to the release speed value) shall be the location of the FLOI supervision limit, calculated for the Release Speed value, taking into account the following assumptions:

a) the estimated acceleration shall be set to “zero”

b) if not inhibited by National Value, the compensation of the inaccuracy of the speed measurement shall be set to a value calculated from the release speed, as defined in SUBSET-041 § 5.3.1.2: V_delta0rs = f_{41}(V_release)

3.13.9.4.7 To do so, the same formulas defined above with V_est and V_delta0 shall be applied, by substituting V_est with V_release and V_delta0 with V_delta0rs.

$$d_{SBI1}\left(V_{release}\right) = d_{SBD}\left(V_{release}\right) - V_{release} \cdot T_{bs1}$$

$$d_{SBI2}\left(V_{release}\right) = d_{EBI}\left(V_{release}\right) - V_{release} \cdot T_{bs2}$$

with $d_{EBI}\left(V_{release}\right) = d_{EBD}\left(V_{release} + V_{delta0rs}\right) - \left(V_{release} + V_{delta0rs}\right) \cdot \left(T_{berem} + T_{traction}\right)$

$d_{FLOI}\left(V_{release}\right) = d_{SBI1}\left(V_{release}\right)$ if $d_{SBI2}(V_{release}) - d_{SBI1}(V_{release}) \geq d_{\max safefront} - d_{estfront}$

Or $d_{FLOI}\left(V_{release}\right) = d_{SBI2}(V_{release})$ if $d_{SBI2}(V_{release}) - d_{SBI1}(V_{release}) < d_{\max safefront} - d_{estfront}$

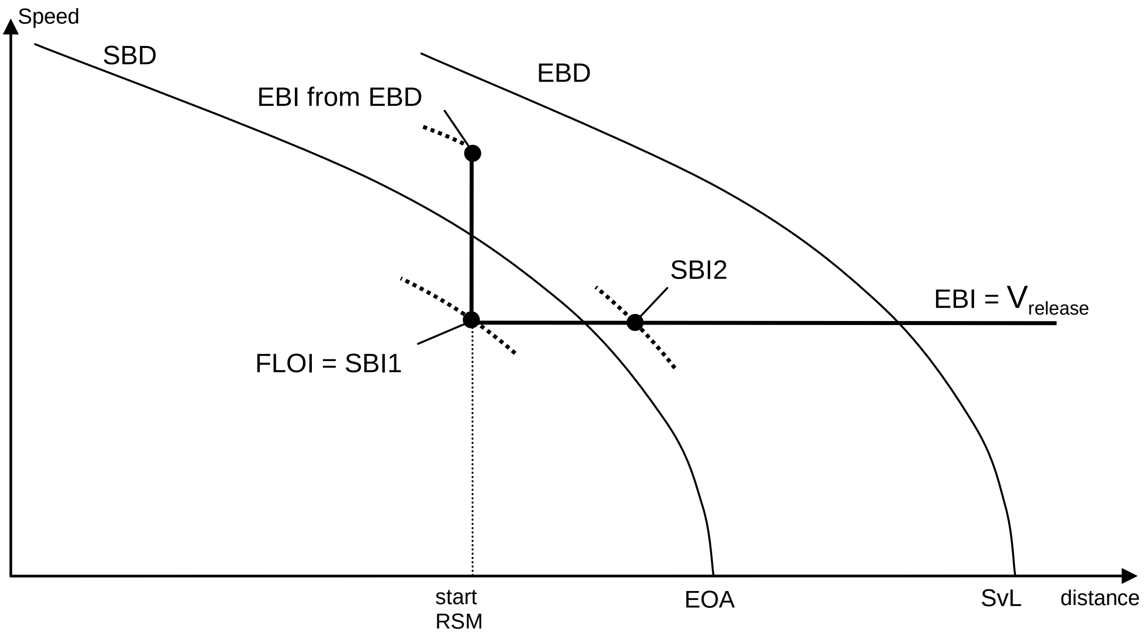


Figure 50: Start location of Release Speed Monitoring

3.13.9.4.8 When the Release Speed is calculated on-board (Figure 51 box 3), its value shall be equal to the most restrictive value, at the Trip location related to the EOA, amongst the EBI supervision limit related to the SvL (Figure 51 box 1) and, if any, the EBI supervision limits(s) related to other target(s) between the Trip location related to the EOA and the SvL (Figure 51 box 2).

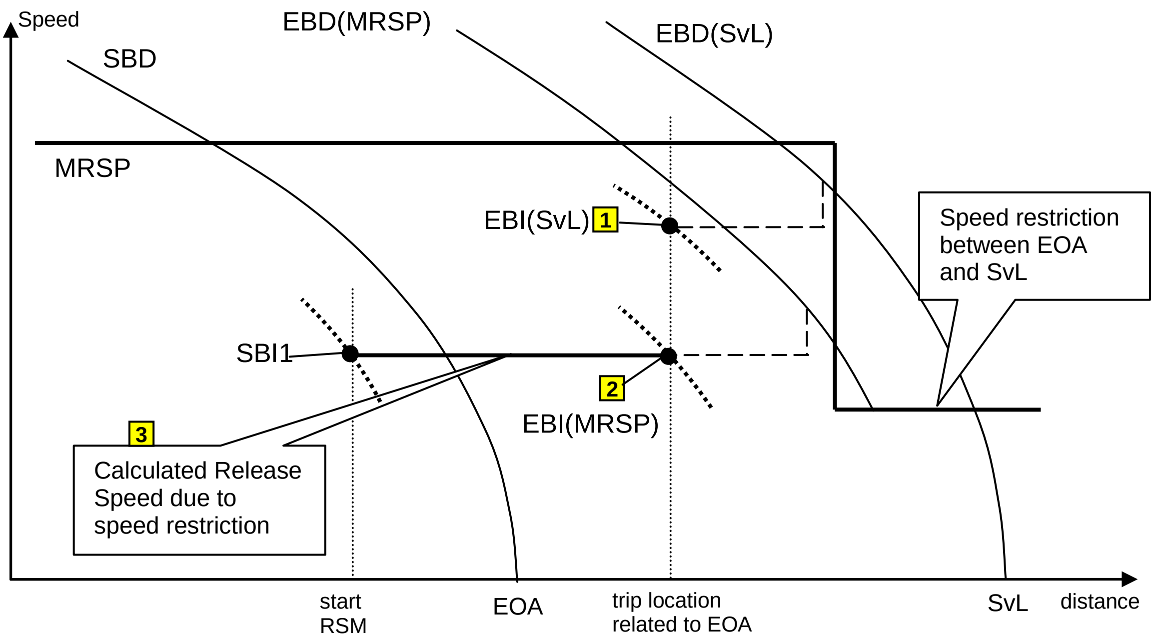


Figure 51: Calculated Release Speed based on speed restriction between EOA and SvL

3.13.9.4.8.1 In order to calculate in advance the EBI supervision limit at the Trip location related to the EOA, the on-board equipment shall take into account an estimated acceleration set to “zero”.

3.13.9.4.8.2 The release speed shall be iteratively calculated as follows:

$$V_{release}^{n+1} = V_{EBD}\left(d_{tripEoA} + D_{bec}^{n}\right) - V_{delta0rsob}^{n}$$

With $V_{delta0rsob}^{n} = \max\left\{f_{41}\left(V_{release}^{n}\right), V_{ura}\right\}$ or $V_{delta0rsob}^{n} = 0$ (if compensation of speed inaccuracy is inhibited by National Value)

With $D_{bec}^{n} = \left(V_{release}^{n} + V_{delta0rsob}^{n}\right)\cdot\left(T_{traction} + T_{berem}\right)$

With

$$d_{tripEoA} = d_{EoA} + \alpha \cdot L_{antenna-front} + \max\left\{\left(2\cdot Q_{locacc\_refBG} + 10m + 10\% \cdot d_{EoA}\right), \left(d_{\max safefront} - d_{\min safefront}\right)\right\}$$

And with $\alpha = 1$ if level = 1

$\alpha = 0$ if level = 2 or 3

$$V_{release}^{n+1} = V_{target} \text{ if } d_{tripEoA} + D_{bec}^{n} \geq d_{EBD}(V_{target})$$

or if $V_{EBD}\left(d_{tripEoA} + D_{bec}^{n}\right) - V_{delta0rsob}^{n} \leq V_{target}$

$$V_{release}^{0} = V_{target}$$

$V_{release} = V_{release}^{n+1}$ as soon as $ABS\left(V_{release}^{n+1} - V_{release}^{n}\right) \leq \varepsilon$

with $\varepsilon = 1km/h$

3.13.9.4.8.2.1 Note: The above formulas are intended to prevent the calculated release speed from fluctuating, according to the distance, speed and acceleration measurements. It allows calculating the release speed only once, for a given on-board reference location, unless

- the distance confidence interval exceeds a predicted one, which is based on the assumption that the whole distance between the current on-board reference location and the EOA would be travelled with SUBSET-041 odometer performance values and without any update of the on-board reference location, or
- the speed under reading amount (V_ura) exceeds the SUBSET-041 performance value

Whenever the on-board reference location is updated (e.g. new LRBG), the release speed will however be recalculated and will increase with a step. This behaviour is acceptable from an operational point of view.

3.13.9.4.9 If the release speed (Figure 52 box 1 gives an example when it is calculated on-board) exceeds the MRSP anywhere in the area (Figure 52 box 2) delimited on one side by the presumed start location of the Release speed monitoring and on the other side by the trip location related to the EOA, the on-board shall use as a fixed release speed (Figure 52 box 4) the most restrictive value of the MRSP (Figure 52 box 3) within this area, and shall re-evaluate the start location of the Release speed monitoring accordingly.

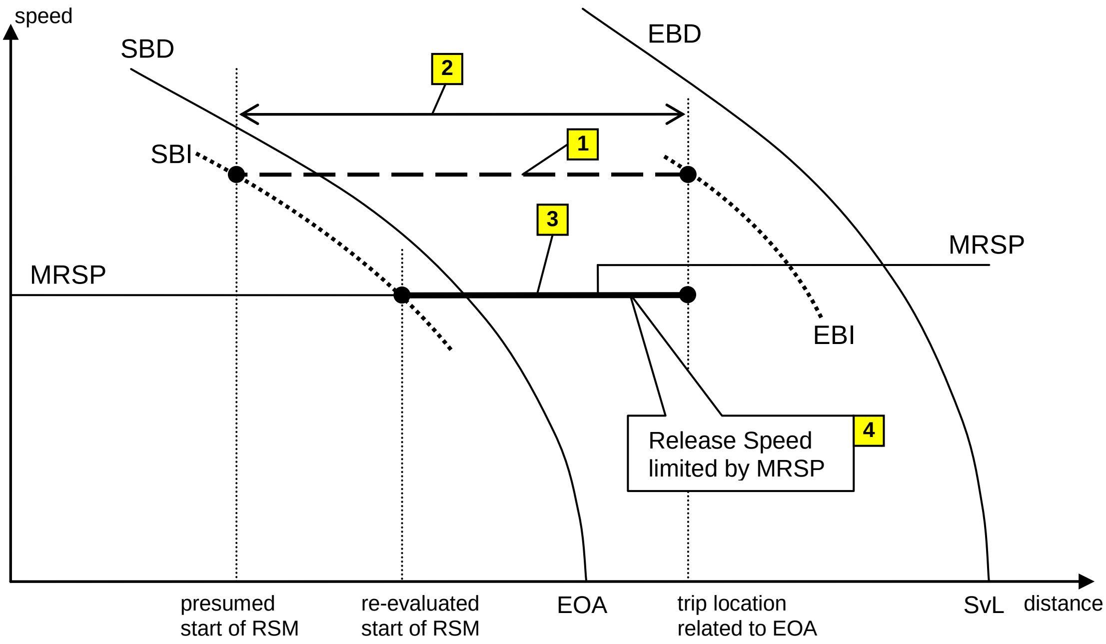


Figure 52: Release Speed limited by MRSP

3.13.9.5 Pre-indication location

3.13.9.5.1 The purpose of the pre-indication is to inform the driver that he is approaching an area where he has to operate the service brake in order to brake to a target. The pre-indication is used to switch from ceiling speed monitoring to target speed monitoring.

3.13.9.5.2 For an EBD based target, the on-board shall calculate the pre-indication location as follows.

3.13.9.5.3 Starting from the first element of the MRSP (i.e. from the start location of the on-board stored track description), the on-board shall calculate the location of the Indication supervision limit, valid for the speed of the MRSP element, taking into account the following assumptions:

a) the estimated acceleration shall be set to “zero”

b) if not inhibited by National Value, the compensation of the inaccuracy of the speed measurement shall be set to a value, calculated from the speed of the MRSP element, as defined in SUBSET-041 § 5.3.1.2: V_delta0ind = f_{41}(V_MRSP-n)

3.13.9.5.4 To calculate the EBI supervision limit, the same formulas defined above with V_est and V_delta0 shall be applied, by substituting V_est with V_MRSP-n and V_delta0 with V_delta0ind.

$$d_{EBI}\left(V_{MRSP-n}\right)=d_{EBD}\left(V_{MRSP-n}+V_{delta0ind}\right)-\left(V_{MRSP-n}+V_{delta0ind}\right)\cdot\left(T_{berem}+T_{traction}\right)$$

$$d_{SBI2}\left(V_{MRSP-n}\right)=d_{EBI}\left(V_{MRSP-n}\right)-V_{MRSP-n}\cdot T_{bs2}$$

$$d_{I}\left(V_{MRSP-n}\right)=d_{P}\left(V_{MRSP-n}\right)-V_{MRSP-n}\cdot T_{indication}$$

With $d_{P}\left(V_{MRSP-n}\right)=d_{SBI2}\left(V_{MRSP-n}\right)-V_{MRSP-n}\cdot T_{driver}$ if the GUI curve is inhibited

Or $d_{P}\left(V_{MRSP-n}\right)=\min\left\{\left(d_{SBI2}\left(V_{MRSP-n}\right)-V_{MRSP-n}\cdot T_{driver}\right),d_{GUI}\left(V_{MRSP-n}\right)\right\}$ if the GUI curve is enabled

3.13.9.5.5 If the Indication supervision limit, obtained from the speed of the nth element, is located between the start and end locations of this nth element, the pre-indication location shall be calculated as follows:

If $d^{a}_{MRSP-n}<d_{I}\left(V_{MRSP-n}\right)\le d^{b}_{MRSP-n}$

Then $d_{preindicaton}=d_{I}\left(V_{MRSP-n}\right)-V_{MRSP-n}\cdot T_{preindicaton}$

3.13.9.5.6 If the Indication supervision limit, obtained from the speed of the nth element, is located in advance of the end location of this nth element, and if the Indication supervision limit, obtained from the speed of the n+1th element is located in rear of the end location of this nth element (see Figure 53), the pre-indication location shall be calculated as follows:

If $d_{I}\left(V_{MRSP-n}\right)>d^{b}_{MRSP-n}$ and $d_{I}\left(V_{MRSP-n+1}\right)<d^{b}_{MRSP-n}$

Then $d_{preindicaton}=d^{b}_{MRSP-n}-V_{MRSP-n}\cdot T_{preindicaton}$

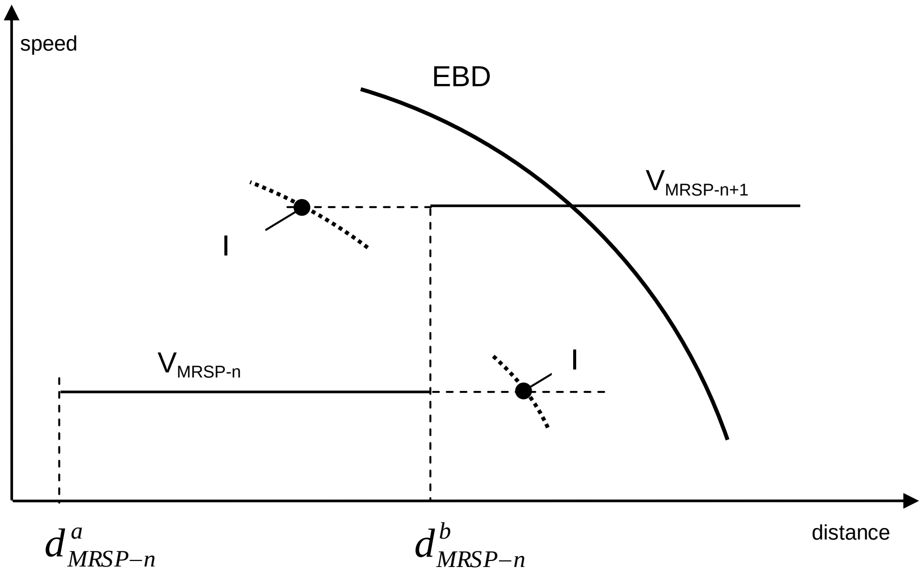


Figure 53: Pre-indication location derived from MRSP speed increase

3.13.9.5.7 T_preindication is defined as a fixed value (refer to A3.1).

3.13.9.5.8 For the EOA, the on-board shall calculate its pre-indication location in the same way as for an EBD based target, except that the formulas to calculate the distance between the location of the Indication supervision limit and the SBD shall be:

$$d_{SBI1}(V_{MRSP-n}) = d_{SBD}(V_{MRSP-n}) - V_{MRSP-n} \cdot T_{bs1}$$

$$d_I(V_{MRSP-n}) = d_P(V_{MRSP-n}) - V_{MRSP-n} \cdot T_{indication}$$

With $d_P(V_{MRSP-n}) = d_{SBI1}(V_{MRSP-n}) - V_{MRSP-n} \cdot T_{driver}$ if the GUI curve is inhibited

Or $d_P(V_{MRSP-n}) = \min\{(d_{SBI1}(V_{MRSP-n}) - V_{MRSP-n} \cdot T_{driver}), d_{GUI}(V_{MRSP-n})\}$ if the GUI curve is enabled

3.13.9.5.9 If, in exceptional situation (e.g. after a shortening of MA), the calculation described above leads to a pre-indication location in rear of the start location of the MRSP, the condition [1] for executing speed monitoring transition (see Table 16) shall be considered as immediately fulfilled.

3.13.9.5.10 If, in exceptional situation (e.g. after a shortening of MA), the EBD, SBD or GUI speed at the start location of the MRSP is lower than the speed of the first element of the MRSP, the condition [1] for executing speed monitoring transition (see Table 16) shall be considered as immediately fulfilled.

3.13.9.5.11 Note 1: For ergonomic reasons, the location of a pre-indication is independent of the estimated speed. If the pre-indication would be derived from an EBD or SBD curve according to the estimated speed, then when the train is running at low speed the driver would see the permitted speed already decrease while the DMI is still in ceiling speed display. That is not consistent for the driver and therefore the pre-indication is independent of the estimated speed.

3.13.9.5.12 Note 2: For trackside engineering reasons, the assumptions for the calculation of the EBI supervision limit are necessary to obtain a fully predictable pre-indication location, i.e. independent from the measured acceleration and speed confidence interval.

3.13.9.5.13 For display purpose only: when the pre-indication location of the target is derived from the location of the Indication supervision limit, this latter is used in order to discriminate, for estimated speeds higher than the MRSP speed, whether the on-board considers that the Indication supervision limit is exceeded (see section 3.13.10.4.11).

3.13.10 Speed and distance monitoring commands

3.13.10.1 Introduction

3.13.10.1.1 By comparing the train speed and position to the various supervision limits defined in the previous section, the on-board equipment generates braking commands, traction cut-off commands and relevant information to the driver. The information displayed to the driver is selected according to the following supervision statuses of the speed and distance monitoring function: Normal status, Indication status, Overspeed status, Warning status and Intervention status.

3.13.10.1.2 The following types of speed and distance monitoring are defined:

- Ceiling speed monitoring (CSM)
- Target speed monitoring (TSM)
- Release speed monitoring (RSM)

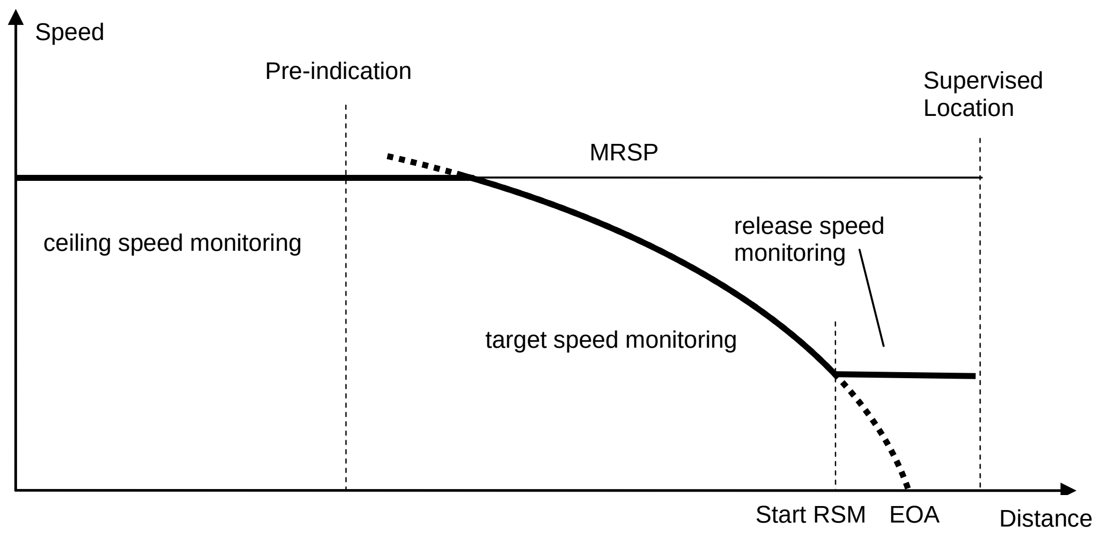


Figure 54: Different types of speed and distance monitoring

3.13.10.1.3 Ceiling speed monitoring is the speed supervision in the area where the train can run with the speed as defined by the MRSP without the need to brake to a target.

3.13.10.1.4 Target speed monitoring is the speed and distance supervision in the area where the specific information related to a target is displayed to the driver and within which the train brakes to a target.

3.13.10.1.5 Release speed monitoring is the speed and distance supervision in the area close to the EOA where the train is allowed to run with release speed to approach the EOA.

3.13.10.2 General requirements

3.13.10.2.1 The train speed indicated to the driver shall be identical to the speed used for the speed monitoring (i.e. the estimated speed).

3.13.10.2.2 Once a Train Interface command (traction cut-off, service brake or emergency brake) is triggered, the on-board shall apply it until its corresponding revocation condition is met.

3.13.10.2.3 If there is no on-board interface with the service brake or if the use of the service brake command is not allowed by a National Value (only in Target speed monitoring), whenever a service brake command is specified, the emergency brake command shall be triggered instead.

3.13.10.2.4 The emergency brake command, which is triggered instead of the service brake command when an SBI supervision limit is exceeded, shall be revoked according to the requirements specified for the revocation of service brake command, unless the emergency brake command has been also triggered due to an EBI supervision limit. In such case, the condition for revoking the emergency brake command due to EBI supervision limit shall prevail.

3.13.10.2.5 The on-board shall revoke the Intervention status only when no brake command is applied by the speed and distance monitoring function.

3.13.10.2.6 In level 2/3: Train trip shall be initiated if the on-board equipment detects that the minimum safe front end has passed the EOA/LOA location.

3.13.10.2.7 In Level 1: Train Trip shall be initiated if the on-board equipment detects that the minimum safe antenna position (calculated by subtracting distance between active Eurobalise antenna and the front end of the train from the min safe front end position) has passed the EOA/LOA location.

3.13.10.3 Requirements for Ceiling speed monitoring

3.13.10.3.1 The on-board equipment shall display the Permitted speed.

3.13.10.3.2 When the supervision status is Overspeed, Warning or Intervention, the on-board equipment shall display the SBI speed (i.e. the FLOI speed).

3.13.10.3.3 The on-board shall compare the estimated speed with the ceiling supervision limits defined in section 3.13.9.2 and shall trigger/revoke commands to the train interface (service brake if implemented or emergency brake) and supervision statuses as described in Table 5 and Table 6.

Triggering condition #	Estimated speed	Location	TI Command triggered	Supervision status triggered
t1	$V_{est} \leq V_{MRSP}$	Any	-	Normal Status
t2	$V_{est} > V_{MRSP}$	Any	-	Overspeed Status
t3	$V_{est} > V_{MRSP} + dV_{warning}(V_{MRSP})$	Any	-	Warning Status
t4	$V_{est} > V_{MRSP} + dV_{sbi}(V_{MRSP})$	Any	SB	Intervention Status
t5	$V_{est} > V_{MRSP} + dV_{ebi}(V_{MRSP})$	Any	EB	Intervention Status

Table 5: triggering of Train Interface commands and supervision statuses in ceiling speed monitoring

Revocation condition #	Estimated speed	Location	TI Command revoked	Supervision status revoked
r0	Standstill		EB	Intervention Status
r1	$V_{est} \leq V_{MRSP}$	Any	SB EB (only if allowed by National Value)	Indication Status Overspeed Status Warning Status Intervention Status (in case of EB command, only if allowed by National Value)

Table 6: Revocation of Train Interface commands and supervision statuses in ceiling speed monitoring

3.13.10.3.4 The on-board equipment shall execute the transitions between the different supervision statuses as described in Table 7 (see section 4.6.1 for details about the symbols). This table takes into account the order of precedence between the supervision statuses and the possible updates of the MRSP while in ceiling speed monitoring (e.g. when a TSR is revoked).

Normal status	< r1 -p1-	< r1 -p1-	< r1 -p1-	< r0, r1 -p1-
	Indication status			
t2 > -p3-	t2 > -p3-	**Overspeed status**		
t3 > -p2-	t3 > -p2-	t3 > -p2	**Warning status**	
t4, t5 > -p1-	t4, t5 > -p1-	t4, t5 > -p1-	t4, t5 > -p1-	**Intervention status**

Table 7: Transitions between supervision statuses in ceiling speed monitoring

3.13.10.3.5 When the speed and distance monitoring function becomes active and the ceiling speed monitoring is the first one entered, the triggering condition t1 defined in Table 5 shall be checked in order to determine whether the Normal status applies. If it is not the case, the on-board shall immediately set the supervision status to the relevant value, applying a transition from the Normal status according to Table 7.

3.13.10.3.6 The Indication status is not used in ceiling speed monitoring. However, in case the ceiling speed monitoring is entered and the supervision status was previously set to Indication, the on-board equipment shall immediately execute one of the transitions from the Indication status, as described in Table 7.

3.13.10.3.7 The locations corresponding to a speed increase of the MRSP shall be supervised by the on-board equipment taking into account the min safe front end of the train.

3.13.10.4 Requirements for Target speed monitoring

3.13.10.4.1 In target speed monitoring, both the ceiling supervision limits and the braking to target supervision limits, described in sections 3.13.9.2 and 3.13.9.3, are used to determine the commands to the Train Interface and the information displayed to the driver.

3.13.10.4.2 The on-board equipment shall display to the driver the information related to one target at a time: the Most Restrictive Displayed Target (MRDT). The MRDT shall be defined as the target of which the braking to target Permitted speed supervision limit (refer to section 3.13.9.3.5), calculated for the current position of the train, is the lowest one amongst the supervised targets:

$$\underset{MRDT}{V_P} = \min\left\{ V_P(\underset{EOA}{d_{estfront}}), V_P(\underset{SvL}{d_{\max safefront}}), V_P(\underset{Target\_1}{d_{\max safefront}}), \ldots, V_P(\underset{Target\_n}{d_{\max safefront}}) \right\}$$

3.13.10.4.2.1 Once the service brake feedback functionality is active (see Appendix A3.10 for details), the on-board equipment shall ensure that the displayed Permitted speed never increases, if it results from the progressive reduction of T_bs1 and T_bs2. In other terms if the Permitted speed calculated as above has a higher value than the previously displayed value, then the previous value shall remain displayed until a further calculated Permitted speed is lower than the displayed one.

3.13.10.4.3 The on-board equipment shall display the Permitted speed, according to following formula:

$$\underset{DMI}{V_P} = \min\left\{ \max\left\{ \underset{MRDT}{V_P}, \underset{MRDT}{V_{target}} \right\}, V_{MRSP} \right\}$$

3.13.10.4.4 When the supervision status is Overspeed, Warning or Intervention, the on-board equipment shall display the FLOI speed, according to the following formulas:

$$\underset{DMI}{V_{FLOI}} = \min\left\{ \max\left\{ \underset{MRDT}{V_{SBI}}, \underset{MRDT}{V_{target}} + dV_{sbi}(\underset{MRDT}{V_{target}}) \right\}, V_{MRSP} + dV_{sbi}(V_{MRSP}) \right\}$$ in case of MRSP target or LOA

$$\underset{DMI}{V_{FLOI}} = \min\left\{ \max\left\{ \underset{MRDT}{V_{SBI}}, V_{release} \right\}, V_{MRSP} + dV_{sbi}(V_{MRSP}) \right\}$$ in case of EOA or SvL

3.13.10.4.5 Note: the MRDT is needed to avoid jumps of displayed Permitted speed, when the SBD intersects an EBD or when the target to which the FLOI is related suddenly changes, due to the growth of the train position confidence interval. As a result the MRDT may temporarily not correspond to the target to which the FLOI is related, but this will never be the case when the train speed/location is reaching the supervision limit.

3.13.10.4.6 If the MRDT is either the EOA or the SvL, the on-board equipment shall display the release speed, if given by the trackside or calculated on-board.

3.13.10.4.7 If the MRDT is neither the EOA nor the SvL, the indicated distance to the target shall be the distance between the maximum safe front end and the location of the Permitted speed supervision limit calculated for the target speed (see section 3.13.9.3.5 for the calculation of this location), but limited to zero after this location is passed.

Target distance = $\max\left\{ \left(d_P\left(V_{target}\right) - d_{\max safefront} \right), 0 \right\}$

3.13.10.4.7.1 Once the service brake feedback functionality is active (see Appendix A3.10 for details), the on-board equipment shall ensure that the displayed target distance never increases, if it results from the progressive reduction of T_bs1 and T_bs2. In other terms if the target distance calculated as above has a higher value than the previously displayed value, then the previous value shall remain displayed until a further calculated target distance is lower than the displayed one.

3.13.10.4.8 If the MRDT is either the EOA or the SvL, the indicated distance to the target shall be calculated as follows:

Target distance = $\max\left\{\min\left\{\left(d_{EOA} - d_{estfront}\right), \left(d_{SvL} - d_{\max safefront}\right)\right\}, 0\right\}$

3.13.10.4.9 The on-board shall consider the service brake command as available for use unless:

a) The service brake command is not implemented, OR

b) The national value inhibits its use.

3.13.10.4.10 The on-board equipment shall compare the estimated speed and train position with the ceiling and braking to target supervision limits and shall trigger/revoke commands to the train interface (traction cut-off if implemented, service brake if available for use or emergency brake) and supervision statuses, as described in Table 8 and Table 10 (for target related to a MRSP speed decrease or LOA), and as described in Table 9 and Table 11 (for target EOA/SvL with release speed).

Triggering condition #	Estimated speed	Train front end position (estimated and max safe)	TI Command triggered	Supervision status triggered
t1	$V_{est} \leq V_{target}$	Not relevant	-	Normal Status
t2	$V_{target} < V_{est} \leq V_{MRSP}$	$d_{\max safefront} \leq d_I(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} \leq d_I(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	-	Normal Status
t3		$d_{\max safefront} > d_I(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} > d_I(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	-	Indication Status
t4		$d_{\max safefront} > d_P(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} > d_P(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	-	Overspeed Status
t5	V_{MRSP} $< V_{est} \leq$ $V_{MRSP} + dV_{warning}(V_{MRSP})$	$d_{\max safefront} \leq d_I(V_{MRSP})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} \leq d_I(V_{MRSP})$ if $FLOI(V_{est}) = SBI1(V_{est})$	-	Overspeed Status(Pre-indication display area)
t6		$d_I(V_{MRSP}) < d_{\max safefront} \leq d_W(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_I(V_{MRSP}) < d_{estfront} \leq d_W(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	-	Overspeed Status
t7	$V_{target} + dV_{warning}(V_{target})$ $< V_{est} \leq$ $V_{MRSP} + dV_{warning}(V_{MRSP})$	$d_{\max safefront} > d_W(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} > d_W(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	TCO	Warning Status
t8	$V_{MRSP} + dV_{warning}(V_{MRSP})$ $< V_{est} \leq$ $V_{MRSP} + dV_{sbi}(V_{MRSP})$	$d_{\max safefront} \leq d_I(V_{MRSP})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} \leq d_I(V_{MRSP})$ if $FLOI(V_{est}) = SBI1(V_{est})$	TCO	Warning Status(Pre-indication display area)
t9		$d_I(V_{MRSP}) < d_{\max safefront} \leq d_{FLOI}(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_I(V_{MRSP}) < d_{estfront} \leq d_{FLOI}(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	TCO	Warning Status

Triggering condition #	Estimated speed	Train front end position (estimated and max safe)	TI Command triggered	Supervision status triggered
t10	$V_{target} + dV_{sbi}(V_{target}) < V_{est} \leq V_{MRSP} + dV_{sbi}(V_{MRSP})$	$d_{\max safefront} > d_{FLOI}(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} > d_{FLOI}(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	SB	Intervention Status
t11	$V_{MRSP} + dV_{sbi}(V_{MRSP}) < V_{est} \leq V_{MRSP} + dV_{ebi}(V_{MRSP})$	$d_{\max safefront} \leq d_I(V_{MRSP})$	SB	Intervention Status(Pre-indication display area)
t12		$d_I(V_{MRSP}) < d_{\max safefront} \leq d_{EBI}(V_{est})$	SB	Intervention Status
t13	$V_{target} + dV_{ebi}(V_{target}) < V_{est} \leq V_{MRSP} + dV_{ebi}(V_{MRSP})$	$d_{\max safefront} > d_{EBI}(V_{est})$	EB	Intervention Status
t14	$V_{est} > V_{MRSP} + dV_{ebi}(V_{MRSP})$	Not relevant	EB	Intervention Status

Table 8: Triggering of Train Interface commands and supervision statuses in target speed monitoring, MRSP target or LOA

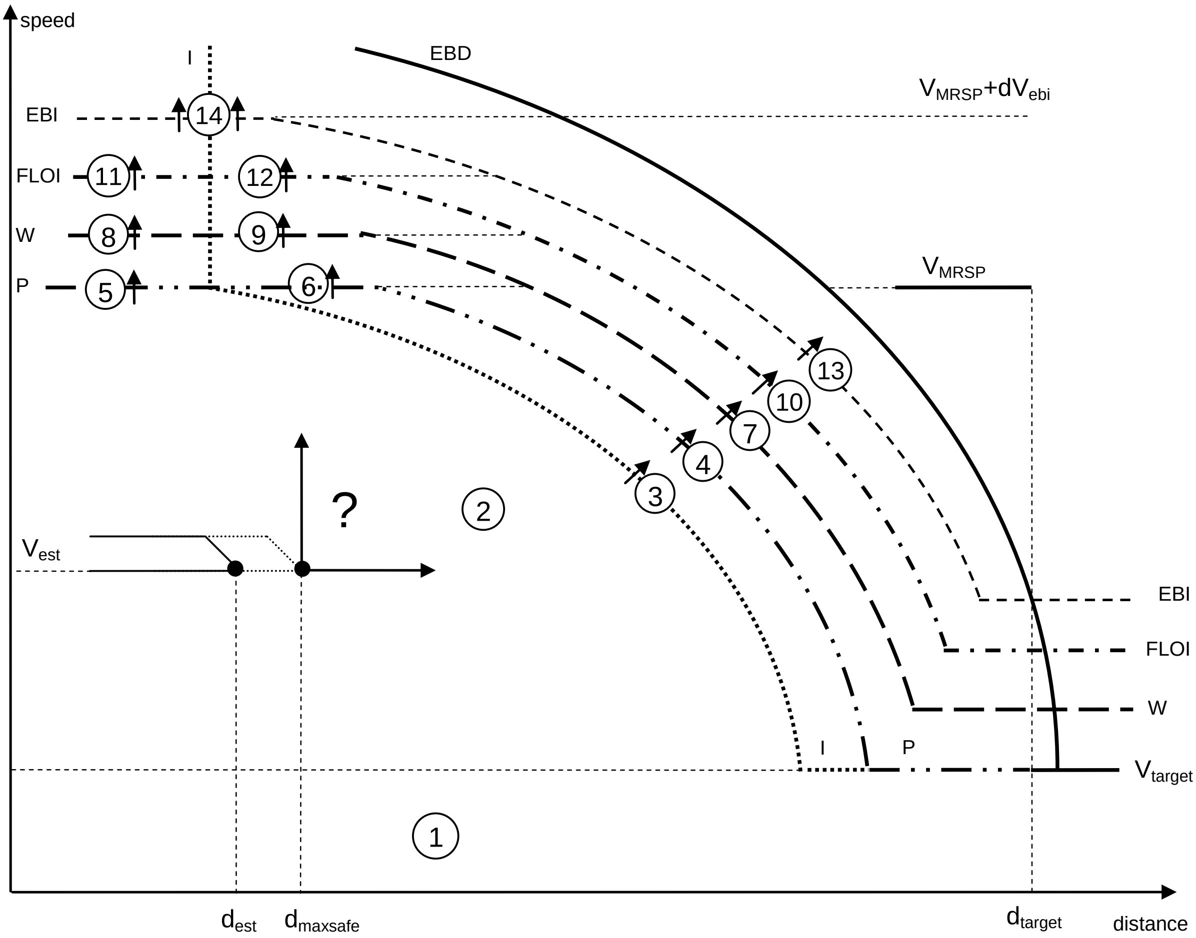


Figure 55: Triggering of Train Interface commands and supervision statuses in target speed monitoring, MRSP target or LOA (number in circle corresponds with the equivalent triggering condition in Table 8)

Triggering condition #	Estimated speed	Train front end position (estimated and max safe)	TI Command triggered	Supervision status triggered
t1	$V_{est} \leq V_{release}$	Not relevant	-	Normal Status
t2	$V_{release} < V_{est} \leq V_{MRSP}$	$d_{\max safefront} \leq d_I(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} \leq d_I(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	-	Normal Status
t3		$d_{\max safefront} > d_I(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} > d_I(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$		Indication Status
t4		$d_{\max safefront} > d_P(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} > d_P(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$		Overspeed Status
t5	$V_{MRSP} < V_{est} \leq V_{MRSP} + dV_{warning}(V_{MRSP})$	$d_{\max safefront} \leq d_I(V_{MRSP})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} \leq d_I(V_{MRSP})$ if $FLOI(V_{est}) = SBI1(V_{est})$	-	Overspeed Status(Pre-indication display area)
t6		$d_I(V_{MRSP}) < d_{\max safefront} \leq d_W(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_I(V_{MRSP}) < d_{estfront} \leq d_W(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	-	Overspeed Status
t7	$V_{release} < V_{est} \leq V_{MRSP} + dV_{warning}(V_{MRSP})$	$d_{\max safefront} > d_W(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} > d_W(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	TCO	Warning Status
t8	$V_{MRSP} + dV_{warning}(V_{MRSP}) < V_{est} \leq V_{MRSP} + dV_{sbi}(V_{MRSP})$	$d_{\max safefront} \leq d_I(V_{MRSP})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} \leq d_I(V_{MRSP})$ if $FLOI(V_{est}) = SBI1(V_{est})$	TCO	Warning Status(Pre-indication display area)
t9		$d_I(V_{MRSP}) < d_{\max safefront} \leq d_{FLOI}(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_I(V_{MRSP}) < d_{estfront} \leq d_{FLOI}(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	TCO	Warning Status
t10	$V_{release} < V_{est} \leq V_{MRSP} + dV_{sbi}(V_{MRSP})$	$d_{\max safefront} > d_{FLOI}(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} > d_{FLOI}(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	SB	Intervention Status

Triggering condition #	Estimated speed	Train front end position (estimated and max safe)	TI Command triggered	Supervision status triggered
t11	$V_{MRSP} + dV_{sbi}(V_{MRSP}) < V_{est} \leq V_{MRSP} + dV_{ebi}(V_{MRSP})$	$d_{\max safefront} \leq d_I(V_{MRSP})$	SB	Intervention Status(Pre-indication display area)
t12		$d_I(V_{MRSP}) < d_{\max safefront} \leq d_{EBI}(V_{est})$	SB	Intervention Status
t13	$V_{release} < V_{est} \leq V_{MRSP} + dV_{ebi}(V_{MRSP})$	$d_{\max safefront} > d_{EBI}(V_{est})$	EB	Intervention Status
t14	$V_{est} > V_{MRSP} + dV_{ebi}(V_{MRSP})$	Not relevant	EB	Intervention Status

Table 9: Triggering of Train Interface commands and supervision statuses in target speed monitoring, EOA/SvL with release speed

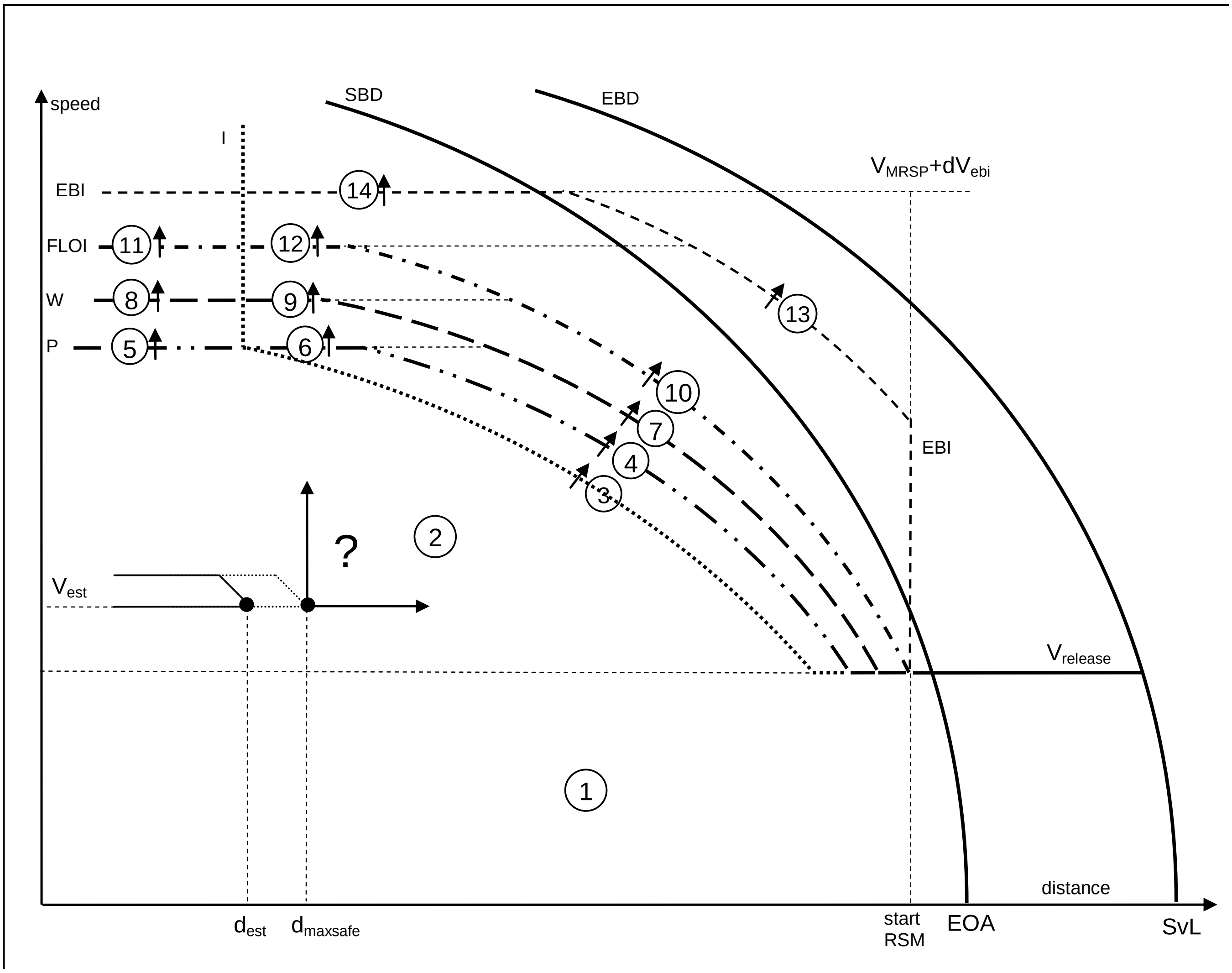


Figure 56: Triggering of Train Interface commands and supervision statuses in target speed monitoring, EOA/SvL with release speed (number in circle corresponds with equivalent triggering condition in Table 9)

3.13.10.4.11 The braking to target Indication supervision limit is not used for estimated speeds higher than V_MRSP. However the location of the Indication supervision limit, valid for V_MRSP, when used to derive the pre-indication location of the target, shall be used for estimated speeds higher than V_MRSP in order to discriminate whether information related to the Indication status has to be displayed to the driver. In other terms, for estimated speeds above V_MRSP, the Indication supervision limit is a fixed location, which defines a pre-indication display area starting from the pre-indication location and ending to this fixed location.

3.13.10.4.12 Note: Figure 56 shows the parts of the ceiling speed and braking to target supervision limits, which are used in target speed monitoring to trigger the brake commands and the transitions between supervision statuses. It does not show what is displayed to the driver: in particular, the braking to target Permitted supervision limit is displayed (even if not supervised) for values lower than the release speed.

Revocation condition #	Estimated speed	Train front end position (estimated and max safe)	TI Command revoked	Supervision status revoked
r0	Standstill		EB	Intervention status
r1	$V_{est} \leq V_{target}$	Not relevant	TCO SB EB (in case V_target ≠ 0, only if allowed by National Value)	Indication status Overspeed status Warning status Intervention status (in case of EB command and V_target ≠ 0, only if allowed by National Value)
r2	$V_{target} < V_{est} \leq V_{MRSP}$	$d_{\max safefront} \leq d_I(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} \leq d_I(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	TCO SB EB (only if allowed by National Value)	Indication status (only in case of change of displayed target) Overspeed status Warning status Intervention status (in case of EB command and V_target ≠ 0, only if allowed by National Value)
r3		$d_{\max safefront} \leq d_P(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} \leq d_P(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	TCO SB EB (only if allowed by National Value)	Overspeed status Warning status Intervention status (in case of EB command, only if allowed by National Value)

Table 10: Revocation of Train Interface commands and supervision statuses in target speed monitoring, MRSP target or LOA

Revocation condition #	Estimated speed	Train front end position (estimated and max safe)	TI Command revoked	Supervision status revoked
r0	Standstill		EB	Intervention status
r1	$V_{est} \leq V_{release}$	Not relevant	TCO SB EB (in case V_target ≠ 0, only if allowed by National Value)	Indication status (only in case of change of displayed target) Overspeed status Warning status Intervention status (in case of EB command and V_target ≠ 0, only if allowed by National Value)
r2	$V_{release} < V_{est} \leq V_{MRSP}$	$d_{\max safefront} \leq d_I(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} \leq d_I(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	TCO SB EB (only if allowed by National Value)	Indication status (only in case of change of displayed target) Overspeed status Warning status Intervention status (in case of EB command and V_target ≠ 0, only if allowed by National Value)
r3		$d_{\max safefront} \leq d_P(V_{est})$ if $FLOI(V_{est}) = SBI2(V_{est})$ OR $d_{estfront} \leq d_P(V_{est})$ if $FLOI(V_{est}) = SBI1(V_{est})$	TCO SB EB (only if allowed by National Value)	Overspeed status Warning status Intervention status (in case of EB command, only if allowed by National Value)

Table 11: Revocation of Train Interface commands and supervision statuses in target speed monitoring, EOA/SvL with release speed

3.13.10.4.13 In case of target EOA/SvL without any supervised release speed, the Table 9 and Table 11 shall be applied, by substituting V_release with the value 0.

3.13.10.4.14 Note: as long as the same MRSP or LOA target is displayed, the on-board will revoke the Indication status only when the estimated speed does no longer exceed the target speed. On the other hand, as long as the same EOA/SvL target is displayed, the Indication status, once it is triggered, is never revoked. However, for all types of target and only in case of MRDT change, the on-board will revoke the Indication status if the Indication supervision limit (speed and location) is not exceeded (see Table 10 and Table 11).

3.13.10.4.15 The on-board equipment shall execute the transitions between the different supervision statuses as described in Table 12 (see section 4.6.1 for details about the symbols). This table takes into account the order of precedence between the supervision statuses and the possible changes of the displayed target (MRDT), e.g. when the list of supervised targets is updated.

Normal status	< r1, r2 -p1-	< r1, r2 -p1-	< r1, r2 -p1-	< r0, r1, r2 -p1-
t3 > -p4-	**Indication status**	< r3 -p2-	< r3 -p2-	< r3 -p2-
t4, t5, t6 > -p3-	t4, t5, t6 > -p3-	**Overspeed status**		
t7, t8, t9 > -p2-	t7, t8, t9 > -p2-	t7, t8, t9 > -p2-	**Warning status**	
t10, t11, t12, t13, t14 > -p1-	t10, t11, t12, t13, t14 > -p1-	t10, t11, t12, t13, t14 > -p1-	t10, t11, t12, t13, t14 > -p1-	**Intervention status**

Table 12: Transitions between supervision statuses in target speed monitoring

3.13.10.4.16 When the speed and distance monitoring function becomes active and the target speed monitoring is the first one entered, the triggering conditions t1 and t2 defined in Table 8 or Table 9 shall be checked in order to determine whether the Normal status applies. If it is not the case, the on-board shall immediately set the supervision status to the relevant value, applying a transition from the Normal status according to Table 12.

3.13.10.5 Requirements for release speed monitoring

3.13.10.5.1 The on-board equipment shall display the Release speed.

3.13.10.5.2 The on-board equipment shall display the target distance, in the same way as for target speed monitoring.

3.13.10.5.3 The braking to target Permitted speed supervision limit related to the MRDT (i.e. EOA or SvL), as calculated in target speed monitoring from the EBD or SBD, shall also be displayed.

3.13.10.5.4 The on-board equipment shall compare the estimated speed with the release speed and shall trigger/revoke commands to the train interface (emergency brake) and supervision statuses as described in Table 13 and Table 14.

Triggering condition #	Estimated speed	Location	TI Command triggered	Supervision status triggered
t1	$V_{est} \leq V_{release}$	Any	-	Indication Status
t2	$V_{est} > V_{release}$	Any	EB	Intervention Status

Table 13: Triggering of Train Interface commands and supervision statuses in release speed monitoring

Triggering condition #	Estimated speed	Location	TI Command revoked	Supervision status revoked
r0	Standstill		EB	Intervention Status
r1	$V_{est} \leq V_{release}$	Any	-	Overspeed Status Warning Status

Table 14: Revocation of Train Interface commands and supervision statuses in release speed monitoring

3.13.10.5.5 The on-board equipment shall execute the transitions between the different supervision statuses as described in Table 15 (see section 4.6.1 for details about the symbols). This table takes into account the order of precedence between the supervision statuses and the possible updates of the release speed while in release speed monitoring.

Normal status				
t1 > -p1-	**Indication status**	< r1 -p1-	< r1 -p1-	< r0 -p1-
		Overspeed status		
			Warning status	
t2 > -p1-	t2 > -p1-	t2 > -p1-	t2 > -p1-	**Intervention status**

Table 15: Transitions between supervision statuses in release speed monitoring

3.13.10.5.6 When the speed and distance monitoring function becomes active and the release speed monitoring is the first one entered, the triggering condition t1 defined in Table 13 shall be checked in order to determine whether the Indication status applies. If it is not the case, the on-board shall immediately set the supervision status to the Intervention status, applying a transition from the Indication status according to Table 15.

3.13.10.5.7 The Normal, Warning and Overspeed statuses are not used in release speed monitoring. However, in case the release speed monitoring is entered and the supervision status was previously set to Normal, Warning or Overspeed, the on-board equipment shall immediately execute one of the transitions from respectively the Normal, Warning or Overspeed status, as described in Table 15.

3.13.10.6 Transitions between types of Speed and distance monitoring

3.13.10.6.1 The transitions between the Ceiling speed monitoring, the Target speed monitoring and the Release speed monitoring shall be achieved as described in the Table 16:

Condition id	Transition condition	CSM	TSM	RSM
[1]	(The train has passed with its max safe front end the pre-indication location calculated from an EBD) OR (The train has passed with its estimated front end the pre-indication location calculated from the SBD)	●──	──►	

Condition id	Transition condition	CSM	TSM	RSM
[2]	(The train has passed with its max safe front end the RSM start location if it is calculated from an EBD) OR (The train has passed with its estimated front end the RSM start location if it is calculated from the SBD)			
[3]	(The list of supervised targets is updated) AND (condition [1] is not fulfilled)			
[4]	(The list of supervised targets is updated) AND (condition [1] is fulfilled) AND (condition [2] is not fulfilled)			
[5]	(The list of supervised targets is updated) AND (condition [2] is fulfilled)			

Table 16: Transitions between types of Speed and distance monitoring

3.13.10.6.2 If a transition of speed and distance monitoring occurs while a brake command is already applied, the concerned command shall be maintained until the revocation condition, if specified for the newly entered speed and distance monitoring, is fulfilled.

3.13.10.6.2.1 Note: This means that when the service brake is commanded in ceiling speed monitoring while it is not available in target speed monitoring, the service brake remains commanded when the on-board switches to target speed monitoring and is only revoked when the Permitted speed supervision limit is no longer exceeded.

3.13.10.6.3 If a transition from target speed monitoring to ceiling speed or release speed monitoring occurs while a traction cut-off command is already applied, the traction cut-off command shall be immediately revoked.

3.13.10.6.4 If a transition from target speed monitoring to release speed monitoring occurs while a service brake command is already applied, the service brake command shall be immediately revoked.

3.13.10.6.5 On executing a transition between types of speed and distance monitoring, the supervision status shall be determined according to the requirements specified for the newly entered speed and distance monitoring.

3.14 Brake Command Handling and Protection against Undesirable Train Movement

3.14.1 Brake Command Handling

3.14.1.1 Note: Whenever the type of brake used is not specified explicitly in the text, it shall be interpreted as not being important for technical interoperability and being a property of the specific implementation.

3.14.1.2 In case only the application of (the non-vital) service brake has been commanded and the service brake fails to be applied, the emergency brake command shall be given.

3.14.1.3 If the emergency brake command was triggered due to a trip condition (see chapter 4) the emergency brake command shall be released at standstill and after driver acknowledgement of the trip condition.

3.14.1.4 For handling of brake commands resulting from the speed and distance monitoring, refer to section 3.13.10.

3.14.1.5 If the brake command was triggered due to roll away protection, reverse movement protection or standstill supervision the brake command shall be released at standstill and after driver acknowledgement.

3.14.1.6 If the brake command was triggered due to linking error, balise group message inconsistency or RAMS related supervision error, the brake command shall be released at standstill.

3.14.1.7 If the brake command was triggered due to supervision of the safe radio connection (T_NVCONTACT) the brake command shall be released at standstill or if a new consistent message has been received from the RBC.

3.14.1.7.1 If the brake command was triggered due to an overpassed reversing distance related to a reversing area or due to any further movement in the direction opposite to the train orientation while the reversing distance is still overpassed, the brake command shall be released if the reversing distance becomes extended so that the reversing distance is no longer overpassed, or at standstill after driver acknowledgement.

3.14.1.7.2 If the brake command was triggered due to change of Train Data while running (see section 5.17 procedure "Changing Train Data from sources different from the driver”), the brake command shall be released at standstill and after driver acknowledgement.

3.14.1.7.3 If the brake command was triggered due to the detection of a train movement while modifying/revalidating train data or while entering SR speed/distance limits, the brake command shall be released at standstill and after driver acknowledgement..

3.14.1.7.4 If the brake command was triggered due to an overpassed distance allowed for moving backwards in Post Trip mode or due to any further movement in the direction opposite to the train orientation while the distance allowed for moving backwards in Post Trip mode is still overpassed, the brake command shall be released at standstill and after driver acknowledgement.

3.14.1.7.5 If the brake command was triggered due to the driver not having acknowledged a text message, the brake command shall be released after the driver has acknowledged the text message.

3.14.1.8 An indication shall be given to the driver to indicate when the brakes can be released and when an acknowledgement is requested.

3.14.2 Roll Away Protection

3.14.2.1 Note: This protection is only applicable if the required information can be obtained from the direction controller.

3.14.2.2 The Roll Away Protection (RAP) shall prevent the train from moving in a direction, which conflicts with the current position of the direction controller in the active desk.

3.14.2.3 If the controller is in neutral position, the RAP shall prevent forward and reverse movements of the train.

3.14.2.4 When the system recognises a movement exceeding the national value for the allowed roll away distance the brakes shall be triggered.

3.14.2.5 Refer to section 3.14.1.

3.14.2.6 An indication shall be given to the driver showing when the RAP is commanding the brakes.

3.14.2.7 After revocation of the brake command the RAP will be re-initialised using the current position of the train as the new reference location.

3.14.3 Reverse Movement Protection

3.14.3.1 The Reverse Movement Protection (RMP) shall prevent the train from moving in the opposite direction to the permitted one. The permitted movement direction of a train shall be the one of the currently valid MA, if available on-board. See chapter 4 concerning permitted direction for special cases.

3.14.3.2 When a reverse movement is detected, the brake command shall be triggered after a distance specified by the national value.

3.14.3.3 Refer to section 3.14.1.

3.14.3.4 An indication shall be given to the driver showing when the RMP is commanding the brakes.

3.14.3.5 After revocation of the brake command the RMP will be reinitialised using the current position of the train as the new reference location.

3.14.3.6 Information received from balises during reverse movement shall be rejected.

3.14.4 Standstill supervision

3.14.4.1 This function shall prevent the train from moving.

3.14.4.2 When a movement is detected, the brake command shall be triggered after a distance specified by the national value.

3.14.4.3 Refer to section 3.14.1.

3.14.4.4 After revocation of the brake command the standstill supervision will be re-initialised.

3.14.4.5 If a cab is active, an indication shall be given to the driver showing when the Standstill Supervision is commanding the brakes.

3.15 Special functions

3.15.1 RBC/RBC Handover

3.15.1.1 Introduction

3.15.1.1.1 Trains with one or more radio(s) shall be able to pass from one RBC area to another automatically (without driver action).

3.15.1.1.2 Since an RBC is unable to know whether the on-board is able to manage one or two communication session(s) at once, the following principles are applicable for both cases. Thereby, the RBCs will have the same behaviour in both cases.

3.15.1.1.3 An RBC/RBC handover performed by a train with one communication session available may result in performance penalties since it will not be able to “prepare” (session establishment, version determination, …) the expected supervision by the Accepting RBC until the on-board disconnects from the Handing Over RBC.

3.15.1.1.4 In level 3, trains following the one with one communication session available will always suffer performance penalties since no more position reports will be issued from the disconnection from the Handing Over RBC until the connection to the Accepting RBC.

3.15.1.2 Handing Over RBC

3.15.1.2.1 When the Handing Over RBC detects that a route is set for a train to enter another RBC area, it shall send:

a) Intentionally deleted.

b) To the Accepting RBC the following information:

- The ETCS identity of the on-board equipment;
- The border location that will be passed by the train when entering the Accepting RBC area;
- Current mode of the on-board equipment;
- Optionally, Train Data;
- Optionally, for a non-leading engine, the ETCS identity of the leading engine.

3.15.1.2.2 The Handing Over RBC shall not send information to an on-board equipment concerning the route in advance of the border without receiving the corresponding information from the Accepting RBC.

3.15.1.2.3 It shall be possible for the Handing Over RBC to request route related information from the Accepting RBC, limited to a maximum amount of data.

3.15.1.2.3.1 Note: Route related information is :

a) Movement authorities
b) Linking
c) International static speed profiles
d) Axle Load Speed profiles
e) Gradients
f) Temporary speed restrictions
g) Mode profiles
h) Intentionally deleted
i) Track Conditions
j) Level Transition orders
k) Intentionally deleted
l) Route Suitability Data
m) National Values
n) Adhesion Factor
o) Level Crossings
p) Permitted Braking Distance Information

3.15.1.2.3.2 Note: The amount of information to be sent between the RBCs is depending on the implementation trackside.

3.15.1.2.4 Note: Route related information received from the Accepting RBC will be processed by the Handing Over RBC if possible.

3.15.1.2.5 Deleted.

3.15.1.2.6 When the Handing Over RBC receives a position report and detects that the maximum safe front end of the train has passed the border location, it shall inform the Accepting RBC.

3.15.1.2.6.1 Note: This information might be needed to inform the signalman of the Accepting RBC that the train has entered the Accepting RBC area.

3.15.1.2.7 When the Handing Over RBC receives a position report and detects that the minimum safe rear end of the train has crossed the border, it shall send a disconnection order to the on-board equipment.

3.15.1.2.8 When the Accepting RBC informs the Handing Over RBC that it has taken over the responsibility, the latter shall stop sending route related information to the on-board equipment.

3.15.1.2.9 When the Handing Over RBC detects that the transition to the Accepting RBC has to be cancelled, it shall send this cancellation information to the Accepting RBC (including the train identification).

3.15.1.2.9.1 Note: For instance, the cancellation procedure can be triggered by:

- Change to a route which does no more include the border;
- The sending of an “end of mission” information from the on-board equipment.

3.15.1.3 On-board equipment

3.15.1.3.1 When receiving an order to switch to another RBC at a given location, the on-board equipment shall:

a) Establish the communication session with the Accepting RBC;

b) Send a position report to the Handing Over RBC when the maximum safe front end of the train passes the given location;

c) Send a position report to the Handing Over RBC when the minimum safe rear end of the train passes the given location;

3.15.1.3.2 It is up to the on-board equipment to manage the establishment of one communication session and the release of the other one:

a) If it is able to handle two communication sessions at the same time, the radio session with the Accepting RBC shall be established as soon as it receives the RBC transition order .

b) If it is able to handle one communication session only at a given time, it shall wait until the session with the Handing over RBC is terminated due to crossing the border (refer to 3.5.5.1e and 3.15.1.2.7) and then establish the session with the Accepting RBC.

3.15.1.3.3 As soon as the on-board equipment has established the session with the Accepting RBC, it shall send its Train Data unless it is in sleeping or non leading mode.

3.15.1.3.4 When the on-board equipment is connected to both RBCs, it shall send its position reports to both of them with the use of the position report parameters valid for the Handing Over RBC.

3.15.1.3.4.1 If the on-board equipment is connected to both RBCs, and it executes an End of Mission, it shall execute the End of Mission procedure with both RBCs

3.15.1.3.5 When the on-board sends a position report directly to the Accepting RBC with its maximum safe front end having passed the border, it shall use information received from the Accepting RBC and only a disconnection order shall be accepted from the Handing Over RBC.

3.15.1.3.5.1 Note: This requirement implies that the connection to the Accepting RBC and that the determination of the version have been achieved and that the on-board is able to handle two communication sessions at the same time.

3.15.1.3.6 In case two communication sessions are opened, if information is received from the Accepting RBC before a position report is sent to the Accepting RBC with the maximum safe front end having passed the border, this information shall be stored on-board.
Exception: The acknowledgement of Train Data shall be immediately accepted by the on-board equipment.

3.15.1.3.6.1 Note: for the exhaustive list of accepted/rejected information, please refer to Chapter 4 Use of received information.

3.15.1.3.7 Intentionally deleted.

3.15.1.4 Accepting RBC

3.15.1.4.1 The Accepting RBC shall keep route related information sent to the Handing Over RBC updated. In particular, this possibly includes temporary speed restrictions.

3.15.1.4.2 As soon as the Accepting RBC receives from the on-board equipment a position report and detects that the maximum safe front end of the train has passed the border, it shall inform the Handing Over RBC that it has taken over the responsibility.

3.15.1.4.3 When the Accepting RBC receives Train Data from both the on-board equipment and the Handing over RBC Train Data provided by the on-board equipment shall take precedence.

3.15.1.4.4 If the Accepting RBC receives a cancellation information from the Handing Over RBC, it shall send an order to terminate the communication session to the corresponding on-board equipment (if already established).

3.15.1.4.5 The Accepting RBC shall comply with the maximum amount of data contained in the last received route related information request from the Handing Over RBC.

3.15.1.5 RBC/RBC message acknowledgement

3.15.1.5.1 As soon as a consistent RBC/RBC message including the request for acknowledgement is received, the receiving RBC shall send an acknowledgement to the emitting RBC.

3.15.1.5.2 The RBC/RBC message is consistent when all checks have been completed successfully:

a) It has passed the checks performed by the RBC/RBC Safe Communication Interface protocol (see SUBSET-098);

b) Variables in the message do not have invalid values.

3.15.1.5.3 The acknowledgement message shall refer to the identity of the concerned message sent by the emitting RBC.

3.15.2 Handling of Trains with Non Leading Engines

3.15.2.1 It shall be possible to operate a train using more than one engine, each engine being under the control of a driver.

3.15.2.2 Only the leading engine shall be responsible for the train movement supervision functions.

3.15.3 Splitting/joining

3.15.3.1 ERTMS/ETCS shall allow Splitting and Joining using the normal supervision functions available (e.g. On-sight, Shunting).

3.15.3.2 Splitting only refers to the case that the two resulting trains contain at least one ERTMS/ETCS on-board equipment each.

3.15.3.2.1 Note: This must be ensured by operational procedures.

3.15.3.3 ERTMS/ETCS is not responsible for providing information that a Splitting/Joining operation has been correctly completed (technical aspect and/or operational aspect).

3.15.3.4 Justification: ERTMS/ETCS is not able to provide this information. Splitting and Joining shall require the fulfilment of operating rules ensuring that a Splitting/Joining operation has been correctly completed (e.g. physical disconnection).

3.15.4 Reversing of movement direction

3.15.4.1 It shall be possible to send in advance to an on-board equipment information about areas, where initiation of reversing of movement direction is possible, i.e. change the direction of train movement without changing the train orientation.

3.15.4.1.1 A new reversing area given from the trackside shall replace the one already available on-board.

3.15.4.2 Together with start and end of reversing area, the following supervision information shall be sent:

a) Maximum distance to run in the direction opposite to the orientation of the reversing area, the fixed reference location being the end location of the area where reversing of movement is permitted at the time of reception of this reversing area information.

b) Reversing mode speed limit allowed during reverse movement.

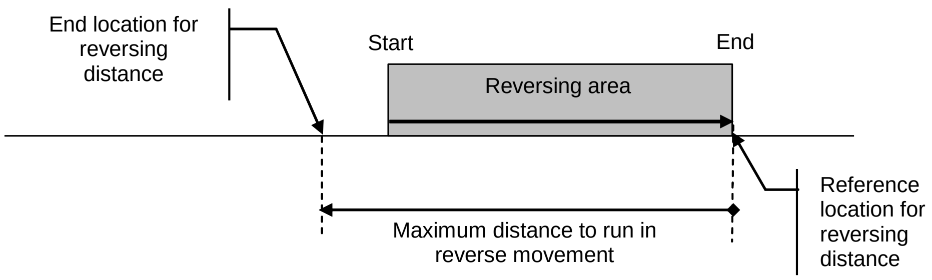


Figure 57: Reversing area and maximum distance to run

3.15.4.2.1 Note: If a closer SvL is defined, see Appendix 3.4 for a complete list of situations, the reversing area is deleted beyond the new SvL. The reference location for the distance to run in the direction opposite to the reversing area remains fixed at its original position.

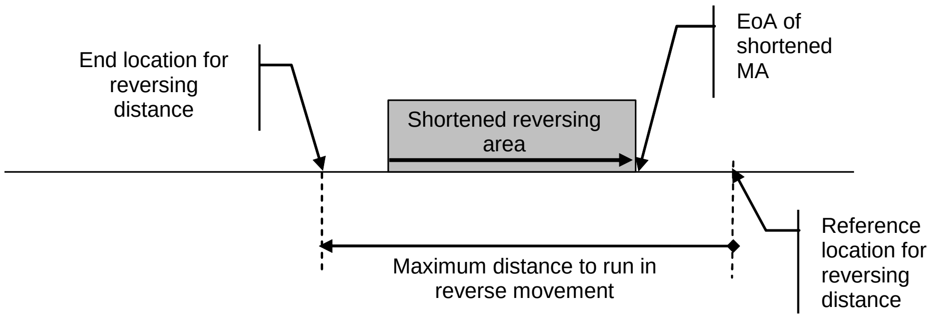


Figure 58: Influence of a shortened Movement Authority

3.15.4.2.2 Note: All locations refer to the estimated front end of the train (refer to clause 3.6.4.6).

3.15.4.3 New distance to run and Reversing mode speed limit given from the trackside shall replace the one already available on-board.

3.15.4.3.1 In case of update of distance to run in reverse movement, the fixed reference location for reversing distance shall remain unchanged.

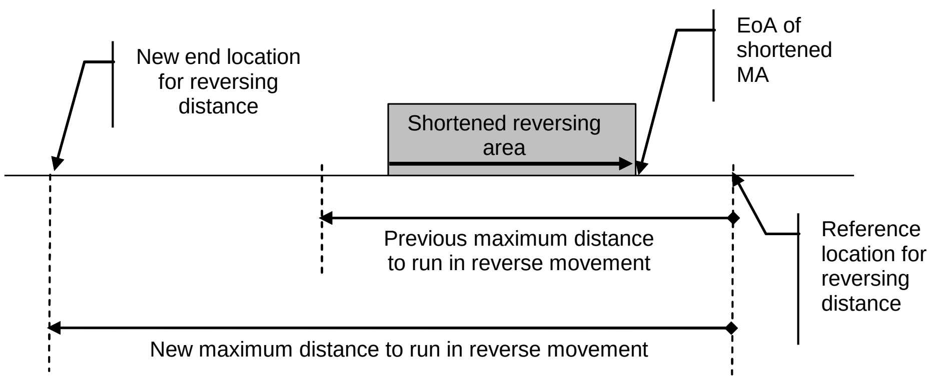


Figure 59: New maximum distance to run

3.15.4.4 While at standstill with the front end of the train inside the indicated area, it shall be possible for the driver to reverse the direction of movement.

3.15.4.5 The on-board equipment shall allow movement in the direction opposite to the train orientation, supervising it according to distance and speed received.

3.15.4.6 Note: level transitions and RBC/RBC handovers are not handled by the ERTMS/ETCS on-board equipment when in Reversing mode.

3.15.4.7 When at standstill the on-board equipment shall inform the driver if the reversing of movement is permitted.

3.15.4.8 If the end location of the maximum distance to run in the opposite direction is passed by the train front end, the emergency brake command shall be triggered.

3.15.5 Track ahead free

3.15.5.1 In a level 2/3 area, the ERTMS/ETCS on-board equipment shall be able to handle a track ahead free request given by the RBC.

3.15.5.2 The track ahead free request from the RBC shall indicate to the on-board

a) at which location the ERTMS/ETCS on-board equipment shall begin to display the request to the driver.

b) at which location the ERTMS/ETCS on-board equipment shall stop to display the request to the driver (in case the driver did not acknowledge).

3.15.5.3 The driver shall have the possibility to acknowledge the track ahead free request (meaning the driver confirms that the track between the head of the train and the next signal or board marking signal position is free).

3.15.5.4 When the driver acknowledges, the ERTMS/ETCS on-board equipment shall stop displaying the request, and shall inform the RBC that the track ahead is free.

3.15.5.5 There shall be no restrictive consequence by the on-board system if the driver does not acknowledge.

3.15.5.6 A new track ahead free request shall replace the one previously received and stored.

3.15.6 Handling of National Systems

3.15.6.1 The ERTMS/ETCS on-board shall support driving on national infrastructure under the supervision of National Systems.

3.15.6.2 In case the ERTMS/ETCS on-board equipment is interfaced to a National System through an STM, refer to Subset 035 for detailed requirements.

3.15.6.2.1 Intentionally deleted.

3.15.6.3 Intentionally deleted.

3.15.6.4 Intentionally deleted.

3.15.6.5 Amongst the data to be used by applications outside ERTMS/ETCS that can be transmitted by trackside over the ERTMS/ETCS transmission channels, it shall be possible to send from balises or RBC data to be forwarded to a National System.

3.15.6.5.1 Note: Definition of what qualifies as “data to be forwarded to a National System” is national dependent and outside the scope of Subset 026.

3.15.7 Tolerance of Big Metal Mass

3.15.7.1 Big metal object in the track, exceeding the limits for big metal masses as defined in Subset-036, section 6.5.2 “Metal Masses in the Track” may trigger an alarm reporting a malfunction for the onboard balise transmission function.

3.15.7.2 In Levels 0/NTC, the alarms which may be triggered by metal masses shall be ignored for a defined distance (see A3.1). If the alarm persists for a longer distance the ERTMS/ETCS on-board equipment shall trigger a safety reaction.

3.15.7.3 Justification: Ignoring the alarm for a defined distance eliminates the need to equip all excessive big metal masses with track condition “Big Metal Mass” outside ETCS fitted areas.

3.15.8 Cold Movement Detection

3.15.8.1 After being switched off (i.e. once in No Power mode), the ERTMS/ETCS on-board equipment shall be capable, if fitted with, to detect and record whether the engine has been moved or not, during a period of at least 72 hours.

3.15.8.2 When powered on again, the ERTMS/ETCS on-board equipment shall use, if available, the memorised information about cold movement in order to update the status of information stored by on-board equipment (see chapter 4 section 4.11 for details).

3.15.8.3 Note: information memorised by Cold Movement Detection function is considered as not available if:

a) no Cold Movement Detection function is implemented in the ERTMS/ETCS on-board equipment, OR

b) the Cold Movement Detection function has encountered a condition, during the No Power period, which prevents the use of the Cold Movement information (e.g. the battery ensuring the Cold Movement Detection function has run down during the No Power period).

3.15.9 Virtual Balise Cover

3.15.9.1 It shall be possible to set and remove from balise a Virtual Balise Cover (VBC). A VBC is defined by:

a) A marker corresponding to balises to be ignored by the on-board together with the area (country or region) in which the VBC is applicable. The VBC marker and the country/region identity form the unique VBC identity.

b) Its validity period.

3.15.9.2 During a start of mission, the driver shall have the opportunity to set a new VBC, or to remove an existing one.

3.15.9.3 As long as a VBC is stored on-board:

a) The ERTMS/ETCS on-board equipment shall ignore any balise telegram that includes a VBC marker and a country/region identity that both match the VBC identity.

b) No reaction shall be applied if errors in the reading of the rest of such balise telegram occur.

3.15.9.4 If the ERTMS/ETCS on-board equipment receives from balise or from driver a new VBC with the same VBC identity as an already stored VBC, the new VBC shall replace the previous one, including its validity period.

3.15.9.5 A VBC shall be retained on-board when the on-board equipment is switched off (i.e. enters No Power mode) and shall remain applicable when powered on again. It shall be deleted when:

a) it is ordered by trackside, or

b) its validity period has elapsed, or

c) it is removed by the driver (during Start of Mission), or

d) a mismatch is detected between the country/region identity read from a balise group and the country/region identity of the VBC. Note: this means that the reception of a consistent balise group message is a necessary condition for deleting a VBC due to mismatching country/region identities.

3.15.10 Advance display of route related information

3.15.10.1 The ERTMS/ETCS on-board equipment shall offer the possibility to display, only on driver request, an overview of the gradient profile (as received from trackside), of the MRSP, of the track conditions (except the tunnel stopping areas), of the indication location at MRSP speed (see 3.13.10.4.11) and of the first target at zero speed, if any (e.g. the EOA or the start location of a mode profile), with the remaining distances referred to the train front end position.

3.15.10.2 With regards to the MRSP, the track conditions, the indication location at MRSP speed and the first target at zero speed, the remaining distances shall be computed taking into account the min safe, the estimated or the max safe train front end position depending on their respective supervision.

3.15.10.3 With regards to the gradient profile, the remaining distances shall be computed taking into account the estimated train front end position.

3.15.10.4 The overview of route related information shall be restricted to the elements contained within the movement authority and up to the first target at zero speed, if any.

3.16 Data Consistency

3.16.1 Criteria of consistency

3.16.1.1 The on-board shall not consider a message transmitted from the trackside if any of the following criteria is not fulfilled.

a) Correctness of the received message: the whole message shall be complete and respect the ETCS language; variables shall not have invalid values

b) The message shall be received in due time.

c) The message shall be received at the right expected location.

as stated below.

3.16.1.1.1 Note: a value of a variable is invalid when a spare value is used.

3.16.2 Balises

3.16.2.1 Definitions

3.16.2.1.1 The information that is sent from a balise is called a balise telegram.

3.16.2.1.2 The whole set of information (balise telegram or telegrams) coming from a balise group is called a balise group message.

3.16.2.1.2.1 Note: In case of a balise group containing a single balise, telegram and message coincide.

3.16.2.1.3 A balise within a balise group shall be regarded as missed if

a) No balise is found within the maximum distance between balises from the previous balise in the group.

or

b) A following balise within the group has been passed.

3.16.2.2 General

3.16.2.2.1 If the on-board is not able to recognise whether a balise group is linked or unlinked (if none of the balises in the balise group can be read correctly), it shall consider it as unlinked.

3.16.2.2.2 Deleted

3.16.2.3 Linking Consistency

3.16.2.3.1 If linking information is used the on-board shall react according to the linking reaction information in the following cases:

a) If the location reference of the expected balise group is found in rear of the expectation window

b) If the location reference of the expected balise group is not found inside the expectation window (i.e. the end of the expectation window has been reached without having found the expected balise group)

c) If inside the expectation window of the expected balise group another announced balise group, expected later, is found.

3.16.2.3.1.1 The ERTMS/ETCS on-board equipment shall ignore (i.e. it will not consider as LRBG) a balise group found with its location reference outside its expectation window.

3.16.2.3.2 The on-board shall reject the message from the expected group and trip the train if the balise group is passed in the unexpected direction.

3.16.2.3.2.1 Exception: When the expected balise group is referred in the linking information with a balise group with ID “unknown”, 3.4.4.4.2.1 shall apply.

3.16.2.3.3 If the location reference balise of the group is duplicated and the on-board is only able to correctly evaluate the duplicating one, the duplicating one shall be used as location reference instead.

3.16.2.3.4 If the balise duplicating the location reference balise is used as location reference for the group, and is found within the expectation window, no linking reaction shall be applied.

3.16.2.4 Balise Group Message Consistency

3.16.2.4.1 If linking information is used, the on-board shall reject the message from a linked balise group found in the expected location and react according to the linking reaction in the following cases:

a) A balise is missed inside the group.

b) A balise is detected but no telegram is decoded (e.g. wrong CRC,...).

c) Variables in the balise group message have invalid values.

d) Message counters do not match (see 3.16.2.4.7)

3.16.2.4.2 Exception: Concerning a) and b) above, the ERTMS/ETCS on-board equipment shall not reject the message and shall not apply the linking reaction if the balise not found, or not decoded, is duplicated within the balise group and the duplicating one is correctly read.

3.16.2.4.3 If linking information is used, the on-board shall reject the message from a balise group marked as linked but not included in the linking information. No reaction shall be applied, even if errors in the reading of the balise group occur.

3.16.2.4.4 If no linking information is used, the on-board shall reject the message from a balise group marked as linked and command application of the service brake in the following cases:

a) A balise is missed inside the group.

b) A balise is detected, but no telegram is decoded (e.g. wrong CRC).

c) Variables in the balise group message have invalid values.

d) Message counters do not match (see 3.16.2.4.7)

3.16.2.4.4.1 Exceptions: Concerning a) and b) of clause 3.16.2.4.4, the ERTMS/ETCS on-board equipment:

a) shall not reject the message and shall not command application of the service brake if the balise not found, or not decoded, is duplicated within the balise group, the duplicating one is correctly read and contains:

- directional information while the orientation of the balise group can still be evaluated, or
- only information valid for both directions, or
- neither directional information nor information valid for both directions, or
- only data to be used by applications outside ERTMS/ETCS, or
- only data to be used by applications outside ERTMS/ETCS together with other information valid for both directions.

b) shall not command application of the service brake if the telegram correctly read from another balise of the group contains the information “Inhibition of balise group message consistency reaction”.

3.16.2.4.4.2 Concerning clause 3.16.2.4.4, if the service brake is applied, the location based information stored on-board shall be shortened to the current position when the train has reached standstill. Refer to appendix A.3.4 for the exhaustive list of information, which shall be shortened.

3.16.2.4.4.3 Concerning clause 3.16.2.4.4, if the service brake is applied, the driver shall be informed that this is due to a balise group message consistency problem.

3.16.2.4.5 A message counter shall be attached to each balise telegram indicating which balise group message the telegram fits to.

3.16.2.4.6 Instead of a message counter corresponding to a given balise group message, it shall be possible to identify a telegram as always fitting all possible messages of the group.

3.16.2.4.6.1 It shall also be possible to identify a telegram as never fitting any message of the group.

3.16.2.4.7 Comparing message counters of the received telegrams of a balise group message, excluding the ones complying with 3.16.2.4.6, if their values are not all identical, or at least one of them complies with 3.16.2.4.6.1, this shall be considered as a message consistency error. The balise group can, however, be used for location information.

3.16.2.4.7.1 In case of single balise group, if the message counter of the received telegram complies with 3.16.2.4.6.1, this shall also be considered as a message consistency error.

3.16.2.4.8 It shall be possible to indicate failures in the system underlying the balise/loop/RIU (e.g. the Lineside Electronic Unit, LEU) by sending a balise telegram, a loop message or a RIU message including the information "default balise/loop/RIU information".

3.16.2.4.8.1 If one (and only one) out of a pair of duplicated balise telegrams received by the on-board includes the information “default balise information”, the on-board shall ignore any other information included in this telegram and shall consider information from the telegram not containing “default balise information".

3.16.2.4.8.2 When duplicated balises are both found and decoded correctly, and both, or none of them, contain "default balise information", the ERTMS/ETCS on-board equipment shall compose the message using the telegram from the last received balise out of the pair.

3.16.2.4.9 If a message has been received containing the information "default balise information", the driver shall be informed.

3.16.2.5 Unlinked Balise Group Message Consistency

3.16.2.5.1 An on-board equipment shall reject the message received from a balise group marked as unlinked and command application of the service brake in the following cases:

a) A balise is missed inside the unlinked balise group.

b) A balise is detected, but no telegram is decoded (e.g. wrong CRC).

c) Variables in the balise group message have invalid values.

d) Message counters do not match (see 3.16.2.4.7)

3.16.2.5.1.1 Exceptions: Concerning a) and b) of clause 3.16.2.5.1, the ERTMS/ETCS on-board equipment:

a) shall not reject the message and shall not command application of the service brake if the balise not found, or not decoded, is duplicated within the balise group, the duplicating one is correctly read and contains:

- directional information while the orientation of the balise group can still be evaluated, or
- only information valid for both directions, or
- neither directional information nor information valid for both directions, or
- only data to be used by applications outside ERTMS/ETCS, or
- only data to be used by applications outside ERTMS/ETCS together with other information valid for both directions.

b) shall not command application of the service brake if the telegram correctly read from another balise of the group contains the information “Inhibition of balise group message consistency reaction”.

3.16.2.5.2 Concerning clause 3.16.2.5.1, if the service brake is applied, the location based information stored on-board shall be shortened to the current position when the train has reached standstill. Refer to appendix A.3.4 for the exhaustive list of information, which shall be shortened.

3.16.2.5.3 Concerning clause 3.16.2.5.1, if the service brake is applied, the driver shall be informed that this is due to a balise group message consistency problem.

3.16.2.6 Linking Reactions

3.16.2.6.1 When the linking reaction leads to train trip or a service brake application, the driver shall be informed that the intervention is due to data consistency problem with the expected balise group.

3.16.2.6.2 If the service brake is initiated due to the linking reaction, the location based information stored on-board shall be shortened to the current position when the train has reached standstill. Refer to appendix A.3.4 for the exhaustive list of information, which shall be shortened.

3.16.2.7 RAMS related supervision functions

3.16.2.7.1 Mitigation of balise reception degradation

3.16.2.7.1.1 If 2 consecutive linked balise groups announced by linking are not detected and the end of the expectation window of the second balise group has been passed, the ERTMS/ETCS on-board shall command the service brake and the driver shall be informed. At standstill, the location based information stored on-board shall be shortened to the current position. Refer to appendix A.3.4 for the exhaustive list of information, which shall be shortened.

3.16.2.7.2 Mitigation of balise cross-talk while expecting repositioning information

3.16.2.7.2.1 If repositioning is announced and the expected repositioning balise group has been found, the ERTMS/ETCS on-board equipment shall keep looking for a balise group that satisfies the same criteria as this previously expected and already found repositioning balise group, until one of the following events occurs:

a) the on-board antenna leaves the expectation window of the repositioning balise group that was announced and already found

b) a linked balise group that has been announced with known identity is found.

3.16.2.7.2.2 If a second balise group is found that satisfies the same criteria as the previously expected and already found repositioning balise group, the ERTMS/ETCS on-board equipment shall command the service brake and the driver shall be informed. At standstill, the location based information stored on-board shall be shortened to the current position. Refer to appendix A.3.4 for the exhaustive list of information, which shall be shortened.

3.16.2.7.2.3 Note: this function is independent from linking function, i.e. the rules related to linking always apply. This means that once a repositioning balise group has been found and if this latter contains new linking information, the ERTMS/ETCS on-board equipment will start expecting the first balise group announced in this new linking information in parallel with the monitoring specified in 3.16.2.7.2.1.

3.16.3 Radio

3.16.3.1 General issues

3.16.3.1.1 A radio message is consistent when all checks have been completed successfully:

a) Checks performed by Euroradio protocol have been passed (see Subset-037)

b) Time stamps checks have been passed (see 3.16.3.3.3)

c) Variables in the messages do not have in-valid values.

3.16.3.1.1.1 The on-board shall reject a message transmitted from the trackside if the message is not consistent.

3.16.3.1.1.2 The on-board shall inform the trackside if a not consistent message is received.

3.16.3.1.2 Emergency messages shall be transmitted either as high priority data or as normal priority data.

3.16.3.1.3 Other messages shall be sent as normal priority data.

3.16.3.1.3.1 Messages shall only be accepted when received with the data priority for which they are specified.

3.16.3.1.4 The chapters 3.16.3.2 to 3.16.3.5 define data consistency principles and corresponding checks for data transmitted as normal priority data. For high priority data, the checks shall not apply.

3.16.3.2 Time stamping

3.16.3.2.1 The trackside shall always transmit its information with reference to the train time.

3.16.3.2.2 To time-stamp its messages, the trackside shall make a safe estimation of the on-board time, based on the time-stamp of the received messages and the internal processing times.
The estimation shall be made in such a way that the on-board time estimated by the trackside shall not be in advance of the real on-board time.

3.16.3.2.3 Wrap around of the onboard timer can occur during a communication session and shall have no impact on system behaviour.

3.16.3.3 Supervision of Sequence

3.16.3.3.1 The trackside shall time-stamp a message with a value corresponding to the time of sending.

3.16.3.3.2 There shall always be a time stamp increment between consecutive messages.

3.16.3.3.3 If the time stamp of the last received message is lower than or equal to the former one its content shall not be used.

3.16.3.3.3.1 Only time stamps of messages received as normal priority data shall be used.

3.16.3.3.3.2 Note: The supervision does not detect a lost message. This has to be assured by means of the "acknowledge" function.

3.16.3.3.4 If, at the initiation of the communication session, the time stamp is set to unknown the message shall be accepted.

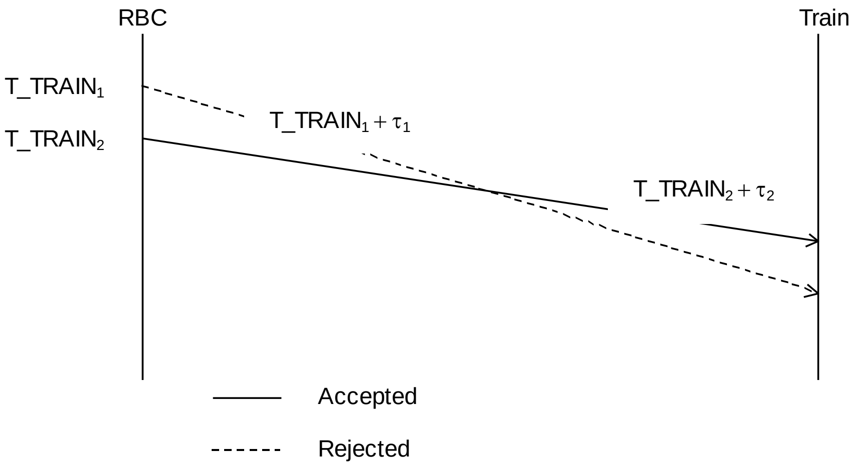


Figure 60: Supervision of sequence

3.16.3.4 Supervision of safe radio connection

3.16.3.4.1 When the difference between the time stamp of the latest consistent received message and the current on-board time is greater than the T_NVCONTACT parameter (national value), the on-board shall apply the reaction as defined in the next section.

3.16.3.4.1.1 After the on-board equipment has switched to L2 or 3 with no communication session established, the current onboard time shall be compared with the on-board time at the moment of the level transition (instead of the time stamp of the latest consistent received message) until a new consistent message has been received.

3.16.3.4.1.2 When an RBC/RBC handover has been announced, the current onboard time shall be compared with the time stamp of the latest consistent message from the Handing over RBC until the train considers the Accepting RBC as the supervising one (refer to 3.15.1.3.5). From then on the current onboard time shall be compared with the time stamp of the latest received consistent message from the Accepting RBC.

3.16.3.4.1.3 After a train has passed an announced radio hole and until a new consistent message has been received, the current onboard time shall be compared with the on-board time when the train front end left the radio hole (instead of the time stamp of the latest consistent received message).

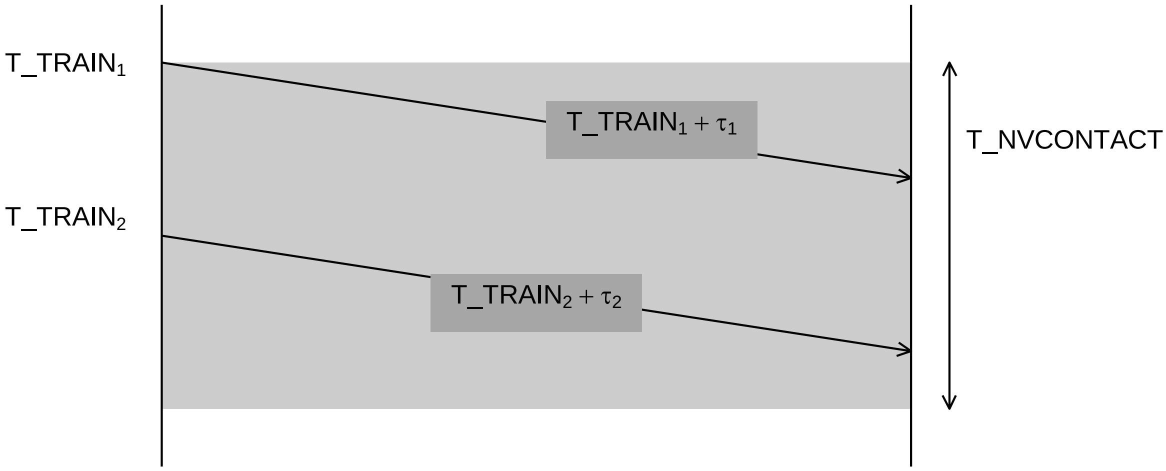


Figure 61: Supervision of the safe radio connection (Message received within the Window)

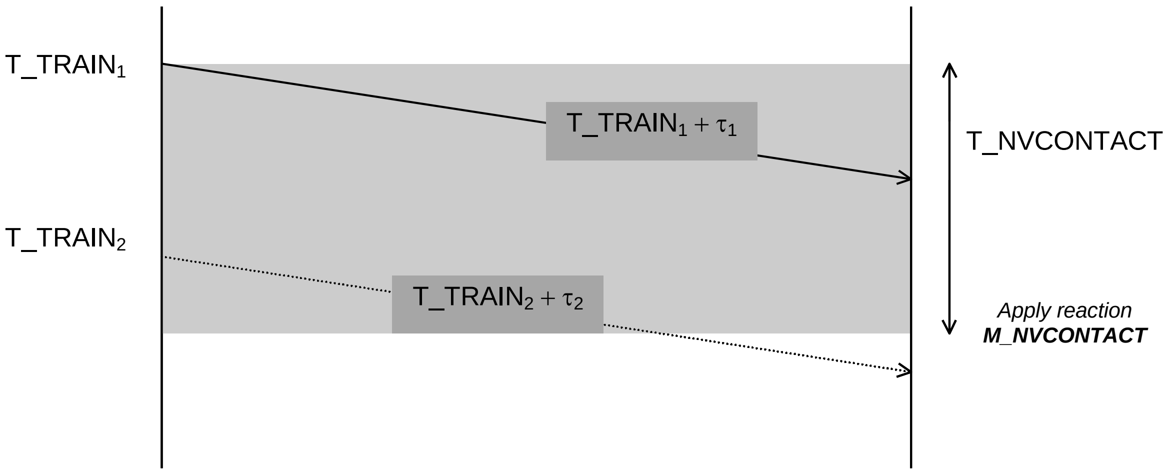


Figure 62: Supervision of the safe radio connection (No message received within the Window)

3.16.3.4.2 It shall be possible to select one of the following reactions (National value) :

a) Train trip

b) Apply service brake

c) No reaction

3.16.3.4.3 For all reactions, if no new consistent message has been received after an additional delay time (as defined in A3.1), the on-board shall release the safe radio connection and then set-up it again (maintaining the communication session).

3.16.3.4.4 When the reaction leads to train trip or a service brake application, the driver shall be informed that no safe radio message has been received in due time.

3.16.3.4.5 If the service brake is initiated, the following reaction shall be taken;

a) For brake command release conditions refer to section 3.14.1.7.

b) If no new consistent message is received until the train reaches standstill, the location based information stored on-board shall be shortened to the current position. Refer to appendix A.3.4 for the exhaustive list of information, which shall be shortened.

3.16.3.4.6 It shall be possible for the RBC to deactivate the supervision of T_NVCONTACT in some areas (e.g. radio hole).

3.16.3.4.7 To avoid the expiration of the on-board timer and if no new information is needed to be sent, the RBC shall send an empty message.

3.16.3.5 Message Acknowledgement

3.16.3.5.1 As soon as a consistent message (see 3.16.3.1.1) including the request for acknowledgement is received, the on-board shall send an acknowledgement to the trackside.

3.16.3.5.1.1 Note: In order to ensure trackside that the on-board has correctly received transmitted information, the RBC may ask the on-board to acknowledge.

3.16.3.5.2 Intentionally deleted

3.16.3.5.3 The acknowledgement message shall refer to the identity of the concerned message sent by the RBC.

3.16.3.5.4 Intentionally deleted (moved to 3.5.5.1 e).

3.16.4 Error reporting to RBC

3.16.4.1 In level 2/3, if a radio communication session is established, errors shall be reported as soon as the availability of a safe radio connection permits.

3.16.4.2 This refers to balise group errors and radio message errors regardless if there is an error reaction.

3.16.4.3 If linking information is used on-board, no error reporting shall be done for balise groups marked as linked but not included in the linking information.

3.17 System Version Management

3.17.1 Introduction

3.17.1.1 Definitions, high level principles and rules regarding the offline management of ERTMS/ETCS system version during the ERTMS/ETCS system life time are given in SUBSET-104.

3.17.1.2 The objective of this section is to define requirements applicable to ERTMS/ETCS on-board equipment and to trackside constituents, when different versions of the ERTMS/ETCS system have been defined.

3.17.1.3 Intentionally deleted.

3.17.2 Determination of the operated system version

3.17.2.1 The on-board equipment shall be able to operate with (i.e. shall support) any of the ERTMS/ETCS system version numbers X included in the envelope of legally operated system versions, as defined in chapter 6.

3.17.2.2 The on-board equipment shall operate with only one system version at a time, i.e. it shall behave according to the whole set of requirements applicable to a system version (refer to chapter 6 in case the operated system version is older than the last one introduced in this release of the SRS).

3.17.2.3 The on-board equipment shall determine the operated system version, in relation to non-RBC trackside constituents, as the system version number X transmitted by any balise, loop or RIU, if this system version number X is higher than the currently operated one.

3.17.2.4 It shall be possible from balise group to order the on-board equipment to operate a system version.

3.17.2.5 On receiving the order to operate system version from balise group, the on-board equipment shall immediately operate the system version given in the order. After the order is executed, the requirement 3.17.2.3 shall be again applied for any further received balise telegram/loop message or any further contacted RIU.

3.17.2.5.1 Note: the system version order is to be used wherever it is necessary to enforce an operated system version number X lower than the currently operated one.

3.17.2.6 If a mismatch has been detected between the country or region identifier read from a balise/loop and the corresponding identifier(s) for which a set of national values is used onboard, the on-board equipment shall consider the system version number X transmitted by this balise/loop as the operated one and shall comply again with requirement 3.17.2.3.

3.17.2.7 If the on-board equipment does not support the system version number X transmitted by a non-RBC trackside constituent or the one specified in the balise group order, it shall consider the operated system version as unchanged.

3.17.2.8 In case of communication session established with an RBC, the system version of the RBC shall take precedence on the operated system version in relation to non-RBC constituents and on system version ordered from balise group; the operated system version shall be determined according to the following principles:

a) if the on-board equipment is in level 0, NTC or 1 (e.g. entrance in level 2/3 area), the RBC system version shall be operated when the transition to level 2/3 is executed;

b) if the on-board equipment is in level 2/3 (SoM procedure or order received from trackside), the RBC system version shall be operated immediately;

c) in case of session established with an accepting RBC (RBC/RBC Handover), the accepting RBC system version shall be operated as soon as the engine has passed the RBC/RBC border location with its maximum safe front end;

d) in case the on-board equipment switches from level 2/3 to another level (e.g. exit from a level 2/3 area), the system version control in relation to non-RBC constituents shall be again applied and the balise group orders shall be again considered;

e) in case the engine passes the RBC/RBC border location with its maximum safe front end and no session is established with the accepting RBC, the system version control in relation to non-RBC constituents shall be again applied and the balise group orders shall be again considered.

3.17.2.9 The system version currently operated when the on-board equipment is switched off (i.e. enters No Power mode) shall be retained and re-used when powered on.

3.17.2.9.1 If the on-board equipment loses the information (failure situation), the highest supported system version shall be used.

3.17.3 Handling of trackside data in relation to system version

3.17.3.1 Every telegram transmitted by a balise, and every message transmitted by Euroloop and Radio Infill Unit shall contain only the data related to one system version. It is not allowed for the balise, Euroloop and Radio Infill Unit to transmit data correspondent to several system versions.

3.17.3.2 All messages transmitted by an RBC shall contain data only related to one system version.

3.17.3.3 The on-board equipment shall check the system version prior to any further checks (data consistency, ..), as they depend on the system version.

3.17.3.4 Intentionally deleted.

3.17.3.4.1 Intentionally deleted.

3.17.3.4.2 Intentionally deleted.

3.17.3.5 The on-board equipment shall check the ERTMS/ETCS system version number X transmitted by any balise:

a) In all levels, if this system version number X equals to 0, the balise information shall be ignored.

b) In all levels, if this system version number X is different from 0 and lower than the lowest system version number X supported by the on-board equipment, it shall be able to interpret the balise information, to the extent defined for each type of information (see chapter 6 for detailed requirements). If the on-board is not able to interpret the information, this shall be considered as a message consistency error.

c) In all levels, if this system version number X is amongst its supported ones, the on-board equipment shall be able to interpret the balise information. See chapter 6 for detailed requirements.

d) In levels 1, 2 and 3, if this system version number X is greater than the highest version number X supported by the on-board equipment, the information from this balise shall be ignored, the train shall be tripped and an indication shall be given to the driver.

e) In levels 0 and NTC, if this system version number X is greater than the highest version number X supported by the on-board equipment, the information from this balise shall be ignored and no reaction shall be applied.

3.17.3.6 In level 1 the on-board equipment shall check the ERTMS/ETCS system version number X transmitted by any Euroloop found:

a) if this system version number X is lower than the lowest system version number X supported by the on-board equipment, it shall be able to interpret the loop information, to the extent defined for each type of information (see chapter 6 for detailed requirements). If the on-board is not able to interpret the information, this shall be considered as a message consistency error.

b) if this system version number X is amongst its supported ones, the on-board equipment shall be able to interpret the loop information. See chapter 6 for detailed requirements.

c) If this system version number X is greater than the highest version number X supported by the on-board equipment, no reaction shall be applied and the information from this loop shall be ignored.

3.17.3.7 The on-board equipment shall check the ERTMS/ETCS system version number X transmitted the first time any RBC is contacted (including RBC hand over) or any RIU is contacted. Refer to section 3.5.3.8 for details.

3.17.3.8 Intentionally deleted.

3.17.3.9 Intentionally deleted.

3.17.3.10 Intentionally deleted.

3.17.3.11 For trackside information only differing by Y with regards to the highest system version number X supported by on-board, the on-board equipment shall not consider the reception of unknown packet/message as a message data consistency error (i.e. use of spare value for NID_PACKET or NID_MESSAGE) and shall ignore the content of the unknown packet/message in the following cases:

a) unknown packet included in a balise telegram/loop message related to the higher system version;

b) unknown radio message from an RBC or RIU operating with the higher system version;

c) unknown packet from an RBC or RIU operating with the higher system version, included in a message in which one or more optional packet can be added according to the version operated by on-board.

3.17.3.12 Intentionally deleted.

3.17.3.12.1 Intentionally deleted.

3.17.3.13 Intentionally deleted.

3.18 System Data

3.18.1 Fixed Values

3.18.1.1 Note: Appendix to chapter 3 contains a list of Fixed values used as system parameters in the supervision. These parameters are system related and can easily be changed in later versions of the ERTMS/ETCS if required. These parameters are not defined as National data.

3.18.2 National / Default Values

3.18.2.1 Note: Appendix to chapter 3 contains list of National and Default Values.

3.18.2.2 Trains shall be supervised according to the National Values of the current infrastructure if they are available on-board.

3.18.2.3 National Values are transmitted with the area(s) (country or region) in which they are applicable. They shall become applicable at a defined location, or shall be applicable immediately.

3.18.2.4 Evaluating a balise group message, the balise identity information referring to the country or region shall be used to ensure that correct National Values are used.

3.18.2.5 For each National Value, the corresponding Default Value shall be used as fall back value if:

- the National Value is not available, or
- a mismatch has been detected between the country or region identifier read from a balise group and the corresponding identifier(s) of the applicable set with which the National Value was received and stored.

3.18.2.6 Note: even though the National Values are always transmitted as a single set for a given system version, the content of a set depends on the system version, so that when a set of National Values is received or becomes applicable, or when passing a balise group, the on-board equipment may apply clause 3.18.2.5 for a subset of National Values

3.18.2.7 The National Values currently applicable when the on-board equipment is switched off (i.e. enters No Power mode) shall be retained and shall remain applicable when powered on.

3.18.2.7.1 Justification: The aim of this requirement is to limit the number of balise groups containing National Value information. Once a set of National Values has been received on-board, there is no need to re-load the information unless National Values change, the on-board equipment loses the information (failure situation), or the train enters an area requiring different National Values.

3.18.2.8 The applicable set of National Values data shall be transmitted from the trackside on transition between areas requiring a different set of National Values.

3.18.2.8.1 When a new set of National Values becomes applicable its content shall always overwrite the corresponding National Values currently applicable regardless of the country or region identifier(s).

3.18.2.9 A previously received set of National Values which is not yet applicable shall be deleted if:

- a new set of National Values is received, or
- the ERTMS/ETCS on-board equipment is switched off (i.e., enters No Power mode).

3.18.2.10 If a National Value becomes invalid, i.e., a mismatch has been detected between the country or region identifier read from a balise group and the corresponding identifier(s) of the applicable set with which the National Value was received and stored, then it shall be deleted.

3.18.2.11 When a new set of National Values becomes applicable, any on-going supervision involving an overwritten National Value of type time or distance shall continue, but using the corresponding value from the new set. However, the starting location or starting time shall remain unchanged.

3.18.3 Train Data

3.18.3.1 Train Data shall neither be provided nor modified by ERTMS/ETCS trackside equipment.

3.18.3.2 Before starting a mission, the following Train Data shall be acquired by the ERTMS/ETCS on-board equipment of a leading engine

a) Train category(ies)

b) Train length

c) Traction / brake parameters

d) Maximum train speed

e) Loading gauge

f) Axle load category

g) Traction system(s) accepted by the engine

h) Train fitted with airtight system

i) List of National Systems available on-board

j) Intentionally deleted

k) Axle number

3.18.3.2.1 The Train Data may come from ERTMS/ETCS external sources (e.g. the Train Interface), from pre-configured values or from the driver. .

3.18.3.2.2 Exception: The driver shall never be involved in the entry/ modification/validation of the Train Data "Traction system(s) accepted by the engine", "List of National Systems available on-board" and "Axle number".

3.18.3.3 At standstill, it shall be possible for the driver to enter, modify and revalidate the Train Data that requires driver validation according to the specific train implementation.

3.18.3.3.1 In normal operation after the start of mission, if a train movement is detected while the driver is modifying or revalidating the Train Data, the ERTMS/ETCS on-board equipment shall trigger the brake command.

3.18.3.4 Following any entry/modification of Train Data when a communication session is already established or following the successful establishment of a communication session when valid Train Data are already available (e.g. when approaching a level 2/3 area or an accepting RBC area), the ERTMS/ETCS on-board equipment of the leading engine shall send the following set of Train Data to the RBC:

a) Train category(ies).

b) Train length.

c) Maximum train speed.

d) Loading gauge.

e) Axle load category.

f) Traction system(s) accepted by the engine.

g) Train fitted with airtight system.

h) List of National Systems available on-board

i) Axle number

3.18.3.4.1 The RBC shall acknowledge the reception of this set of Train Data.

3.18.3.4.2 In case the safe radio connection is lost before the acknowledgement is received, the Train Data shall be sent again once the safe radio connection has been re-established within the on-going communication session.

3.18.3.5 Intentionally deleted.

3.18.3.6 For modification of Train Data, which is/are affected by a change of input information from the ERTMS/ETCS on-board equipment external interface, refer to procedure "Changing Train Data from sources different from the driver" described in section 5.17.

3.18.3.7 In case the Train Data regarding train category, axle load category, loading gauge or traction system has been changed and the train is at standstill:

a) the location based information stored on-board shall be shortened to the current position of the train. Refer to appendix A.3.4 for the exhaustive list of information, which shall be shortened.

b) the stored MA, linking and track description, which have been received from the RBC after a level 2/3 transition or a RBC transition for a further location has been ordered, shall be deleted.

3.18.3.8 In case the Train Data regarding train length has been increased, the currently used track description, if any, shall be considered as unknown in rear of the former min safe rear end of the train.

3.18.4 Additional Data

3.18.4.1 Driver ID

3.18.4.1.1 The driver ID shall be used to identify the responsible person for operating an active desk.

3.18.4.1.1.1 Note: This data is used for recording purposes only.

3.18.4.1.2 If allowed by a National value, it shall be possible for the driver to change driver ID while the train is running.

3.18.4.1.3 It shall be possible to enter driver ID also in a non-leading engine.

3.18.4.2 ERTMS/ETCS Level

3.18.4.2.1 The driver shall have the possibility to enter the ERTMS/ETCS level during a start of a mission.

3.18.4.2.2 The ERTMS/ETCS level information is required for train operation except sleeping mode.

3.18.4.2.3 In normal operation after the start of mission the driver shall not have to select the ERTMS/ETCS level (all other level transitions are executed automatically).

3.18.4.2.4 For operational fallback situations: at standstill, the onboard equipment shall allow the driver to change the ERTMS/ETCS level..

3.18.4.2.4.1 Intentionally deleted.

3.18.4.2.5 If the table of supported levels given by trackside is available, the selection of level by the driver shall be limited to those contained in this table. If the table of trackside supported levels is not available, the driver can select any level within a default list configured on-board.

3.18.4.3 Radio Network identification / RBC Identification / Telephone Number

3.18.4.3.1 Note: If a valid RBC identity and telephone number is available on-board, no driver data entry is needed to establish a connection to the RBC.

3.18.4.3.2 If the driver enters level 2/3, at start of mission, the ERTMS/ETCS on-board equipment shall offer the driver different means to select the RBC contact information (including RBC identity, RBC telephone number, and the identity of the radio network to be used), for details see chapter 5, Start of Mission procedure.

3.18.4.3.3 In normal operation after the start of mission, the driver shall have no further possibility to modify the RBC contact information (all further modifications of this data are executed automatically). Exception: after a manual level change to level 2/3 and if either no Mobile Terminal is registered to a Radio Network or no valid RBC-ID/phone number is available, the ERTMS/ETCS on-board equipment shall request the driver to select the RBC contact information by the same means as for Start of Mission.

3.18.4.3.4 If the driver selects “Use of EIRENE short number” to contact the RBC and the communication session is successfully established, the ERTMS/ETCS on-board equipment shall store as valid RBC identity and telephone number, the RBC identity reported by EURORADIO and the EIRENE short number, respectively.

3.18.4.3.4.1 Note: If the short number is re-used by the ERTMS/ETCS on-board equipment (e.g. following a loss of safe radio connection) and does not direct to a RBC with the stored RBC ID, the connection will be terminated (EURORADIO functionality).

3.18.4.4 ETCS Identity

3.18.4.4.1 The ETCS identity of an on-board equipment is made of a single identity number. The ETCS identity of an RBC, balise group, loop or RIU is composed of a country/region identity number and of an identity number within the country/region.

3.18.4.4.2 All on-board equipments in service, balise groups marked as linked, RBC's, RIU's, and loops shall be assigned a unique ETCS identity within their respective group.

3.18.4.4.3 The assignment of (unique or not) ETCS identities to balise groups marked as unlinked is the sole responsibility of the entity in charge of the assignment of values (see SUBSET-054), depending on the specific trackside implementation.

3.18.4.5 Train Running Number

3.18.4.5.1 During the Start of Mission, the ERTMS/ETCS on-board equipment of a leading engine shall acquire the train running number from driver input, from the RBC or from other ERTMS/ETCS external sources.

3.18.4.5.2 It shall be possible to enter train running number also in a non-leading engine.

3.18.4.5.3 It shall be possible to change the train running number while running, from driver input, from the RBC or from other ERTMS/ETCS external sources.

3.18.4.5.4 Following any entry/modification of the train running number when a communication session is already established or following the successful establishment of a communication session when valid train running number is already available, the ERTMS/ETCS on-board equipment shall send the train running number to the RBC.

3.18.4.5.4.1 Exception: if the train running number has been received from the RBC, it shall not be sent back to the RBC by the ERTMS/ETCS on-board equipment.

3.18.4.6 Adhesion Factor

3.18.4.6.1 The adhesion factor shall be used to adjust the emergency brake model of the train (see 3.13).

3.18.4.6.2 The adhesion factor may be changed while the train is running.

3.18.4.6.2.1 It shall be possible to update the adhesion factor from trackside and - if permitted by a National value - by the driver. If, following a change of National Values, the update of the adhesion factor is no more permitted to the driver, the adhesion factor previously modified by the driver to slippery rail shall immediately be reset to non slippery rail. Any trackside adhesion profile is not affected.

3.18.4.6.2.2 The adhesion factor shall be sent as profile data from trackside when needed.

3.18.4.6.2.3 The driver shall be informed whether the value of the adhesion factor is “slippery rail”.

3.18.4.6.3 The selection of the adhesion value from trackside or by driver entry shall be limited to the options slippery rail/ non slippery rail.

3.18.4.6.3.1 Intentionally deleted.

3.18.4.6.4 The default value for the adhesion factor shall be the highest value (i.e. not slippery rail).

3.18.4.6.5 Intentionally deleted.

3.18.5 Date and Time

3.18.5.1 Each ERTMS/ETCS on-board equipment shall be able to provide the date (day, month, year) and time (hour, minute, second) in Universal Time Co-ordinated (UTC) and Local Time.

3.18.5.2 The local time shall be presented to the driver, while the UTC shall be used for the juridical data.

3.18.5.3 Deleted.

3.18.6 Data view

3.18.6.1 Outside the context of data entry, the ERTMS/ETCS on-board equipment shall offer the possibility to the driver to view the driver ID, the train running number, the RBC contact information, the Virtual Balise Cover(s) and the Train Data either modifiable by the driver or modifiable by other ERTMS/ETCS external sources.

3.18.6.2 Only valid data shall be presented to the driver.

3.19 Intentionally deleted

3.20 Juridical Data

3.20.1.1 The on-board recording device of the train is not part of the ERTMS/ETCS on-board equipment..

3.20.1.2 The ERTMS/ETCS on-board equipment shall transmit to the on-board recording device the information that may be used for legal purpose after hazardous situations.

3.20.1.2.1 For details about data messages that shall be transmitted to the on-board recording device and their related triggering events, refer to SUBSET-027.

3.20.1.3 Intentionally deleted.

3.20.1.4 Intentionally deleted.

3.20.1.5 Intentionally deleted.

3.20.1.6 Intentionally deleted.

3.20.1.7 Intentionally deleted.

3.20.1.8 Intentionally deleted.

3.20.1.9 Intentionally deleted.

APPENDIX TO CHAPTER 3

A.3.1 List of Fixed Value Data

Fixed Value Data	Value	Name
The number of times to try to establish a safe radio connection.	3 times	
Repetition of radio messages (i.e. excluding the first sending)	3 times	
Waiting time before radio message repetition	15 s	
Speed difference between Permitted speed and Emergency Brake Intervention supervision limits, minimum value	7.5 km/h	dV_ebi_min
Speed difference between Permitted speed and Emergency Brake Intervention supervision limits, maximum value	15 km/h	dV_ebi_max
Value of MRSP where dV_ebi starts to increase to dV_ebi_max	110 km/h	V_ebi_min
Value of MRSP where dV_ebi stops to increase to dV_ebi_max	210 km/h	V_ebi_max
Speed difference between Permitted speed and Service Brake Intervention supervision limits, minimum value	5.5 km/h	dV_sbi_min
Speed difference between Permitted speed and Service Brake Intervention supervision limits, maximum value	10 km/h	dV_sbi_max
Value of MRSP where dV_sbi starts to increase to dV_sbi_max	110 km/h	V_sbi_min
Value of MRSP where dV_sbi stops to increase to dV_sbi_max	210 km/h	V_sbi_max
Speed difference between Permitted speed and Warning supervision limits, minimum value	4 km/h	dV_warning_min
Speed difference between Permitted speed and Warning supervision limits, maximum value	5 km/h	dV_warning_max
Value of MRSP where dV_warning starts to increase to dV_warning_max	110 km/h	V_warning_min
Value of MRSP where dV_warning stops to increase	140 km/h	V_warning_max

to dV_warning_max		
Time between Warning supervision limit and FLOI	2 s	T_warning
Driver reaction time between Permitted speed supervision limit and FLOI	4 s	T_driver
Time between the pre-indication location and the indication supervision limit valid for MRSP speed.	7 s	T_preindication
Maximum possible rotating mass as a percentage of the total weight of the train	15 %	M_rotating_max
Minimum possible rotating mass as a percentage of the total weight of the train	2 %	M_rotating_min
Compensation of the speed measurement inaccuracy used for the calculation of speed restriction to ensure given permitted braking distance	5 km/h	
MA request repetition cycle, default value	60 s	$T_{CYCRQSTD}$
Mode transitions: Driver acknowledgement time	5 s	T_{ACK}
Maximum time to maintain a communication session in case of failed re-connection attempts	5 minutes	
Distance of metal immunity in Levels 0/NTC	300 metres	D_Metal
Driver reaction time before sounding the horn	4 s	
Time between minimum safe rear end of the train leaving a track condition area and on-board deleting the applicable indication	5 s	
Distance to keep on-board information in rear of the min safe rear end of the train	300 metres	
Additional delay time to disconnection on supervision of safe radio connection	60 s	
“Connection status” timer for safe radio connection indication	45 s	

A.3.2 List of National / Default Data

National / Default Data	**Default Value**	**SRS Name (Reference only)**
Modification of adhesion factor by driver	Not allowed	Q_NVDRIVER_ADHES
Shunting mode speed limit	30km/h	V_NVSHUNT
Staff Responsible mode speed limit	40km/h	V_NVSTFF

On Sight mode speed limit	30km/h	V_NVONSIGHT
Limited Supervision mode speed limit	100 km/h	V_NVLIMSUPERV
Unfitted mode speed limit	100km/h	V_NVUNFIT
Release Speed	40km/h	V_NVREL
Distance to be used in Roll Away protection, Reverse movement protection and Standstill supervision	2m	D_NVROLL
Permission to use service brake in target speed monitoring	Yes	Q_NVSBTSMPERM
Permission to release emergency brake	Only at standstill	Q_NVEMRRLS
Permission to use guidance curves	No	Q_NVGUIPERM
Permission to use the service brake feedback	No	Q_NVSBFBPERM
Permission to inhibit the compensation of the speed measurement inaccuracy	No	Q_NVINHSMICPERM
Speed limit for triggering the override function	0km/h	V_NVALLOWOVTRP
Override speed limit to be supervised when the “override” function is active	30 km/h	V_NVSUPOVTRP
Distance for train trip suppression when override function is triggered	200m	D_NVOVTRP
Max. time for train trip suppression when override function is triggered	60 s	T_NVOVTRP
Change of driver ID permitted while running	Yes	M_NVDERUN
System reaction if radio channel monitoring time limit expires (T-Contact)	No reaction	M_NVCONTACT
Maximum time since creation in the RBC of last received telegram.	∞	T_NVCONTACT
Distance to be allowed for reversing in Post Trip mode.	200 m	D_NVPOTRP
Max permitted distance to run in Staff Responsible mode	∞	D_NVSTFF
Default location accuracy of a balise group	12 m	Q_NVLOCACC
Weighting factor for available wheel/rail adhesion	0	M_NVAVADH
Confidence level for emergency brake safe deceleration on dry rails	99.9999999 %	M_NVEBCL
Train length step used for the integrated correction factor Kr_int	N/A	L_NVKRINT
Train length dependent integrated correction factor Kr_int	0.9	M_NVKRINT*
Speed step used for the integrated correction factor Kv_int	N/A	V_NVKVINT

Speed dependent integrated correction factor Kv_int	0.7	M_NVKVINT*
Integrated correction factor for brake build up time	1.1	M_NVKTINT
Maximum deceleration value under reduced adhesion conditions (1)	1.0 m/s^2	A_NVMAXREDADH1
Maximum deceleration value under reduced adhesion conditions (2)	0.7 m/s^2	A_NVMAXREDADH2
Maximum deceleration value under reduced adhesion conditions (3)	0.7 m/s^2	A_NVMAXREDADH3
Lower deceleration limit to determine the set of Kv_int to be used	N/A	A_NVP12
Upper deceleration limit to determine the set of Kv_int to be used	N/A	A_NVP23

*The default value of the correction factor Kr_int shall be valid for any train length, and likewise the default value of the correction factor Kv_int shall be valid for any brake position, speed and maximum emergency brake deceleration. This means that the Kr_int model does not contain any train length step, and that the Kv_int model is valid for all train types and does neither contain any speed step nor any pivot deceleration limit.

A.3.3 Intentionally deleted

A.3.4 Handling of Accepted and Stored Information in specific Situations

A.3.4.1 Introduction

A.3.4.1.1 All data that can be stored onboard after being accepted may be influenced in special situations.

A.3.4.1.2 The situations acting on the “status” of stored information are:

a) the execution of a conditional emergency stop (3.10.2.2);

b) the reception of a shortened MA (3.8.5.1.3, 3.8.5.1.4);

c) the stored MA is shortened due to a section time-out (3.8.4.2.2);

d) the SvL is shifted (to the DP if any or to the EOA) due to an overlap time-out (3.8.4.4.2) ;

e) the stored MA is shortened due to an end section time-out (3.8.4.1.2);

f) a cooperative MA revocation is granted by the onboard (3.8.6.2);

g) inconsistency in a balise group marked as unlinked and the train is at standstill (3.16.2.5.2);

h) a linking reaction led to a service brake and the train is at standstill (3.16.2.6.2) ;

i) the reaction due to the supervision of the safe radio connection led to a service brake and the train is at standstill (3.16.3.4.5 b) ;

j) the train category, axle load category, loading gauge or traction system is changed and the train is at standstill (3.18.3.7) ;

k) driver closes the desk during SoM ;

l) RAMS related supervision functions led to a service brake and the train is at standstill (3.16.2.7)

m) inconsistency in a balise group marked as linked and no linking is used onboard and the train is at standstill (3.16.2.4.4.2)

n) the Limit of Authority becomes an End of Authority and the on-board considers an SvL (3.8.4.3.2)

A.3.4.1.3 Depending on the situation, the action can be:

a) data is deleted,

b) data is reset (set to initial states)

c) data status is unchanged,

d) data is to be revalidated

D = Deleted U = Unchanged R = Reset TBR = To Be Revalidated

Data Stored on-board	Situations listed above		
	a – d, f, n	**e, g – j, l, m**	**k**
National Values	U	U	U
Not yet applicable National Values	D[1]	D[10]	D
Linking	D[1]	D[10]	D
Movement Authority	D[1] [3]	D[10] [11]	D[5]
Gradient Profile	D[1]	D[10]	D
International SSP	D[1]	D[10]	D
Axle load speed profile	D[1]	D[10]	D
STM max speed	U	U	D
STM system speed/distance	U	U	D
Level Transition Order	U	U	D
Stop Shunting on desk opening	U	U	U
List of balises for SH area	D	D[9]	D[5]
MA Request Parameters	U	U	U

Data Stored on-board	Situations listed above		
	a – d, f, n	e, g – j, l, m	k
Position Report parameters	U	U	U
List of Balises in SR Authority + SR mode speed limit and distance	U[2]	U	D[5]
Temporary Speed Restrictions	U	U	D
Inhibition of revocable TSRs from balises in L2/3	U	U	D
Default Gradient for TSR	U[4]	U[4]	D
Signalling related Speed Restriction	D[1]	D[10]	D[5]
Route Suitability Data	D[1]	D[10]	D
Plain Text Information (location based)	D[8]	D[13]	D
Plain Text Information (not location based)	U	U	D
Fixed Text Information (location based)	D[8]	D[13]	D
Fixed Text Information (not location based)	U	U	D
Geographical Position	U	U	U
Mode Profile	D[1] [7] [14]	D[10] [12]	D[5]
RBC Transition Order	D[1]	D[10]	D
Radio Infill Area information	D[1]	D[10]	D
EOLM information	U	U	U
Track Conditions excluding big metal masses	R[1]	R[10]	R
Track condition big metal masses	R[1]	R[10]	R
Unconditional Emergency Stop	U	U	D
Conditional Emergency Stop	U	U	D
Train Position	U	U	U
Train Data	U	U	TBR
Adhesion factor	U	U	D
ERTMS/ETCS level	U	U	U
Table of priority of trackside supported levels	U	U	U
Driver ID	U	U	TBR
Radio Network ID	U	U	U

Data Stored on-board	Situations listed above		
	a – d, f, n	e, g – j, l, m	k
RBC ID/Phone Number	U	U	U
Train Running Number	U	U	TBR
Reversing Area Information	D[1]	D[10]	D
Reversing Supervision Information	U	U	D
Track Ahead Free Request	U[6]	U	D
Level Crossing information	U	U	D
Permitted Braking Distance Information	D[1]	D[10]	D
RBC/RIU System Version	U	U	U
Operated System Version	U	U	U
Language used to display information to the driver	U	U	U
Virtual Balise Covers	U	U	U

[1]: beyond the new SvL or in case of situation a, beyond the stop location of the accepted CES

[2]: The considered situations cannot occur when a list of balises to be used in SR is available onboard. Indeed, the onboard is in SR mode and since no MA or track description are stored onboard, no new SvL may be defined.

[3]: In case of reception of a new non-infill MA (situation b or f), the stored MA is fully replaced with the new one. In case of reception of a new infill MA (situation b), the stored MA is replaced beyond the infill location reference, i.e. the balise group at the next main signal

[4]: The considered situations a-d, f, h, i cannot occur when the default gradient for a TSR is used on-board.

[5]: The considered situation cannot occur because acceptance of this information has led to exit from SoM procedure.

[6]: The considered situations b-d, f cannot occur when a TAF request is stored on-board

[7]: If the start location of the Mode Profile is beyond the new SvL, the acknowledgement window of the Mode Profile shall be deleted as well

[8]: only if the location where to start to display the text is beyond the new SvL; otherwise all the text information (i.e. including end location where to stop display, if any) shall remain unchanged

[9]: unchanged if the onboard is in SH mode

[10]: beyond the current max safe front end position of the train

[11]: the ERTMS/ETCS on-board equipment shall consider the current estimated front end and max safe front end positions of the train, as the EOA and SvL respectively, with no release speed

[12]: If the start location of the Mode Profile is beyond the current max safe front end, the acknowledgement window of the Mode Profile shall be deleted as well

[13]: only if the location where to start to display the text is beyond the current max safe front end; otherwise all the text information (i.e. including end location where to stop display, if any) shall remain unchanged

[14]: In case of reception of a new non-infill MA with or without Mode Profile (situation b or f), the stored Mode Profile is deleted. In case of reception of a new infill MA (situation b), the stored Mode Profile is deleted only beyond the infill location reference, i.e. the balise group at the next main signal

A.3.4.1.4 NOTES:

A.3.4.1.4.1 "Location" contains LRBG, distance travelled from LRBG, position of the front end in relation to the LRBG, the confidence interval and the orientation in relation to the LRBG.

A.3.4.1.4.2 The following information is not considered to be stored information:

a) Repositioning information
b) Session Management (exception: the RBC ID/phone number, which is given with an order to establish a communication session, is stored on-board)
c) Danger for SH information
d) Assignment of Co-ordinate system
e) Infill Location Reference
f) Location Identity (NID_C + NID_BG transmitted in the balise telegram)
g) Recognition of exit from TRIP mode
h) Acknowledgement of Train Data
i) SH refused
j) SH authorised
k) Balise/loop system version
l) Track Condition Station Platforms
m) Track Condition Change of Allowed Current Consumption
n) Revocation of Emergency Stop (Conditional or Unconditional)
o) Temporary Speed Restriction Revocation
p) Initiation of communication session
q) Acknowledgement of session termination
r) Default Balise Information
s) Co-operative shortening of MA (if this message is used, it replaces the movement authority)
t) Train Rejected
u) Train Accepted
v) SoM position report confirmed by RBC
w) Track Ahead Free up to level 2/3 transition location
x) Signalling related speed restriction value zero (i.e., train trip order)
y) Stop if in SR mode
z) Data to be forwarded to a National System through the STM interface

A.3.5 Handling of Actions in Specific Situations

A.3.5.1 Regards actions executed in reference to location information received from trackside, the on-board equipment shall ensure that the action related to a location is neither reverted, nor executed twice. Situations to be considered shall include reverse movement (initiated by driver or due to roll-away) and the sub-sequent forward movement, or adjustment of train position on passing a new LRBG. This rule shall apply to the following actions:

- Change of National Values (see 3.18.2)
- Request to acknowledge new level, level transition (see SRS chapter 5.10)
- Start and stop displaying plain or fixed text messages (see 3.12.3)
- Request to acknowledge a mode profile, mode transition due to mode profile (see 3.12.4)
- Start and stop accepting radio infill information (see 3.9.3)
- Actions related to RBC/RBC handover (see 3.15.1)
- Actions related to track condition information (see 3.12.1) with the exception of big metal masses
- Permission to initiate Reversing mode, i.e., limits of Reversing Area (see 3.15.4)
- Start and stop Track Ahead free request to driver (see 3.15.5)”
- Start and stop calculation of geographical position (see 3.6.6)

A.3.5.2 Once the ERTMS/ETCS on-board equipment has received a balise group message (i.e. once it has received the last balise telegram of the balise group), the action(s) resulting from its content shall take into account the train position measured at the time of reception of this last telegram and shall take precedence on any other action related to a further location that is reached before the message has been fully processed.

A.3.5.2.1 Example 1: in level 1, the crossing of the EOA/LOA location with the min safe antenna, before a new extended MA (received when the min safe antenna was in rear of the EOA/LOA) has been processed, will not lead to train trip. In other terms the replacement of the EOA/LOA is considered by the on-board as happening before the min safe antenna crosses the EOA/LOA location (i.e. preventing that clause 3.13.10.2.7 applies).

A.3.5.2.2 Example 2: when the override function is active, the crossing of the former EOA location by the min safe antenna, before a “Stop if in SR” information (received when the min safe antenna was in rear of the former EOA) has been processed, will not lead to the end of the override procedure followed by a train trip due to “Stop if in SR”. In other terms, both the deletion of the former EOA and the end of override procedure (see 5.8.3.1.3 and 5.8.4.1 c)) are considered by the on-board as simultaneously happening before the min safe antenna crosses the former EOA/LOA location.

A.3.6 Deletion of accepted and stored information when used

A3.6.1 Standard case

A3.6.1.1 When the train moves in the direction of its train orientation, storage capacity occupied by trackside information no longer used, i.e., the related on-board functionality has been completed, shall be made available immediately.

A3.6.1.1.1 Note: The requirement is needed to allow trackside to predict the storage capacity available on-board in order to comply with dimensioning rules regards information stored on-board given in Subset 040.

A3.6.2 Exception

A3.6.2.1 Following information shall remain stored on-board for a distance defined by a fixed value in rear of the min safe rear end position of the train:

- location dependent static speed restrictions , i.e., SSP, ASP, TSR, LX SR, PBD SR (see 3.11.2.2)
- gradient information,
- reduced adhesion information received from trackside,
- Track condition “Big metal masses”.

A3.6.2.1.1 Note: The above information remains stored for the case of a reverse movement:

- With the exception of the track condition “Big metal masses”, the stored information allows the ERTMS/ETCS on-board equipment to calculate speed supervision limits after a reverse movement (roll-away, or initiated by the driver)
- Track condition “Big metal masses” is needed also for a reverse movement itself to avoid any false alarms due to Big metal masses in the track.

A3.6.2.1.2 Note: The distance to intervention of the roll away or reverse movement supervision is determined by a National/Default value. This is also true for a reverse movement in Post trip mode. However, following an intervention, the train will not stop immediately. In order to keep the on-board functionality simple, a fixed distance value was chosen to define an unambiguous location in rear of the train where the above information is no longer required and the related on-board storage capacity is made available again.

A.3.7 Calculation of the basic deceleration

A.3.7.1 The brake percentage (λ) shall be converted into two different input parameters:

$\lambda_o = \lambda$ for calculation of emergency brake deceleration (A_brake_emergency(V))

λ_o = MIN (λ, 135) for calculation of service brake deceleration (A_brake_service(V)) where λ is the brake percentage defined as part of Train Data.

A.3.7.2 The calculation of the basic deceleration (A_basic(V)) shall use a common algorithm that will be used twice, once for the service brake and once for the emergency brake.

A.3.7.3 The speed limit for the first step shall be calculated as V_lim = x * λ_o^y.

V_lim is the speed limit for the first step in km/h

x = 16.85

y = 0.428

A.3.7.4 The first step of the basic deceleration shall be calculated as AD_0 = A * λ_o + B

AD_0 is the basic deceleration in m/s^2 for 0 ≤ speed ≤ V_lim.

A = 0.0075

B = 0.076

A.3.7.5 The following steps of the basic deceleration shall be calculated by means of a set of polynomials of the third order with the following format:

AD_n = a3_n * λ_o^3 + a2_n * λ_o^2 + a1_n * λ_o + a0_n

and with the following values for n (all speed limits in km/h):

n = 1	valid for V_lim < speed ≤ 100	if V_lim ≤ 100
	to be ignored	if V_lim > 100
n = 2	valid for V_lim < speed ≤ 120	if 100 < V_lim ≤ 120
	valid for 100 < speed ≤ 120	if V_lim ≤ 100
	to be ignored	if V_lim > 120
n = 3	valid for V_lim < speed ≤ 150	if 120 < V_lim ≤ 150
	valid for 120 < speed ≤ 150	if V_lim ≤ 120
	to be ignored	if V_lim > 150
n = 4	valid for V_lim < speed ≤ 180	if 150 < V_lim ≤ 180
	valid for 150 < speed ≤ 180	if V_lim ≤ 150
	to be ignored	if V_lim > 180
n = 5	valid for V_lim < speed	if V_lim > 180
	valid for 180 < speed	if V_lim ≤ 180

A.3.7.6 The coefficients for the polynomials shall be defined as follows:

am_n		m =			
		3	2	1	0
n =	1	-6.30E-07	6.10E-05	4.72E-03	0.0663
	2	2.73E-07	-4.54E-06	5.14E-03	0.1300
	3	5.58E-08	-6.76E-06	5.81E-03	0.0479

	4	3.00E-08	-3.85E-06	5.52E-03	0.0480
	5	3.23E-09	1.66E-06	5.06E-03	0.0559

A.3.8 Calculation of the emergency brake equivalent time

A.3.8.1 The basic brake build up time for the emergency brake with the brake position in passenger trains in P shall be calculated as:

T_brake_basic_eb = a + b * (L/100) + c * $(L/100)^2$

where

L = MAX (400m; train length in m)

a = 2.30

b = 0.00

c = 0.17

A.3.8.2 The basic brake build up time for the emergency brake with the brake position in freight trains in P shall be calculated as:

T_brake_basic_eb = a + b * (L/100) + c * $(L/100)^2$

where

L = MAX (400m; train length in m)

If train length ≤ 900m:

a = 2.30

b = 0.00

c = 0.17

If 900m < train length ≤ 1500m:

a = -0.40

b = 1.60

c = 0.03

A.3.8.3 The basic brake build up time for the emergency brake with the brake position in freight trains in G shall be calculated as:

T_brake_basic_eb = a + b * (L/100) + c * $(L/100)^2$

where

L = train length in m

If train length ≤ 900m:

a = 12.00

b = 0.00

c = 0.05

If 900m < train length ≤ 1500m:

a = -0.40

b = 1.60

c = 0.03

A.3.8.4 The equivalent brake build up time for the emergency brake shall be computed as follows:

T_brake_emergency_cm0 = T_brake_basic_eb when V_target = 0

T_brake_emergency_cmt = kto * T_brake_basic_eb when V_target > 0

where

V_target is the target speed

A.3.8.5 The correction factor kto shall depend on the brake position as follows:

kto = 1 + Ct

where

Ct = 0.16 for freight trains in G

Ct = 0.20 for freight trains in P

Ct = 0.20 for passenger trains

A.3.9 Calculation of the full service brake equivalent time

A.3.9.1 The basic brake build up time for full service brake for passenger trains in P shall be calculated as:

T_brake_basic_sb = a + b * (L/100) + c * $(L/100)^2$

where

L = train length in m

a = 3.00

b = 1.50

c = 0.10

A.3.9.2 The basic brake build up time for full service brake for freight trains in P shall be calculated as:

T_brake_basic_sb = a + b * (L/100) + c * $(L/100)^2$

where

L = train length in m

If train length ≤ 900m:

a = 3.00

b = 2.77

c = 0.00

If 900m < train length ≤ 1500m:

a = 10.50

b = 0.32

c = 0.18

A.3.9.3 The basic brake build up time for full service brake for freight trains in G shall be calculated as:

T_brake_basic_sb = a + b * (L/100) + c * (L/100)^2

where

L = MAX (400m; train length in m)

If train length ≤ 900m:

a = 3.00

b = 2.77

c = 0.00

If 900m < train length ≤ 1500m:

a = 10.50

b = 0.32

c = 0.18

A.3.9.4 The equivalent brake build up time for the service brake shall be computed as follows:

T_brake_service_cm0 = T_brake_basic_sb when V_target = 0

T_brake_service_cmt = kto * T_brake_basic_sb when V_target > 0

A.3.9.5 The correction factor kto shall be defined as in A.3.8.5

A.3.9.6 The values of a, b, c and kto used in A.3.9.1, A.3.9.2, A.3.9.3 and A.3.9.4 define reference values for the equivalent brake build up time for the service brake, which shall be considered as maximum ones. If justified by the specific brake system of the train other values of these coefficients, which lead to shorter values of the equivalent brake build up time for the service brake, may be used.

A.3.9.7 Note: Although certain trains may perform better, the reference values for the equivalent brake build up time for the service brake, as defined here, are the appropriate basis for infrastructure planning.

A.3.10 Service brake feedback

A.3.10.1 The purpose of service brake feedback is to reduce the distance between the SBI and EBI supervision limits and between the SBI and SBD curves.

A.3.10.2 The on-board shall consider the service brake feedback as available for use if:

a) The service brake feedback is implemented, AND

b) The national value does not inhibit its use.

A.3.10.3 Two different types of feedback from the service brake are specified, main brake pipe pressure and brake cylinder pressure. The algorithms below are made for main brake pipe pressure. When brake cylinder pressure is used instead this shall be converted into a fictive main brake pressure value in the following way:

p = fictive main brake pipe pressure (kPa)

p_cylinder = brake cylinder pressure (kPa)

k1 = vehicle dependent constant (set by engineering of ETCS on-board; k1 is normally between 2.0 and 2.7)

p = 500 - p_cylinder / k1

A.3.10.4 The value of T_bs1 and T_bs2 shall be calculated according to the following algorithm to take the service brake feedback into account:

p = current main brake pipe pressure (or fictive main brake pipe pressure calculated in A.3.10.3)

p0 = reference pressure when not braking

p1 = pressure at which the train starts to brake = p0 - 30

p2 = pressure limit, under which T_bs1 and T_bs2 are locked = p0 - 60

p3 = pressure at full service brake = p0 - 150

Q_feedback_started = a Boolean stating whether the feedback function has started to reduce T_bs1 and T_bs2.

Q_Tbslocked = a boolean stating whether T_bs1 and T_bs2 have been locked to the following values due to enough main brake pipe pressure reduction:

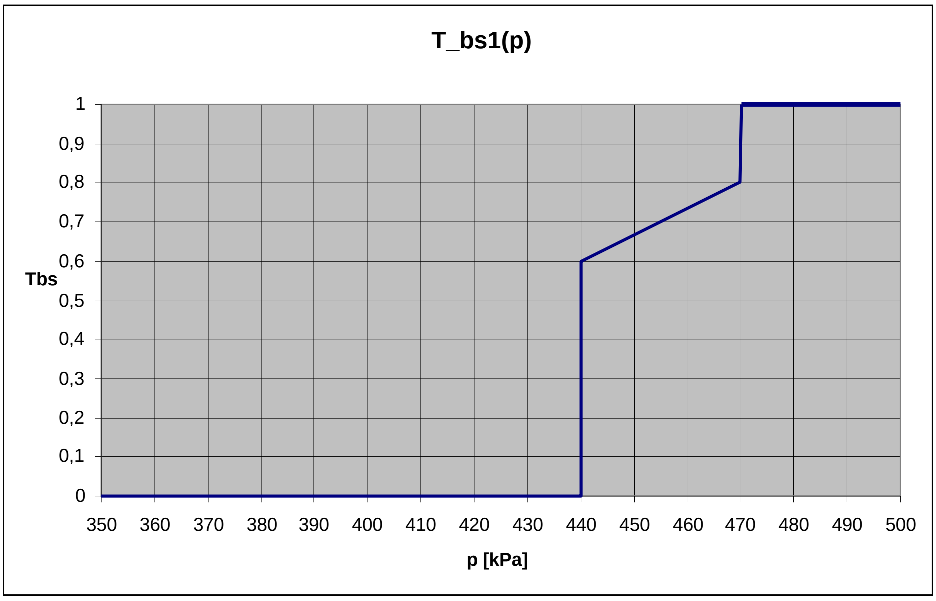
T_bs1_locked = 0 s.

T_bs2_locked = 2 s.

```
If (Q_Tbslocked) or (Q_feedback_started) or (V_est > V_target and the indication supervision limit has been exceeded) then
    If Q_Tbslocked then
        T_bs1 = T_bs1_locked
        T_bs2 = T_bs2_locked
    Else
        If p > p2 then
            If Q_feedback_started or p ≤ p1 then
                Q_feedback_started = true
                T_bs_feedback = T_bs * (p - p3) / (p0 - p3)
                T_bs1 = T_bs2 = T_bs_feedback
                If T_bs_feedback > T_bs then
                    T_bs1 = T_bs2 = T_bs
                Else if T_bs_feedback < T_bs2_locked then
                    T_bs2 = T_bs2_locked
                End If
            Else
                T_bs1 = T_bs
```

```
                T_bs2 = T_bs
            End If
        Else
            T_bs1 = T_bs1_locked
            T_bs2 = T_bs2_locked
            Q_Tbslocked = true
        End If
    End If
Else
    T_bs1 = T_bs
    T_bs2 = T_bs
End if

If (the target speed monitoring is left) or (the target location is passed) then
    Q_Tbslocked = false
    Q_feedback_started = false
End If
```



The reference pressure p0 (nominal value 500 kPa) shall be set on starting the ETCS:

a) To the first stable p value between 400-550 kPa achieved.

b) Stable in this instance means that the pressure has not varied more than ± 20 kPa over 3 seconds.

The reference pressure p0 shall thereafter be adapted to the current pressure according to the following table (which applies if the calculation is performed once per second):

	CONDITIONS:	ACTION:	REMARKS
a)	p = p0	No change	Constant pressure
b)	p > p0	p0 = p0 + 1,5	Increasing pressure
c)	p < p0 - 30	No change	Braking
d)	p0 > p ≥ p0 - 30	p0 = p0 – 0,5	Decreasing pressure

Where:

- p is limited to max 550 kPa.
- Values given in kPa.

A.3.10.5 Note: If T_bs1 and T_bs2 have been locked to 0s and 2 s, the locking will remain until the target speed monitoring is left, even if the train speed comes below the target speed. This avoids “jumping” indications. It also makes it possible to release the brakes before a speed reduction, without having the curves moving back again. It might though result in emergency brake intervention if the driver releases the brakes too early. But since EBI is not moved, this is not a safety issue. To keep 2 s between the SBI and EBI enables the service brake to be activated first and thus may avoid emergency brake.

A.3.10.6 Note: If feedback has started but T_bs1 and T_bs2 are not locked, the feedback function will remain active until the target point is reached. This avoids “jumping” indications in some rare situations.

ERTMS/ETCS
System Requirements Specification **Chapter 4** **Modes and Transitions**
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4.1 Modification History

Issue Number Date	Section Number	Modification / Description	Author
Issue 0.0.1 1999-07-05	/	This document is based on “SRS Class P – Modes and Transitions” issue 1.1.2 (ref. Subset-006-4)	Laffineur J.C.
Issue 0.0.2 1999-07-16	/	New modes/functions/transitions due to Class 1 scope, and impact from WPs (of 1999-07-13).	Laffineur J.C.
Issue 0.1.0 1999-07-23	/	Unisig Review – Stockholm – 22 & 23 July 1999	Laffineur J.C.
1.0.0 1999-07-29	Version number, editorial changes.	Finalisation meeting, Stuttgart 990729.	HE
1.2.0 990730	Version number	Release version	HE
1.3.0 991209	/	Modifications due to Work Packages on SRS Class 1 v 1.0.0	Laffineur J.C.
1.4.0 991220	/	Modifications due to review meeting in Stockholm (991215 and 991216)	Laffineur J.C.
1.4.1 991221	/	Presentation changes	Laffineur J.C.
2.0.0 991222	Minor editing	Release version	Laffineur J.C.
2.0.1	All	Modifications respect to Unisig review (doc. Unisig_all_com_SRS_2.0.0_2)	Laffineur J.C.
2.1.0	All	Modifications respect to Unisig review (doc. Unisig_all_com_SRS_2.0.1)	Laffineur J.C.
2.2.0	Version number	UNISIG release	SAB

2.2.2 02 02 01	/	SUBSET-026 Corrected Paragraphs, Issue 2.2.2	Laffineur J.C.
2.2.4	Including all CLRs being in state "EEIG" as per list of CLRs agreed by EEIG on 06/05/04.		Hougardy A.
2.2.4 SG checked 28/05/04	Including all CLRs agreed with the EEIG (see "List of CLRs agreed with EEIG for SRS v2.2.4" dated 28/05/04) Affected clauses see change marks		H. Kast
2.2.5 21/01/05	Incorporation of solution proposal for CLR 007 with EEIG users group comments Corrections according to erratum list agreed in SG meeting 170105		Hougardy A.
2.2.6 04/02/05	Including all CLRs being in state "EEIG pending" as per list of CLRs extracted on 28/01/05.		Hougardy A.
2.2.7 16/06/05	Including all CLRs extracted from "CR-Report_10.6.05-by number.rtf" and mentioned in column 2.2.7 in "CR status 13.6.05.xls"		Hougardy A.
2.2.8 29/11/05	Change marks cleaned up and updated according to last CRs decisions (including split of CRs7&126)		Hougardy A.
2.2.9 24/02/06	Including all CRs that are classified as "IN" as per SUBSET-108 version 1.0.0 Removal of all CRs that are not classified as "IN" as per SUBSET-108 version 1.0.0, with the exception of CRs 63,98,120,158,538		Hougardy A.
2.3.0 24/02/06	Release version		HK
2.3.1 15/06/06	Including SG CR decision made since SRS 2.2.8, correct errors in 2.2.8 detected when creating SRS 2.3.0		Hougardy A.
2.3.2 17/03/08	Including all CRs that are classified as "IN" as per SUBSET-108 version 1.2.0 and all CRs that are in state "Analysis completed" according to ERA CCM		Hougardy A.

2.9.1 06/10/08	Including all enhancement CR's retained for 3.0.0 baseline and all other error CR's that are in state "Analysis completed" according to ERA CCM For editorial reasons, the following CR's are also included: CR656, CR804, CR821	Hougardy A.
3.0.0 23/12/08	Release version	Hougardy A.
3.0.1 22/12/09	Including the results of the editorial review of the SRS 3.0.0 and the other error CR's that are in state "Analysis completed" according to ERA CCM	Hougardy A.
3.1.0 22/02/10	Release version	Hougardy A.
3.1.1 08/11/10	Including all CR's that are in state "Analysis completed" according to ERA CCM, plus CR972 and 1000.	Hougardy A.
3.2.0 22/12/10	Release version	Hougardy A.
3.2.1 13/12/11	Including all CR's that are in state "Analysis completed" according to ERA CCM, plus CR772	Hougardy A.
3.3.0 07/03/12	Baseline 3 release version	Hougardy A.

4.2 Table of Contents

4.3 Introduction

4.3.1 Presentation of the document

4.3.1.1 This document defines the modes of the ERTMS/ETCS on-board equipment (see chapter 4.4 “Definition of the modes” and chapter 4.5 “Modes and on-board functions”.

4.3.1.2 This document gives all transitions between modes (see chapter 4.6 “Transitions between modes”).

4.3.1.3 This document describes the possible exchanged information between the driver and the ERTMS/ETCS on-board equipment, respect to the mode (see chapter 4.7 “DMI depending on modes”).

4.3.1.4 This document describes how the received information is filtered, respect to several criteria such as the level, the mode, etc.. (see chapter 4.8 “Acceptance of received information”).

4.3.1.5 This document describes how the stored information is handled, respect to several criteria such as the level, the mode, etc. (see chapter 4.9 “What happens to accepted and stored information when entering a given level”, and chapter 4.10 “What happens to accepted and stored information when entering a given mode”).

4.3.1.6 All the tables that are included in this document shall be considered as mandatory requirements.

4.3.1.7 Some notes appear in this document. These notes are here to help the reader to understand the specifications, or to explain the reason(s) of a requirement.

4.3.2 Identification of the possible modes

4.3.2.1 List of the modes:

Full Supervision	(FS)
Limited Supervision	(LS)
On Sight	(OS)
Staff Responsible	(SR)
Shunting	(SH)
Unfitted	(UN)
Passive Shunting	(PS)
Sleeping	(SL)
Stand By	(SB)
Trip	(TR)

Post Trip	(PT)
System Failure	(SF)
Isolation	(IS)
No Power	(NP)
Non Leading	(NL)
National System	(SN)
Reversing	(RV)

4.4 Definition of the modes

4.4.1 Introduction

4.4.1.1 For each mode the following information is given:

a) The context of utilisation of the mode and the functions that characterise the mode (chapter “Description”).

b) The ERTMS/ETCS levels in which the mode can be used (chapter “Used in levels”).

c) The related responsibility of the ERTMS/ETCS on-board equipment and of the driver, once the equipment is in this mode (chapter “Responsibilities”).

4.4.1.2 A complete list of transitions to and from each mode is given in the section 4.6.2 “Transitions Table”).

4.4.2 General Requirements

4.4.2.1 When the desk is open, a clear indication of the ERTMS/ETCS mode shall be shown to the driver.

4.4.2.2 Intentionally deleted.

4.4.3 ISOLATION

4.4.3.1 Description

4.4.3.1.1 In Isolation mode, the ERTMS/ETCS on-board equipment shall be physically isolated from the brakes and can be isolated from other on-board equipments/systems depending on the specific on-board implementation.

4.4.3.1.2 There shall be a clear indication to the driver that the ERTMS/ETCS on-board equipment is isolated.

4.4.3.1.3 To leave Isolation mode, a special operating procedure is needed (no transition from Isolation is specified). This procedure shall ensure that the on-board equipment is only put back into service when it has been proven that this is safe for operation.

4.4.3.1.4 Note: for the list of main functions related to this mode, refer to chapter 4.5 “Modes and on-board functions”.

4.4.3.2 Used in levels

4.4.3.2.1 Used in all levels: Level 0, level 1, level 2, level 3 and level NTC.

4.4.3.3 Responsibilities

4.4.3.3.1 Isolation of the ERTMS/ETCS on-board equipment is performed by the driver under his complete responsibility.

4.4.3.3.2 Once the ERTMS/ETCS on-board equipment is isolated, the ERTMS/ETCS on-board equipment has no more responsibility.

4.4.4 NO POWER

4.4.4.1 Description

4.4.4.1.1 When the ERTMS/ETCS on-board equipment is not powered, the equipment shall be in the No Power mode.

4.4.4.1.1.1 Note: in order to ensure cold movement detection function, some parts of the ERTMS/ETCS on-board equipment may be fed by an auxiliary power supply.

4.4.4.1.2 The ERTMS/ETCS on-board equipment shall permanently command the emergency brake.

4.4.4.1.3 Note: for the list of main functions related to this mode, refer to chapter 4.5 “Modes and on-board functions”.

4.4.4.2 Used in levels

4.4.4.2.1 Used in all levels: Level 0, level 1, level 2, level 3 and level NTC.

4.4.4.3 Responsibilities

4.4.4.3.1 The ERTMS/ETCS on-board equipment has no responsibility in this mode, except commanding the emergency brake and (optionally) monitoring cold movements.

4.4.4.3.2 The notion of responsibility of the driver is not relevant for the No Power mode.

4.4.4.3.3 If it is required to move a loco in NP mode as a wagon, ETCS brake command must be overridden by external means.

4.4.5 SYSTEM FAILURE

4.4.5.1 Description

4.4.5.1.1 The ERTMS/ETCS on-board equipment shall switch to the System Failure mode in case of a fault, which affects safety.

4.4.5.1.2 The ERTMS/ETCS on-board equipment shall permanently command the Emergency Brakes.

4.4.5.1.3 Note: for the list of main functions related to this mode, refer to chapter 4.5 “Modes and on-board functions”.

4.4.5.2 Used in levels

4.4.5.2.1 Used in all levels: Level 0, level 1, level 2, level 3 and level NTC.

4.4.5.3 Responsibilities

4.4.5.3.1 The ERTMS/ETCS on-board equipment is responsible for commanding the Emergency Brakes.

4.4.5.3.2 No responsibility of the driver.

4.4.6 SLEEPING

4.4.6.1 Description

4.4.6.1.1 The Sleeping mode is defined to manage the ERTMS/ETCS on-board equipment of a slave engine that is remote controlled.

4.4.6.1.2 The desk(s) of a sleeping engine must be closed (since there is no driver, no information shall be shown).

4.4.6.1.3 As the engine is remote controlled by the leading engine, its ERTMS/ETCS on-board equipment shall not perform any train movement supervision.

4.4.6.1.4 The ERTMS/ETCS on-board equipment shall perform the Train Position function; in particular, the front/rear end of the engine (i.e., not the train) shall be used to refer to train front/rear end.

4.4.6.1.5 Sleeping mode shall be automatically detected on-board via the train interface.

4.4.6.1.6 If possible, the train must not be stopped due to a safety critical fault in a sleeping engine. The ERTMS/ETCS on-board equipment shall therefore try to memorise the occurrence of such fault(s), which shall be handled when the engine leaves the Sleeping mode. The ERTMS/ETCS on-board equipment shall also try to send an error information to the RBC.

4.4.6.1.7 If a desk of the sleeping engine is opened while the train is running (this is an abnormal operation), the ERTMS/ETCS on-board equipment shall switch to Stand-By mode.

4.4.6.1.8 If the “sleeping input signal” is lost (no more detection of the remote control), the switch to Stand-By mode shall be made only if the train is at standstill.

4.4.6.1.9 Intentionally deleted.

4.4.6.1.10 The ERTMS/ETCS on-board equipment shall open a communication session with the RBC when at least one of the following events occurs:

a) in all levels, on receipt of the order to contact the RBC.

b) In level 2/3, when entering or exiting Sleeping mode (to report the change of mode to the RBC).

c) In level 2/3, when a safety critical fault of the ERTMS/ETCS on-board equipment occurs (to report the fault to the RBC).

4.4.6.1.11 Note: for the list of main functions related to this mode, refer to chapter 4.5 “Modes and on-board functions”.

4.4.6.1.12 In case of balise group message consistency error (refer to 3.16.2.4.4 and 3.16.2.5.1), the ERTMS/ETCS onboard equipment shall not command the service brake.

4.4.6.1.13 When in levels 2 or 3, if no compatible version has been established between the on-board equipment in Sleeping mode and the RBC, the ERTMS/ETCS onboard equipment shall react as specified in 3.5.3.8 b) but no driver's indication shall be given.

4.4.6.2 Used in levels

4.4.6.2.1 Used in all levels: Level 0, level 1, level 2, level 3 and level NTC.

4.4.6.3 Responsibilities

4.4.6.3.1 The ERTMS/ETCS on-board equipment of an engine in Sleeping mode has no responsibility for the train protection.

4.4.6.3.2 The notion of responsibility of the driver is not relevant for the Sleeping mode.

4.4.6.3.2.1 Note**:** The leading engine is responsible for the movement of the train. It is then the ERTMS/ETCS on-board equipment of the leading engine that is fully/partially/not responsible for the train protection, with respect to its mode.

4.4.7 STAND BY

4.4.7.1 Description

4.4.7.1.1 The Stand-By mode is a default mode and cannot be selected by the driver.

4.4.7.1.2 It is in the Stand-By mode that the ERTMS/ETCS on-board equipment awakes.

4.4.7.1.3 Data for mission shall be collected in Stand-By (see SRS-chapter 5: “Start of Mission” procedure).

4.4.7.1.4 In Stand-By mode, the desk of the engine can be open or closed. No interaction with the driver shall be possible as long as the desk is closed, except isolation of the ERTMS/ETCS on-board equipment.

4.4.7.1.5 The ERTMS/ETCS on-board equipment shall perform the Standstill Supervision.

4.4.7.1.6 Note: for the list of main functions related to this mode, refer to chapter 4.5 “Modes and on-board functions”.

4.4.7.2 Used in levels

4.4.7.2.1 Used in all levels: Level 0, level 1, level 2, level 3 and level NTC.

4.4.7.3 Responsibilities

4.4.7.3.1 The ERTMS/ETCS on-board equipment is responsible for maintaining the train at standstill.

4.4.7.3.2 The driver has no responsibility for train movements.

4.4.8 SHUNTING

4.4.8.1 Description

4.4.8.1.1 The purpose of the Shunting mode is to enable shunting movements. In Shunting mode, The ERTMS/ETCS on-board equipment supervises the train movements against:

a) a ceiling speed: the shunting mode speed limit

b) a list of expected balise groups (if such list was sent by the trackside equipment). The train shall be tripped if a balise group, not contained in the list, is passed (When an empty list is sent, no balise group can be passed. When no list is sent, all balise groups can be passed)

c) “stop if in shunting mode” information. The train is tripped if such information is received from balise groups

d) Intentionally deleted

4.4.8.1.2 The Shunting mode shall not require Train Data.

4.4.8.1.3 The ERTMS/ETCS on-board equipment shall perform the Train Position function

4.4.8.1.4 Intentionally deleted.

4.4.8.1.5 When in Shunting mode, the ERTMS/ETCS on-board shall not manage level transitions. However, an immediate level transition order or a conditional level transition order shall be stored and evaluated only when another mode than Shunting or Passive Shunting has been entered (i.e. when the Shunting movement is terminated).

4.4.8.1.5.1 When receiving a communication session establishment order, the ERTMS/ETCS on-board in Shunting mode shall not establish the communication session, but shall store the RBC ID/phone number.

4.4.8.1.5.2 When in Shunting mode, the ERTMS/ETCS on-board shall not manage RBC-RBC hand-over, except for storing the RBC ID/phone number given at the RBC/RBC border.

4.4.8.1.6 Shunting mode can be selected by the driver, only accepted when the train is at standstill, or ordered by the trackside.

4.4.8.1.7 In case of selection of Shunting mode by the driver:

- in level 1 operations, the switch to shunting is always accepted by the on-board equipment
- in level 2 and 3 areas, the on-board shall ask the trackside for an authorisation. The switch to shunting is possible only after receiving such authorisation. The trackside can send a list of balises, that the train is allowed to pass while in SH, together with the authorisation

4.4.8.1.8 In case of order to switch to Shunting mode from trackside, the order:

- in level 1 is given by a balise group. A list of balises, that the train is allowed to pass after the entry in Shunting, can be sent together with the order
- in level 2 and 3 is sent via radio. A list of balises, that the train is allowed to pass after the entry in Shunting, can be sent together with the order

4.4.8.1.9 When the switch to shunting is ordered by trackside, a driver acknowledgement is requested.

4.4.8.1.9.1 Note: in Shunting mode the train is only partially supervised, therefore it is necessary that the driver takes the responsibility.

4.4.8.1.10 The ERTMS/ETCS on-board equipment shall display the train speed and, only on driver request, the permitted speed. The display of the permitted speed shall also be stopped on driver request.

4.4.8.1.11 Intentionally deleted.

4.4.8.1.12 Note: for the list of main functions related to this mode, refer to chapter 4.5 “Modes and on-board functions”.

4.4.8.2 Used in levels

4.4.8.2.1 Used in level 0, NTC, 1, 2 and 3.

4.4.8.3 Responsibilities

4.4.8.3.1 The ERTMS/ETCS on-board equipment is responsible for the supervision of the shunting mode speed limit, and that the engine with the active antenna is tripped when passing the defined border of the shunting area (only if there is a defined border: balise group not in the list given by trackside, or balise group giving the information “stop if in shunting”).

4.4.8.3.2 The driver is responsible for**:**

a) Remaining inside the shunting area defined by a procedure or an external system outside ERTMS/ETCS (also when the shunting area is protected by balises)

b) Train/engine movements and shunting operations

4.4.9 FULL SUPERVISION

4.4.9.1 Description

4.4.9.1.1 The ERTMS/ETCS on-board equipment shall be in the Full Supervision mode when all train and track data, which is required for a complete supervision of the train, is available on board.

4.4.9.1.2 Full supervision cannot be selected by the driver, but shall be entered automatically when all necessary conditions are fulfilled.

4.4.9.1.3 To be in Full Supervision mode, SSP and gradient are not required for the whole length of the train, but shall be at least available from the FRONT END of the train.

4.4.9.1.4 Once in Full Supervision mode, if SSP and gradient are not known for the whole length of the train, an indication "ENTRY IN FULL SUPERVISION" shall be clearly displayed to the driver until SSP and gradient are known for the whole length of the train.

4.4.9.1.4.1 Note: this indication may also be displayed in case the train length has been increased, see 3.18.3.8.

4.4.9.1.5 The ERTMS/ETCS on-board equipment shall supervise train movements against a dynamic speed profile.

4.4.9.1.6 The ERTMS/ETCS on-board equipment shall display the train speed, the permitted speed, the target distance and the target speed to the driver (this list is not exhaustive – refer to chapter 4.7 "DMI depending on modes").

4.4.9.1.7 Note: for the list of main functions related to this mode, refer to chapter 4.5 "Modes and on-board functions".

4.4.9.2 Used in levels

4.4.9.2.1 Used in level 1, 2 and 3.

4.4.9.3 Responsibilities

4.4.9.3.1 The ERTMS/ETCS on-board equipment is fully responsible for the train protection (except for the 2 situations described below).

4.4.9.3.2 The driver is responsible for respecting the EOA when approaching an EOA with a release speed.

4.4.9.3.3 When "ENTRY IN FULL SUPERVISION" is displayed to the driver, the driver is responsible for respecting speed restrictions that apply for the part of the train that is not covered by SSP and gradient data.

4.4.10 UNFITTED

4.4.10.1 Description

4.4.10.1.1 The Unfitted mode is used to allow train movements in either:

a) Areas that are equipped neither with ERTMS/ETCS track-side equipment nor with national train control system

b) Intentionally deleted

c) Areas that are equipped with ERTMS/ETCS trackside equipment and/or national train control system(s), but operation under their supervision is currently not possible

4.4.10.1.2 The ERTMS/ETCS on-board equipment shall supervise train movements against a ceiling speed: the lowest of the maximum train speed and the Unfitted mode speed limit for unfitted area (national value).

4.4.10.1.2.1 Intentionally deleted.

4.4.10.1.3 The ERTMS/ETCS on-board equipment shall also supervise temporary speed restrictions.

4.4.10.1.4 The ERTMS/ETCS on-board equipment shall display the train speed to the driver.

4.4.10.1.5 Note: for the list of main functions related to this mode, refer to chapter 4.5 “Modes and on-board functions”.

4.4.10.2 Used in levels

4.4.10.2.1 Used in level 0.

4.4.10.3 Responsibilities

4.4.10.3.1 The ERTMS/ETCS on-board equipment supervises a ceiling speed and (if available) temporary speed restrictions.

4.4.10.3.2 The driver must respect the existing line-side signals and is fully responsible for train movements.

4.4.11 STAFF RESPONSIBLE

4.4.11.1 Description

4.4.11.1.1 The Staff Responsible mode allows the driver to move the train under his own responsibility in an ERTMS/ETCS equipped area.

4.4.11.1.2 This mode is used when the system does not know the route. For example:

a) After the ERTMS/ETCS on-board equipment starts-up (awakening of the train).

b) To pass a signal at danger / override an EOA.

c) After a trackside failure (for example: loss of radio contact).

4.4.11.1.3 The ERTMS/ETCS on-board equipment shall supervise train movements against**:**

a) a ceiling speed: the staff responsible mode speed limit

b) a given distance (regarding its origin location see 4.4.11.1.3.1). The ERTMS/ETCS on-board equipment shall supervise braking curves with a target speed of zero to the end of this distance. If the train overpasses this distance (see next note) the ERTMS/ETCS on-board equipment shall trip the train

c) a list of expected balise groups, if this list has been sent by the RBC. The train shall be tripped if over-passing a balise group that is not in the list. (When an empty list is sent, no balise group can be passed. When no list is sent, all balise groups can be passed)

d) balise groups giving the order ‘stop if in SR’. This order shall immediately trip the train, unless the over-passed balise group is included in a list of expected balises as defined in item c)

e) running in the direction opposite to the train orientation (reverse movement protection)

4.4.11.1.3.1 The ERTMS/ETCS on-board shall determine the start location of the SR distance as follows:

a) If the National/Default value determines the max permitted distance to run in SR mode, the starting point of this distance shall refer to the estimated position of the train front when SR mode was entered, or, already in Staff Responsible mode, when Override was activated.

b) If the max permitted distance to run in SR mode is determined by the value transmitted by the RBC, or entered by the driver, the start location of the distance shall refer to the estimated position of the train front when the distance information is received or entered.

c) If the max permitted distance to run in SR mode is determined by the value transmitted by EUROLOOP, the distance information transmitted by EUROLOOP shall be referred to one or more reference balise groups. On-board shall evaluate the distance to run in SR mode by matching the reference balise groups given with the LRBG.

In case the LRBG is, due to a change of orientation, in front of the train when the distance to run in SR mode is to be determined from the EUROLOOP information, the complete distance to run in SR mode shall be determined as the distance given by EUROLOOP plus the distance between the estimated train front end and the LRBG.

4.4.11.1.4 Note: Since the gradient is unknown, the supervision of the braking curves in Staff Responsible mode does not ensure that the train will not pass the given distance.

4.4.11.1.5 The ERTMS/ETCS on-board equipment shall give the possibility to the driver to modify the value of the SR mode speed limit and of the given distance. This shall be possible only at standstill.

4.4.11.1.5.1 If a train movement is detected while the driver is entering the SR speed/distance limits, the ERTMS/ETCS on-board equipment shall trigger the brake command.

4.4.11.1.6 In level 2/3, the driver shall have the possibility to request a new distance to run in Staff Responsible, by selecting "Start". This triggers an MA request.

4.4.11.1.6.1 Note: Once the SR distance is covered, the driver may have to go further.

4.4.11.1.6.2 When entering SR mode, the value applicable for SR mode speed limit and the value applicable for SR distance shall be the corresponding National/Default values. Exception for SR distance: SR mode is authorised by RBC giving an SR distance.

4.4.11.1.6.3 While in SR mode, the value applicable for the SR mode speed limit shall be, if available, the last value entered by the driver.

4.4.11.1.6.4 While in SR mode, the value applicable for the SR distance shall be, if available, the last value received by the ERTMS/ETCS on-board equipment amongst:

a) the distance to run in SR entered by the driver;

b) the distance to run in SR given by trackside.

4.4.11.1.6.5 When "Override" is selected, the SR mode speed limit value and the SR distance value previously entered by driver or given by trackside, if any, shall be deleted. The corresponding National/Default values shall enter in force.

4.4.11.1.6.6 If the train is in SR and receives a new distance to run in SR mode from the RBC, the stored list of expected balise groups, if any, shall be deleted or shall be replaced by the list of expected balise groups sent together with the distance to run in SR.

4.4.11.1.6.7 If an ERTMS/ETCS on-board equipment in SR mode, after having received from EUROLOOP max permitted distance to run in SR mode information, detects the main signal balise group being part of this information then it shall ignore any new max permitted distance to run in SR mode information from that loop.

4.4.11.1.7 The ERTMS/ETCS on-board equipment shall display the train speed and the (when active) override (permission to pass a signal at danger, trip inhibited). The permitted speed, target distance and the target speed shall be displayed only on driver request, until the driver requests to stop their display.

4.4.11.1.8 Intentionally deleted.

4.4.11.1.9 If receiving a "track ahead free" request from the RBC, the ERTMS/ETCS on-board equipment requests the driver to enter the "track ahead free" information.

4.4.11.1.10 Note: for the list of main functions related to this mode, refer to chapter 4.5 “Modes and on-board functions”.

4.4.11.1.11 Intentionally deleted.

4.4.11.2 Used in levels

4.4.11.2.1 Level 1, 2 and 3.

4.4.11.3 Responsibilities

4.4.11.3.1 The ERTMS/ETCS on-board equipment supervises a ceiling speed and a SR distance if finite (and if level 2/3, might also supervise a list of balises).

4.4.11.3.2 The driver must check if the track is free, if points are correctly positioned, and must respect the existing line-side information (signals, speed boards etc.).

4.4.11.3.3 When using the possibility to modify the value of the SR mode speed limit and of the given distance, the driver is responsible for entering reasonable values.

4.4.12 ON SIGHT

4.4.12.1 Description

4.4.12.1.1 The On Sight mode enables the train to enter into a track section that could be already occupied by another train, or obstructed by any kind of obstacle.

4.4.12.1.2 On Sight mode cannot be selected by the driver, but shall be entered automatically when commanded by trackside and all necessary conditions are fulfilled.

4.4.12.1.3 The ERTMS/ETCS on-board equipment shall supervise train movements against a dynamic speed profile.

4.4.12.1.4 The ERTMS/ETCS on-board equipment shall display the train speed to the driver (this list is not exhaustive). The permitted speed, target distance,target speed and release speed (if any) shall be displayed only on driver request, until the driver requests to stop their display.

4.4.12.1.5 If receiving a "track ahead free" request from the RBC, the ERTMS/ETCS on-board equipment requests the driver to enter the "track ahead free" information.

4.4.12.1.6 To be in On Sight mode, SSP and gradient are not required for the whole length of the train, but shall be at least available from the FRONT END of the train.

4.4.12.1.7 Once in On Sight mode, if SSP and gradient are not known for the whole length of the train, an indication “ENTRY IN ON SIGHT” shall be clearly displayed to the driver until SSP and gradient are known for the whole length of the train.

4.4.12.1.7.1 Note: this indication may also be displayed in case the train length has been increased, see 3.18.3.8.

4.4.12.1.8 Deleted

4.4.12.1.9 Note: for the list of main functions related to this mode, refer to chapter 4.5 “Modes and on-board functions”.

4.4.12.2 Used in levels

4.4.12.2.1 Used in level 1, 2 and 3.

4.4.12.3 Responsibilities

4.4.12.3.1 The ERTMS/ETCS on-board equipment is responsible for the supervision of the train movements.

4.4.12.3.2 The driver is responsible for checking the track occupancy when moving the train, because the track may be occupied.

4.4.13 TRIP

4.4.13.1 Description

4.4.13.1.1 Deleted

4.4.13.1.1.1 Note: Application of emergency brakes and train trip are two different things. For example, exceeding the permitted speed leads to application of the emergency brakes, but as long as the train does not pass the EOA, it is not a train trip.

4.4.13.1.2 The ERTMS/ETCS on-board equipment shall command the emergency brakes (no brake release is possible in Trip mode).

4.4.13.1.3 The ERTMS/ETCS on-board equipment shall indicate to the driver the reason of the train trip.

4.4.13.1.4 The ERTMS/ETCS on-board equipment shall request an acknowledgement from the driver once train is at standstill (to allow the driver to acknowledge the train trip).

4.4.13.1.4.1 Note: This acknowledgement is mandatory to exit from Trip mode.

4.4.13.1.5 Note: for the list of main functions related to this mode, refer to chapter 4.5 “Modes and on-board functions”.

4.4.13.1.6 Closing the desk while being in Trip mode will not cause a mode change but no interaction with the driver shall be possible as long as the desk is closed, except isolation of the ERTMS/ETCS on-board equipment

4.4.13.2 Used in levels

4.4.13.2.1 Used in level 0, NTC, 1, 2 and 3.

4.4.13.3 Responsibilities

4.4.13.3.1 The ERTMS/ETCS on-board equipment is responsible for stopping the train and for maintaining the train at standstill.

4.4.13.3.2 The driver has no responsibility for train movements.

4.4.14 POST TRIP

4.4.14.1 Description

4.4.14.1.1 The Post Trip mode shall be entered immediately after the driver acknowledges the trip.

4.4.14.1.2 Once in post trip mode, the onboard equipment shall release the Command of the emergency brake.

4.4.14.1.3 The train shall only be authorised to move backwards a given distance (national value). The ERTMS/ETCS on-board equipment shall supervise this national distance for reverse movements, and shall command the service brakes if the distance is over-passed. The driver shall be informed about the reason for the brake application.

4.4.14.1.3.1 Note: The ERTMS/ETCS onboard equipment performs the Reverse Movement Protection (as in PT mode, the "normally allowed movement" is backwards, then the Reverse Movement Protection avoids the train running in forward direction when in PT mode). This implies that the given distance to run backwards in PT is considered as a directional data, oriented backwards.

4.4.14.1.3.2 After the release of a brake command initiated due to an overpassed distance allowed for moving backwards in Post Trip mode, the ERTMS/ETCS on-board equipment shall command the service brake for any further movement in the direction opposite to the train orientation.

4.4.14.1.4 When moving backwards in Post Trip mode, the train trip shall be inhibited.

4.4.14.1.5 Intentionally deleted.

4.4.14.1.6 When ERTMS/ETCS level is 1, if the driver selects “Start” the onboard equipment proposes Staff Responsible. When ERTMS/ETCS level is 2 or 3, the selection of Start leads to an MA Request to the RBC. It is the RBC responsibility to give an SR authorisation, or a Full Supervision MA or an On Sight/Shunting MA to an ERTMS/ETCS equipment that is in Post Trip mode.

4.4.14.1.7 Intentionally deleted.

4.4.14.1.8 Note: for the list of main functions related to this mode, refer to chapter 4.5 “Modes and on-board functions”.

4.4.14.1.9 In case of balise group message consistency error (refer to 3.16.2.4.4 and 3.16.2.5.1), the ERTMS/ETCS onboard equipment shall not command the service brake.

4.4.14.2 Used in levels

4.4.14.2.1 Used in level 1, 2 and 3.

4.4.14.3 Responsibilities

4.4.14.3.1 The ERTMS/ETCS on-board equipment is responsible for supervising that the train moves only backwards and that the backward movement does not exceed the maximum permitted distance (national value).

4.4.14.3.2 The driver is responsible if moving the train backwards.

4.4.15 NON LEADING

4.4.15.1 Description

4.4.15.1.1 The Non-Leading mode is defined to manage the ERTMS/ETCS on-board equipment of a slave engine that is NOT electrically coupled to the leading engine (and so, not remote controlled) but has its own driver.

4.4.15.1.1.1 Note: This operating situation is called Tandem.

4.4.15.1.1.2 The ERTMS/ETCS on-board equipment shall use, as a necessary condition to enter in Non-Leading mode, a “non leading input signal" from the train interface.

4.4.15.1.1.3 If the “non leading input signal" is no longer present, the switch to Stand-By mode shall be made only if the train is at standstill.

4.4.15.1.2 The ERTMS/ETCS on-board equipment shall not perform any train movement supervision in Non-Leading mode.

4.4.15.1.3 The ERTMS/ETCS on-board equipment shall perform the Train Position function; in particular, the front/rear end of the engine (i.e., not the train) shall be used to refer to train front/rear end.

4.4.15.1.4 When level is 2 or 3, the ERTMS/ETCS on-board equipment shall report its position to the RBC, according to the previously received parameters.

4.4.15.1.5 If possible, the train must not be stopped due to a safety critical fault in a non-leading engine. The ERTMS/ETCS on-board equipment shall therefore try to memorise the occurrence of such fault(s), which shall be handled when the engine leaves Non Leading mode. The ERTMS/ETCS on-board equipment shall also try to send an error information to the RBC.

4.4.15.1.6 The ERTMS/ETCS on-board equipment shall display the train speed to the driver.

4.4.15.1.7 Intentionally deleted

4.4.15.1.8 Note: for the list of main functions related to this mode, refer to chapter 4.5 “Modes and on-board functions”.

4.4.15.1.9 The supervision of linking consistency shall not be performed in Non Leading mode.

4.4.15.1.10 In case of balise group message consistency error (refer to 3.16.2.4.4 and 3.16.2.5.1), the ERTMS/ETCS onboard equipment shall not command the service brake..

4.4.15.2 Used in levels

4.4.15.2.1 Used in all levels: Level 0, level 1, level 2, level 3 and level NTC.

4.4.15.3 Responsibilities

4.4.15.3.1 The ERTMS/ETCS on-board equipment shall perform NO protection functions, except forwarding track conditions associated orders through DMI or train interface.

4.4.15.3.2 The driver is responsible for obeying the orders associated to track conditions, when they are displayed by the DMI..

4.4.16 Intentionally deleted

4.4.17 National System (SN) mode

4.4.17.1 Description

4.4.17.1.1 In SN mode, according to the specific on-board implementation, the National System may access the following resources via the ERTMS/ETCS on-board equipment: DMI, Juridical Recording interface, odometer, train interface and brakes. This can be achieved through the STM interface.

4.4.17.1.2 A limited set of data coming from balises shall be used by the ERTMS/ETCS on-board equipment, refer to SRS chapter 4.8 “Use of received information”.

4.4.17.1.3 Note: for the list of main functions related to this mode, refer to chapter 4.5 “Modes and on-board functions”.

4.4.17.2 Used in levels

4.4.17.2.1 Level NTC.

4.4.17.3 Responsibilities of ERTMS/ETCS Onboard

4.4.17.3.1 No train supervision functionality is provided by the ERTMS/ETCS on-board equipment. In case the ERTMS/ETCS on-board equipment is interfaced to the National System through an STM, refer to the FFFIS STM (Subset 035) for the functionality provided by ERTMS/ETCS on-board.

4.4.17.3.2 Intentionally deleted.

4.4.17.4 Responsibilities of the National System

4.4.17.4.1 The National System is responsible for all train supervision and protection functions.

4.4.17.4.2 The National System is responsible for issuing and revoking brake command.

4.4.17.4.3 The National System is responsible for maintaining national system behaviour and interact with national trackside equipment.

4.4.17.4.4 The National System is responsible for interaction with the driver.

4.4.17.5 Responsibilities of the driver

4.4.17.5.1 The responsibility of the driver depends on the National System in use.

4.4.18 REVERSING

4.4.18.1 Description

4.4.18.1.1 The Reversing mode allows the driver to change the direction of movement of the train and drive from the same cab, i.e. the train orientation remains unchanged. This shall be possible only in areas so marked by trackside. Reversing areas shall be announced in advance by trackside.

4.4.18.1.2 Note: This mode is used to allow the train to escape from a dangerous situation and to reach as fast as possible a “safer” location.

4.4.18.1.3 The ERTMS/ETCS on-board equipment shall supervise train movements against**:**

a) a ceiling speed: the Reversing mode speed limit given from trackside

b) a distance to run in the direction opposite to the train orientation, given from trackside. The emergency brake shall be commanded if overpassing this distance

4.4.18.1.4 After the release of a brake command initiated due to an overpassed reversing distance, and while the reversing distance is still overpassed, the ERTMS/ETCS on-board equipment shall command the emergency brake for any further movement in the direction opposite to the train orientation.

4.4.18.1.5 The ERTMS/ETCS on-board equipment shall display the train speed, the permitted speed and the remaining distance to run.

4.4.18.1.6 In case the SBI supervision limit is exceeded (refer to chapter 3 table 5, triggering condition t4), the ERTMS/ETCS on-board equipment shall command the emergency brake instead of the service brake. For the revocation of the brake command, refer to 3.13.10.2.4.

4.4.18.1.7 The position reports sent when in reversing mode shall refer to the location of the driving cab (as before reversing).

4.4.18.1.8 Note: The ERTMS/ETCS onboard equipment performs the Reverse Movement Protection (as in RV mode, the "normally allowed movement" is backwards, then the Reverse Movement Protection avoids the train running in forward direction when in RV mode). This implies that the given distance to run in reversing is considered as a directional data, oriented backwards.

4.4.18.1.9 Note: for the list of main functions related to this mode, refer to chapter 4.5 “Modes and on-board functions”.

4.4.18.1.10 In case of balise group message consistency error (refer to 3.16.2.4.4 and 3.16.2.5.1), the ERTMS/ETCS onboard equipment shall not command the service brake.

4.4.18.1.11 In case there is an alarm reporting a malfunction for the onboard balise transmission function, the ERTMS/ETCS onboard equipment shall ignore this alarm.

4.4.18.1.12 In case the ERTMS/ETCS system version number X transmitted by any balise is greater than the highest version X supported by the onboard equipment (refer to 3.17.3.5), the information from this balise shall be ignored, the train shall not be tripped and the driver shall not be informed.

4.4.18.2 Used in levels

4.4.18.2.1 Level 1, 2, 3.

4.4.18.3 Responsibilities

4.4.18.3.1 The ERTMS/ETCS on-board equipment supervises a ceiling speed and a distance to run in reverse direction.

4.4.18.3.2 The driver must keep the train movement inside the received distance to run.

4.4.19 LIMITED SUPERVISION

4.4.19.1 Description

4.4.19.1.1 The Limited Supervision mode enables the train to be operated in areas where trackside information can be supplied to realise background supervision of the train.

4.4.19.1.2 Limited supervision can not be selected by the driver, but shall be entered automatically when commanded by trackside and all necessary conditions are fulfilled.

4.4.19.1.3 The ERTMS/ETCS on-board equipment shall supervise train movements against a dynamic speed profile.

4.4.19.1.4 The ERTMS/ETCS on-board equipment shall display the train speed. If the permitted speed is lower than both the Limited Supervision mode speed limit and the maximum train speed, the permitted speed and the target speed shall be indicated (this list and the conditions are not exhaustive – refer to chapter 4.7 “DMI depending on modes”).

4.4.19.1.5 If receiving a "track ahead free" request from the RBC, the ERTMS/ETCS on-board equipment requests the driver to enter the "track ahead free" information.

4.4.19.1.6 To be in Limited Supervision mode, SSP and gradient are not required for the whole length of the train, but shall be at least available from the FRONT END of the train.

4.4.19.1.7 Note: for the list of main functions related to this mode, refer to 4.5 “Modes and on-board functions”.

4.4.19.2 Used in levels

4.4.19.2.1 Used in levels 1, 2 and 3.

4.4.19.3 Responsibilities

4.4.19.3.1 The ERTMS/ETCS on-board equipment is responsible for the background supervision of the train movement to the extent permitted by the information provided by trackside.

4.4.19.3.1.1 Note: The Limited Supervision mode enables the train to be operated in areas equipped with lineside signals where ETCS does not have information regarding the status of some signals, i.e. not all signals are fitted with LEUs or connected to an RBC

4.4.19.3.2 The driver must observe the existing line-side information (signals, speed boards etc.) and National operating rules.

4.4.20 PASSIVE SHUNTING

4.4.20.1 Description

4.4.20.1.1 The Passive Shunting mode is defined to manage the ERTMS/ETCS on-board equipment of a slave engine (NOT remote controlled, but mechanically coupled to the leading engine), being part of a shunting consist. This mode can also be used to carry on a shunting movement with a single engine fitted with one on-board equipment and two cabs, when the driver has to change the driving cab.

4.4.20.1.2 The desk of a Passive Shunting engine must be closed (since there is no driver, no information shall be shown).

4.4.20.1.3 As the engine is coupled to a leading engine, its ERTMS/ETCS on-board equipment shall not perform any train movement supervision.

4.4.20.1.4 The ERTMS/ETCS on-board equipment shall perform Train Position function; in particular, the front/rear end of the engine (i.e., not the train) shall be used to refer to train front/rear end.

4.4.20.1.5 It shall only be possible to enter in Passive Shunting mode from the Shunting mode; while in Shunting mode, the driver shall have the possibility to enable the function “Continue Shunting on desk closure”.

4.4.20.1.6 When the active desk is closed, the ERTMS/ETCS on-board equipment shall switch to Passive Shunting mode if the function “Continue Shunting on desk closure” is active and the “passive shunting input signal” is received from the train interface. If the function “Continue Shunting on desk closure” is not active or the “passive shunting input signal” is not present, the ERTMS/ETCS on-board equipment shall switch to Stand-By mode instead.

4.4.20.1.7 The special function “Continue Shunting on desk closure” shall allow one and only one transition from Shunting mode to Passive Shunting mode. The special function shall be inactive once the Shunting mode is left.

4.4.20.1.8 If a desk of the Passive Shunting engine is opened and no “Stop Shunting on desk opening” information previously received from balise group is stored onboard, the ERTMS/ETCS on-board equipment shall switch to Shunting mode.

4.4.20.1.9 If a desk of the Passive Shunting engine is opened and “Stop Shunting on desk opening” information previously received from balise group is stored onboard, the ERTMS/ETCS on-board equipment shall switch to Stand By mode.

4.4.20.1.10 If possible, the train must not be stopped due to a safety critical fault in a Passive Shunting engine. The ERTMS/ETCS on-board equipment shall therefore try to memorise the occurrence of such fault(s), which shall be handled when the engine leaves the Passive Shunting mode.

4.4.20.1.11 When in Passive Shunting mode, the ERTMS/ETCS on-board shall not manage level transitions. However, an immediate level transition order or a conditional level transition order shall be stored and shall be evaluated only when another mode than Shunting or Passive Shunting has been entered (i.e. when the Shunting movement is terminated).

4.4.20.1.12 When receiving a communication session establishment order, the ERTMS/ETCS on-board in Passive Shunting mode shall not establish the communication session, but shall store the RBC ID/phone number information.

4.4.20.1.13 When in Passive Shunting mode, the ERTMS/ETCS on-board shall not manage RBC-RBC hand-over, except for storing the RBC ID/phone number information given at the RBC/RBC border.

4.4.20.1.14 Note: for the list of main functions related to this mode, refer to chapter 4.5 "Modes and on-board functions".

4.4.20.1.15 In case of balise group message consistency error (refer to 3.16.2.4.4 and 3.16.2.5.1), the ERTMS/ETCS onboard equipment shall not command the service brake.

4.4.20.2 Used in levels

4.4.20.2.1 Used in all levels: Level 0, level 1, level 2, level 3 and level NTC

4.4.20.3 Responsibilities

4.4.20.3.1 The ERTMS/ETCS on-board equipment of an engine in Passive Shunting mode has no responsibility for the train protection.

4.4.20.3.2 The notion of responsibility of the driver is not relevant for the Passive Shunting mode.

4.4.20.3.3 Note: The leading engine is responsible for the movement of the train. It is then the ERTMS/ETCS on-board equipment of the leading engine that is fully/partially/not responsible for the train protection, with respect to its mode.

4.5 Modes and on-board functions

4.5.1 Introduction

4.5.1.1 The following table specifies in which modes the on-board functions are active or not. The functions are described in the “Related SRS §” (second column of the table).

4.5.1.2 Note: Modes are not the only thing that can influence an onboard function. This is why this Table is not enough in itself to understand all the ERTMS/ETCS onboard behaviour. It must be understood as a complement to all other SRS chapters (especially §4.7, 4.8, 4.9 and 4.10).

4.5.1.3 Note: for DMI depending on modes, refer to §4.7.

4.5.2 Active Functions Table

4.5.2.1 X = functions shall be active
Empty case = function shall be inactive
O = Optional (function is not required for interoperability, but is not forbidden)

ONBOARD-FUNCTIONS	**RELATED SRS §**	**NP**	**SB**	**PS**	**SH**	**FS**	**LS**	**SR**	**OS**	**SL**	**NL**	**UN**	**TR**	**PT**	**SF**	**IS**	**SN**	**RV**
Data Consistency																		
Check linking consistency	3.16.2.3 3.4.4					X	X		X									
Check Balise Group Message Consistency if linking consistency is checked	3.16.2.4.1 3.16.2.4.3					X	X		X									
Check Balise Group Message Consistency if no linking consistency is checked (because no linking information is available and/or because the function “check linking consistency is not active)	3.16.2.4.4		X	X	X	X	X	X	X	X	X	X	X	X			X	X
Check Unlinked Balise Group Message Consistency	3.16.2.5		X	X	X	X	X	X	X	X	X	X	X	X			X	X
Check correctness of radio messages	3.16.3.1.1		X	X	X	X	X	X	X	X	X	X	X	X			X	X
Check radio sequence	3.16.3.3		X	X	X	X	X	X	X	X	X	X	X	X			X	X
Check safe radio connection (only level 2/3)	3.16.3.4					X	X		X									
Determine Train Speed and Position:																		

ONBOARD-FUNCTIONS	RELATED SRS §	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
Determine train position referenced to LRBG	3.6.1 3.6.4		X	X	X	X	X	X	X	X	X	X	X	X			X	X
Determine train speed, train acceleration, train standstill	None		X	X	X	X	X	X	X	X	X	X	X	X		O	X	X
Determine Geographical Position	3.6.6		X			X	X	X	X		X	X	X	X				
Report train position when train reaches standstill	3.6.5.1.4 a)					X	X	X	X							O		X
Report train position when mode changes to…[1]	3.6.5.1.4 b)		X		X[2]	X	X	X	X	X	X	X	X	X	X	O	X	X
Report train position when train integrity confirmed by driver	3.6.5.1.4 c)		X			X	X	X	X					X				
Report train position when loss of train integrity is detected	3.6.5.1.4 d)		X			X	X	X	X				X	X				X
Report train position when train front/rear passes a RBC/RBC border	3.6.5.1.4 e) 3.6.5.1.4 k)					X	X	X	X				X					
Report train position when train rear passes a level transition border (from level 2/3 to 0, NTC, 1)	3.6.5.1.4 f)					X	X	X	X			X	X				X	
Report train position when change of level due to trackside order	3.6.5.1.4 g)					X	X	X	X		X		X					
Report train position when change of level due to driver request	3.6.5.1.4 g)		X			X	X	X	X		X							
Report train position when establishing a session with RBC	3.6.5.1.4 h)		X		X	X	X	X	X	X	X	X	X	X			X	X
Report train position as requested by RBC…	3.6.5.1.4		X			X	X	X	X		X	X	X	X			X	X
… or Report train position at every balise group passage	3.6.5.1.4 j)					X	X	X	X		X	X	X	X			X	X
Manage MA																		
Request MA Cyclically respect to approach of target indication point (T_MAR) or MA timer elapsing (T_TIMEOUTRQST) (only level 2/3)	3.8.2.3 a) and b)					X	X		X									
Request MA Cyclically when “Start” is selected (only level 2/3)	4.4.11 5.4, 5.11		X					X						X				

[1] For ETCS level 2 and 3 this may imply establishing a radio communication session if none is established.

[2] Exception: the transition PS => SH shall not be reported

ONBOARD-FUNCTIONS	RELATED SRS §	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
Request MA on reception of "track ahead free up to the level 2/3 transition location" (only level 0,1,NTC)	3.8.2.7.1		X			X	X	X	X			X	X	X			X	
Request MA on track description deletion	3.8.2.7.3					X	X		X									
Determine EOA/LOA, SvL, Danger Point, etc…	3.8.4 3.8.5					X	X		X									
Handle Co-operative MA revocation	3.8.6					X	X		X									
Manage Unconditional Emergency Stop	3.10		X			X	X	X	X					X				
Manage Conditional Emergency Stop	3.10					X	X		X					X				
Determine Most Restrictive Speed Profile, based on :																		
SSP	3.11.3					X	X		X									
ASP	3.11.4					X	X		X									
TSR	3.11.5					X	X	X	X			X						
Signalling related speed restriction when evaluated as a speed limit	3.11.6					X	X		X									
Mode related speed restriction	3.11.7				X		X	X	X			X						X
Train related speed restriction	3.11.8					X	X	X	X			X						X
STM max speed	3.11.2.2 g)					X	X	X	X			X					X	
STM system speed	3.11.2.2 h)					X	X	X	X			X						
LX speed	3.12.5.6					X	X		X									
Speed restriction to ensure a given permitted braking distance	3.11.11					X	X		X									
Override related speed restriction	5.8.3.6				X			X				X						
Supervise Train Speed																		
Speed and Distance Monitoring based on MRSP, MA, release speed, gradient, mode profile, non protected LX start location, and route unsuitability location	3.13 5.9.3.5 5.7.3.4 3.12.2.8 3.12.5.4					X	X		X									
Speed and Distance Monitoring based on MRSP	4.4.10.1											X						
Speed and Distance Monitoring based on MRSP, allowed distance to run in Staff Resp. mode	4.4.11							X										

ONBOARD-FUNCTIONS	RELATED SRS §	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
Ceiling Speed Monitoring only (no braking curve) based on MRSP	4.4.8.1.1 a) 4.4.18.1.3 a)				X												X[3]	X
Supervise Train Movements																		
Backwards Distance Monitoring	4.4													X				X
Roll Away Protection	3.14.2				X	X	X	X	X			X		X				X
Reverse Movement Protection	3.14.3					X	X	X	X					X				X
Standstill Supervision	3.14.4 4.4.7.1.5		X															
Supervise "danger for shunting" information and list of expected balises for shunting	4.4.8.1.1 b) and c)				X													
Supervise "Stop if in SR" information and list of expected balises for Staff Responsible	4.4.11.1.3 c) and d)							X										
Supervise signalling related speed restriction when evaluated as a trip order	3.11.6.4					X	X	X	X									
Command Emergency Brake	4	X											X		X			
Determine Mode and Level																		
Determine ERTMS/ETCS Mode	3.12.4, 4.6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine ERTMS/ETCS level	5.10		X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Other functions																		
System Version Management	3.17		X	X	X	X	X	X	X	X	X	X	X	X			X	X
Manage Communication Session	3.5		X	X	X	X	X	X	X	X	X	X	X	X			X	X
Delete Revoked TSR	3.11.5.5		X			X	X	X	X			X	X	X				
Override (Trip inhibition)[4]	5.8				X			X				X					X	
Manage Track Conditions excluding Sound Horn, Non Stopping Areas, Tunnel Stopping Areas and Big Metal Masses	3.12.1					X	X		X		X		X	X				
Manage Track Conditions Sound Horn, Non Stopping Areas, Tunnel Stopping Areas	3.12.1					X	X		X									
Manage Track Condition Big Metal Masses	3.12.1		X	X	X	X	X	X	X	X	X	X	X	X	O		X	

[3] In case the ERTMS on-board equipment is interfaced to the National System through an STM, refer to SUBSET-035 for details

[4] For UN and SN mode, conditions for re-activation of transition to Trip mode (see § 5.8.4.1a) & b)) shall be supervised.

ONBOARD-FUNCTIONS	RELATED SRS §	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
Manage Route Suitability	3.12.2					X	X		X									
Manage Text Display to the driver	3.12.3		X			X	X	X	X		X	X	X	X				X
Manage RBC/RBC Handover	3.15.1, 5.15					X	X	X	X	X	X		X					
Manage Track Ahead Free Request	3.15.5		X				X	X	X					X				
Provide Fixed Values, and Default/National Values	3.18.1 3.18.2		X	X	X	X	X	X	X	X	X	X	X	X			X	X
Manage change of Train Data from external sources	5.17		X			X	X	X	X			X	X	X			X	
Provide Date and Time	3.18.5		X	X	X	X	X	X	X	X	X	X	X	X			X	X
Provide Juridical Data	3.20		X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X
Inhibition of revocable TSRs from balises(only level 2/3)	3.11.5.12 3.11.5.13 3.11.5.14 3.11.5.15					X	X		X				X	X				
Cold Movement Detection		O																
Continue Shunting on desk closure (Enabling transition to Passive Shunting mode)	5.12.4				X													
Manage “Stop Shunting on desk opening” information	4.4.20.1.8 4.4.20.1.9			X														
Manage Virtual Balise Covers	3.15.9		X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X
Advance display of route related information	3.15.10					O												

Figure 1: Active Functions table

4.6 Transitions between modes

4.6.1 Symbols

4.6.1.1 The indication “**4>**” means: The condition n°4 must be fulfilled to trigger the transition

4.6.1.2 From the mode located in the column

4.6.1.3 To the mode that is indicated by the arrow “**>**”.

4.6.1.4 Each transition from a given mode receives a priority order (indicated by “**-px-**”, x is the priority order) to avoid a conflict between the different transitions when they occur at the same time (i.e. in the same clock cycle). P1 has a higher priority than P2.

4.6.1.5 Some transitions have received the same priority order. This has been decided when it is obvious that these transitions cannot occur at the same time, and so can never lead to a conflicting situation (for example, the RBC cannot give in the same time a MA for FS and a MA for OS to a given engine, this is why the transition “from SR to FS” and the transition “from SR to OS” have the same priority order).

4.6.1.6 "16, 17, 18" means "16 or 17 or 18".

4.6.2 Transitions Table

NP	<29 -p2-	<29 -p2-	<29 -p2-	<29 -p2-	<29 -p2-	<29 -p2-	<29 -p2-	<29 -p2-	<29 -p2-	<29 -p2-	<29 -p2-	<29 -p2-	<29 -p2-		<29 -p2-	<29 -p2-
4> -p2-	**SB**	<22 -p4-	<19, 27, 30 -p5-	<28 -p5-	<28 -p5-	<28, -p5-	<28, -p5-	<2, 3 -p3-	<28, 47 -p3-	<28, -p6-		<28, -p4			<28 -p6-	<28 -p4-
		PS	<26 -p5-													
	5, 6, 50> -p7-	23> -p4	**SH**	<5,6, 50,51 -p6-	<5,6, 50,51 -p6-	<5,6, 51 -p6-	<5,6 50,51 -p6-			<5,61 -p7-	<68 -p4	<5,6, 50 -p5-			<5,61 -p7	
	10> -p7-			**FS**	<31,32 -p6-	<31,32 -p6-	<31,32 -p6-			<25 -p7-		<31 -p5-			<25 -p7-	
	70> -p7-			70,72> -p6-	**LS**	<72 -p6-	<70,74 -p6-			<71 -p7-		<70 -p5-			<71 -p7-	
	8,37> -p7-			37> -p6-	37> -p6-	**SR**	<37 -p6-			<44,45 -p4-		<8,37 -p5-			<44,45 -p4-	
	15> -p7-			15,40> -p6-	15,73> -p6-	40> -p6-	**OS**			<34 -p7-		<15 -p5-			<34 -p7-	
	14> -p5-	14> -p4						**SL**								
	46> -p6-		46> -p5-	46> -p6-	46> -p6-	46> -p6-	46> -p6-		**NL**							
	60> -p7-			21> -p6-	21> -p6-	21> -p6-	21> -p6-			**UN**	<62 -p4-				<21 -p7-	
	20> -p4-		49,52, 65> -p4-	12,16, 17,18, 20,41, 65,66, 69> -p4-	12,16, 17,18, 20,41, 65,66, 69> -p4-	18,20, 42, 43, 36, 54,65> -p4-	12,16, 17,18, 20,41, 65,66, 69> -p4-			67,39, 20> -p5-	**TR**				<67, 39,38, 35,20 -p5-	
											7> -p4-	**PT**				
	13> -p3-	13> -p3-	13> -p3-	13> -p3-	13> -p3-	13> -p3-	13> -p3-			13> -p3-	13> -p3-	13> -p3-	**SF**		<13 -p3-	<13 -p3-
1> -p1-	1> -p1-	1> -p1-	1> -p1-	1> -p1-	1> -p1-	1> -p1-	1> -p1-	1> -p1-	1> -p1-	1> -p1-	1> -p1-	1> -p1-	1> -p1-	**IS**	<1 -p1-	<1 -p1-
	58> -p7-			56> -p6-	56> -p6-	56> -p6-	56> -p6-			56> -p7-	63> -p4-				**SN**	
				59> -p6-	59> -p6-		59> -p6-									**RV**

Figure 2: Transition table.

4.6.3 Transitions Conditions Table

Condition Id	Content of the conditions
[1]	The driver isolates the ERTMS/ETCS on-board equipment.
[2]	(a desk is open)
[3]	(no “go sleeping” input signal is received any more) AND (train is at standstill)
[4]	The ERTMS/ETCS on-board equipment is powered.
[5]	(train is at standstill) AND (ERTMS/ETCS level is 0 or NTC or 1) AND (driver selects Shunting mode)
[6]	(train is at standstill) AND (ERTMS/ETCS level is 2 or 3) AND (reception of the information “Shunting granted by RBC”, due to a Shunting request from the driver)
[7]	(the driver acknowledges the train trip) AND (the train is at standstill) AND (the ERTMS/ETCS level is different from 0, NTC)
[8]	(Staff Responsible mode is proposed to the driver) AND (driver acknowledges) **{4}**
[9]	*Empty*
[10]	(valid Train Data is stored on board) AND (MA + SSP +gradient are on-board) AND (no specific mode is required by a Mode Profile)
[11]	*Empty*
[12]	(The train/engine overpasses the EOA/LOA with its min safe antenna position) AND (ERTMS/ETCS level is 1)
[13]	The ERTMS/ETCS on-board equipment detects a fault that affects safety
[14]	(The “sleeping” input signal is received) AND (train is at standstill) AND (all desks connected to the ERTMS/ETCS on-board equipment are closed)
[15]	(An ackn. request for On Sight is displayed to the driver) AND (the driver acknowledges) **see {1} here under**
[16]	(The train/engine overpasses the EOA/LOA with its min safe front end) AND (ERTMS/ETCS level is 2 or 3).
[17]	The onboard reacts according to a linking reaction set to “trip”.
[18]	(the train/engine receives and uses a trip order given by balise) AND (override is not active)
[19]	(driver selects “exit Shunting”) AND (train is at standstill).
[20]	(unconditional emergency stop message is accepted)
[21]	(ERTMS/ETCS level switches to 0) **see {2} here under**
[22]	(a desk is open) AND (”Stop Shunting on desk opening” information is stored onboard)
[23]	(a desk is open) AND (no ”Stop Shunting on desk opening” information is stored

	onboard)
[24]	*Empty*
[25]	(ERTMS/ETCS level switches to 1,2 or 3) AND (MA+SSP+gradient are on-board) AND (no specific mode is required by a Mode Profile)
[26]	(desks are closed) AND (”Continue Shunting on desk closure” function is active) AND (the “passive shunting” input signal is received)
[27]	(desks are closed) AND (”Continue Shunting on desk closure” function is not active)
[28]	(desks are closed)
[29]	the ERTMS/ETCS on-board equipment is NOT powered
[30]	(desks are closed) AND (no “passive shunting” input signal is received)
[31]	(MA+SSP+gradient are on-board) AND (no specific mode is required by a Mode Profile) AND (ERTMS/ETCS level is 2 or 3)
[32]	(MA+SSP+gradient are on-board) AND (no specific mode is required by a Mode Profile) AND (ERTMS/ETCS level is 1) AND (no trip order is given by balise)
[33]	*Empty*
[34]	(A Mode Profile defining an On Sight area is on-board) AND (The max safe front end of the train is inside the On Sight area) AND (The ERTMS/ETCS level switches to 1,2 or 3)
[35]	(driver selects Shunting mode) AND (The ERTMS/ETCS on-board equipment is interfaced to the National System through an STM) AND (a National Trip Procedure is active, **see {8} here under**)
[36]	(the identity of the over-passed balise group is not in the list of expected balises related to SR mode) AND (override is not active).
[37]	(driver selects “override”) AND (train speed is under or equal to the speed limit for triggering the “override” function) **see {3} here under**
[38]	(The ERTMS/ETCS on-board equipment is interfaced to the National System through an STM) AND (The ERTMS/ETCS level switches to 0,1,2 or 3) AND (a National Trip Procedure is active) **see {8} here under**
[39]	(The ERTMS/ETCS level switches to 1,2 or 3) AND (no MA has been accepted)
[40]	(A Mode Profile defining an On Sight area is on-board) AND (The max safe front end of the train is inside the On Sight area)
[41]	(T_NVCONTACT is passed) AND (associated reaction is “train trip”)
[42]	(The train/engine overpasses the SR distance with its estimated front end) AND (override is not active)
[43]	(The train/engine overpasses the former EOA (when Override was activated) with the min safe antenna position) AND (override is not active), see {3} here under
[44]	(“override” function is active) AND (ERTMS/ETCS level switches to 1) **see {3} here under**
[45]	(“override” function is active) AND (no unconditional emergency stop message has

	been received) AND (ERTMS/ETCS level switches to 2 or 3) **see {3} here under**
[46]	(Driver selects NON LEADING) AND (train is at standstill) AND (The “non leading” input signal is received)
[47]	(no “non leading” input signal is received any more) AND (train is at standstill)
[48]	*Empty*
[49]	(reception of information “stop if in shunting”) AND (override is not active)
[50]	(An ackn. request for Shunting is displayed to the driver) AND (the driver acknowledges) **see {5} here under**
[51]	(A Mode Profile defining the entry of a Shunting area is used on-board) AND (The max safe front end of the train is inside the Shunting area)
[52]	(the identity of the over-passed balise group is not in the list of expected balise groups related to SH mode) AND (override is not active).
[53]	*Empty*
[54]	(reception of information “stop if in Staff Responsible”) AND (no list of expected balise groups related to SR mode has been received or the list of expected balise groups related to SR mode does not include the identity of the over-passed balise group) AND (override is not active)
[56]	(the ERTMS/ETCS level switches to “NTC”)
[58]	(the ERTMS/ETCS level is “NTC”) AND (an acknowledgement request for SN mode is displayed to the driver) AND (the driver acknowledges)
[59]	(train is at standstill) AND (driver has acknowledged the reversing) **see {6} here under**
[60]	(an acknowledgement request for UN mode is displayed to the driver) AND (the driver acknowledges)
[61]	(A Mode Profile defining a Shunting area is on-board) AND (The max safe front end of the train is inside the Shunting area) AND (The ERTMS/ETCS level switches to 1,2 or 3)
[62]	(the driver acknowledges the train trip) AND (the train is at standstill) AND (the ERTMS/ETCS level is 0) AND (valid Train Data is on-board)
[63]	(the driver acknowledges the train trip) AND (the train is at standstill) AND (the ERTMS/ETCS level is NTC) AND (valid Train Data is on-board)
[65]	(The system version number X of a received balise telegram is greater than the highest version number X supported by the on-board equipment) AND (ERTMS/ETCS level is 1, 2 or 3)
[66]	A balise group contained in the linking information is passed in the unexpected direction
[67]	(The ERTMS/ETCS level switches to level 1) AND (a trip order has been received) AND (override is not active)
[68]	(the driver acknowledges the train trip) AND (the train is at standstill) AND (the

	ERTMS/ETCS level is 0 or NTC) AND (no valid Train Data is on-board)
[69]	Estimated train front end is in rear of the start location of either SSP or gradient profile stored on-board
[70]	(An ackn. request for Limited Supervision is displayed to the driver) AND (the driver acknowledges) **see {7} here under**
[71]	(A Mode Profile defining a Limited Supervision area is on-board) AND (The max safe front end of the train is inside the Limited Supervision area) AND (The ERTMS/ETCS level switches to 1,2 or 3)
[72]	(A Mode Profile defining a Limited Supervision area is on-board) AND (The max safe front end of the train is inside the Limited Supervision area).
[73]	(A Mode Profile defining an On Sight area is on-board) AND (The max safe front end of the train is inside the On Sight area) AND (The estimated front end of the train is not inside an LS acknowledgement area)
[74]	(A Mode Profile defining a Limited Supervision area is on-board) AND (The max safe front end of the train is inside the Limited Supervision area) AND (The estimated front end of the train is not inside an OS acknowledgement area)

{1} The request to acknowledge On Sight is displayed to the driver only if certain conditions are fulfilled. These conditions are not specified here. See the “On Sight” procedure” of SRS-§5 (for transitions from FS/LS/UN to OS) and the "Start of mission" procedure (for transition from SB to OS).

{2} This transition to the Unfitted mode is also a transition of level.. For further information, See the “Level Transition” procedure” (SRS-§5) for transitions from FS/SR/OS/LS to UN and the “Start Of Mission” procedure” (SRS-§5) for transition from SB to UN.

{3} See the “Override” procedure” of SRS-§5.

{4} The Staff Responsible mode is proposed to the driver only if certain conditions are fulfilled. These conditions are not specified here. See the “Start Of Mission” procedure and the "Train Trip" procedure of SRS-§5.

{5} The request to acknowledge Shunting is displayed to the driver only if certain conditions are fulfilled. These conditions are not specified here. See the “Entry in Shunting” procedure and the “Start Of Mission” procedure of SRS-§5.

{6} The request to acknowledge Reversing is displayed to the driver when certain conditions are fulfilled. These conditions are not specified here. See the “reversing” procedure of SRS-§5.

{7} The request to acknowledge Limited Supervision is displayed to the driver only if certain conditions are fulfilled. These conditions are not specified here. See the “Limited Supervision” procedure” of SRS-§5 (for transitions from FS/OS/UN to LS) and the "Start of mission" procedure (for transition from SB to LS).

{8} Refer to Subset-035 for details.

4.7 DMI depending on modes

4.7.1 Introduction

4.7.1.1 The DMI is an interface that allows the direct exchange of information between the driver and the ERTMS/ETCS onboard equipment. The indirect exchange of information done via the train interface (e.g. a driver's action on the service brake used for the service brake feedback, opening/closing the desk) is not part of the DMI.

4.7.1.2 The device(s) used to select "ERTMS/ETCS onboard equipment powered/unpowered" is (are) not part of the DMI.

4.7.1.3 The device(s) used to select/indicate "ERTMS/ETCS onboard equipment isolated/not isolated" is (are) part of the DMI.

4.7.1.4 Intentionally deleted.

4.7.1.5 Information (input or output) only relevant for National System and not originated by the ERTMS/ETCS on-board is not included in the following section.

4.7.2 DMI versus Mode Table

4.7.2.1.1 X = active: For a DMI output, this means that the output information shall be shown to the driver when the ERTMS/ETCS onboard equipment is in the mode indicated in the column. For a DMI input, this means that it shall be possible for the driver to enter this information when the ERTMS/ETCS onboard equipment is in the mode indicated in the column).

4.7.2.1.2 A = available: This means that the input/output shall become active ONLY if another condition(s) is (are) fulfilled. This condition(s) are not described here.

4.7.2.1.3 Grey cells: availability and meaning defined by national system.

4.7.2.1.4 NA = Not Applicable: This concerns the modes SF and IS in which the DMI inputs and outputs cannot be determined.

Input information	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
Train Data (refer to 3.18.3.2)		A			A	A	A	A			A			NA	NA	A	
Selection of language		A		A	A	A	A	A		A	A	A	A	NA	NA	A	A
Driver id		A		A	A	A	A	A		A	A			NA	NA	A	
Train running number		A			A	A	A	A		A	A			NA	NA	A	
ERTMS/ETCS level		A			A	A	A	A		A	A			NA	NA	A	
Track Adhesion factor		A			A	A	A	A			A			NA	NA	A	

Input information	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
RBC contact information - Radio network-id - RBC-id - RBC phone number		A			A	A	A	A		A			A	NA	NA		
Train integrity		A			A	A	A	A					A	NA	NA		
Start		A					A						A	NA	NA		
Override request		A		A	A	A	A	A			A		A	NA	NA	A	
Shunting request		A			A	A	A	A			A		A	NA	NA	A	
"Continue Shunting on desk closure" request				A										NA	NA		
"Exit of Shunting" request				X										NA	NA		
Non Leading request		A		A	A	A	A	A						NA	NA		
Ackn of fixed text information		A			A	A	A	A		A	A	A	A	NA	NA		A
Ackn of plain text information		A			A	A	A	A		A	A	A	A	NA	NA		A
Ackn of level transition		A			A	A	A	A			A	A		NA	NA	A	
Ackn of Limited Supervision mode		A			A	A		A					A	NA	NA		
Ackn of On Sight mode		A			A	A		A					A	NA	NA		
Ackn of Shunting mode		A		A	A	A		A					A	NA	NA		
Ackn of Staff Resp. mode		A											A	NA	NA		
Ackn of Unfitted mode		A												NA	NA		
Ackn of Reversing mode					A	A		A						NA	NA		
Ackn of SN mode		A												NA	NA		
Ackn of Train Trip												A		NA	NA		
Ackn for Roll Away Protection				A	A	A	A	A			A		A	NA	NA		A
Ackn for Reverse Movement Protection					A	A	A	A					A	NA	NA		A
Ackn for Standstill Supervision		A												NA	NA		
Ackn for Post Trip distance exceeded													A	NA	NA		
Ackn of Train Data change from source different from the driver					A	A	A	A			A	A		NA	NA	A	
Ackn for reversing distance exceeded														NA	NA		A
Track Ahead Free		A				A	A	A					A	NA	NA		
SR mode speed limit and distance							A							NA	NA		
Virtual Balise Cover		A												NA	NA		

Input information	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
Isolation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Output information	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
ERTMS/ETCS Mode		A		X	X	X	X	X		X	X	A	X	A	X	X	X
Current ERTMS/ETCS level		A		X	X	X	X	X		X	X	A	X	NA	NA	X	X
Train Speed		A		X	X	X	X	X		X	X	A	X	NA	NA	A	X
Permitted Speed				A	X	A	A	A						NA	NA		X
FLOI Speed					A									NA	NA		
Target Speed					A	A	A	A						NA	NA		
Target distance					A		A	A						NA	NA		X
Release speed					A	A		A						NA	NA		
Speed and distance monitoring supervision status				A	A	A	A	A			A		A	NA	NA		A
Trip reason												A		NA	NA		
Train Data (refer to 3.18.3.2)		A			A	A	A	A			A	A	A	NA	NA	A	A
Driver id		A		A	A	A	A	A		A	A	A	A	NA	NA	A	A
Train running number		A		A	A	A	A	A		A	A	A	A	NA	NA	A	A
RBC contact information - Radio network-id - RBC-id - RBC phone number		A		A	A	A	A	A		A	A	A	A	NA	NA	A	A
Virtual Balise Covers		A		A	A	A	A	A		A	A	A	A	NA	NA	A	A
Brake indication		A		A	A	A	A	A			A	A	A	NA	NA	A	A
Fixed text information		A			A	A	A	A		A	A	A	A	NA	NA		A
Plain text information		A			A	A	A	A		A	A	A	A	NA	NA		A
Reversing allowed					A	A		A						NA	NA		
Track condition excluding sound horn, non stopping areas, tunnel stopping areas and big metal masses - Power control - Pantograph control - Air tightness control - Radio hole, supervision of safe radio connection stopped - Brakes control					A	A		A		A		A	A	NA	NA		

Output information	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
Track conditions sound horn, non stopping areas, tunnel stopping areas					A	A		A						NA	NA		
Geographical position		A			A	A	A	A		A	A	A	A	NA	NA		
Override status				A			A				A			NA	NA	A	
LX status "not protected"					A	A		A						NA	NA		
Shunting refused by RBC		A			A	A	A	A					A	NA	NA		
Shunting request not answered by RBC		A			A	A	A	A					A	NA	NA		
Accepted Emergency Stop(s)					A	A		A				A	A	NA	NA		
Entry in FS/OS					A			A						NA	NA		
Level transition announcement					A	A	A	A		A	A	A	A	NA	NA	A	
Track Ahead Free request		A				A	A	A					A	NA	NA		
Adhesion factor “slippery rail”		A			A	A	A	A			A	A	A	NA	NA	A	A
SR mode proposed		A											A	NA	NA		
OS/LS/SH mode proposed		A											A	NA	NA		
SN mode proposed		A												NA	NA		
UN mode proposed		A												NA	NA		
RV mode proposed					A	A		A						NA	NA		
Trackside malfunction		A		A	A	A	A	A			A	A	A	NA	NA	A	A
Notification of Train Data change from source different from the driver		A			A	A	A	A			A	A	A	NA	NA	A	A
Operated System Version		A		A	A	A	A	A		A	A	A	A	NA	NA	A	A
Radio Network registration failed		A			A	A	A	A		A			A	NA	NA		
Safe radio connection indication		A		A	A	A	A	A		A	A	A	A	NA	NA	A	A
Local time		A		X	X	X	X	X		X	X	A	X	NA	NA	A	X
Gradient					A									NA	NA		
MRSP					A									NA	NA		
Indication location at MRSP speed (see 3.13.10.4.11)					A									NA	NA		
First target at zero speed					A									NA	NA		
Brake reason		A		A	A	A	A	A			A		A	NA	NA	A	A
Trackside not compatible		A		A	A	A	A	A		A	A	A	A	NA	NA	A	A
Train is rejected		A												NA	NA		
Route unsuitability(ies)					A	A		A						NA	NA		

4.8 Acceptance of received information

4.8.1 Introduction

4.8.1.1 The aim of this chapter is to give an overview of which information is accepted or rejected depending on the state of the on-board (level, mode) and the nature of the received information (transmission medium, type of information: infill or non-infill).

4.8.1.2 The following sections have to be interpreted by applying the filters as shown in Figure 3. The first filter is detailed in section 4.8.3 “Accepted information depending on the level and transmission media”, the third filter in section 4.8.4 “Accepted information depending on the modes”.

4.8.1.3 If a message contains level transition information, any other information in that message shall be evaluated considering the level transition information.

4.8.1.3.1 Information received in the same message as an immediate level transition order or a conditional level transition order that causes a level transition shall be evaluated first considering the on-board currently operated level, as if a level transition order for further location had been received (i.e. conditions [1], [2] or [6] of Figure 3, if applied, shall be automatically fulfilled). Then, if relevant, it shall be immediately extracted from the buffer and re-evaluated according to the new selected level.

4.8.1.4 Note: As shown in Figure 3, information stored following an announcement of a change of level, is re-checked for acceptance when the level has changed. This implies that, when the level changes, the mode is - for a short moment – still unchanged, until the stored information has been processed. The consequence for the Third Filter is that information needs to be accepted for this short period also in modes in which this information is otherwise useless.

4.8.1.5 If a message contains infill information, this latter shall be evaluated considering all other non-infill information in that message.

4.8.1.6 When evaluating trackside information received by radio or when re-evaluating a set of information released from the transition buffer, linking information, if any, shall be evaluated prior to any other location related information.

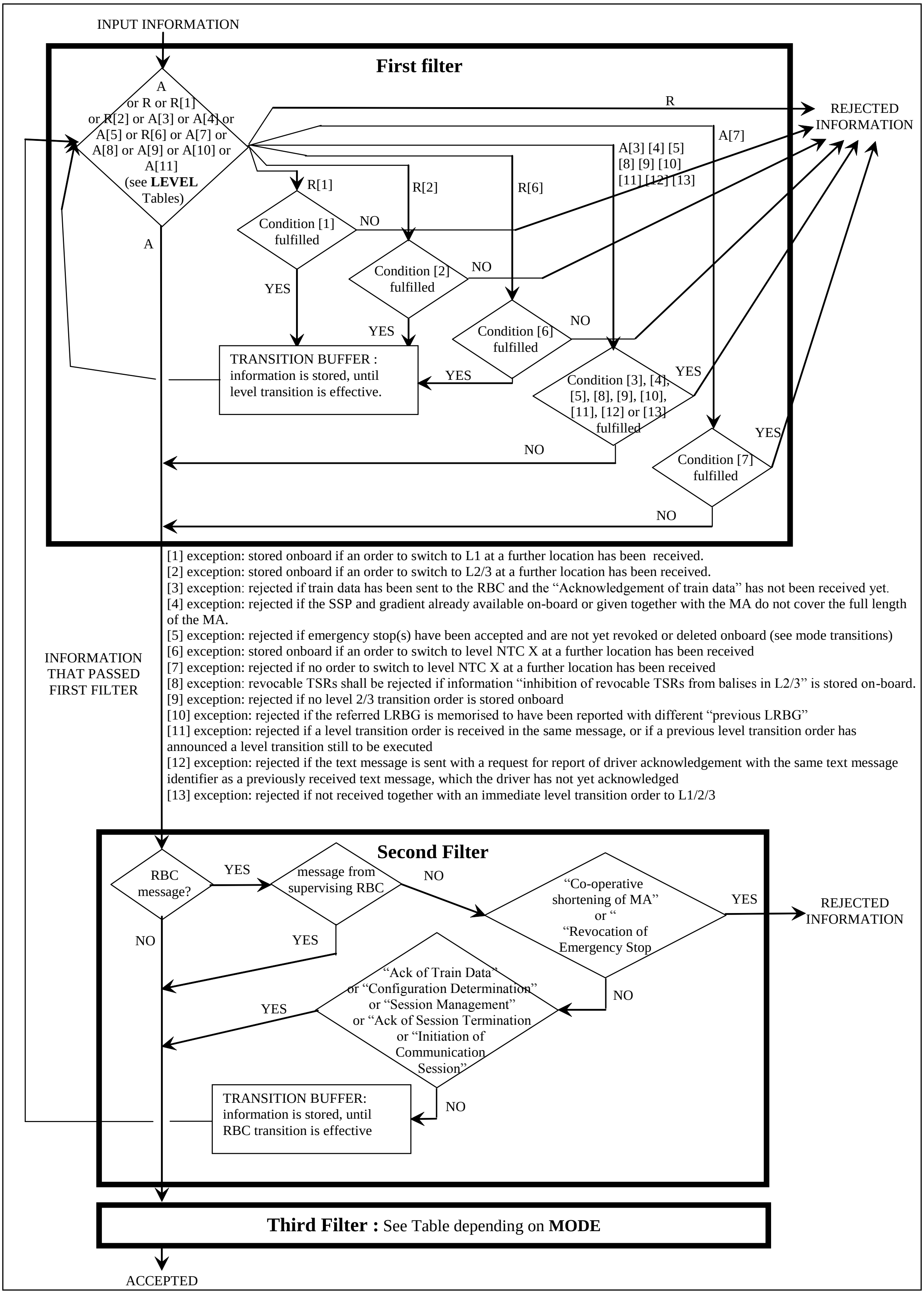

Figure 3: schematic representation of the filtering of received information:

4.8.2 Assumptions

4.8.2.1 The following tables shall be applied assuming that:

a) the information complies with the data consistency checks.(see section 3.16)

b) the direction for which the information is valid matches the current train orientation, or the balise group crossing direction (for SL, PS and SH engines).(see section 3.6.3)

c) In levels 2/3, it is assumed that the "RBC" information which is marked "A" (Accepted) comes from the supervising RBC (see RBC/RBC handover). If this information is received from the "Accepting" RBC while the "Handing Over" RBC is still responsible, it is stored onboard until the RBC transition is performed <u>exception1</u>: the information "Acknowledgement of Train Data", "Trackside constituent system version", "Initiation of Communication Session", "Session Management" and "Acknowledgement of Session Termination" shall be immediately accepted.
<u>exception2:</u> the information "Co-operative shortening of MA" and "Revocation of Emergency Stop" shall be rejected."

d) to check exception [4] in 4.8.3, the track description is referred to the LRBG.

4.8.2.2 Regarding 4.8.2.1 a): In case a balise is missed or a balise telegram cannot be decoded, the information "Inhibition of balise group message consistency reaction" is only used by the on-board equipment to inhibit the service brake reaction, while the balise group message is rejected. If all the telegrams from a balise group are correctly read, the information "Inhibition of balise group message consistency reaction", if received, shall be ignored by the on-board equipment. Therefore this information need not to be referred to in the following tables.

4.8.2.3 In case a balise telegram contains the information VBC marker and a country/region identity that both match a stored VBC, the whole balise telegram is ignored and any further check in relation to this balise telegram is irrelevant (refer to 3.15.9.3 b)). Otherwise the information VBC marker, if included in a consistent balise group message, shall always be ignored by the ERTMS/ETCS on-board equipment and need not to be referred to in the following tables.

4.8.2.4 Note: with the exception of the data that is forwarded to a National System through the STM interface (see 3.15.6 and SUBSET-035), what will happen to the data to be used by applications outside ERTMS/ETCS (e.g. whether it is discarded, forwarded to an external application, processed by a national function…) is outside the scope of this specification and is assumed as not being part of the ERTMS/ETCS on-board functionality.

4.8.3 Accepted information depending on the level and transmission media

4.8.3.1 From RBC or not

4.8.3.1.1 Note: “No” in column “From RBC” has to be understood as any information (type: infill or non-infill) received from a balise group, loop or RIU; this does not include information received from the STM interface.

A = Accepted R = Rejected

Information	From RBC	Onboard operating level				
		0	NTC	1	2	3
National Values	No	A	A	A	A	A
	Yes	R [2]	R [2]	R [2]	A	A
Linking	No	R [1]	R [1]	A	R [1]	R [1]
	Yes	R [2]	R [2]	R [2]	A [3]	A [3]
Signalling Related Speed Restriction	No	R [1]	R [1]	A	R [1]	R [1]
	Yes					
Movement Authority + (optional) Mode Profile + (optional) List of Balises for SH area	No	R [1]	R [1]	A [4]	R [1]	R [1]
	Yes	R [2]	R [2]	R [2]	A [3] [4] [5]	A [3] [4] [5]
Repositioning Information	No	R	R	A	R	R
	Yes					
Gradient Profile	No	R [1]	R [1]	A	R [1]	R [1]
	Yes	R [2]	R [2]	R [2]	A [3]	A [3]
International SSP	No	R [1]	R [1]	A	R [1]	R [1]
	Yes	R [2]	R [2]	R [2]	A [3]	A [3]
Axle Load speed profile	No	R [1]	R [1]	A	R [1]	R [1]
	Yes	R [2]	R [2]	R [2]	A [3]	A [3]
Level Transition Order	No	A	A	A	A	A
	Yes	A	A	A	A	A
Conditional Level Transition Order	No	A [11]	A [11]	A [11]	A [11]	A [11]
	Yes					
Session Management	No	A	A	A	A	A
	Yes	A	A	A	A	A
Radio Network registration	No	A	A	A	A	A
	Yes	A	A	A	A	A
MA Request Parameters	No					
	Yes	A	A	A	A	A
Position Report parameters	No					
	Yes	A	A	A	A	A

Information	From RBC	Onboard operating level				
		0	NTC	1	2	3
SR Authorisation + (optional) List of Balises in SR mode	No					
	Yes	R	R	R	A [3]	A [3]
Stop if in SR mode	No	R	R	A	A	A
	Yes					
SR distance information from loop	No	R	R	A	R	R
	Yes					
Temporary Speed Restriction	No	A	R [1] [2]	A	A [8]	A [8]
	Yes	R [2]	R [2]	R [2]	A [3]	A [3]
Temporary Speed Restriction Revocation	No	A	R [1] [2]	A	A	A
	Yes	R [2]	R [2]	R [2]	A [3]	A [3]
Inhibition of revocable TSRs from balises in L2/3	No					
	Yes	R [2]	R [2]	R [2]	A	A
Default Gradient for TSR	No	A	R [1] [2]	A	A	A
	Yes					
Route Suitability Data	No	R [1]	R [1]	A	R [1]	R [1]
	Yes	R [2]	R [2]	R [2]	A [3]	A [3]
Adhesion Factor	No	R[1]	R[1]	A	R	R
	Yes	R[2]	R[2]	R[2]	A	A
Plain Text Information	No	A	R [1] [2]	A	A	A
	Yes	R [2]	R [2]	R [2]	A [12]	A [12]
Fixed Text Information	No	A	R [1] [2]	A	A	A
	Yes	R [2]	R [2]	R [2]	A [12]	A [12]
Geographical Position	No	A	R [1] [2]	A	A	A
	Yes	R [2]	R [2]	R [2]	A	A
RBC Transition Order	No	R	R	R	A	A
	Yes	R	R	R	A [3]	A [3]
Danger for SH information	No	A [13]	A [13]	A	A	A
	Yes					
Stop Shunting on desk opening	No	A	A	A	A	A
	Yes					
Radio Infill Area information	No	R	R	A	R [1]	R [1]
	Yes					

Information	From RBC	Onboard operating level				
		0	NTC	1	2	3
Session Management with neighbouring RIU	No	R	R	A	R	R
	Yes					
EOLM information	No	A	A	A	A	A
	Yes					
Assignment of Co-ordinate system	No					
	Yes	A [10]	A [10]	A [10]	A [10]	A [10]
Infill Location Reference	No	R	R	A	R [1]	R [1]
	Yes					
Track Conditions excluding big metal masses	No	R [1]	R [1]	A	R [1]	R [1]
	Yes	R [2]	R [2]	R [2]	A [3]	A [3]
Track condition big metal masses	No	A	A	A	A	A
	Yes					
Location Identity (NID_C + NID_BG transmitted in the balise telegram)	No	A	A	A	A	A
	Yes					
Recognition of exit from TRIP mode	No					
	Yes	R	R	R	A	A
Acknowledgement of Train Data	No					
	Yes	A	A	A	A	A
Co-operative shortening of MA + (optional) Mode Profile + (optional) List of Balises for SH area	No					
	Yes	R	R	R	A [3] [4] [5]	A [3] [4] [5]
Unconditional Emergency Stop	No					
	Yes	R [2]	R [2]	R [2]	A	A
Conditional Emergency Stop	No					
	Yes	R [2]	R [2]	R [2]	A	A
Revocation of Emergency Stop (Conditional or Unconditional)	No					
	Yes	R	R	R	A	A
SH refused	No					
	Yes	R	R	R	A [3]	A [3]
SH authorised + (optional) List of Balises for SH area	No					
	Yes	R	R	R	A [3]	A [3]
Trackside constituent System Version	No	A	A	A	A	A

Information	From RBC	Onboard operating level				
		0	NTC	1	2	3
	Yes	A	A	A	A	A
System Version order	No	A	A	A	A	A
	Yes					
Track Ahead Free Request	No					
	Yes	R	R	R	A [3]	A [3]
Train Running Number	No					
	Yes	R	R	R	A	A
Initiation of session	No					
	Yes	R	R	R	A	A
Acknowledgement of session termination	No	A	A	A	A	A
	Yes	A	A	A	A	A
Train Rejected	No					
	Yes	R	R	R	A	A
Train Accepted	No					
	Yes	R	R	R	A	A
SoM Position Report Confirmed by RBC	No					
	Yes	R	R	R	A	A
Reversing Area Information	No	R [1]	R [1]	A	R [1]	R [1]
	Yes	R [2]	R [2]	R [2]	A [3]	A [3]
Reversing Supervision Information	No	R [1]	R [1]	A	R [1]	R [1]
	Yes	R [2]	R [2]	R [2]	A [3]	A [3]
Default Balise/Loop/RIU Information	No	A	A	A	A	A
	Yes					
Track Ahead Free up to level 2/3 transition location	No	A [9]	A [9]	A [9]	R	R
	Yes					
Permitted Braking Distance Information	No	R [1]	R [1]	A	R [1]	R [1]
	Yes	R [2]	R [2]	R [2]	A [3]	A [3]
Level Crossing information	No	R [1] [2]	R [1] [2]	A	A	A
	Yes	R [2]	R [2]	R [2]	A [3]	A [3]
Virtual Balise Cover order	No	A	A	A	A	A
	Yes					

Information	From RBC	Onboard operating level				
		0	NTC	1	2	3
Data to be used by applications outside ERTMS/ETCS	No	A	A	A	A	A
	Yes	A	A	A	A	A

[1] exception: stored onboard if an order to switch to L1 at a further location has been received.

[2] exception: stored onboard if an order to switch to L2/3 at a further location has been received.

[3] exception: rejected if Train Data has been sent to the RBC and the "Acknowledgement of Train Data" has not been received yet.

[4] exception: rejected if the SSP and gradient already available on-board or given together with the MA do not cover the full length of the MA.

[5] exception: rejected if emergency stop(s) have been accepted and are not yet revoked or deleted onboard (see mode transitions).

[8] exception: revocable TSRs shall be rejected if information "inhibition of revocable TSRs from balises in L2/3" is stored on-board.

[9] exception: rejected if no level 2/3 transition order is stored onboard.

[10] exception: rejected if the referred LRBG is memorised to have been reported with different "previous LRBG"

[11] exception: rejected if a level transition order is received in the same message, or if a previous level transition order has announced a level transition still to be executed

[12] exception: rejected if the text message is sent with a request for report of driver acknowledgement with the same text message identifier as a previously received text message, which the driver has not yet acknowledged

[13] exception: rejected if not received together with an immediate level transition order to L1/2/3

4.8.3.2 From National System X (through STM interface)

Information from National System X through STM interface	Onboard operating level					
	0	NTC X	NTC Y	1	2	3
STM max speed	A [7]	R	R [6]	A [7]	A [7]	A [7]
STM system speed/distance	A [7]	R	R	A [7]	A [7]	A [7]

[6] exception: stored by ETCS onboard if an order to switch to level NTC X at a further location has been received.

[7] exception: rejected by ETCS onboard if no order to switch to level NTC X at a further location has been received.

4.8.3.3 Intentionally deleted.

4.8.3.4 Intentionally deleted.

4.8.4 Accepted Information depending on the modes

4.8.4.1 Assumptions

4.8.4.1.1 For infill information, only the columns FS and LS apply. In all other modes, infill information is rejected.

4.8.4.1.2 Intentionally deleted.

4.8.4.2 Intentionally deleted.

NR = Not Relevant A = Accepted R = Rejected

Information	Modes																
	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
National Values	NR	A [2]	A	A	A	A	A	A	A	A	A	A	A [1]	NR	NR	A	A
Linking	NR	A[2][4]	R	R	A	A	A	A	R	A	A	R	A [1]	NR	NR	A	R
Signalling Related Speed Restriction	NR	A[2][4]	R	R	A	A	A	A	R	R	A	R	A [1]	NR	NR	A	R
Movement Authority + (optional) Mode Profile + (optional) List of Balises for SH area	NR	A[2][4]	R	R	A	A	A	A	R	R	A	R	A [1]	NR	NR	A	R
Repositioning Information	NR	R	R	R	A	A	R	A	R	R	R	R	R	NR	NR	R	R
Gradient Profile	NR	A[2][4]	R	R	A	A	A	A	R	R	A	R	A [1]	NR	NR	A	R
International SSP	NR	A[2][4]	R	R	A	A	A	A	R	R	A	R	A [1]	NR	NR	A	R
Axle load speed profile	NR	A[2][4]	R	R	A	A	A	A	R	R	A	R	A [1]	NR	NR	A	R
STM max speed	NR	A [2]	R	R	A	A	A	A	R	R	A	A	A [1]	NR	NR	A	R
STM system speed/distance	NR	A [2]	R	R	A	A	A	A	R	R	A	A	A [1]	NR	NR	R	R
Level Transition Order and Conditional Level Transition Order	NR	A [2]	A [7]	A [7]	A	A	A	A	A	A	A	A	A [1] [5]	NR	NR	A	R
Session Management	NR	A	A [3]	A [3]	A	A	A	A	A	A	A	A	A [1]	NR	NR	A	A
Radio Network registration	NR	A [2]	A	A	A	A	A	A	A	A	A	A	A [1]	NR	NR	A	A
MA Request Parameters	NR	A [2]	R	R	A	A	A	A	R	R	A	R	A [1]	NR	NR	A	R
Position Report parameters	NR	A [2]	R	R	A	A	A	A	R	A	A	R	A [1]	NR	NR	A	A

Information	Modes																
	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
SR Authorisation+ (optional) List of Balises in SR mode	NR	A[2][4]	R	R	R	R	A	R	R	R	R	R	A [1]	NR	NR	R	R
Stop if in SR mode	NR	R	R	R	R	R	A	R	R	R	R	R	R	NR	NR	R	R
SR distance information from loop	NR	R	R	R	R	R	A [6]	R	R	R	R	R	R	NR	NR	R	R
Temporary Speed Restriction	NR	A [2][4]	R	R	A	A	A	A	R	R	A	A	A [1]	NR	NR	A	R
Temporary Speed Restriction Revocation	NR	A[2][4]	R	R	A	A	A	A	R	R	A	A	A [1]	NR	NR	A	R
Inhibition of revocable TSRs from balises in L2/3	NR	A [2]	R	R	A	A	A	A	R	R	A	A	A [1]	NR	NR	A	R
Default Gradient for TSR	NR	A[2][4]	R	R	A	A	A	A	R	R	A	A	A [1]	NR	NR	A	R
Route Suitability Data	NR	A[2][4]	R	R	A	A	A	A	R	R	A	R	A [1]	NR	NR	A	R
Adhesion Factor	NR	A[2][4]	R	R	A	A	A	A	R	R	A	R	A [1]	NR	NR	A	R
Plain Text Information	NR	A [2]	R	R	A	A	A	A	R	A	A	A	A [1]	NR	NR	A	A
Fixed Text Information	NR	A [2]	R	R	A	A	A	A	R	A	A	A	A [1]	NR	NR	A	A
Geographical Position	NR	A [2]	R	R	A	A	A	A	R	A	A	A	A [1]	NR	NR	A	R
RBC Transition Order	NR	A[2][4]	A [8]	A [8]	A	A	A	A	A	A	R	A	A [1]	NR	NR	R	R
Danger for SH information	NR	R	R	A	R	R	R	R	R	R	R	R	R	NR	NR	R	R
Stop Shunting on desk opening	NR	R	A	R	R	R	R	R	R	R	R	R	R	NR	NR	R	R
Radio Infill Area information	NR	R	R	R	A	A	A	A	R	R	R	R	R	NR	NR	R	R
Session Management with neighbouring RIU	NR	R	R	R	A	A	A	A	R	R	R	R	R	NR	NR	R	R
EOLM information	NR	R	R	A	A	A	A	A	A	A	A	A	R	NR	NR	A	A
Assignment of Co-ordinate system	NR	A [2]	R	R	R	R	A	R	R	A	A	R	A [1]	NR	NR	A	R
Infill Location Reference	NR	R	R	R	A	A	R	R	R	R	R	R	R	NR	NR	R	R
Track Conditions excluding sound horn, non stopping areas, tunnel stopping areas and big metal masses	NR	A[2][4]	R	R	A	A	A	A	R	A	A	A	A [1]	NR	NR	A	R

Information	Modes															
	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
Track conditions sound horn, non stopping areas, tunnel stopping areas	NR	A[2][4]	R	R	A	A	A	A	R	R	A	R	A [1]	NR	NR	A	R
Track condition big metal masses	NR	A[2][4]	A	A	A	A	A	A	A	A	A	A	A [1]	NR	NR	A	R
Location Identity (NID_C + NID_BG)	NR	A [2]	A	A	A	A	A	A	A	A	A	A	A	NR	NR	A	A
Recognition of exit from TRIP mode	NR	R	R	R	R	R	R	R	R	R	R	R	A	NR	NR	R	R
Acknowledgement of Train Data	NR	A [2]	R	R	A	A	A	A	R	R	A	A	A	NR	NR	A	A
Co-operative shortening of MA + (optional) Mode Profile + (optional) List of Balises for SH area	NR	R	R	R	A	A	R	A	R	R	R	R	R	NR	NR	R	R
Unconditional Emergency Stop	NR	A [2]	R	R	A	A	A	A	R	R	A	R	R	NR	NR	A	R
Conditional Emergency Stop	NR	R	R	R	A	A	R	A	R	R	A	R	R	NR	NR	A	R
Revocation of Emergency Stop (Conditional or Unconditional)	NR	R	R	R	A	A	R	A	R	R	R	R	A [1]	NR	NR	R	R
SH refused	NR	A [2]	R	R	A	A	A	A	R	R	R	R	A [1]	NR	NR	R	R
SH authorised + (optional) List of Balises for SH area	NR	A [2]	R	R	A	A	A	A	R	R	R	R	A [1]	NR	NR	R	R
Trackside constituent System Version	NR	A	A	A	A	A	A	A	A	A	A	A	A	NR	NR	A	A
System Version order	NR	A	A	A	A	A	A	A	A	A	A	A	A	NR	NR	A	A
Track Ahead Free Request	NR	A [2]	R	R	R	A	A	A	R	R	R	R	A[1]	NR	NR	R	R
Train Running Number	NR	A [2]	R	R	A	A	A	A	R	A	R	A	A	NR	NR	R	A
Initiation of session	NR	A	R	R	A	A	A	A	A	A	R	A	A	NR	NR	R	A
Acknowledgement of session termination	NR	A	A	A	A	A	A	A	A	A	A	A	A	NR	NR	A	A
Train Rejected	NR	A [2]	R	R	R	R	R	R	R	R	R	R	R	NR	NR	R	R
Train Accepted	NR	A [2]	R	R	R	R	R	R	R	R	R	R	R	NR	NR	R	R
SoM Position Report Confirmed by RBC	NR	A [2]	R	R	R	R	R	R	R	R	R	R	R	NR	NR	R	R

Information	Modes																
	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
Reversing Area Information	NR	A[2][4]	R	R	A	A	A	A	R	R	A	R	A [1]	NR	NR	A	A
Reversing Supervision Information	NR	A[2][4]	R	R	A	A	A	A	R	R	A	R	A [1]	NR	NR	A	A
Default Balise/Loop/RIU Information	NR	A [2]	A	A	A	A	A	A	A	A	A	A	A	NR	NR	A	A
Track Ahead Free up to level 2/3 transition location	NR	A [2]	R	R	A	A	A	A	R	R	A	A	A	NR	NR	A	R
Permitted Braking Distance Information	NR	A[2][4]	R	R	A	A	A	A	R	R	A	R	A [1]	NR	NR	A	R
Level Crossing information	NR	A[2][4]	R	R	A	A	A	A	R	R	A	R	A [1]	NR	NR	A	R
Virtual Balise Cover order	NR	A	A	A	A	A	A	A	A	A	A	A	A	NR	NR	A	A
Data to be used by applications outside ERTMS/ETCS	NR	A	A	A	A	A	A	A	A	A	A	A	A	NR	NR	A	A

[1]: for level 2/3: only if following the reception of the information “Recognition of Exit from TR mode” with a more recent time stamp; for level 1: rejected

[2]: only if a cab is active

[3]: for order to establish a communication session: RBC ID/phone number is stored without establishing the communication session

[4]: only if valid Train Data are stored on-board

[5]: only level transition announcement (i.e., immediate level transition order and conditional level transition order shall be rejected)

[6]: rejected if override is active

[7]: only immediate level transition order and conditional level transition order shall be accepted (i.e., level transition announcement shall be rejected) and stored for later evaluation (see 4.4.8.1.5)

[8]: only RBC transition order with null distance to execution shall be accepted (i.e., RBC transition announcement shall be rejected) for storing the RBC ID/phone number (see 4.4.8.1.5.2)

4.8.5 Handling of transition buffer in case of level transition announcement or RBC/RBC handover

4.8.5.1 If an order to switch to level NTC, 1, 2 or 3 at a further location has been received, the ERTMS/ETCS onboard equipment shall be able to store in a transition buffer (see figure 3, first filter) three sets of information obtained from three filtered messages.

4.8.5.2 If a RBC transition order has been received and the Handing Over RBC is still the supervising one, the ERTMS/ETCS onboard equipment shall be able to store in a transition buffer (see figure 3, second filter) three sets of information obtained from three filtered messages from the Accepting RBC.

4.8.5.2.1 Note: the term “set of information” refers to the part of a message being stored in the transition buffer (i.e. information which is neither accepted nor rejected immediately) according to the conditions stated in 4.8.3.1 [1] and [2] (for level transition) or according to 4.8.2.1c (for RBC/RBC handover).

4.8.5.3 In case three sets of information are already stored in the transition buffer, any new set to be stored shall replace the oldest one currently stored.

4.8.5.4 The sets of information stored in the transition buffer shall be deleted:

a) in case the level transition order is deleted or overwritten by another level transition order for a different level, OR

b) in case the RBC transition order is deleted or overwritten by an order to switch to another Accepting RBC, OR

c) in case the communication session with the RBC that provided the stored information is terminated

4.8.5.5 At the same time the level transition is performed or at the same time the Accepting RBC becomes the supervising one, the sets of information stored in the transition buffer shall be released and re-evaluated in the sequence they have been received.

4.8.5.6 This sequential re-evaluation of all the released information shall be a prerequisite to any use by the on-board equipment (e.g. it will lead neither to an intermediate change of mode nor to a change of information displayed to the driver) and shall obey the following principles:

a) Starting from the information currently used by on-board at the moment the level/RBC transition is effective, the ERTMS/ETCS on-board equipment shall determine the new information for train supervision, by performing sequential updates from the information released from the transition buffer, if accepted.

b) For each information update related to a re-evaluated set of information, the same rules shall apply as to information update related to new information accepted outside a level/RBC transition context.

c) The information resulting from this sequential update shall then be used by the ERTMS/ETCS on-board equipment.

4.8.5.7 Accepting re-evaluated Conditional Emergency Stop information according to table 4.8.3 implies that the accepted Conditional Emergency Stop information may be accepted or rejected in a further step (see clause 3.10.2.2) depending on the given stop location. This decision, based on the comparison between the min safe front end position of the train at the time the message was received and the given stop location, shall be considered part of the evaluation process as it affects the further re-evaluation of information stored in the transition buffer (see clause 3.10.2.4).

4.8.5.7.1 Note: For the case of the Unconditional Emergency Stop information accepting the information according to table 4.8.3 will always lead to the train being tripped (see clause 3.10.2.3) when re-evaluation of the transition buffer is completed. Information accepted during re-evaluation of information stored in the transition buffer can then be affected on transition to TR mode according to conditions in Table 4.10.

4.8.5.8 Note: The requirement to acknowledge an Emergency Stop information according to clause 3.10.1.4, i.e., communicating to the RBC if the information has been accepted or ignored, applies to the time when the information is used, immediately after the sequential update has been completed.
Regards acknowledging the reception of an emergency stop message, as for any other information received from trackside, see clause 3.16.3.5.

4.9 What happens to accepted and stored information when entering a given level

4.9.1 Introduction

4.9.1.1 Every data that can be stored onboard after being accepted may be influenced by a level transition.

4.9.1.2 A level transition acts on the “status” of stored information.

4.9.1.3 In case of entering level 1, MA Request Parameters, Position Report Parameters and Track Ahead Free Request shall be deleted.

4.9.1.3.1 In case of entering level 0, NTC or 1, the information “Inhibition of revocable TSRs from balises in L2/3” shall be deleted.

4.9.1.4 For all other stored data, a level transition has no effect (void).

4.10 What happens to accepted and stored information when entering a given mode

4.10.1 Introduction

4.10.1.1 Every data that can be stored onboard after being accepted may be influenced by a mode transition.

4.10.1.2 A mode transition acts on the "status" of stored information.

4.10.1.3 Depending on which mode is entered, the action shall be one of the following:

a) data is deleted,

b) data is to be revalidated,

c) data is reset (set to default values)

d) data status is unchanged,

e) not relevant (the action on the data cannot be determined. This concerns the entry in SF and IS modes)

D = Deleted TBR = To Be Revalidated U = Unchanged NR = Not relevant R = Reset

Data Stored on-board	Entered Mode																
	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
National Values	U	U	U	U	U	U	U	U	U	U	U	U	U	NR	NR	U	U
Not yet applicable National Values	D	U	U	U	U	U	U	U	U	U	U	U	U	NR	NR	U	U
Linking	D	D	D	D	U	U	D	U	D	D	D	D	U	NR	NR	D	D
Movement Authority	D	D	D	D	U	U	D	U	D	D	D	D	U	NR	NR	D	D
Gradient Profile	D	D	D	D	U	U	D	U	D	D	D	D	U	NR	NR	D	D
International SSP	D	D	D	D	U	U	D	U	D	D	D	D	U	NR	NR	D	D
Axle load speed profile	D	D	D	D	U	U	D	U	D	D	D	D	U	NR	NR	D	D
STM max speed	D	D	D	D	U	U	D	U	D	D	U	U	U	NR	NR	U	D
STM system speed/distance	D	D	D	D	U	U	D	U	D	D	U	U	U	NR	NR	U	D
Level Transition Order	D	D [1] [2]	U	D [2]	U	U	D	U	D [2]	D [1]	D	U	U	NR	NR	D	D
Stop Shunting on desk opening	D	D	U	U	U	U	U	U	D	U	U	U	U	NR	NR	U	U

Data Stored on-board	Entered Mode																
	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
List of balises for SH area	D	D	U	U	U	U	D	U	D	D	D	D	U	NR	NR	D	D
MA Request Parameters	D	U	U	U	U	U	U	U	U	U	U	U	U	NR	NR	U	U
Position Report parameters	D	U	U	U	U	U	U	U	U	U	U	U	U	NR	NR	U	U
List of Balises in SR Authority + SR mode speed limit and distance	D	D	D	D	D	D	U	D	D	D	D	D	U	NR	NR	D	D
Temporary Speed Restriction	D	D	D	D	U	U	U	U	D	D	U	U	U	NR	NR	D	D
Inhibition of revocable TSRs from balises in L2/3	D	D	D	D	U	U	D	U	D	D	D	U	U	NR	NR	D	D
Default Gradient for TSR	D	D	D	D	U	U	U	U	D	D	U	U	U	NR	NR	D	D
Signalling related Speed Restriction	D	D	D	D	U	U	D	U	D	D	D	D	U	NR	NR	D	D
Route Suitability Data	D	D	D	D	U	U	D	U	D	D	D	D	U	NR	NR	D	D
Adhesion Factor (from trackside)	R	R	R	R	U	U	U	U	R	R	U	U	U	NR	NR	R	U
Adhesion Factor (from driver)	R	R	R	R	U	U	U	U	R	R	U	U	U	NR	NR	U	U
Plain Text Information	D	D	D	D	U	U	U	U	D	U	U	U	U	NR	NR	D	U
Fixed Text Information	D	D	D	D	U	U	U	U	D	U	U	U	U	NR	NR	D	U
Geographical Position	D	U	D	D	U	U	U	U	D	U	U	U	U	NR	NR	D	D
Mode Profile	D	D	D	D	U	U	D	U	D	D	D	D	U	NR	NR	D	D
RBC Transition Order	D	D	D	D	U	U	D	U	D	D	D	D	U	NR	NR	D	D
Radio Infill Area information	D	D	D	D	U	U	D	D	D	D	D	D	U	NR	NR	D	D
EOLM information	TBR	U	U	U	U	U	U	U	U	U	U	U	U	NR	NR	U	U
Track Conditions excluding sound horn, non stopping areas, tunnel stopping areas and big metal masses	R	R	R	R	U	U	R	U	R	U	R	U	U	NR	NR	R	R
Track conditions sound horn, non stopping areas, tunnel stopping areas	R	R	R	R	U	U	R	U	R	R	R	R	R	NR	NR	R	R
Track condition big metal masses	R	R	R	R	U	U	R	U	R	U	U	U	U	NR	NR	U	R
Unconditional Emergency Stops	D	D	D	D	U	U	D	U	D	D	D	U	U	NR	NR	D	D
Conditional Emergency Stops	D	D	D	D	U	U	D	U	D	D	D	U	U	NR	NR	D	D
Train Position	TBR	U	U	U	U	U	U	U	U	U	U	U	U	NR	NR	U	U

Data Stored on-board	Entered Mode																
	NP	SB	PS	SH	FS	LS	SR	OS	SL	NL	UN	TR	PT	SF	IS	SN	RV
Train Data	D	TBR	U	TBR	U	U	U	U	U	U	U	U	U	NR	NR	U	U
ERTMS/ETCS level	TBR	U	U	U	U	U	U	U	U	U	U	U	U	NR	NR	U	U
Table of priority of trackside supported levels	TBR	U	U	U	U	U	U	U	U	U	U	U	U	NR	NR	U	U
Driver ID	D	TBR	U	U	U	U	U	U	D	U	U	U	U	NR	NR	U	U
Radio Network ID	U	U	U	U	U	U	U	U	U	U	U	U	U	NR	NR	U	U
RBC ID/Phone Number	TBR	U	U	U	U	U	U	U	U	U	D	U	U	NR	NR	D	U
Train Running Number	D	TBR	U	U	U	U	U	U	D	U	U	U	U	NR	NR	U	U
Reversing Area Information	D	D	D	D	U	U	D	U	D	D	D	D	U	NR	NR	D	U
Reversing Supervision Information	D	D	D	D	U	U	D	U	D	D	D	D	U	NR	NR	D	U
Track Ahead Free Request	D	D	D	D	D	D	U	U	D	D	D	D	U	NR	NR	D	D
Permitted Braking Distance Information	D	D	D	D	U	U	D	U	D	D	D	D	U	NR	NR	D	D
Level Crossing information	D	D	D	D	U	U	D	U	D	D	D	D	U	NR	NR	D	D
RBC/RIU System Version	D	U	U	U	U	U	U	U	U	U	U	U	U	NR	NR	U	U
Operated System Version	U	U	U	U	U	U	U	U	U	U	U	U	U	NR	NR	U	U
Virtual Balise Covers	U	U	U	U	U	U	U	U	U	U	U	U	U	NR	NR	U	U
Language used to display information to the driver	U	U	U	U	U	U	U	U	U	U	U	U	U	NR	NR	U	U

[1]: exception: “U” when coming from SH

[2]: exception: “U” when coming from PS

4.10.1.4 NOTES:

4.10.1.4.1 Intentionally deleted.

4.10.1.4.2 The following information is not considered to be stored information:

a) Repositioning information

b) Session Management (exception: the RBC ID/phone number, which is given with an order to establish a communication session, is stored on-board)

c) Danger for SH information

d) Assignment of Co-ordinate system

e) Infill Location Reference

f) Location Identity (NID_C + NID_BG transmitted in the balise telegram)

g) Recognition of exit from TRIP mode

h) Acknowledgement of Train Data

i) SH refused

j) SH authorised

k) Balise/loop System Version

l) Track Condition Station Platforms

m) Track Condition Change of Allowed Current Consumption

n) Revocation of Emergency Stop (Conditional or Unconditional)

o) Temporary Speed Restriction Revocation

p) Initiation of communication session

q) Acknowledgement of session termination

r) Default Balise Information

s) Co-operative shortening of MA (if this message is used, it replaces the movement authority)

t) Train Rejected

u) Train Accepted

v) SoM position report confirmed by RBC

w) Track Ahead Free up to level 2/3 transition location

x) Signalling related speed restriction value zero (i.e., train trip order)

y) Stop if in SR mode

z) Data to be forwarded to a National System through the STM interface

4.11 What happens to stored information when exiting NP mode

4.11.1.1 Status of stored information, which is set to "Invalid" when No Power mode is entered, shall be affected, when relevant, by information from the Cold Movement Detection function, according to the following table:

	Status of On-board stored information														
	EOLM information			Train Position			ERTMS/ETCS Level			Table of trackside supported levels			RBC ID/Phone Number		
Transition conditions	Un-known	Invalid	Valid	Un-known	Invalid	Valid	Un-known	Invalid	Valid	Un-known	Invalid	Valid	Un-known	Invalid	Valid
No Cold movement occurred		●——	——▶		●——	——▶		●——	——▶		●——	——▶		●——	——▶
Cold movement detected or Cold movement information not available	◀——	——●								◀——	——●				

4.11.1.2 Note: Status of stored information, which remains valid after NP mode has been entered, is not affected by information from the Cold Movement Detection function.

4.11.1.3 If a cold movement has been detected, or the Cold Movement Detection function is not able to confirm that no cold movement has taken place, no change of status of information to “valid” shall be made until it has been validated by a different means than cold movement detection.

ERTMS/ETCS

System Requirements Specification

Chapter 5

Procedures

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2.2.2 020201	Refer to document: SUBSET-026 Corrected Paragraphs, Issue 2.2.2		HK
2.2.4 SG checked 28/05/04	Including all CLRs agreed with the EEIG (see “List of CLRs agreed with EEIG for SRS v2.2.4” dated 28/05/04) Affected clauses see change marks		H. Kast
2.2.5 21/01/05	Incorporation of solution proposal for CLR 007 with EEIG users group comments Corrections according to erratum list agreed in SG meeting 170105		Hougardy A
2.2.6 31/01/05	Including all current CR decisions (CR status “EEIG pending”)		H. Kast
2.2.7 22/07/05	Including all current CR decisions by the UNISIG SG 22/07/05 CR 126 added		H. Kast

2.2.8 06/12/05	Including all new CR decisions made since SRS version 2.2.7 (i.e., since July ’05)	H. Kast
2.2.9 24/02/06	Including all CRs that are classified as “IN” as per SUBSET-108 version 1.0.0 Removal of all CRs that are not classified as “IN” as per SUBSET-108 version 1.0.0, with the exception of CRs 63,98,120,158,538	H. Kast
2.3.0 24/02/06	Release version	HK
2.3.1 15/06/06	Including SG CR decision made since SRS 2.2.8, correct errors in 2.2.8 detected when creating SRS 2.3.0	H. Kast
2.3.2 17/03/08	Including all CRs that are classified as “IN” as per SUBSET-108 version 1.2.0 and all CRs that are in state “Analysis completed” according to ERA CCM	A. Hougardy
2.9.1 06/10/08	Including all enhancement CR’s retained for 3.0.0 baseline and all other error CR’s that are in state “Analysis completed” according to ERA CCM For editorial reasons, the following CR’s are also included: CR656, CR804, CR821	A. Hougardy
3.0.0 23/12/08	Release version	A. Hougardy
3.0.1 22/12/09	Including the results of the editorial review of the SRS 3.0.0 and the other error CR’s that are in state “Analysis completed” according to ERA CCM	A. Hougardy
3.1.0 22/02/10	Release version	A. Hougardy
3.1.1 08/11/10	Including all CR’s that are in state “Analysis completed” according to ERA CCM, plus CR 731? 972 and 1000.	A. Hougardy
3.2.0 22/12/10	Release version	A. Hougardy
3.2.1 13/12/11	Including all CR’s that are in state “Analysis completed” according to ERA CCM	A. Hougardy
3.3.0 07/03/12	Baseline 3 release version	A. Hougardy

5.2 Table of Contents

5.3 Introduction

5.3.1 Scope and Purpose

5.3.1.1 This document defines the procedures that are necessary for interoperability within the scope of ERTMS/ETCS.

5.3.1.2 Each procedure is defined by a set of mandatory requirements and, where convenient, is illustrated by a flowchart.

5.3.1.3 In case the condition(s) in chapter 4 triggering a mode transition is(are) fulfilled, this transition shall be executed even if not shown in the chapter 5 procedures.

5.3.1.3.1 Note: Such a mode transition could lead to exiting a procedure immediately (e. g. cut off power of on-board equipment, isolation of on-board equipment).

5.3.1.4 National operation rules (outside of ERTMS/ETCS) are also excluded, but may be applied by the railways in addition to the procedures as long as interoperability is retained.

5.3.2 Definitions

5.3.2.1 Procedures

A procedure defines the required reaction of the ERTMS/ETCS entities (subsystems and components) to either information exchanged between ERTMS/ETCS entities or events (triggered by external entities or internal events). The procedures focus on the required change in status and mode of the described ERTMS/ETCS entities.

5.3.2.2 Entities

The procedures define the required system behaviour on a context level, i. e. the entities that are used to define the procedures are for example: the on-board equipment, the trackside equipment (RBC/Balise), the driver.

5.3.2.3 States

States are situations of an ETCS subsystem with a specific set of available functions and a specific set of events that may start or terminate the state. A state remains active as long as the conditions to trigger the transition to a succeeding state are not completely satisfied.

Note 1: one mode of operation may include several states for the on-board equipment.

Note 2: A new state is only created, if the behaviour of the system differs from another one. Possession of information (e. g. location information) or not does not force branching in states.

5.3.2.4 Transitions

Transitions define the rules for passing from one state to another. A transition is triggered by a set of conditions which has to be fulfilled in a defined order or at the same time. When a transition refers to a driver's selection, it means that the conditions to enable the corresponding button on the DMI were fulfilled.

5.4 Procedure Start of mission

5.4.1 Introduction

5.4.1.1 The driver may have to start a mission:

a) Once the train is awake, OR

b) Once shunting movements are finished, OR

c) Once a mission is ended, OR

d) Once a slave engine becomes a leading engine.

5.4.1.2 The common point of all these situations is that the ERTMS/ETCS on-board is in Stand-By mode, but the Start of Mission will be different, since some data may be already stored on-board, depending on the previous situation.

5.4.1.3 Once the ERTMS/ETCS on-board equipment is in Stand-By mode, the start of mission is not the only possibility, the engine may become remote controlled (i.e. the on-board switches to Sleeping mode).

5.4.2 Status of data stored in the ERTMS/ETCS on-board equipment

5.4.2.1 At the beginning of the Start of Mission procedure, the data required may be in one of three states:

a) “valid” (the stored value is known to be correct)

b) “Invalid” (the stored value may be wrong)

c) “Unknown” (no stored value available)

5.4.2.2 This refers to the following data: Driver ID, ERTMS/ETCS level, RBC ID/phone number, Train Data, Train Running Number, Train Position (see 3.6.1.3).

5.4.2.3 **Note 1**: The status of data in relation to the previous and the actual mode is described in chapter 4, section "What happens to stored information when entering a mode".

5.4.2.4 **Note 2**: The change of status of data in course of the procedure is shown in the table in section 5.4.3.3.

5.4.3 Table of requirements for “Start of Mission” procedure

5.4.3.1 The ID numbers in the table are used for the representation of the procedure in form of a flow chart in section 5.4.4.

5.4.3.2 Procedure

ID #	Requirements
S0	The Start of Mission procedure shall be engaged when the ERTMS/ETCS on-board equipment is in Stand-By mode with a desk open and no communication session is established or is being established.
S1	Depending on the status of the Driver-ID, the ERTMS/ETCS on-board equipment shall request the driver to enter the Driver-ID (if the Driver-ID is unknown) or shall request the driver to revalidate or re-enter the Driver-ID (if the Driver-ID is invalid). The ERTMS/ETCS on-board equipment shall offer the driver the possibility to enter/re-validate (depending on the status) the Train running number. The ERTMS/ETCS on-board equipment shall also offer the driver the possibility to set/remove a Virtual Balise Cover. Once the Driver-ID is entered or revalidated **(E1)** (possibly further to the Train running number entry/revalidation and/or to Virtual Balise Cover setting/removal), the process shall go to **D2**
D2	If both the stored position and the stored level are valid, the process shall go to **D3** If the stored position or the stored level is “invalid” or “unknown”, the process shall go to **S2**
D3	If the stored level is 2 or 3, the process shall go to **D7** If the stored level is 0,1 or NTC, the process shall go to **S10**
D7	If at least one Mobile Terminal is registered to a Radio Network, the process shall go to **A31** If no Mobile Terminal is registered to a Radio Network, the process shall go to **A29**
S2	If the status of the Level data is "unknown", the ERTMS/ETCS on-board equipment shall request the driver to enter it. If the status of the Level data is "invalid", the ERTMS/ETCS on-board equipment shall request the driver to re-validate or re-enter the ERTMS/ETCS level. If the entered / re-validated level is 2 or 3, the process shall go to **S3** If the entered / re-validated level is 0, 1 or one of proposed NTC level(s) (see 3.18.4.2 for the levels the driver is allowed to select), the process shall go to **S10**

ID #	Requirements
S3	The ERTMS/ETCS on-board equipment shall offer the possibility to the driver to re-enter the Radio Network ID. If the driver elects to do so, the on-board equipment shall acquire an alphanumeric list of available and allowed networks, based on a request to the Mobile Terminal(s) and: • If this list is empty (**E3**) the process shall go to **A29** • If the driver selects a new Radio Network ID from the proposed list, the registration of the Mobile Terminal(s) to this new Radio Network shall be ordered and the status of the RBC-ID/phone number shall be immediately set to “unknown”. If at least one Mobile Terminal is registered to a Radio Network, the ERTMS/ETCS on-board equipment shall offer the following options to the driver for the RBC-ID/phone number: • Only if the status of the RBC-ID/phone number is “invalid": order the ERTMS/ETCS on-board equipment to use the last stored RBC-ID/phone number • Order the ERTMS/ETCS on-board equipment to use the EIRENE short number (trackside call routing function) • Enter the RBC-ID/phone number (if its status is "unknown"), or revalidate/re-enter it (if its status is “invalid”). Once the driver has selected the first or second option or once data is validated (**E5**), the process shall go to **A31**
A29	The ERTMS/ETCS on-board equipment shall inform the driver that the Radio Network registration has failed This condition leads to **S10** (the driver has to unlock the situation to continue e.g. selection of new level)
S10	The ERTMS/ETCS on-board equipment shall offer the possibility to the driver to select SH, NL, or to select Train Data Entry. • If the driver selects SH (**E12**), the process shall continue in the same way as the procedure “Shunting initiated by the driver”. If, in level 2 or 3, the RBC rejects the request for Shunting (**E13**), the process shall go back to **S10**. • If the driver selects NL (**E10**) then the ERTMS/ETCS on-board equipment shall immediately switch to Non Leading mode (refer to SRS chapter 4, transition between modes: transition [46]). The mission starts in NL mode (if level is 2 or 3, the ERTMS/ETCS on-board equipment also reports the change of mode to the RBC). • If the driver selects Train Data Entry (**E11**), the process shall go to **S12** • Following E10, E12, if the position is still invalid, the ERTMS/ETCS on-board shall delete the train position data (new status: “unknown”)

ID #	Requirements
S12	The ERTMS/ETCS on-board equipment shall request the driver to enter/revalidate the Train Data that requires driver validation . Once Train Data is stored and validated (**E16**), the process shall go to **D12**
D12	If Train running number is valid, the process shall go to **D10** If Train running number is “unknown” or “invalid”, the process shall go to **S13**
S13	If the status of the Train running number is "unknown" or “invalid”, the ERTMS/ETCS on-board equipment shall request the driver to enter/re-validate the Train running number now. Once Train running number is entered/re-validated (**E18**), the process shall go to **D10.**
D10	When the validated level is 2/3, the process shall go to **D11** When the validated level is 0,1 or NTC, the process shall go to **S20**
D11	When the session is open, the process shall go to **S11**, otherwise it shall go to **S10**
S11	The ERTMS/ETCS on-board equipment shall send Train Data to the RBC. When the RBC acknowledges Train Data (**E14**), then the ERTMS/ETCS onboard equipment shall go to the step **S20**.
S20	The ERTMS/ETCS on-board equipment shall offer the possibility to the driver to select “Start” a) When the validated level is NTC and the driver selects "start" (**E20**), the process shall go to **S22** b) When the validated level is 0 and the driver selects "start" (**E21**), the process shall go to **S23** c) When the validated level is 1 and the driver selects "start" (**E22**), the process shall go to **S24** d) When the validated level is 2 or 3 and the driver selects "start" (**E24**), the process shall go to **S21**
S21	The ERTMS/ETCS on-board equipment shall send an MA request to the RBC and wait. If an SR authorisation is received from RBC (**E26**), the process shall go to **S24** If an MA allowing OS/LS/SH is received from RBC (**E27**), the process shall go to **S25** If an MA allowing FS is received from RBC (**E29**), the mission starts in Full Supervision mode (refer to SRS chapter 4, transitions between modes: transition from SB to FS)

<table>
<tr><th>ID #</th><th>Requirements</th></tr>
<tr><td>S22</td><td>The ERTMS/ETCS on-board equipment shall request an acknowledgement from the driver for running under supervision of the selected National System. When the driver acknowledges (E30) , the mission starts in SN mode (refer to SRS chapter 4, transitions between modes).

Following E30, if the position is still invalid, the ERTMS/ETCS on-board shall delete the train position data (new status: “unknown”)</td></tr>
<tr><td>S23</td><td>The ERTMS/ETCS on-board equipment shall require an acknowledgement from the driver for running in Unfitted mode. When the driver acknowledges (E31), the mission starts in Unfitted mode (refer to SRS chapter 4, transitions between modes: transition from SB to UN)

Following E31, if the position is still invalid, the ERTMS/ETCS on-board shall delete the train position data (new status: “unknown”)”</td></tr>
<tr><td>S24</td><td>The ERTMS/ETCS on-board equipment shall require an acknowledgement from the driver for running in Staff Responsible mode. When the driver acknowledges (E32), the mission starts in SR mode (refer to SRS chapter 4, transitions between modes: transition from SB to SR)

Following E32, if the position is still invalid, the ERTMS/ETCS on-board shall delete the train position data (new status: “unknown”)”</td></tr>
<tr><td>S25</td><td>The ERTMS/ETCS on-board equipment shall require an acknowledgement from the driver for running in On Sight/Limited Supervision/Shunting mode. When the driver acknowledges (E33), the mission starts in On Sight/Limited Supervision/Shunting mode (refer to SRS chapter 4, transitions between modes: transition from SB to OS, LS or SH)</td></tr>
<tr><td>A31</td><td>The ERTMS/ETCS on-board equipment shall open the session with the RBC.</td></tr>
<tr><td>D31</td><td>If the opening of the session is successful, the process shall go to D32

If the opening of the session has failed, the process shall go to A32</td></tr>
<tr><td>A32</td><td>The driver shall be informed when the on-board equipment fails to open a radio session.

Opening of a radio session has failed if

• No connection to the RBC can be established (see section 3.5.3.7) OR

• The ERTMS/ETCS on-board equipment, based on the system configuration reported by the RBC, decides that compatibility is not ensured and terminates the communication session

This condition leads to S10 (The driver has to unlock the situation to continue e.g. selection of new level).</td></tr>
<tr><td>D32</td><td>If the stored position is valid, the process shall go to A33

If the stored position is invalid, the process shall go to A34</td></tr>
</table>

ID #	Requirements
A33	If the train position data stored in the on-board equipment is of status “valid”, the train position, marked as “valid” shall be transmitted to the RBC via the "SoM position report" message. This condition leads to **S10**.
A34	If the train position data stored in the on-board equipment is of status “invalid” or "unknown", the train position, marked as “invalid” or "unknown" shall be transmitted to the RBC via the "SoM position report" message. The process shall then go to **D33**
D33	When the position report marked as "invalid" is received by the RBC, this latter shall check whether it can validate this position report. If the position report can be validated by the RBC, the process shall go to **A35** Otherwise, if the position report was marked "unknown", or the "invalid" position report cannot be validated by the RBC, the process shall go to **D22** Note: How the RBC is able to validate the position report is a national issue, out of the scope for this specification
A35	The RBC shall inform the ERTMS/ETCS onboard equipment that the reported position is valid. When this message is received by the ERTMS/ETCS on-board equipment, the status of the position shall be set to "valid" The process shall go to **S10**.
D22	If the reported train position is "unknown", or the RBC is not able to confirm a reported "invalid" position, the RBC shall nevertheless decide whether it accepts the train or not. If yes, the process shall go to **A23** If no, the process shall go to **A38** Note: How the RBC assumes responsibility for the train is a national issue, out of the scope for this specification
A23	The RBC shall inform the ERTMS/ETCS on-board equipment that it accepts the train although the on-board has no "valid" position information.
A24	When the ERTMS/ETCS on-board equipment is informed that the train is accepted without valid position data, it shall delete the train position data (new status: “unknown”) This condition leads to **S10**.
A38	The RBC shall inform the ERTMS/ETCS on-board equipment that it rejects the train

ID #	Requirements
A39	When the ERTMS/ETCS on-board equipment is informed that the train is rejected, it shall delete the train position data (new status: “unknown”) and shall terminate the session with the RBC. The process shall then go to **A40**
A40	The ERTMS/ETCS on-board equipment shall inform the driver that the train is rejected This condition leads to **S10** (the driver has to unlock the situation to continue e.g. selection of new level).

5.4.3.2.1 The SoM procedure shall end as soon as at least one of the following conditions is fulfilled:

- Transition to any mode other than SB
- The desk is closed

5.4.3.3 Status of On-board Variables Affected by Start of Mission Procedure

	State of On-board Variables																	
	ERTMS/ETCS Level			RBC ID/Phone Number			Train position data			Driver ID			Train Data			Train Running Number		
Transition conditions	Un-known	Invalid	Valid	Un-known	Invalid	Valid	Un- known	Invalid	Valid	Un- known	Invalid	Valid	Un- known	Invalid	Valid	Un- known	Invalid	Valid
Following S1 : Driver has entered driver ID										●	—	→						
Following S1 : Driver has re-validated/ re-entered driver ID											●	→						
Following S1 : Driver has entered Train running number																●	—	→
Following S1: Driver has re-validated/ re-entered Train running number																	●	→
Following D2: stored position is “invalid” or “unknown”		←	●		←	●												
Following D2: stored level is “invalid” or “unknown”					←	●												
Following S2 : driver has entered level	●	—	→															
Following S2 : driver has re-validated/ re-entered level		●	→															
S3: driver has re-entered a Radio Network ID				←	●													
Following S3 : driver has entered RBC ID/Phone Number				●	—	→												
Following S3: driver has re-validated/re-entered RBC ID/Phone Number					●	→												
Following D31: session has been successfully opened					●	→												
Following D31: session has been successfully opened				●	—	→												
A35 : RBC reports to On-board : position valid								●	→									
A24 : On-board deletes stored position data							←	●										
A39 : On-board terminates session, deletes stored position data							←	●										
Following E10, E12, E30, E31, E32, On-board deletes stored position data							←	●										
Following 5.4.5.3 a), f), g), On-board deletes stored position data							←	●										
Following S12: Train Data have been entered													●	—	→			

	State of On-board Variables																	
	ERTMS/ETCS Level			RBC ID/Phone Number			Train position data			Driver ID			Train Data			Train Running Number		
Transition conditions	Un-known	Invalid	Valid	Un-known	Invalid	Valid	Un- known	Invalid	Valid	Un- known	Invalid	Valid	Un- known	Invalid	Valid	Un- known	Invalid	Valid
Following S12: Driver has (re-) validatedTrain Data														●	►			
Following S13: Driver has entered train running number																●		►
Following S13: Driver has re-validated/re-entered train running number																	●	►
Following S10 or S20: Driver chooses to re-enter the level		◄	●		◄	●												

5.4.4 Flowchart

5.4.4.1 The ID numbers in the flowchart refer to the ID numbers of the table in section 5.4.3.

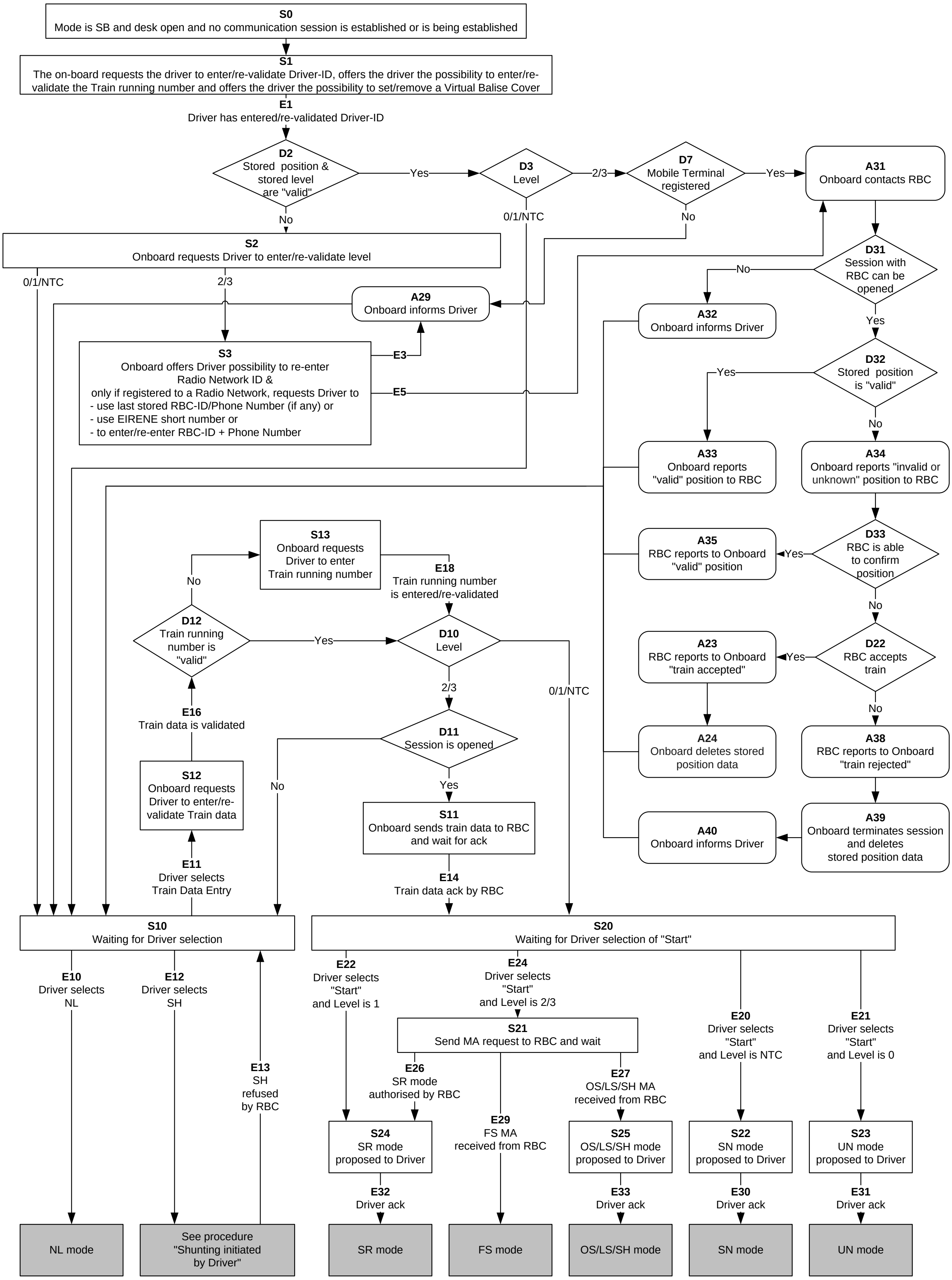

Figure 1: Flowchart for "Start of Mission"

5.4.5 Degraded Situations

5.4.5.1 Nominally, accidental loss of an already open session (that can occur at any step) has not been taken into account for the design of the SoM flowchart. However, should such a fault occur above D11 the nominal procedure applies (refer to D11 in flowchart). On the other hand, if it occurs in any step further than D11, the process shall go to S10.

5.4.5.2 The SoM flowchart described in section 5.4.3 only includes the main paths and does not exhaustively cover the various operational situations, which could occur while performing the SoM procedure (e.g. when revised instructions are given to the driver or when the driver needs to re-enter already captured data).

5.4.5.3 The ERTMS/ETCS on-board equipment shall also offer the driver the following possibilities, in addition to the ones that are described in section 5.4.3:

a) only at S10 and S20 and if valid Train data is available, to select “Override”. If the driver chooses to do so, then the process shall go to the procedure “Override” and, if the position is still invalid, the ERTMS/ETCS on-board shall delete the train position data (new status: “unknown”)

b) only at S10 and S20, to re-enter the Driver-ID

c) only at S10 and S20,to re-enter the “Train running number”

d) only at S20, to re-enter the Train data. If the driver chooses to do so, then the process shall go to S12.

e) only at S10 and S20, to re-enter the Level. If the driver chooses to do so, then the process shall go to S2

f) only at S20, to select “Non Leading”. If the driver chooses to do so, then the ERTMS/ETCS on-board equipment shall immediately switch to Non Leading mode and, if the position is still invalid, the ERTMS/ETCS on-board shall delete the train position data (new status: “unknown”).

g) only at S20, to select “Shunting”. If the driver chooses to do so, then the process shall go to the procedure “Shunting initiated by driver” and, if the position is still invalid, the ERTMS/ETCS on-board shall delete the train position data (new status: “unknown”). If, in level 2 or 3, the RBC rejects the request for Shunting, the process shall go back to S20.

h) only at S10, if valid Train Data is available, to select “Start”. If the driver chooses to do so:

- if the level is 0, then the process shall go to S23.
- if the level is NTC, then the process shall go to S22.
- if the level is 1, then the process shall go to S24.
- if the level is 2/3 and a session is open, then the process shall go to S21.
- if the level is 2/3 and no session is open, then the process shall go to S24.

i) only at S10 and S20, to set/remove a Virtual Balise Cover.

5.4.6 Entry to Mode Considered as a Mission

5.4.6.1 A mission shall be considered as started as soon as the ERTMS/ETCS on-board equipment enters FS, LS, SR, OS, NL, UN, or SN mode.

5.4.6.2 Entry in all other modes, from SB mode, shall not be considered as a mission.

5.5 Procedure End of Mission

5.5.1 Introduction

5.5.1.1 End of mission refers to the situation where the trackside stops to authorise the movement of a unit. End of mission is initiated by the ERTMS/ETCS on-board equipment when entering specific modes (see below).

5.5.2 Entry to Mode Considered as an End of Mission:

5.5.2.1 Stand-By mode

5.5.2.1.1 From FS, LS, OS, UN, NL, SR, PT, RV or SN mode, the entry of the ERTMS/ETCS on-board equipment into the Stand-by mode is considered as an End of Mission

5.5.2.1.2 Note: While in SN mode (level NTC), some other conditions to end the mission may depend on the National System.

5.5.2.1.3 The entry of the ERTMS/ETCS on-board equipment into the Stand-by mode, from PT mode, is only considered as an End of Mission if there was an on-going mission.

5.5.2.2 Sleeping mode

5.5.2.2.1 The entry of the ERTMS/ETCS on-board equipment into the Sleeping mode is considered as an End of Mission.

5.5.2.2.1.1 Note: The transition to Sleeping mode is always made from the Stand-By mode (refer to chapter 4, transition between modes). If the end of mission has been already executed in Stand-by mode no further end of mission is required.

5.5.2.3 Shunting mode

5.5.2.3.1 The entry of the ERTMS/ETCS on-board equipment into the Shunting mode, from FS, LS, OS, SR, SN or UN mode, is considered as an End of Mission.

5.5.2.3.2 The entry of the ERTMS/ETCS on-board equipment into the Shunting mode, from PT mode, is only considered as an End of Mission if there was an on-going mission.

5.5.2.3.3 Note: While in SN mode (level NTC), some other conditions to end the mission may depend on the National System.

5.5.3 End of Mission Procedure

5.5.3.1 The procedure comprises the following steps

5.5.3.1.1 Step 1 - MA, Track Description Data and Train Data may be deleted (mode dependent, see Chapter 4, section "What happens to accepted and stored information when Entering a Mode").

End of Procedure, if there is no existing communication session.”

5.5.3.1.2 If a communication session with an RIU exists:

Step 2 - The ERTMS/ETCS on-board equipment shall terminate the communication session

End of procedure

5.5.3.1.3 If a communication session with an RBC exists:

Step 2 - The end of mission shall be reported to the RBC by means of the message “End of Mission”.

Step 3 - The RBC shall request to terminate the communication session.

Step 4 - The ERTMS/ETCS on-board equipment shall terminate the communication session

End of procedure

5.5.3.1.3.1 Note: For the termination of the communication session refer to chapter 3, Management of Radio Communication.

5.5.3.1.3.2 Note: The “End of Mission” message contains a position report.

5.5.3.2 Intentionally deleted.

5.5.4 Degraded Situation

5.5.4.1.1 Level 2,3 : In case a communication session is established and no request to terminate the communication session is received from the RBC within a fixed waiting time (see appendix to chapter 3, List of Fixed Value Data) after sending the “End of Mission” message, the message shall be repeated with the fixed waiting time after each repetition.

5.5.4.1.1.1 After a defined number of repetitions (see appendix to chapter 3, List of Fixed Value Data), and if no reply is received within the fixed waiting time from the time of the last sending of “End of Mission”, the ERTMS/ETCS onboard equipment shall terminate the communication session.

5.5.4.1.2 Level 2,3 : In case no communication session is open, no communication session shall be established to report the end of mission.

5.6 Shunting Initiated by Driver

5.6.1 Introduction

5.6.1.1 The procedure describes the selection of shunting by the driver.

5.6.1.2 Intentionally deleted.

5.6.2 Table of requirements for “Shunting Initiated by Driver” procedure

5.6.2.1 The ID numbers in the table are used for the representation of the procedure in form of a flowchart in section 5.6.3.

5.6.2.2 Procedure

ID #	Requirements	
E015	The train is at standstill and the ERTMS/ETCS on-board equipment is in FS, LS, OS, SR, SN, UN or PT mode or is in SB mode with necessary preconditions fulfilled (Driver ID known, Level known, ... see procedure "Start of mission"). When the driver selects Shunting (**E015**) the process shall go to **D020**.	
D020	If the current ETCS Level of operation is 0 or 1, the process shall go to **A050**. If the current ETCS Level of operation is 2 or 3, the process shall go to **A045**. If the current ETCS Level of operation is NTC, the process shall go to **D030**	
D030	If there is an on-going National Trip procedure reported by the STM, the process shall go to **A030** Otherwise the process shall go to **A050**	
A030	The process shall go to the “Train trip" procedure	
A045	The ERTMS/ETCS on-board equipment shall send the “Request for Shunting” message to the RBC together with a position report (with special value “position unknown” if the position is not known) The process shall go to **S050**.	
S050	The ERTMS/ETCS on-board equipment awaits the reply to the SH request. If SH authorised is received from the RBC (optionally with a list of balise groups for SH area, which the train can pass when the ERTMS/ETCS onboard equipment is in shunting mode) (**E090**), the process shall go to **A050**. If “SH refused” is received from the RBC (**E215**), the process shall go to **A220**.	

ID #	Requirements	
A050	The mode shall change to SH. Any previous list of balise groups for SH area shall be deleted or replaced by a new list of balise groups for SH area. The process shall go to **D040**.	
D040	If there is an on-going mission, the process shall go to **A100**. If there is no on-going mission, the process shall go to **D080**.	
A100	The process shall go to the “End of Mission" procedure	
D080	If the current ETCS Level of operation is 2 or 3, the process shall go to **A095**. If the current ETCS Level of operation is 0, 1 or NTC the process shall **END**.	
A095	The mode change shall be reported to the RBC. The process shall go to **S100**.	
S100	The ERTMS/ETCS on-board equipment awaits the RBC order to terminate the communication session. When an order to terminate the communication session is received from RBC the process shall go to **A115**.	
A115	The ERTMS/ETCS on-board equipment shall terminate the communication session. The process shall **END**.	
A220	An indication shall be given to the driver that SH was refused by the RBC. The process shall **END**.	

5.6.3 Flowchart

5.6.3.1 The ID numbers in the flowchart refer to the ID numbers of the table in section 5.6.2.

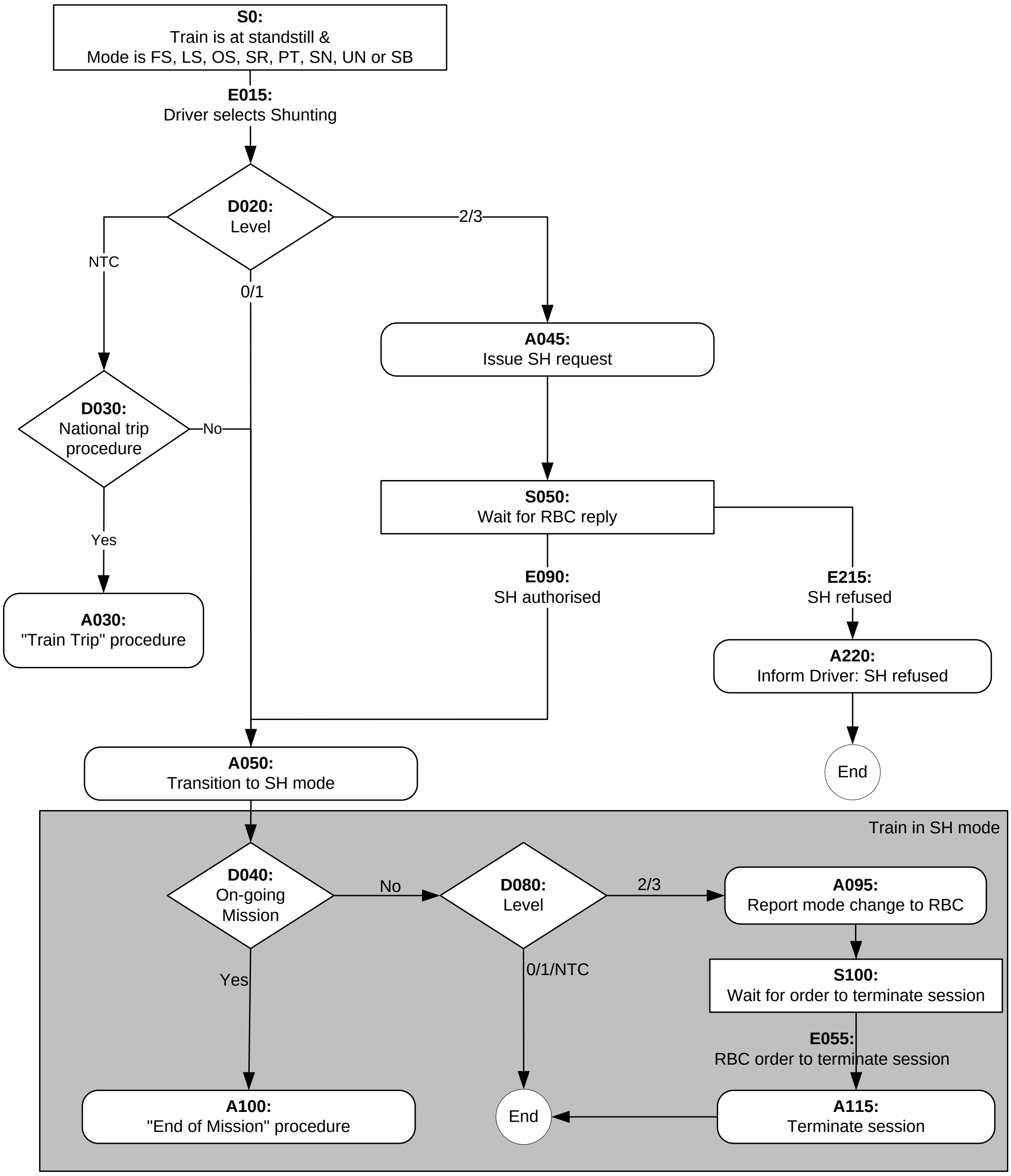

Figure 2: Flowchart for "Shunting Initiated by Driver"

5.6.4 Degraded Situation

5.6.4.1 ERTMS/ETCS level 2 or 3: no answer to Shunting request is received from the RBC

5.6.4.1.1 In case a communication session is established and no reply is received from the RBC within a fixed waiting time (see appendix to chapter 3, List of Fixed Value Data) after sending the "Request for Shunting" message, the message shall be repeated with the fixed waiting time after each repetition.

5.6.4.1.2 After a defined number of repetitions (see appendix to chapter 3, List of Fixed Value Data), and if no reply is received within the fixed waiting time from the time of the last sending of “Request for Shunting”,. the ERTMS/ETCS onboard equipment shall inform the driver and shall terminate the communication session.

5.6.4.1.3 If no authorisation for SH mode can be received from the RBC, refer to procedure “Override”.

5.6.4.2 ERTMS/ETCS level 2 or 3: in case a communication session is established and no order to terminate the session is received from the RBC within a fixed waiting time (see appendix to chapter 3, List of Fixed Value Data) after reporting the mode change, the report shall be repeated with the fixed waiting time after each repetition

5.6.4.3 After a defined number of repetitions (see appendix to chapter 3, List of Fixed Value Data), and if no reply is received within the fixed waiting time from the last sending of the mode change report, the ERTMS/ETCS onboard equipment shall terminate the communication session.

5.7 Entry in Shunting with Order from Trackside

5.7.1 General Requirements

5.7.1.1 This procedure is used to allow the entry of a train into a shunting area.

5.7.1.2 Note: The shunting area, possibly including a "safety envelope", can be already occupied by shunting units, not controlled by the trackside. It is therefore possible that the train shall enter into the shunting area in OS mode. The switch to OS is performed according to the relevant procedure.

5.7.1.3 The order to switch to SH mode shall be given by means of a mode profile, optionally with a list of balises groups, which the train can pass when the ERTMS/ETCS on-board equipment is in shunting mode.

5.7.1.4 The switch to shunting, if the transition to shunting was ordered by trackside, requires a driver acknowledgement, according to the specifications below.

5.7.1.5 When the ERTMS/ETCS on-board equipment has switched to Shunting mode, End of Mission, according to chapter 5.5.2.3, is performed.

5.7.2 Shunting is requested for the current location (from modes different from Stand By and Post Trip)

5.7.2.1 In a level 1 area, or at the border from a level 0 to a level 1 area, the beginning of the shunting area can be the location where a balise group is installed. In level 2/3 it is possible to send an ERTMS/ETCS on-board equipment the order to switch to shunting at the current location.

5.7.2.2 Shunting is requested for the current location means that, according to the mode profile received the max safe front end of the train is at or in advance of the location for which switching to SH mode is requested.

5.7.2.3 The ERTMS/ETCS on-board equipment shall switch immediately to SH mode and a request for acknowledgement shall be displayed to the driver (refer to SRS chapter 4, transitions between modes).

5.7.2.4 If the driver does not acknowledge within the driver acknowledgement time (refer to Appendix A3.1) after the change to SH mode, the service brake command shall be triggered. The command shall be released as soon as the driver acknowledges (unless the command was triggered also for other reasons).

5.7.3 Shunting is requested for a further location

5.7.3.1 An order to switch to SH at a further location can be sent

a) in a level 1 area by a balise group,

b) in a level 2 or 3 area by the RBC.

5.7.3.2 A request for acknowledgement shall be displayed to the driver, when the following two conditions are fulfilled:

a) the distance between the estimated front end of the train and the beginning of shunting area is shorter than a value, contained in the mode profile

b) the speed is lower than the Shunting mode speed limit (National Value, or value given in the mode profile)

5.7.3.3 Once the request for acknowledgement is displayed, it shall not be taken back, even if the above conditions are no more fulfilled (e.g., the train accelerates).

5.7.3.4 Until the ERTMS/ETCS on-board equipment has switched to SH mode, according to the mode profile, the beginning of the shunting area shall be considered either as the EOA (keeping the SvL given by the MA) or as both the EOA and SvL (instead of the EOA and SvL given by the MA), with no release speed.

5.7.3.5 When the driver acknowledges, the ERTMS/ETCS on-board equipment shall immediately switch to SH mode (refer to chapter 4, transitions between modes).

5.7.3.6 If the max safe front end of the train reaches the beginning of the shunting area according the mode profile and the driver has not yet acknowledged, the ERTMS/ETCS on-board equipment shall switch immediately to SH mode and a request for acknowledgement shall be displayed to the driver (refer to SRS chapter 4, transitions between modes).

5.7.3.7 If, in this case, the driver does not acknowledge within the driver acknowledgement time (refer to Appendix A3.1) after the change to SH mode, the service brake command shall be triggered. The command shall be released as soon as the driver acknowledges (unless the command was triggered also for other reasons).

5.7.4 Shunting from Stand By or Post Trip mode

5.7.4.1 When performing a SoM or a Train Trip procedure and when the current level is 2 or 3, the ERTMS/ETCS on-board equipment can receive a mode profile giving an Shunting area which the train has already entered with its max safe front end. In this case, the ERTMS/ETCS on-board equipment shall first require an acknowledgement from the driver.

5.7.4.2 When the driver acknowledges, the ERTMS/ETCS on-board equipment shall perform transition to Shunting mode.

5.7.5 Flowchart

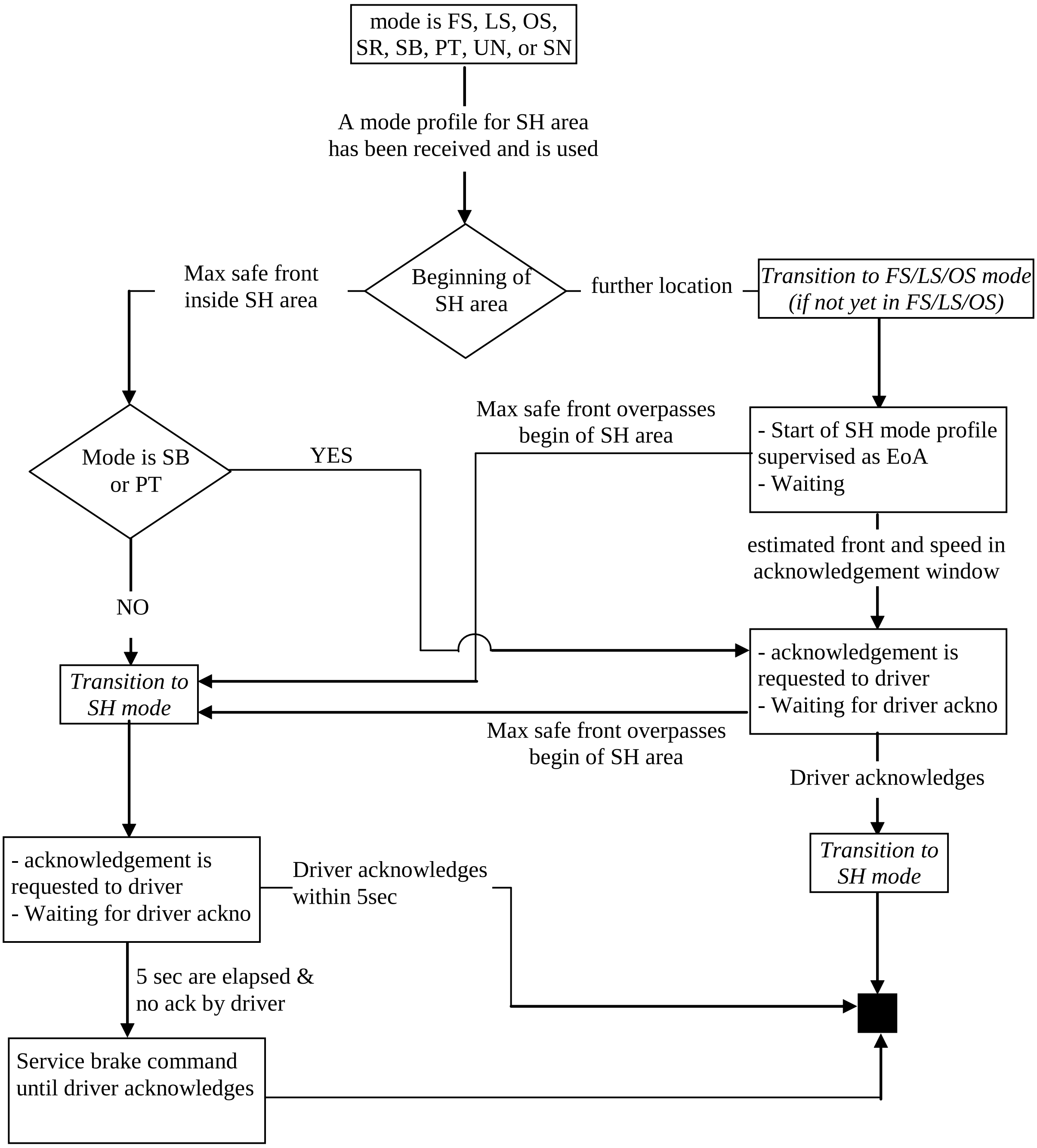

Figure 3: Flowchart for "Entry in Shunting with Order from Trackside"

5.8 Procedure Override

5.8.1 Introduction

5.8.1.1 In specific degraded situations (for example in the case of a failed signal, failed track circuit, failed point…), railways allow a train to pass its EOA.

5.8.1.2 For ERTMS/ETCS, passing an EOA can be required in degraded situations, e.g.

- In level 2/3, if a train is stopped without MA in a location where radio is unavailable (e.g. after having received an emergency message, or after a train trip).
- In level 2/3, if a train is stopped at the border between two adjacent RBCs (e.g. the interface between RBCs is unavailable).
- In level 2/3, if a train is stopped after having passed the border between two adjacent RBCs (e.g. the connection to the Accepting RBC cannot be established).
- In level 2/3, if the RBC is unable to give a permission to run (e.g. lost connection with the interlocking)
- In level 1, if a signal cannot show a proceed aspect (e.g., signal failure, route cannot be set)
- In level 1, if a train is stopped without MA (e.g. after the MA has been shortened due to a time-out).

5.8.1.3 In level 0/NTC areas, passing a signal at danger is only a national procedure. The ERTMS/ETCS on-board equipment is not involved in this procedure, since it does not supervise the train movements.

5.8.1.4 In ERTMS equipped areas (level 1, 2 or 3), locations where the train shall stop are supervised by the ERTMS/ETCS on-board equipment. Receiving an order from the signalman to pass the EOA, the driver must then be able to inhibit this supervision.

5.8.1.4.1 **Note:** The driver must not use the “Override” procedure unless authorised by trackside personnel. This authorisation is covered by operational procedures.

5.8.1.5 If an EOA must be passed between announcement and execution of the level transition from an unfitted area (level 0) or from an area fitted with a National System (level NTC) to an ERTMS equipped area (level 1, 2, 3), the signalman gives the order to the driver to select “override”.

5.8.1.6 **Note**: Passing the EOA by using this procedure the driver is fully responsible for the train driving. Therefore Staff Responsible mode is entered when the driver selects “override”.

5.8.1.7 In addition the procedure allows to avoid a train trip when passing a balise group:

a) transmitting "stop in SR mode"

b) not contained in the list of expected balises in SR mode

c) transmitting "stop in SH mode"

d) not contained in the list of expected balises in SH mode"

e) Intentionally deleted

5.8.1.8 Further, the Override procedure allows a train in SR mode reaching the end of the SR distance to proceed (see also 4.4.11.1.4)

5.8.2 Selection of "Override"

5.8.2.1 The ERTMS/ETCS on-board equipment shall allow the driver to select "Override" (i.e. the "Override" button becomes available) only when:

a) The train speed is under or equal to the speed limit for triggering the "override" function (national value) AND

b) The current mode is Full Supervision, Limited Supervision, On Sight, Staff Responsible, Shunting, Unfitted, Post Trip, Stand By (in level 2/3 only) or SN (National System) AND

c) Validated Train Data is available (except when already in Shunting mode).

5.8.2.2 Intentionally deleted.

5.8.2.3 The "Override" procedure shall be triggered when selected by the driver.

5.8.3 Once the "Override" procedure has been triggered

5.8.3.1 The mode shall change as follows:

a) If the current mode is Full Supervision, Limited Supervision, On Sight, Stand-By or Post Trip, the mode shall immediately switch to the Staff Responsible (SR) mode (if the mode is already SR it remains unchanged)

b) If the current mode is Shunting the mode shall remain unchanged

c) If the current mode is Unfitted (level 0 area) or SN (level NTC area) the mode shall only change to Staff Responsible when the level changes to 1,2 or 3 (refer to SRS chapter 4, transitions between modes)

5.8.3.1.1 If the mode, when activating Override, is OS, LS or FS, the former EOA shall be retained. If the mode is SB or PT, the current position of the train front shall be considered as the former EOA.

5.8.3.1.2 Note: This former EOA will be used as a Trip condition if the Override function is no longer active. Any further activation of the Override in SR mode has no effect on the former EOA.

5.8.3.1.3 The former EOA shall be deleted if:

a) the train reads the information "stop in SR mode" from a balise group OR

b) SR mode is left.

5.8.3.2 **Note 1:** In level 2, 3, if radio communication is available, the RBC is only informed that the Override has been triggered by means of the reported mode change (if there is any)

5.8.3.3 **Note 2:** In level 2,3, if the ERTMS/ETCS- onboard equipment is able to report the mode change to the RBC, the RBC may transmit limits for the distance to run in SR mode (overriding the national value), a list of balises to be passed in SR mode (refer to chapter 4, Staff Responsible mode)

5.8.3.4 **Note 3:** In level 2,3, the transition to SR mode triggered by selecting Override revokes all emergency stop orders previously received.

5.8.3.5 In SR mode the driver may modify the value of the SR mode speed limit and of the distance to run in SR mode (refer to chapter 4, Staff Responsible mode)

5.8.3.6 The train trip shall be inhibited (suppression of the transition to the Trip mode), and only in level 0, 1, 2, 3, the MRSP shall include the Override function related Speed Restriction (see 3.11.10) as long as the Override function is active.

5.8.3.7 The status “override active” shall be indicated to the driver.

5.8.3.8 As long as the Override function is active, new SR distance information received from EUROLOOP shall be rejected.

5.8.3.9 When “Override” is selected and Override is already active, the supervision of the time and distance (see 5.8.4.1 a) and b)) for train trip suppression shall be re-started.

5.8.4 End of Override procedure

5.8.4.1 The Override procedure shall end when at least one of the following conditions is fulfilled:

a) The "max. time for train trip suppression when Override function is triggered" (national value) elapses after Override has been selected, OR

b) The train has run more than the "distance for train trip suppression when Override function is triggered" (national value) after Override has been selected, OR

c) The former EOA has been passed with the min safe antenna position (calculated by subtracting distance between active EUROBALISE antenna and the front end of the train from the min safe front end position), OR

d) The train passes a balise group giving “stop in SR” or “stop in SH” information, OR

e) The train passes a balise group giving proceed information (i.e., MA with no signalling related speed restriction of value zero)

f) In level 2,3, an MA is received from the RBC

g) The train passes a balise group not in the list of expected balises in SR mode or the list of expected balises in SH mode

h) The train overpasses the SR distance supervised before overriding with its estimated front end

i) The ERTMS/ETCS on-board equipment switches to TR, LS, OS or SH mode.

5.8.4.1.1 Note: For modes UN and SN, only end conditions a) and b) are supervised.

5.8.4.2 Intentionally deleted.

5.8.4.3 Intentionally deleted.

5.9 Procedure On-Sight

5.9.1 General Requirements

5.9.1.1 The ERTMS/ETCS on-board equipment shall be in On Sight mode before the train reaches the beginning of the On Sight area or, at the latest, when the train reaches the beginning of the On Sight area.

5.9.1.2 An acknowledgement for running in On Sight mode shall be requested from the driver. The conditions of the acknowledgement are specified below.

5.9.2 On Sight is requested for current location (from modes different from Stand By and Post Trip)

5.9.2.1 In a level 1 area, the beginning of the On Sight area can be the balise (group) that gives the Mode Profile. When the train passes the balise group and receives this information, the ERTMS/ETCS on-board equipment shall immediately switch to On Sight mode.

5.9.2.2 In a level 2 or 3 area, the ERTMS/ETCS on-board equipment can receive a mode profile giving an On Sight area which the train has already entered with its max safe front end. In this case, the ERTMS/ETCS on-board equipment shall immediately switch to On Sight mode.

5.9.2.3 The driver must acknowledge the On Sight mode. A request of acknowledgement shall be displayed to the driver.

5.9.2.4 If the driver has not acknowledged after the driver acknowledgement time (refer to Appendix A3.1), the service brake command shall be triggered. The brake command is released when the driver acknowledges, except if brakes are also applied for another reason(s).

5.9.2.5 **Note**: Once in On Sight mode, the speed supervision is such that the train speed cannot exceed the OS mode speed limit. If, when entering the On Sight mode, the train speed was higher than the OS mode speed limit (because a higher speed was allowed in Full Supervision mode, in Limited Supervision mode or in Staff Responsible mode) then a service/emergency brake command could be immediately triggered, independently of the acknowledgement of the driver, but because of the On Sight supervision (see Figure 4).

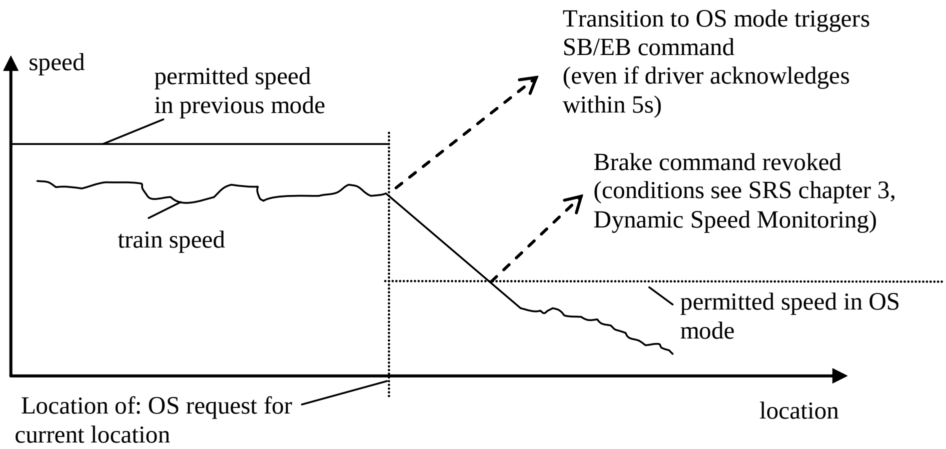

Figure 4: Train enters OS area with too high speed

5.9.2.6 **Note**: This sharp brake reaction can be avoided in Full Supervision or Limited Supervision mode by giving with the previous MA an EOA (or a LOA = OS mode speed limit) at the location of transition to On Sight mode. In Staff Responsible mode, lateral signals (if available) can also order the driver to decrease the train speed.

5.9.2.7 If the ERTMS/ETCS on-board equipment is already in OS mode when receiving the OS mode profile, no further acknowledgement shall be requested from the driver.

5.9.3 On Sight is requested for a further location

5.9.3.1 The beginning of the On Sight area can be a location that the train has not reached yet. This occurs when:

a) In a level 1 area, a balise group gives a Mode Profile with an On Sight area that is located at a further location.

b) In a level 2 or 3 area, the RBC gives a Mode Profile with an On Sight area that is located at a further location.

5.9.3.2 A request for acknowledgement shall be displayed to the driver when the following conditions are fulfilled:

a) The distance between the estimated front end of the train and the beginning of On Sight area is shorter than a value, contained in the mode profile.

b) The speed is lower than the On Sight mode speed limit (national value, or value given in the mode profile).

c) The current mode is not On Sight

5.9.3.3 **Note**: The first 2 conditions define the “rectangle of acknowledgement”.

5.9.3.4 Once the acknowledgement request is displayed, it is not taken back if the train leaves the “rectangle of acknowledgement” (for example: because the train accelerates).

5.9.3.5 Until the ERTMS/ETCS on-board equipment has switched to OS mode, according to the mode profile, the beginning of the On Sight area shall be temporarily considered either as the EOA (keeping the SvL given by the MA) or as both the EOA and SvL (instead of the EOA and SvL given by the MA), with no Release Speed.

5.9.3.6 When the driver acknowledges the On Sight mode, the ERTMS/ETCS on-board equipment shall immediately switch to the On Sight mode.

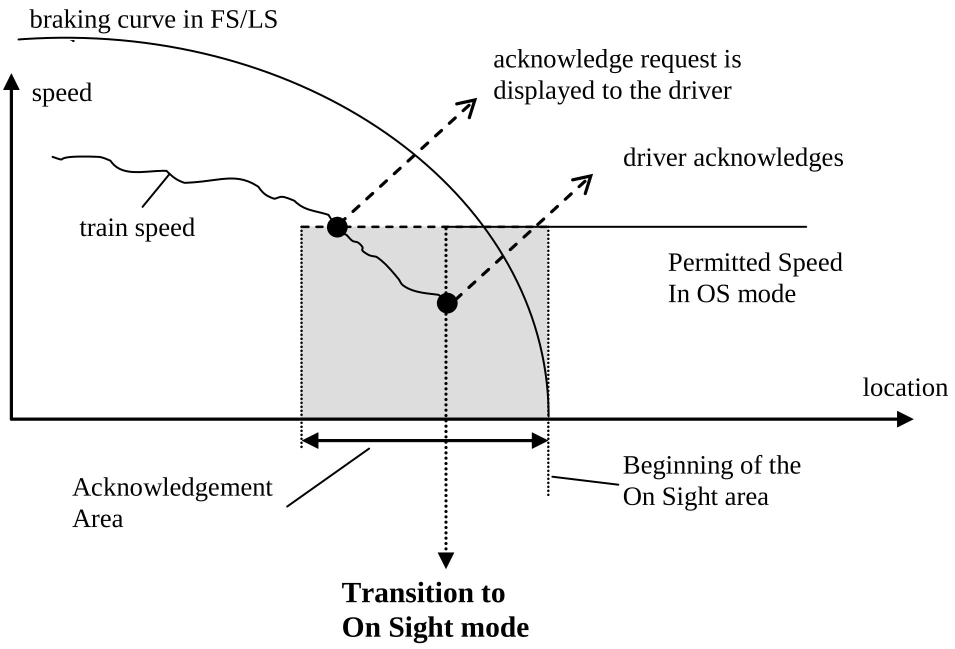

Figure 5: Transition from FS/LS to OS mode after driver acknowledgement

5.9.3.7 If the max safe front end of the train reaches the beginning of the On Sight area according to the mode profile and the driver has not yet acknowledged, the ERTMS/ETCS on-board equipment shall switch immediately to OS mode and a request for acknowledgement shall be displayed to the driver (refer to SRS chapter 4, transitions between modes).

5.9.3.8 If, in this case, the driver does not acknowledge within the driver acknowledgement time (refer to Appendix A3.1) after the change to OS mode, the service brake command shall be triggered. The command shall be released as soon as the driver acknowledges (unless the command was triggered also for other reasons).

5.9.4 On Sight from Unfitted or SN mode

5.9.4.1 The mode profile with regards to an OS area is only evaluated in levels 1,2,3, although the mode profile may have been received in level 0 (Unfitted mode) or NTC (SN mode). A transition to On Sight mode can therefore earliest occur at a transition of level: from level 0 or NTC to level 1 or 2 or 3.

5.9.4.2 Specifications of chapters 5.9.2 and 5.9.3 about the acknowledgement shall apply here.

5.9.5 On Sight from Stand By or Post Trip mode

5.9.5.1 When performing a SoM or a Train Trip procedure and when the current level is 2 or 3, the ERTMS/ETCS on-board equipment can receive a mode profile giving an On Sight area which the train has already entered with its max safe front end. In this case, the ERTMS/ETCS on-board equipment shall first require an acknowledgement from the driver.

5.9.5.2 When the driver acknowledges, the ERTMS/ETCS on-board equipment shall perform the transition to On Sight mode.”

5.9.6 Exit of On Sight mode

5.9.6.1 General rule

5.9.6.1.1 The ERTMS/ETCS on-board equipment exits the On Sight mode when the min safe front end of the train passes the end of the On Sight area.

5.9.6.2 First case: The On Sight area ends at the EOA of the current MA

5.9.6.2.1 This occurs when the end of the On Sight area that is given by the Mode Profile has the same location as the EOA of the related MA.

5.9.6.2.2 In this case, the train must receive a new Movement Authority to be able to exit the On Sight area.

5.9.6.2.3 Note: In an On Sight area there is no guarantee for the RBC that the track in front of the supervised train is free. Therefore, if the next block section is free, the RBC has nevertheless to ensure that there is no train/vehicle between the train and the end of the On Sight area. This information

- can be given to the RBC by the signalman or any other trackside means (outside scope of ERTMS/ETCS), or
- can be inquired by the RBC by means of the following mechanism: the RBC sends a “track ahead free” request which the ERTMS/ ETCS on-board equipment displays to the driver. If the driver confirms that the track is free up to the end of the current section, the ERTMS/ ETCS on-board equipment will transmit this information to the RBC.

5.9.6.2.4 Note: Receiving the “track ahead free” information, the RBC may be able to transmit an MA from the current position of the train, e.g., for Full Supervision (refer to SRS chapter 4, transitions between modes).

5.9.6.3 Second case: The On Sight area ends before the EOA of the current MA

5.9.6.3.1 In this case, the current Movement Authority already allows the train to exit the On Sight area.

5.9.6.3.2 When exiting the On Sight area, the ERTMS/ETCS on-board equipment switches either to Full Supervision, to Limited Supervision or to Shunting mode (refer to SRS chapter 4, transitions between modes).

5.9.7 Flowchart

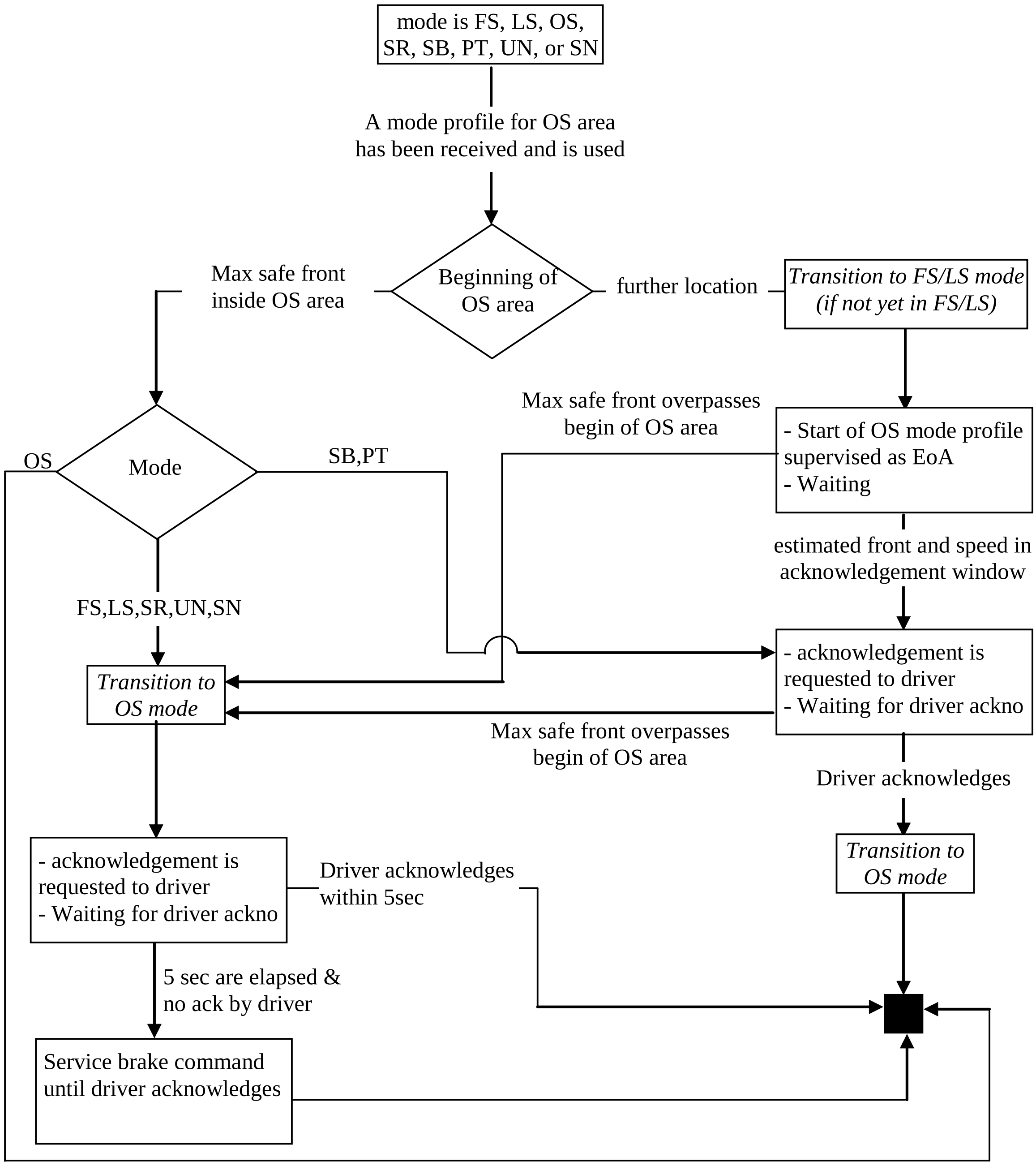

Figure 6: Flowchart for "On-Sight"

5.10 Level Transitions

5.10.1 General requirements

5.10.1.1 Every level transition border to levels 2, 3, or NTC shall be announced to the ERTMS/ETCS on-board equipment via balise group or via the RBC.

5.10.1.2 A level transition announcement to the ERTMS/ETCS on-board equipment shall consist of an order to execute the level transition at a further location corresponding to the border.

5.10.1.3 When the ERTMS/ETCS on-board equipment receives a level transition announcement, and if this announcement will result in a change of the on-board level, it shall immediately inform the driver about the announced level transition.

5.10.1.3.1 Note: In a mixed level area the actual level of the on-board equipment may remain unchanged even though a level transition boundary is passed.

5.10.1.4 At the level transition border a balise group shall be placed with an immediate level transition order or a conditional level transition order.

5.10.1.4.1 **Note**: Balise groups are read in all levels and level transition orders and conditional level transition orders from balises are accepted independent of the level of operation. Also sleeping units read balise groups.

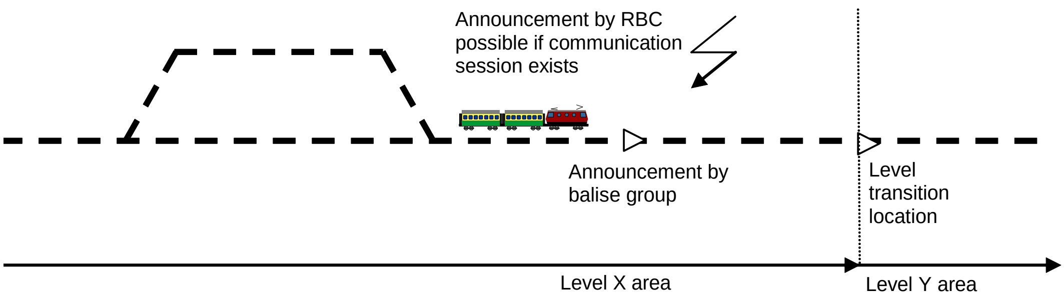

Figure 7: Transition from level X area to level Y area

5.10.1.5 If the message from the border balise group is not received, the level transition shall still be executed when the estimated front end passes the location given in the announcement.

5.10.1.6 The on-board equipment shall manage only one level transition order at a time. Therefore a new level transition order shall replace a previously received order, i.e. if a new order to switch to a different level or to the same level but at a different location is received, before the action from the first order has been performed, only the last order shall be executed.

5.10.1.6.1 In Shunting and Passive Shunting modes only one set of Level Transition Information shall be stored at a time. Therefore a set of Level Transition Information received shall replace any Level Transition Information already stored on-board.

5.10.1.7 As soon as the announcement of the level transition has been received, some data (mainly movement authority and track description data) from the transmission media of the new level shall be accepted, but shall not be used until the level transition is effective.

5.10.1.7.1 Note: for the exhaustive list of accepted/rejected information, please refer to SRS chapter 4.8.

5.10.1.7.2 Note: if only track description has been received from the new media without any movement authority, this track description still replaces the one previously received from the current media when the transition is performed.

5.10.1.8 When the onboard has performed the level transition, further data (mainly movement authority and track description data) received from the transmission media of the level being left shall be rejected.

5.10.1.8.1 Note: for the exhaustive list of accepted/rejected information, please refer to SRS chapter 4.8.

5.10.1.9 Intentionally deleted.

5.10.2 Table of priority of trackside supported levels

5.10.2.1 Any combination of ERTMS/ETCS levels 0, NTC, 1, 2, and 3 on a given area shall be possible.

5.10.2.2 The level transition announcement and the immediate or conditional level transition order at the border shall contain all the supported ERTMS/ETCS levels with a table of priority. Even if only one level is permitted this is considered as a table of priority.

5.10.2.2.1 Note: Level 0 is considered in the same way as the other levels. This means that, for example, when an area permits ERTMS/ETCS level 0, and is fitted with ERTMS/ETCS level 1 and 2, the track-side includes levels 0, 1 and 2 in a table of priority of supported levels in all level transition orders and conditional level transition orders applying to that area.

5.10.2.3 The table of priority shall list all the supported levels from the highest priority level to the lowest one.

5.10.2.3.1 Intentionally deleted.

5.10.2.4 When receiving the information about all ERTMS/ETCS levels that are supported by trackside, the ERTMS/ETCS on-board equipment shall select from the table the level with the highest priority, which is available for use by the onboard equipment.

5.10.2.4.1 The on-board equipment shall consider an ERTMS/ETCS level as “Available for use” as follows:

a) Level 2 or 3: the level is configured on-board and at least one Mobile Terminal is available on-board, i.e. the ETCS onboard has detected at least one Mobile Terminal in working condition, independently whether it is registered to a network or not.

b) Level NTC: the concerned National System is available on-board (if an STM is used, refer to SUBSET-035 for further details).

c) Level 0 or 1: always.

5.10.2.4.1.1 Note regarding a) and b): how the ERTMS/ETCS on-board equipment checks the availability of the Mobile Terminals or of the National System (in case no STM is used) is an implementation issue.

5.10.2.4.2 Examples: The table of trackside supported levels gives 2, NTC X, 1, NTC Y. If level 1, 0 and NTC X are “Available for use”, the ERTMS/ETCS on-board will select NTC X level. If level 1, 0 and NTC Y are “Available for use”, it will select level 1. If level 2, 1 and 0 are “Available for use”, it will select level 2.

5.10.2.5 When the onboard has selected the level it will switch to, it shall carry out the level transition as if it has received a level transition order to this level only i.e. it shall ignore the requirements related to transitions to the other levels.

5.10.2.6 The ERTMS/ETCS on-board equipment shall inform the driver about the selected level transition only.

5.10.2.7 If none of the ordered level(s) is available for use by the ERTMS/ETCS on-board equipment, it shall nevertheless make the transition, to the ordered level with the lowest priority.

5.10.2.7.1 **Justification:** The On-board equipment will then indicate the trackside level to the driver to allow him to select the correct procedures for degraded situations.

5.10.2.8 The ERTMS/ETCS on-board equipment shall store the table of priority of trackside supported ERTMS/ETCS levels.

5.10.2.9 Intentionally deleted.

5.10.2.10 Intentionally deleted.

5.10.2.10.1 Intentionally deleted.

5.10.3 Specific Additional Requirements

5.10.3.1 Transition from Level 1 to Level 2/3 area

5.10.3.1.1 An order to connect to the RBC with a given id and telephone number shall be given via balise group in rear of the border location.

5.10.3.1.2 For the train to be able to enter the new area, the old area must possess information about at least the first section of the new area. The information may be transmitted to the train either:

a) as an MA and track description information into the new area, or

b) as a target speed at the border location i.e. as an LOA.

5.10.3.1.3 When the ERTMS/ETCS communication session is open, Train Data shall be sent to the RBC (which acknowledges the data) unless the onboard equipment is in SL or NL mode.

5.10.3.1.4 If no Level 2/3 MA and track description has been received when entering the new area, the train shall still be supervised according to the level 1 MA previously received.

5.10.3.1.5 When the ERTMS/ETCS on-board equipment has switched to the new level, it shall report the new on-board level, including a position report.

5.10.3.1.6 If an order to connect to an RBC has been received and the train will not enter the announced RBC area, an order to terminate the session shall be sent either from balises or from the RBC for any route not leading to the RBC area. This is the case both if the train turns back and if the train continues in the same direction, but on another route.

5.10.3.2 Transition from Level 0 (Unfitted) to Level 2/3 area

5.10.3.2.1 An order to connect to the RBC with a given id and telephone number shall be given via balise group in rear of the border location.

5.10.3.2.2 When the ERTMS/ETCS communication session is open, Train Data shall be sent to the RBC (which acknowledges the data) unless the onboard equipment is in SL or NL mode.

5.10.3.2.3 A level 2/3 MA and track description information shall be received from the RBC before the level transition border. If not, the train shall be tripped at passage of the border, i.e. after switching to level 2 or 3, movement is not allowed without a movement authority (refer to SRS chapter 4, transitions between modes).

5.10.3.2.4 The driver is responsible for entering the level 2/3 area at a speed not exceeding the speed limits of the unequipped line.

5.10.3.2.5 When the ERTMS/ETCS on-board equipment has switched to the new level, it shall report the new on-board level, including a position report.

5.10.3.2.6 If an order to connect to an RBC has been received and the train will not enter the announced RBC area, an order to terminate the session shall be sent either from balises or from the RBC for any route not leading to the RBC area. This is the case both if the train turns back and if the train continues in the same direction, but on another route.

5.10.3.3 Transition from Level 2/3 to Level 1 area

5.10.3.3.1 For the train to be able to enter the new area, the old area must possess information about at least the first section of the new area. The information may be transmitted to the train either

a) as an MA and track description information into the new area, or

b) as a target speed at the border location i.e. as an LOA.

5.10.3.3.2 If no Level 1 MA and track description has been received when entering the new area, the train shall still be supervised according to the level 2/3 MA previously received from the RBC.

5.10.3.3.3 When the train has passed the level transition border with its min safe rear end, i.e. when the whole train has left the level 2/3 area, the onboard equipment of the leading engine shall send a position report to the RBC.

5.10.3.3.4 After receiving this exit position report, the RBC can order the train to terminate the session (leading and non-leading engines).

5.10.3.4 Transition from Level 0 (Unfitted) to Level 1 area

5.10.3.4.1 A level 1 MA and track description information shall be received before or at the level transition border. If not, when the level transition is performed, the train shall be tripped, i.e. after switching to level 1, movement is not allowed without a movement authority (refer to SRS chapter 4, transitions between modes).

5.10.3.4.2 The driver is responsible for entering the level 1 area at a speed not exceeding the speed limits of the unequipped line.

5.10.3.5 Transition from Level 1 to Level 0 (Unfitted) area

5.10.3.5.1 For the train to be able to enter the new area, the old area must possess information about at least the first section of the new area. The information may be transmitted to the train either

a) as an MA and track description information into the new area, or

b) as a target speed at the border location i.e. as an LOA.

5.10.3.5.2 Note: When entering UN mode, all MA and track description data is deleted (refer to SRS Chapter 4, What happens to stored data when entering a mode)

5.10.3.6 Transition from Level 2/3 to Level 0 (Unfitted) area

5.10.3.6.1 For the train to be able to enter the new area, the old area must possess information about at least the first section of the new area. The information may be transmitted to the train either

a) as an MA and track description information into the new area, or

b) as a target speed at the border location i.e. as an LOA.

5.10.3.6.2 When the train has passed the level transition border with its min safe rear end, i.e. when the whole train has left the level 2/3 area, the onboard equipment of the leading engine shall send a position report to the RBC.

5.10.3.6.3 After receiving this exit position report, the RBC can order the train to terminate the session (leading and non-leading engines).

5.10.3.6.4 Note: When entering UN mode, all MA and track description data is deleted (refer to SRS Chapter 4, What happens to stored data when entering a mode)

5.10.3.7 Transition from Level NTC to Level 2/3 area

5.10.3.7.1 An order to connect to the RBC with a given id and telephone number shall be given via balise group in rear of the border location.

5.10.3.7.2 When the ERTMS/ETCS communication session is open, Train Data shall be sent to the RBC (which acknowledges the data) unless the onboard equipment is in SL or NL mode.

5.10.3.7.3 A level 2/3 MA and track description information shall be received from the RBC before the level transition border. If not, the train shall be tripped at passage of the border, i.e. after switching to level 2 or 3, movement is not allowed without a movement authority (refer to SRS chapter 4, transitions between modes).

5.10.3.7.4 The driver is responsible for entering the level 2/3 area at a speed not exceeding the speed limits of the level NTC line.

5.10.3.7.5 When the level transition location is passed with the estimated front end a position report shall be sent to the RBC. In case the ERTMS/ETCS on-board equipment is interfaced to the National System through an STM, please refer to SUBSET-035 for the STM state transition order.

5.10.3.7.6 If an order to connect to an RBC has been received and the train will not enter the announced RBC area, an order to disconnect shall be sent either from balises or from the RBC for any route not leading to the RBC area. This is the case both if the train turns back and if the train continues in the same direction, but on another route.

5.10.3.8 Transition from Level NTC to Level 1 area

5.10.3.8.1 A level 1 MA and track description information shall be received before or at the level transition border. If not, when the level transition is performed, the train shall be tripped, i.e. after switching to level 1, movement is not allowed without a movement authority (refer to SRS chapter 4, transitions between modes).

5.10.3.8.2 The driver is responsible for entering the level 1 area at a speed not exceeding the speed limits of the Level NTC line.

5.10.3.8.3 In case the ERTMS/ETCS on-board equipment is interfaced to the National System through an STM, please refer to SUBSET-035 for the STM state transition orders in relation to the level transition announcement and border.

5.10.3.9 Transition from Level 1 to Level NTC area

5.10.3.9.1 For the train to be able to enter the new area, the old area must possess information about at least the first section of the new area. The information may be transmitted to the train either

a) as an MA and track description information into the new area, or

b) as a target speed at the border location i.e. as an LOA.

5.10.3.9.2 Intentionally deleted.

5.10.3.9.3 In case the ERTMS/ETCS on-board equipment is interfaced to the National System through an STM, please refer to SUBSET-035 for the STM state transition orders in relation to the level transition announcement and border.

5.10.3.10 Transition from Level 2/3 to Level NTC area

5.10.3.10.1 For the train to be able to enter the new area, the old area must possess information about at least the first section of the new area. The information may be transmitted to the train either

- as an MA and track description information into the new area, or
- as a target speed at the border location i.e. as an LOA.

5.10.3.10.2 Intentionally deleted.

5.10.3.10.3 When the train has passed the level transition border with its min safe rear end, i.e. when the whole train has left the level 2/3 area, the onboard equipment of the leading engine shall send a position report to the RBC.

5.10.3.10.4 After receiving this exit position report, the RBC can order the train to terminate the session (leading and non-leading engines).

5.10.3.10.5 In case the ERTMS/ETCS on-board equipment is interfaced to the National System through an STM, please refer to SUBSET-035 for the STM state transition orders in relation to the level transition announcement and border..

5.10.3.11 Transition from Level NTC (National System X) to Level NTC (National System Y)

5.10.3.11.1 Intentionally deleted.

5.10.3.11.2 In case the ERTMS/ETCS on-board equipment is interfaced to the National System through an STM, please refer to SUBSET-035 for the STM state transition orders in relation to the level transition announcement and border.

5.10.3.11.3 Intentionally deleted.

5.10.3.12 Transition from Level NTC to Level 0

5.10.3.12.1 In case the ERTMS/ETCS on-board equipment is interfaced to the National System through an STM, please refer to SUBSET-035 for the STM state transition orders in relation to the level transition announcement and border.

5.10.3.12.2 The driver is responsible for entering the level 0 area at a speed not exceeding the maximum speed of the Level NTC line.

5.10.3.12.3 Intentionally deleted.

5.10.3.13 Transition from Level 0 to Level NTC

5.10.3.13.1 Intentionally deleted.

5.10.3.13.2 In case the ERTMS/ETCS on-board equipment is interfaced to the National System through an STM, please refer to SUBSET-035 for the STM state transition orders in relation to the level transition announcement and border.

5.10.3.13.3 The driver is responsible for entering the level NTC area at a speed not exceeding the speed limits of the unequipped line.

5.10.3.14 Conditional level transition order

5.10.3.14.1 When the ERTMS/ETCS on-board equipment accepts a conditional level transition order the onboard shall check whether the current level is contained in the priority list of the conditional level transition order.

5.10.3.14.2 If the current level is contained in the priority list of the conditional level transition order, the onboard shall not change the level.

5.10.3.14.3 If the current level is not contained in the priority list of the conditional level transition order, the onboard shall evaluate the conditional level transition order in the same way as an immediate level transition order (see section 5.10.2).

5.10.3.14.4 In the same way as for a level transition order, the ERTMS/ETCS on-board equipment shall store the table of ERTMS/ETCS levels supported by trackside.

5.10.3.14.5 Note: The conditional level transition order allows to check, whether a train operates in a permitted level e.g. following a start of mission after a cold movement. The level of a train driving in a permitted level will not be changed, regardless of the priority of the current level operated by the train.

5.10.3.15 Transition initiated by driver

5.10.3.15.1 In addition to the level transitions ordered by trackside, it is also possible, at standstill, for the driver to change the ERTMS/ETCS level (refer to section 3.18.4.2).

5.10.3.15.2 If the driver changes the level to 2 or 3, the ERTMS/ETCS on-board equipment shall establish a communication session with the RBC:

a) immediately if at least one Mobile Terminal is registered to a Radio Network and a valid RBC ID/ phone number is available, OR

b) once the driver has selected the RBC contact information (by the same means as for Start of Mission), if either no Mobile Terminal is registered to a Radio Network or no valid RBC ID/phone number is available.

5.10.3.15.2.1 Note regarding b): If the level transition leads to TR mode, the request for RBC contact information is only displayed once the ERTMS/ETCS on-board equipment is in PT mode.

5.10.3.15.3 If the driver changes the level from 2 or 3 to any other, the ERTMS/ETCS on-board equipment shall report the new level to the RBC if a communication session is established. When receiving the level change report, the RBC shall order the communication session to be terminated.

5.10.4 Acknowledgement of the level transition

5.10.4.1 If defined so for the level transition (see table below), the driver shall be requested to acknowledge the transition

a) when the max safe front end of the train has passed a trackside defined location in rear of the level transition border

b) upon receipt of the order to switch to the new level immediately

5.10.4.1.1 Exception: An ERTMS/ETCS on-board equipment in NL mode shall not require an acknowledgement from the driver.

5.10.4.2 If the driver has not yet acknowledged within the driver acknowledgement time (refer to Appendix A3.1) after the level transition, a service brake command shall be initiated.

5.10.4.3 The driver shall then acknowledge the level transition in order to release the service brake command.

5.10.4.4 For the following transitions marked as "YES", the level transition announcement shall define the location from where an acknowledgement is required:

		Acknowledgement when entering				
		L 0	L 1	L 2	L 3	L NTC
Coming from ...	L 0	-	No	No	No	Yes
	L 1	Yes	-	No	No	Yes
	L 2	Yes	No	-	No	Yes
	L 3	Yes	No	No	-	Yes
	L NTC	Yes	Yes	Yes	Yes	Yes

5.11 Procedure Train Trip

5.11.1 Introduction

A train can be tripped for various reasons: refer to SRS chapter 4, mode transition table.

5.11.2 Table of requirements for “Train Trip” procedure

5.11.2.1 The ID numbers in the table are used for the representation of the procedure in form of a flowchart in section 5.11.3.

5.11.2.2 Procedure

ID #	Requirements	Level
S010	The ERTMS/ETCS on-board equipment is in one of the following modes: FS, LS, OS, SR, SB, SH, SN or UN When an event occurs, which leads to train trip reaction (**E015 –** refer to chapter 4, transitions between modes), the process shall go to **A025**.	0,NTC, 1,2,3
A025	The mode shall change to TR. The process shall go to **A030**.	1,2,3
D020	If the level is 0/1/NTC, the process shall go to **A035**. If the level is 2/3, the process shall go to **A030**.	
A030	The ERTMS/ETCS on-board equipment shall report the mode change to the RBC The process shall go to **A035**.	2, 3
A035	All current MA and track description data, except track conditions, shall be deleted and new ones shall not be accepted The process shall go to **S050**.	1,2,3
S050	The ERTMS/ETCS on-board equipment awaits standstill. While braking a border to a level 0 or NTC area may be passed. When the train has come to standstill (**E055**), the process shall go to **S060**.	0,1,2,3, NTC
S060	The ERTMS/ETCS on-board equipment shall display the "Request for driver acknowledgement to Train Trip" to the driver. When the driver acknowledges the Train Trip (**E065**), the process shall go to **D080**.	0,1,2,3, NTC

ID #	Requirements	Level
D80	If the level is 1, 2 or 3 the process shall go to **A105**. If the level is 0 or NTC, the process shall go to **D085**	0,1,2,3, NTC
A105	The mode shall change to PT and the ERTMS/ETCS on-board equipment revokes the emergency brake command. For the supervision provided by the PT mode refer to SRS chapter 4. The process shall go to **D110**.	1,2,3
D085	If no valid Train Data is stored on-board, the process shall go to **A140** If valid Train Data is stored on-board, the process shall go to **D090**	
A140	The mode shall change to SH and the process shall **END**.	
D090	If the level is 0, the process shall go to **A145**. If the level is NTC, the process shall go to **A150**.	
A145	The mode shall change to UN and the process shall **END**.	
A150	The mode shall change to SN and the process shall **END**.	0,NTC
D110	If the level is 1, the process shall go to **S140**. If the level is 2 or 3, the process shall go to **A115**.	1,2,3
A115	The mode change to PT shall be reported to the RBC which shall acknowledge the mode report (Recognition of exit from TR). The process shall go to **S120**.	2, 3
S120	The ERTMS/ETCS on-board equipment waits for the RBC to acknowledge the transition to PT. When the acknowledgement is received from the RBC (**E125**), the process shall go to **D130**. Note: See 5.11.4 for degraded situation (no response received).	
D130	If there is at least one pending emergency stop, the process shall go to **S130**. If there are no pending emergency stops the process shall go to **S140**.	
S130	The ERTMS/ETCS on-board equipment waits for the RBC to revoke ALL pending emergency stops. When all emergency stops are revoked (**E135**) the process shall go to **S140**.	2,3

ID #	Requirements	Level
S140	The ERTMS/ETCS on-board equipment shall offer the possibility to the driver to select "start" (only if train data has been previously entered), or to select SH a) if the driver selects "start" and the level is 1 (**E150**), the process shall go to **S160** b) and the driver selects "start" and the level is 2 or 3 (**E155**), the process shall go to **S150** c) If the driver selects SH (**E145**), the process shall continue in the same ways as the procedure “Shunting initiated by the driver”. If the SH request is refused by the RBC (**E165**) the process shall return to **S140**.	1,2,3
S150	The ERTMS/ETCS on-board equipment shall send an MA request to the RBC and wait. a) If an SR authorisation is received from RBC (**E26**), the process shall go to **S160** b) If an MA allowing OS/LS/SH is received from RBC (**E175**), the process shall go to **S170** c) If an MA allowing FS is received from RBC (**E170**), the mode shall change to FS (refer to SRS chapter 4, transitions between modes: transition from PT to FS) and the process shall **END**.	2,3
S160	The ERTMS/ETCS on-board equipment shall request an acknowledgement from the driver for running in SR mode. When the driver acknowledges (**E180**), the mode shall change to SR (refer to SRS chapter 4, transitions between modes: transition from PT to SR) and the process shall **END**.	1,2,3
S170	The ERTMS/ETCS on-board equipment shall request an acknowledgement from the driver for running in OS/LS/SH mode. When the driver acknowledges (**E185**), the mode shall change to OS/LS/SH (refer to SRS chapter 4, transitions between modes: transition from PT to OS/LS/SH) and the process shall **END**.	2,3

5.11.3 Flowchart

5.11.3.1 The ID numbers in the flowchart refer to the ID numbers of the table in section 5.11.2.

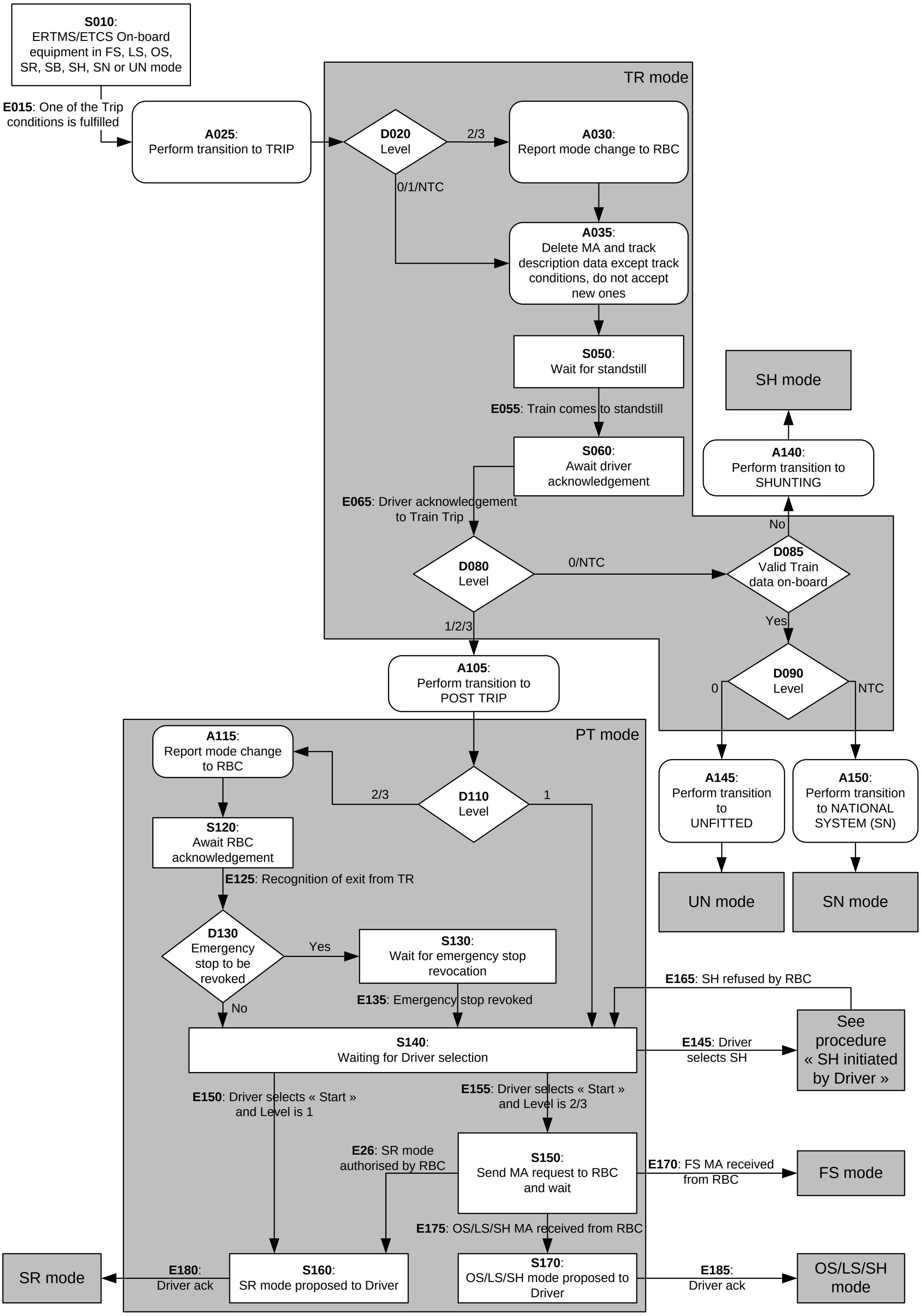

Figure 8: Flowchart for "Train Trip"

5.11.4 Degraded Situations

5.11.4.1 ERTMS/ETCS level 2 or 3: no acknowledge for PT mode is received from the RBC

5.11.4.1.1 In case a communication session is established and no reply is received from the RBC within a fixed waiting time (see appendix to chapter 3, List of Fixed Value Data) after reporting the mode change, the report shall be repeated with the fixed waiting time after each repetition.

5.11.4.1.2 After a defined number of repetitions(see appendix to chapter 3, List of Fixed Value Data) and if no reply is received within the fixed waiting time from the last sending of the mode change report, the ERTMS/ETCS onboard equipment shall terminate the communication session.

5.11.4.2 Nominally, accidental loss of an already open session (that can occur at any step) has not been taken into account for the design of the flowchart. However, should such a fault occur in any step while ERTMS/ETCS on-board equipment is in level 2/3 and in PT mode, the driver shall have the possibility to select "Override" and the process shall go to the procedure "Override "

5.12 Change of Train Orientation

5.12.1 Introduction

5.12.1.1 The scope of this procedure is the supervision of a train where the driver controls the train from the cab in the front of the train with the direction controller in FORWARD position.

5.12.1.2 This implies that when the driver has to change the orientation of the train, he has to change the driving cab.

5.12.1.3 The scope of this procedure is NOT shunting movements, during which the driver changes the running direction of the train without leaving the cab, by changing the position of the direction controller from FORWARD to REVERSE.

5.12.1.4 The scope of this procedure is NOT the backwards movement that is allowed in Post Trip or in Reversing mode.

5.12.2 The driver uses the same engine (a mission is on-going)

5.12.2.1 The situation is the following**:** The driver closes the desk A and leaves the cab A of the leading engine of the train, to go to cab B and open desk B of this same engine.

5.12.2.2 Desk A and desk B are connected to the same ERTMS/ETCS on-board equipment.

5.12.2.3 When the driver closes the desk A, the ERTMS/ETCS on-board equipment shall immediately go to Stand-By mode, which is considered as an end of mission (see “End of Mission” procedure)

5.12.2.4 When the driver opens the desk B, the “Start of Mission” procedure is triggered.

5.12.2.5 When the driver closes a desk and opens the other one of the same engine, the ERTMS/ETCS on-board equipment shall be able to calculate the new train position data (train front position, train orientation), by use of the previous data.

5.12.3 The driver leaves the engine to go to another one

5.12.3.1 The described situation is the following**:** The train has two engines (engine A and engine B). The engine A is the leading engine. The engine B is a slave engine. Each engine has its own ERTMS/ETCS on-board equipment.

a) If engine B is remote controlled, its ETCS on-board equipment is in Sleeping mode. Note: The mode is entered when on-board equipment detects the presence of the "remote control" signal.

b) If the slave engine is not remote controlled (Tandem operation) by the leading engine but there is a driver who controls the engine, then the on-board equipment is in Non leading mode.

c) If the engine B is not remote controlled (Tandem Shunting operation) by the leading engine and there is no driver who controls the engine, then the on-board equipment is in Passive Shunting mode.

5.12.3.2 Assumption: The train configuration does not change.

a) When changing the train orientation, the leading engine A will become the slave engine, and the slave engine B will become the leading engine.

b) If before the change of train orientation engine B was in SL, afterwards engine A will be in SL mode; If before the change of train orientation engine B was in NL, afterwards engine A will be in NL mode; If before the change of train orientation engine B was in PS, afterwards engine A will be in PS mode.

5.12.3.3 Case "Engine B was in SL mode"

5.12.3.3.1 The driver of engine A closes the desk, then the ERTMS/ETCS on-board equipment of engine A switches to Stand-By mode. If the train has a mission, this is a end of mission (see “End of Mission” procedure)

5.12.3.3.2 As soon as the remote control signal disappears, the ERTMS/ETCS on-board equipment of engine B switches to Stand-By mode.

5.12.3.3.3 Level 2,3: The ERTMS/ETCS on-board equipment of engine B shall open a communication session (if possible) and report the mode change to the RBC.

5.12.3.3.4 When the driver opens a desk of engine B he triggers the "Start of Mission" procedure.

5.12.3.4 Case "Engine B was in NL mode"

5.12.3.4.1 The driver of engine A selects "Non Leading". The ERTMS/ETCS equipment switches to Non Leading mode.

5.12.3.4.2 Once the non leading input signal is not received any more, the ERTMS/ETCS on-board equipment of engine B will switch to Stand-By mode (refer to SRS chapter 4, transitions between modes and chapter 5, “End of Mission” procedure).

5.12.3.4.3 Because the desk is open, when the ERTMS/ETCS on-board equipment enters Stand-By mode, the “Start of Mission” procedure is triggered.

5.12.3.5 Case "Engine B was in PS mode"

5.12.3.5.1 The driver of engine A selects "Continue Shunting on desk closure". The ERTMS/ETCS equipment switches to Passive Shunting mode once the driver closes the desk of engine A.

5.12.3.5.2 The driver opens a desk in engine B, and ERTMS/ETCS equipment switches to Shunting mode.

5.12.4 The driver uses the same engine (a Shunting movement is on-going)

5.12.4.1 The situation is the following: while the ERTMS/ETCS on-board equipment is in Shunting mode, the driver closes the desk A and leaves the cab A of the Shunting engine, to go to cab B and open desk B of this same engine.

5.12.4.2 Desk A and desk B are connected to the same ERTMS/ETCS on-board equipment.

5.12.4.2.1 Before closing the desk A, the driver enables the function “Continue Shunting on desk closure”. When the driver closes the desk A, the ERTMS/ETCS on-board equipment shall immediately go to Passive Shunting mode.

5.12.4.2.2 When the driver opens the desk B, the ERTMS/ETCS on-board equipment shall immediately switch back to Shunting mode.

5.12.4.3 When the driver closes a desk and opens the other one of the same engine, the ERTMS/ETCS on-board equipment shall be able to calculate the new train position data (train front position, train orientation), by use of the previous data.

5.13 Train Reversing

5.13.1.1 This procedure is intended to allow the fast reversal of movement of a train, to run away from a danger up to a “safe” location.

5.13.1.2 The area where initiation of reversing will be possible is announced to the ERTMS/ETCS on-board equipment by trackside (refer to 3.15.4.2 for details).

5.13.1.3 While the train is at standstill inside the reversing permitted area, the driver shall be informed that reversing is possible

5.13.1.4 If the ERTMS/ETCS onboard detects the driver’s intention to reverse (e.g. from a direction controller in reverse position), the ERTMS/ETCS on-board equipment shall ask the driver to acknowledge transition to RV mode.

5.13.1.5 If the driver acknowledges, the on-board equipment shall switch to RV mode

5.13.1.6 Once in RV mode, it shall be possible for the trackside to send a new permitted distance to run and a new maximum speed.

5.13.1.7 Once in RV mode, it shall also be possible for the trackside to send, together with the new permitted distance to run and the maximum speed, a new reference location for the new permitted distance to run.

5.13.1.8 Note: this new reference location is the end of a new reversing area given by trackside that the onboard will use only for the purpose of distance referencing.

5.14 Joining / Splitting

5.14.1 Definitions

5.14.1.1 Definition for splitting: The “train to be split” is the train at standstill, waiting for being split. The “front train after splitting” refers to the front part of the train before splitting, the “new train after splitting”, refers to the other part.

5.14.1.2 Definitions for joining: The “train to be joined” is the train at standstill, waiting for being joined. The “joining train” is the train performing the joining operation.

5.14.2 Procedure “Splitting”

5.14.2.1 Step 1 - The electrical and mechanical links between the two trains must be removed (this is a national operational procedure, out of the scope of the SRS).

5.14.2.1.1 Note: If splitting requires moving the two train parts apart from each other for a small distance, this can be done even in SB mode

5.14.2.2 Step 2a - If the ERTMS/ETCS onboard equipment which was supervising the train before splitting has not performed an end of mission for splitting, the driver must modify the Train Data such that it fits with the new train composition after splitting. For level 2 or 3, the new train data is sent to the RBC (see SRS chapter 3 – Data Entry / Modification Process)

5.14.2.3 Step 2b - If an ERTMS/ETCS on-board equipment of the "new train after splitting" was in SL mode before, it will switch to SB mode once the remote control signal is not received any more (refer to SRS chapter 4, transitions between modes). For Level 2 or 3: The ERTMS/ETCS on-board equipment shall open a communication session (if possible) and report the mode change to the RBC.

5.14.2.4 Step - 2c If an ERTMS/ETCS on-board equipment of the "new train after splitting" was in NL mode before, it will switch to SB mode once the non leading input signal is not received any more (refer to SRS chapter 4, transitions between modes and chapter 5, “end of mission” procedure).

5.14.2.5 The driver can then start a new mission with this “new train after splitting” (refer to the “Start of Mission” procedure). In all cases, to start a mission is not the only possibility. Shunting movements, or not moving the new train at all, are also possible.

5.14.3 Procedure “Joining”

5.14.3.1 Step 1 – The “joining train” must approach the “train to be joined”. This can be performed in SR, OS or SH mode (depending on the information available, and on the national procedure for joining).

5.14.3.2 Step 2 – The electrical and mechanical links between the two trains must be closed (vehicle dependent, outside the scope of the ETCS).

5.14.3.3 Step 3a – If a former leading ERTMS/ETCS on-board equipment remains leading and there was no end of mission, the driver must modify the Train Data such that it fits with the new train composition. For level 2 or 3, the new train data is sent to the RBC (see SRS chapter 3 – Data Entry / Modification Process)

5.14.3.4 Step 3b – If a former leading ERTMS/ETCS on-board equipment is to become slave equipment in SL mode, when closing the desk, the ERTMS/ETCS on-board equipment will switch to SB mode (see SRS chapter 4, transitions between modes) and the end of mission procedure is executed (see “End of Mission” procedure). Transition to SL mode is from SB mode.

5.14.3.5 Step 3c: If a former leading ERTMS/ETCS on-board equipment is to become slave equipment in NL mode, the driver selects NL mode (see SRS chapter 4, transitions between modes).

5.14.3.6 For further steps after joining refer to procedures “Start of Mission” and “Change of Train Orientation”.

5.15 RBC/RBC Handover

5.15.1 Principles

5.15.1.1 Every RBC/RBC handover shall be announced to the ERTMS/ETCS on-board equipment via a balise group or via the RBC.

5.15.1.2 The handover announcement (i.e. RBC transition order) to the ERTMS/ETCS on-board equipment shall consist of an order to contact the Accepting RBC (see 3.5.3.5.3) and to execute the handover at a further location corresponding to the border.

5.15.1.2.1 In case of RBC/RBC handover including Radio Network border crossing, ERTMS/ETCS trackside is responsible for the sequence of orders to register to the new Radio Network and to contact the "Accepting" RBC, according to the Radio Network's configuration.

5.15.1.2.2 **Note**: In the following sections, "first" Mobile Terminal refers to the one used for communication session with "Handing Over" RBC and "second" Mobile Terminal to the one used for communication session with "Accepting" RBC.

5.15.1.2.3 **Note**: In the following sections, Radio Networks are supposed to be overlapped.

5.15.1.3 At the RBC/RBC border a balise group with an order to execute the handover immediately shall be placed.

5.15.1.3.1 **Note**: Balise groups are read in all levels and orders from balise groups are accepted independent of the level of operation. Also sleeping units read balise groups.

5.15.1.4 If the message from the border balise group is not (yet) received, the handover shall still be executed when the train with its max safe front end passes the border location according to the announcement information.

5.15.1.5 The on-board equipment shall manage only one RBC/RBC transition at a time, therefore a new transition order shall replace a previously received order.

5.15.2 Case 1: Two communication sessions can be handled simultaneously

5.15.2.1 **Overview**

5.15.2.1.1 In the normal operation, the main functional steps needed for running from one RBC area to another one are the following:

a) Pre-announcement of the transition by the "Handing Over" RBC;

b) Registration to the new Radio Network of second Mobile Terminal (optional) & Establishment of the radio communication session with the "Accepting" RBC;

c) Generation of movement authorities including the border;

d) Announcement of the RBC transition

e) Transfer of train supervision to the “Accepting” RBC;

f) Termination of the session with “Handing Over” RBC.

g) Registration to the new Radio Network of first Mobile Terminal (optional)

5.15.2.2 Step by step description

5.15.2.2.1 Pre-announcement

5.15.2.2.1.1 When the “Handing Over” RBC generates a movement authority which reaches the border to another RBC area, it initiates the processes associated to the transition.

5.15.2.2.1.2 The “Handing Over” RBC informs the “Accepting” RBC about the RBC/RBC handover.

5.15.2.2.2 Registration to the new Radio Network of second Mobile Terminal (optional) & Establishment of the radio communication session with “Accepting” RBC

5.15.2.2.2.1 A radio communication session with the Accepting RBC is opened by the on-board equipment based on the RBC transition order received from the “Handing Over” RBC or from balise group (refer to chapter 3, section "management of radio communication").

5.15.2.2.2.2 In case of RBC/RBC handover including Radio Network border crossing, the registration to the new radio network of the second Mobile Terminal is completed before the RBC transition order is transmitted to the on-board equipment.

5.15.2.2.3 Generation of MAs including the border

5.15.2.2.3.1 The “Handing Over” RBC is responsible for establishing the movement authority based on:

a) Information from the trackside equipment and interlocking of its own area (for the part of route related information up to the border),

b) Information from the “Accepting RBC” for the part of route related information in advance of the border.

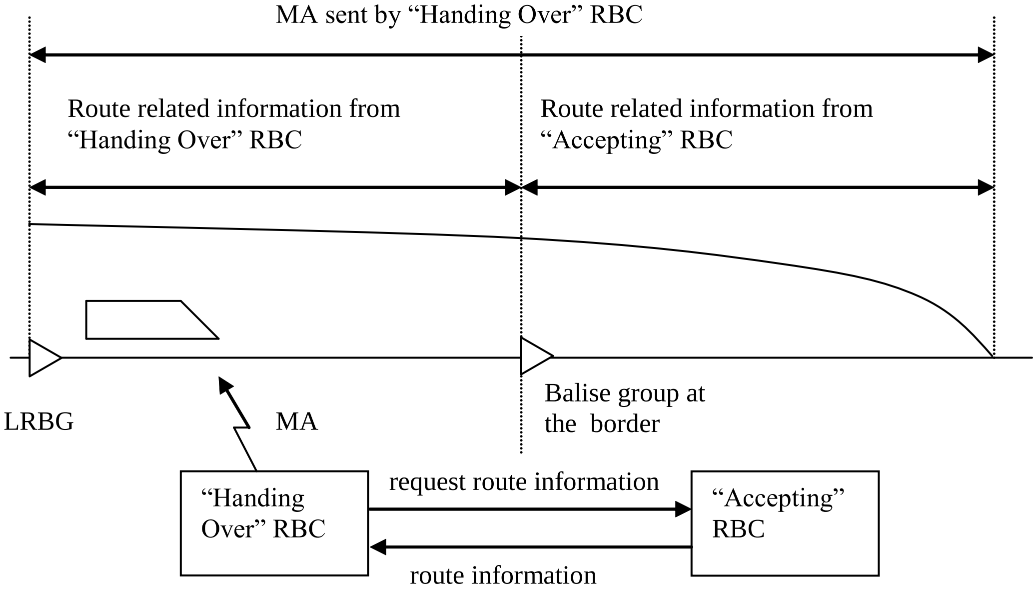

Figure 9: RBC to RBC transition: MA generation.

5.15.2.2.3.2 When it is required to send a movement authority to the train, the "Handing Over" RBC will request from the "Accepting" RBC information needed for extending the MA in advance of the border.

5.15.2.2.4 Announcement

5.15.2.2.4.1 When the train reaches the border with its max safe front end, the ERTMS/ETCS on-board equipment sends a position report both to the "Handing Over" RBC and to the "Accepting" RBC.

5.15.2.2.4.2 The "Handing Over" RBC forwards the announcement information to the "Accepting" RBC.

5.15.2.2.4.2.1 **Note:** Although not required for the case of two communication sessions, the forwarding of the announcement information is executed because the "Handing Over" RBC has no knowledge if the ERTMS/ETCS on-board equipment can handle one or two communication sessions.

5.15.2.2.5 Transfer of train supervision to "Accepting" RBC

5.15.2.2.5.1 As soon as the on-board has sent to the "Accepting" RBC the position report, it considers to be supervised by the "Accepting" RBC i.e. it uses information received from the "Accepting" RBC.

5.15.2.2.5.2 When the "Accepting" RBC receives a position report from the on-board and detects that the max safe front end has passed the border, it takes over the responsibility and informs the "Handing Over" RBC.

5.15.2.2.6 Termination of the session with “Handing Over” RBC

5.15.2.2.6.1 When the min safe rear end of the train passes the location of the border, the ERTMS/ETCS on-board equipment sends a position report to the “Handing Over” RBC.

5.15.2.2.6.2 When this position report is received by the ”Handing Over” RBC, it sends an order to terminate the session to the ERTMS/ETCS on-board equipment.

5.15.2.2.7 Registration to the new Radio Network of first Mobile Terminal (optional)

5.15.2.2.7.1 In case of RBC/RBC handover including Radio Network border crossing, the registration to the new Radio Network of the first Mobile Terminal is initiated by the ERTMS/ETCS on-board equipment as soon as the communication session with the "Handing Over" RBC has been terminated and the safe radio connection has been released.

5.15.3 Case 2: Only one communication session can be handled

5.15.3.1 Overview

5.15.3.1.1 In this case, the main functional steps needed for running from one RBC area to another one are the following:

a) Pre-announcement of the transition by the “Handing Over” RBC;

b) Generation of movement authorities including the border;

c) Announcement of the RBC transition

d) Termination of the session with “Handing Over” RBC;

e) Registration to the new Radio Network of the Mobile Terminal (optional) & Establishment of the radio communication session with the “Accepting” RBC;

f) Transfer of train supervision to the “Accepting” RBC.

5.15.3.2 Step by step description

5.15.3.2.1 Pre-announcement

5.15.3.2.1.1 When the “Handing over” RBC generates a movement authority which reaches the border to another RBC area, it initiates the processes associated to the transition.

5.15.3.2.1.2 The “Handing Over” RBC informs the “Accepting” RBC about the RBC/RBC transition.

5.15.3.2.2 Generation of MAs including the border

5.15.3.2.2.1 The “Handing Over” RBC is responsible for establishing the movement authority based on (see Figure 9)

a) Information from the trackside equipment and interlocking of its own area (for the part of route related information up to the border),

b) Information from the “Accepting RBC” for the part of route related information in advance of the border.

5.15.3.2.2.2 When it is required to send a movement authority to the train, the "Handing Over" RBC will request from the "Accepting RBC" information needed for extending the MA in advance of the border.

5.15.3.2.3 Announcement

5.15.3.2.3.1 When the train with its max safe front end reaches the border, the ERTMS/ETCS on-board equipment sends a position report to the “Handing Over” RBC.

5.15.3.2.3.2 The “Handing Over” RBC forwards the announcement information to the “Accepting” RBC.

5.15.3.2.4 Termination of the session with “Handing Over” RBC

5.15.3.2.4.1 As requested by the RBC transition order, when the min safe rear end of the train passes the location of the border, the on-board equipment sends a position report to the “Handing Over” RBC.

5.15.3.2.4.2 When this position report is received by the “Handing Over” RBC, it sends an order to terminate the session to the ERTMS/ETCS on-board equipment.

5.15.3.2.5 Registration to the new Radio Network of the Mobile Terminal (optional) & Establishment of the radio communication session with “Accepting” RBC

5.15.3.2.5.1 When the ERTMS/ETCS on-board equipment receives the session termination order from the “Handing Over” RBC, it terminates the session with the “Handing over” RBC and opens a session with the “Accepting” RBC (refer to chapter 3, management of radio communication).

5.15.3.2.5.2 In case of RBC/RBC handover including Radio Network border crossing: as soon as the session with the "Handing Over" RBC is terminated, the registration to the new Radio Network of the Mobile Terminal is enforced by the ERTMS/ETCS on-board equipment prior to the opening of a session with the “Accepting” RBC (refer to chapter 3, management of radio communication).

5.15.3.2.6 Transfer of train supervision to “Accepting” RBC

5.15.3.2.6.1 When the ERTMS/ETCS on-board equipment has established a communication session with the “Accepting” RBC and sent to the “Accepting” RBC a position report, it considers to be supervised by the “Accepting” RBC, i.e. it accepts only information received from the “Accepting” RBC.

5.15.3.2.6.2 When the “Accepting” RBC receives a position report from the on-board and detects that the max safe front end has passed the border, it takes over the responsibility and informs the “Handing Over” RBC.

5.15.4 Degraded Situations

5.15.4.1 Note: If the “Handing Over” RBC is not able to extend the MA into the area of the “Accepting RBC”, the driver may select "override", or manually change the level to move the train into the area of the “Accepting RBC”.

5.15.4.2 Note: If the ERTMS/ETCS on-board equipment cannot open a session with the “Accepting RBC”, the train is stopped at the latest when it has reached the EOA given by the “Handing Over” RBC. For passing the EOA the driver may select "override", or manually change the level.

5.15.4.3 If the ERTMS/ETCS on-board equipment is not able to terminate the session with the “Handing Over” RBC: In case a communication session is established and no request to terminate the session is received from the “Handing Over” RBC within a fixed waiting time (see appendix to chapter 3, List of Fixed Value Data) after sending the position report (see 5.15.2.2.6), the position report shall be repeated with the fixed waiting time after each repetition.

5.15.4.4 After a defined number of repetitions (see appendix to chapter 3, List of Fixed Value Data), and if no reply is received within the fixed waiting time from the last sending of the position report, the ERTMS/ETCS onboard equipment shall terminate the communication session.

5.16 Procedure passing a non protected Level Crossing

5.16.1 General Requirements

5.16.1.1 In case the LX is not protected, the ERTMS/ETCS on-board equipment (in FS, LS or OS mode) shall temporarily supervise the LX start location as both the EOA and SvL (instead of the EOA and SvL given by the MA), with no release speed.

5.16.1.2 The supervision of the LX start location as both the EOA and SvL shall be substituted by the inclusion of the LX speed restriction in the MRSP under conditions depending on whether stopping in rear of the LX start location is required or not. The conditions of this substitution are specified in 5.16.2 or 5.16.3.

5.16.1.3 The start location of the LX speed restriction depends on the substitution conditions, which are specified in 5.16.2 or 5.16.3. The end location of the LX speed restriction shall be the LX end location.

5.16.1.4 When approaching a non protected LX, the on-board equipment shall inform the driver about the status of the LX, as soon as:

a) either the EOA or the SvL related to the LX start location becomes the Most Restrictive Displayed Target (see 3.13.10.4.2), or

b) the ERTMS/ETCS on-board equipment substitutes the supervision of the LX start location as both the EOA and SvL by the inclusion of the LX speed restriction in the MRSP.

5.16.1.5 Indication given to the driver shall remain displayed until one of the following conditions is met:

a) information “LX is protected” is received on-board;

b) train has passed the LX end location with its min safe front end.

5.16.2 Stopping in rear of non protected LX is required

5.16.2.1 Once the train has stopped with its estimated front end inside the stopping area, given by trackside, the ERTMS/ETCS on-board equipment shall no longer supervise the LX start location as both the EOA and SvL (i.e. the ones given by the MA shall be again supervised) and shall immediately include the LX speed restriction in the MRSP, starting from the estimated train front end.

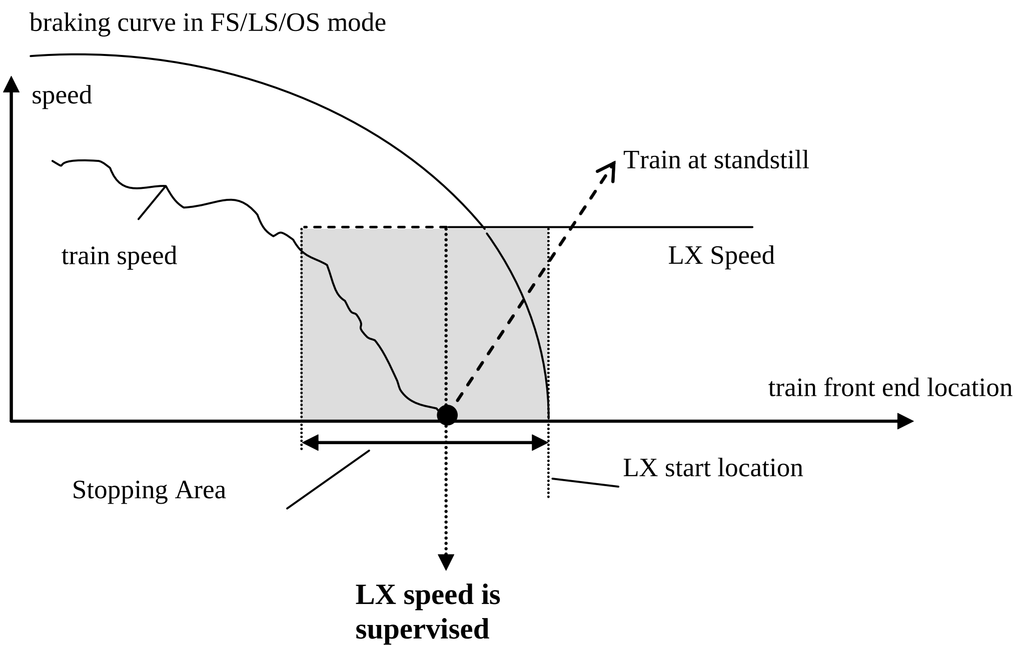

Figure 10: Approaching a non protected LX with stopping required

5.16.3 Stopping in rear of non protected LX is not required

5.16.3.1 In case stopping in rear of the non protected LX is not required, the LX start location shall be supervised as both the EOA and SvL until the train reaches the location of the braking to target Permitted speed supervision limit calculated for the LX speed (see 3.13.9.3.5.11&12 for the calculation of this location).

5.16.3.2 As soon as the estimated or the max safe front end (depending whether the FLOI at LX speed is the SBI1 or the SBI2) reaches the location of the Permitted speed supervision limit calculated for the LX speed, the ERTMS/ETCS on-board equipment shall no longer supervise the LX start location as both the EOA and SvL (i.e. the ones given by the MA shall be again supervised) and shall immediately include the LX speed restriction in the MRSP, starting from the train front end (estimated or max safe), which has reached the concerned Permitted speed supervision limit location.

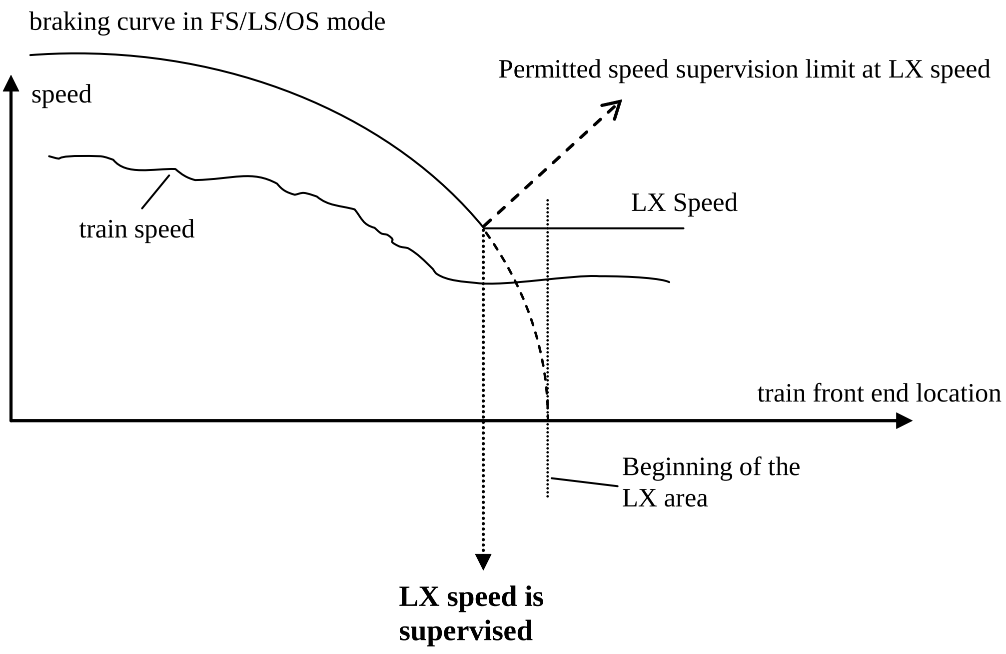

Figure 11: Approaching a non protected LX with stopping not required

5.16.3.3 Note: A braking curve to zero, instead of a braking curve to the LX speed at the LX start location, will ensure that the train is able to stop before the start location of the level crossing, in case this latter is not free for the train to pass. Close to the level crossing it is then the responsibility of the driver to proceed or not with LX speed as a maximum.

5.17 Changing Train Data from sources different from the driver

5.17.1 Introduction

5.17.1.1 When valid Train Data is stored on-board, input information acquired from ERTMS/ETCS external sources different from the driver may affect some of the Train

Data, depending on the type of train (e.g. tilting input information from tilting external device may affect the train category and the loading gauge).

5.17.1.2 The procedure here below describes the necessary steps performed by the ERTMS/ETCS on-board equipment from the detection of an input information change on an external interface, to the effective encountering of the Train Data change by the ERTMS/ETCS on-board equipment.

5.17.1.3 This procedure is not applicable for trains running in RV mode: on leaving RV mode, the Train Data will always be invalidated or deleted.

5.17.2 Table of requirements for "Changing Train Data from sources different from the driver" procedure

5.17.2.1 The ID numbers in the table are used for the representation of the procedure in form of a flow chart in section 5.17.3.

5.17.2.2 Procedure

ID #	Requirements
S0	The ERTMS/ETCS on-board equipment is in one of the following modes: FS, LS, OS, SR, SB, SN, UN, TR, PT and valid Train Data is stored on-board. If a change of input information, which affects Train Data, is detected on an ERTMS/ETCS on-board external interface **(E0)**, the process shall go to **D0**
D0	According to the specific train implementation, Train Data which is/are affected by the change of input information from the ERTMS/ETCS on-board equipment external interface may require validation: • If the affected data requires driver validation, the process shall go to **D2** • If the affected data does not require driver validation, the process shall go to **D1**
D1	Depending on the type of Train Data which is/are affected by the change of input information from the ERTMS/ETCS on-board external interface, the following shall apply: • If the impacted Train Data regards either train category, or axle load category, or traction system(s) accepted by the engine, or loading gauge, the process shall go to **D3** • If the impacted Train Data regards any other type of Train Data, the process shall go to **A1**

ID #	Requirements
D3	Depending on the mode of the ERTMS/ETCS on-board equipment, the following shall apply: • If mode is FS, LS, or OS, the process shall go to **D7** • If mode is SB or PT, the process shall go to **A1** • If mode is UN, SN, SR, or TR the process shall go to **D5**
D5	The ERTMS/ETCS on-board equipment shall check whether MA and track description, received from RBC, are stored on-board, in case a level 2/3 transition or a RBC transition for a further location has been ordered: • If MA and track description are stored, the process shall go to **D7** • If MA and track description are not both stored, the process shall go to **A1**
D7	The ERTMS/ETCS on-board equipment shall check whether the train is at standstill: • If at standstill, the process shall go to **A1** • If not at standstill, the process shall go to **S2**
A1	The ERTMS/ETCS on-board equipment shall inform the driver that Train Data has been changed and the process shall go to **A7**
S2	The ERTMS/ETCS on-board equipment shall command the service brake, inform the driver about the reason of this brake command and waits for the train to be at standstill; when the ERTMS/ETCS on-board equipment detects that the train is at standstill **(E2)**, the process shall go to **S3**
S3	The ERTMS/ETCS on-board equipment shall request the driver to acknowledge the brake command; when the driver acknowledges **(E3)**, the process shall go to **A5**
A5	The ERTMS/ETCS on-board equipment shall release the brake command and the process shall go to **A7**
D2	Depending on the mode of the ERTMS/ETCS on-board equipment, the following shall apply: • If mode is FS, LS, OS, SR, SB, SN or UN the process shall go to **D9** • If mode is TR or PT, the process shall go to **S1**
S1	The ERTMS/ETCS on-board equipment shall wait for the end of the Train Trip procedure (see section 5.11). When the Train Trip procedure is exited **(E1)** (i.e. there is a mode transition to another mode than TR, PT), the process shall go to **D4**
D4	Depending on the mode of the ERTMS/ETCS on-board equipment, the following shall apply: • If mode is FS, LS, OS, SR, SN or UN the process shall go to **S6** • If mode is SH, the Train Data are invalidated and the process shall **END**

ID #	Requirements
D9	The ERTMS/ETCS on-board equipment shall check whether the train is at standstill: • If at standstill, the process shall go to **S6** • If not at standstill, the process shall go to **S4**
S4	The ERTMS/ETCS on-board equipment shall command the service brake, inform the driver about the reason of this brake command and wait for the train to be at standstill; when the ERTMS/ETCS on-board equipment detects that the train is at standstill **(E4)**, the process shall go to **S5**
S5	The ERTMS/ETCS on-board equipment shall request the driver to acknowledge the brake command; when the driver acknowledges **(E5)**, the process shall go to **A6**
A6	The ERTMS/ETCS on-board equipment shall release the brake command and the process shall go to **S6**
S6	The ERTMS/ETCS on-board equipment shall request the driver to re-enter or re-validate the Train Data. Once Train Data is validated **(E6)**, the process shall go to **A7**
A7	The ERTMS/ETCS on-board equipment shall consider the Train Data as being changed and shall apply, when relevant, the requirements regarding change of Train Data (refer to clauses 3.18.3.4, 3.18.3.7 and 3.18.3.8). The process shall **END**.

5.17.3 Flowchart

5.17.3.1 The ID numbers in the flowchart refer to the ID numbers of the table in section 5.17.2.

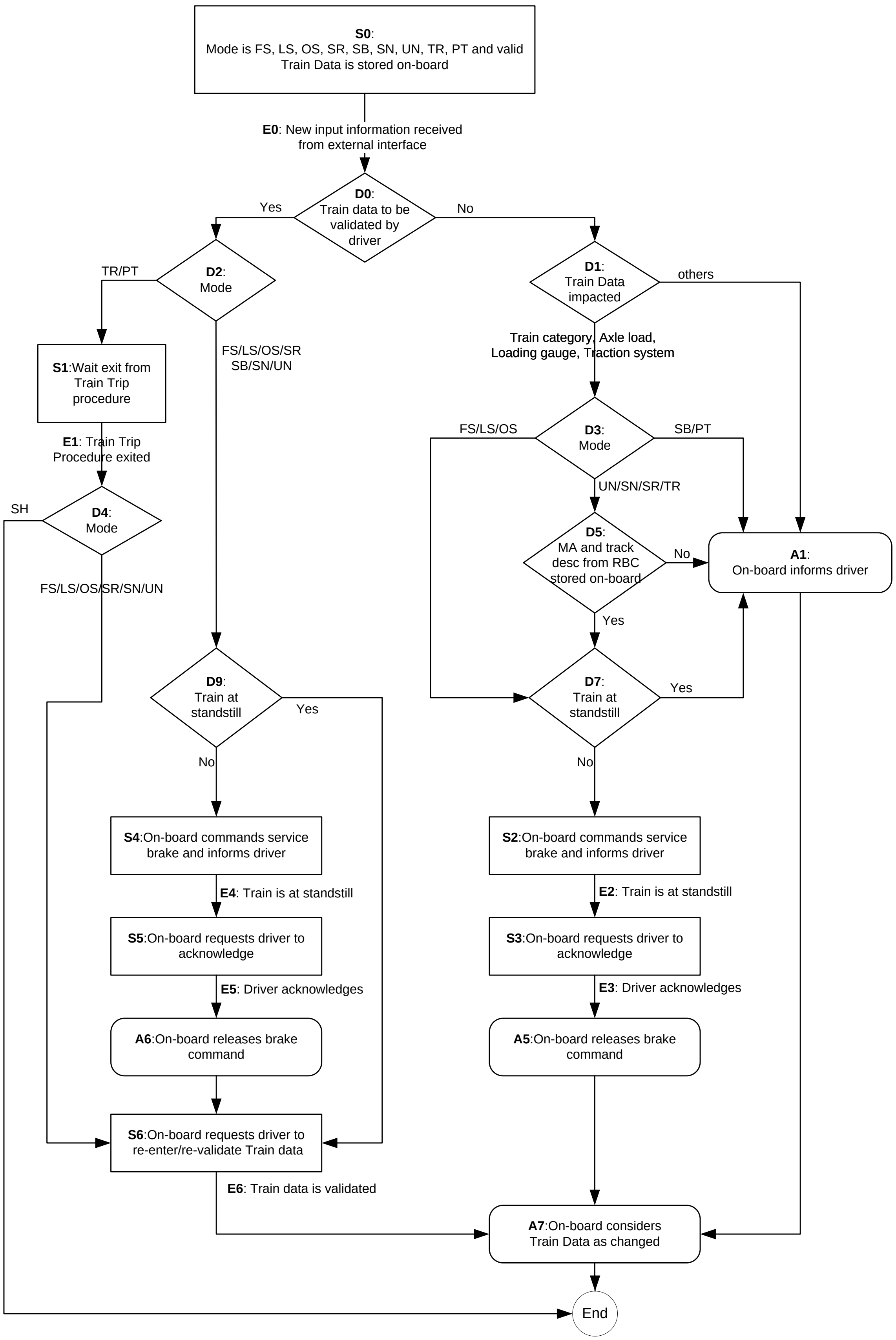

Figure 12: Flowchart for "Changing Train Data from sources different from the driver"

5.18 Indication of Track Conditions

5.18.1 Introduction

5.18.1.1 This set of procedures specifies the sequences of driver indications related to the following track-conditions:

a) powerless section with pantograph to be lowered

b) powerless section with main power switch to be switched off,

c) non-stopping area,

d) radio hole,

e) air tightness area,

f) Inhibition of a defined type of brake,

g) tunnel stopping area,

h) sound horn,

i) change of traction system.

5.18.1.2 Note: For every procedure a figure supports the textual description. The textual description of the procedures contains reference to the figures (point B, point F,…).

5.18.2 Passing a powerless section with pantograph to be lowered

5.18.2.1 This procedure is dealing with the announcement and indication to the driver of a powerless section with the pantograph to be lowered.

5.18.2.1.1 Intentionally deleted.

5.18.2.2 “Lower pantograph announcement” shall be displayed to the driver when the max safe front end of the train reaches a location (point C) in rear of the beginning of the powerless section (point D).

5.18.2.2.1 This location (point C) shall be determined by the ERTMS/ETCS on-board equipment taking into account the time necessary for performing the required actions and the current train speed.

5.18.2.2.2 The displayed “Lower pantograph announcement” information shall also indicate if the related functionality is executed

- automatically, or
- if the driver is requested to act.

5.18.2.2.2.1 Note: Whether the operation is automatic or manual is application dependent.

5.18.2.3 When the max safe front end of the train reaches the start location (point D) of the powerless section:

- "Lower pantograph announcement" shall no longer be displayed to the driver,
- "Lowered Pantograph" information shall be displayed to the driver.

5.18.2.4 Intentionally deleted.

5.18.2.4.1 Intentionally deleted.

5.18.2.5 When the min safe front end of the train reaches the "Powerless section" end location point E):

- "Lowered Pantograph" information shall no longer be displayed to the driver
- "Raise pantograph" information shall be displayed to the driver.

5.18.2.5.1 The displayed "Raise pantograph" information shall also indicate if the related functionality is executed

- automatically, or
- if the driver is requested to act.

5.18.2.5.1.1 Note: Whether the operation is automatic or manual is application dependent.

5.18.2.6 The "Raise pantograph" information shall remain displayed for a fixed time (see Appendix A3.1) after the minimum safe rear end of the train has passed the end of the "Powerless section".

5.18.2.6.1 Note: The train front end position when this information disappears is shown as point G in the Figure 13.

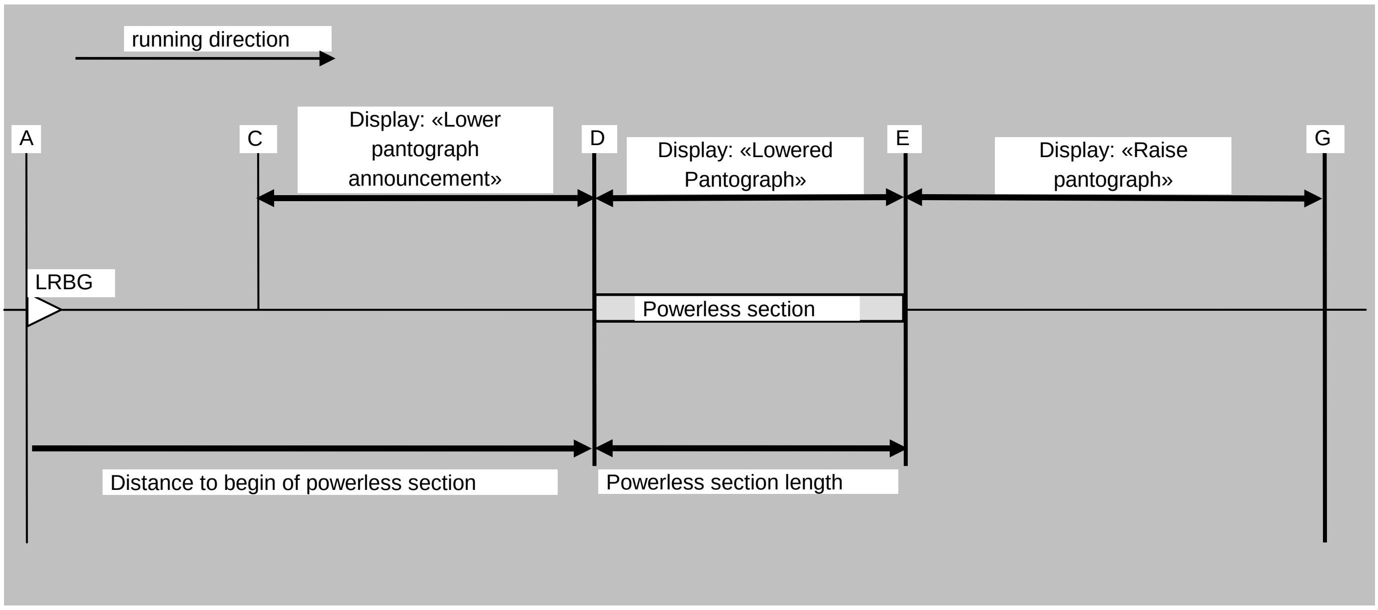

Figure 13: Passing a powerless section with pantograph to be lowered

5.18.3 Passing a powerless section with main power switch to be switched off

5.18.3.1 This procedure is dealing with the announcement and indication to the driver of a powerless section with main power switch to be switched off.

5.18.3.2 "Neutral section announcement" shall be displayed to the driver when the max safe front end of the train reaches a location (point C) in rear of the beginning of the powerless section.

5.18.3.2.1 This location (point C) shall be determined by the ERTMS/ETCS on-board equipment taking into account the time necessary for performing the required actions and the current train speed.

5.18.3.2.2 The displayed "Neutral section announcement" information shall also indicate if the related functionality is executed

- automatically, or
- if the driver is requested to act.

5.18.3.2.2.1 Note: Whether the operation is automatic or manual is application dependent.

5.18.3.3 When the max safe front end of the train reaches the starting location (point D) of the powerless section:

- "Neutral section announcement" shall no longer be displayed to the driver,
- "Neutral section" information shall be displayed to the driver.

5.18.3.4 When the min safe front end of the train reaches the "Powerless section" end location point E):

- "Neutral section" information shall no longer be displayed to the driver
- "End of Neutral section" information shall be displayed to the driver.

5.18.3.4.1 The displayed "End of Neutral section" information shall also indicate if the related functionality is executed

- Automatically, or
- if the driver is requested to act.

5.18.3.4.1.1 Note: Whether the operation is automatic or manual is application dependent.

5.18.3.5 The "End of Neutral section" information shall remain displayed for a fixed time (see Appendix A3.1) after the minimum safe rear end of the train has passed the end of the "Powerless section".

5.18.3.5.1 Note: The train front end position, when this information disappears is shown as point G in the Figure 14.

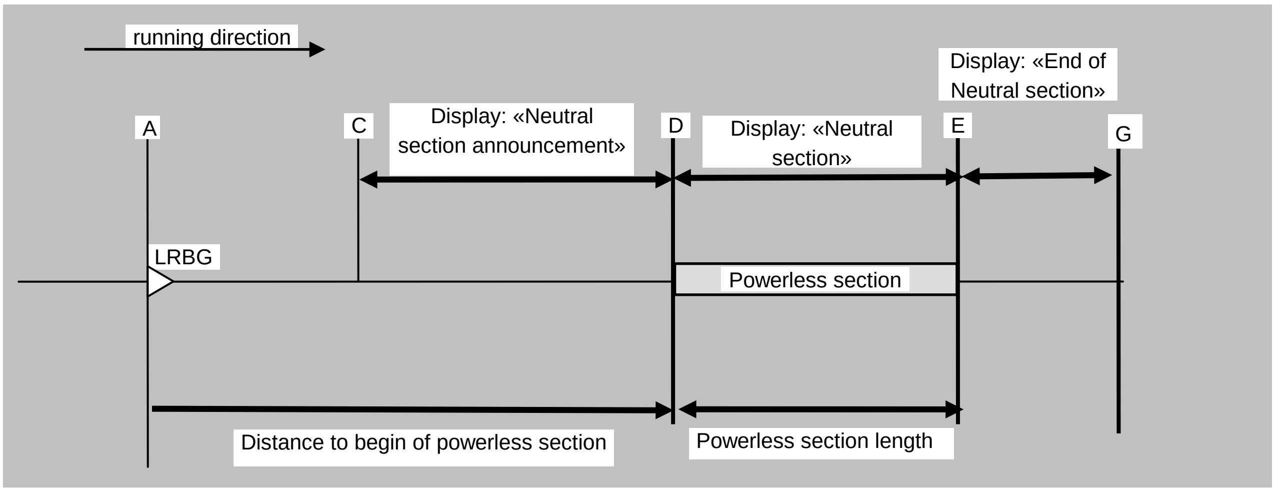

Figure 14: Passing a powerless section with main power switch to be switched off

5.18.4 Passing a non stopping area

5.18.4.1 This procedure is dealing with the announcement and indication to the driver of an area where stopping is not permitted.

5.18.4.2 As long as there are non stopping areas stored on-board, the ERTMS/ETCS on-board equipment shall continuously check the current speed and position of the train whether a full service brake command would stop the train within the closest non stopping area. This shall be achieved taking into account two virtual SBI supervision limits (SBI_D and SBI_G), calculated at the estimated speed from two SBD curves of which the feet are the start location of the non stopping area (point D) and a location (point G) at train length distance in advance of the end location of the non stopping area:

a) If the max safe front end is in rear of the first SBI supervision limit (SBI_D) no information related to this non stopping area shall be displayed

b) If the max safe front end is in advance of first SBI supervision limit and the min safe front end in rear of the second SBI supervision limit, the non stopping area related information shall be displayed to the driver.

c) If the min safe front end is in advance of the second SBI supervision limit (SBI_G), no information related to this non stopping area shall be displayed and the next non stopping area stored on-board, if any, shall be checked.

5.18.4.3 When the max safe front end reaches the first SBI supervision limit (point C), the “Non stopping area announcement” shall be displayed to the driver.

5.18.4.4 When the max safe front end reaches the start location (point D) of the non stopping area:

- “Non stopping area announcement” shall no longer be displayed
- “Non stopping area” information shall be displayed to the driver.

5.18.4.5 When the min safe front end reaches the second SBI supervision limit (point F), the non stopping area information shall no longer be displayed.

5.18.4.6 Note: the display of the "non stopping area" information will always end before the min safe rear end reaches the point E, because of the condition 5.18.4.2 c).

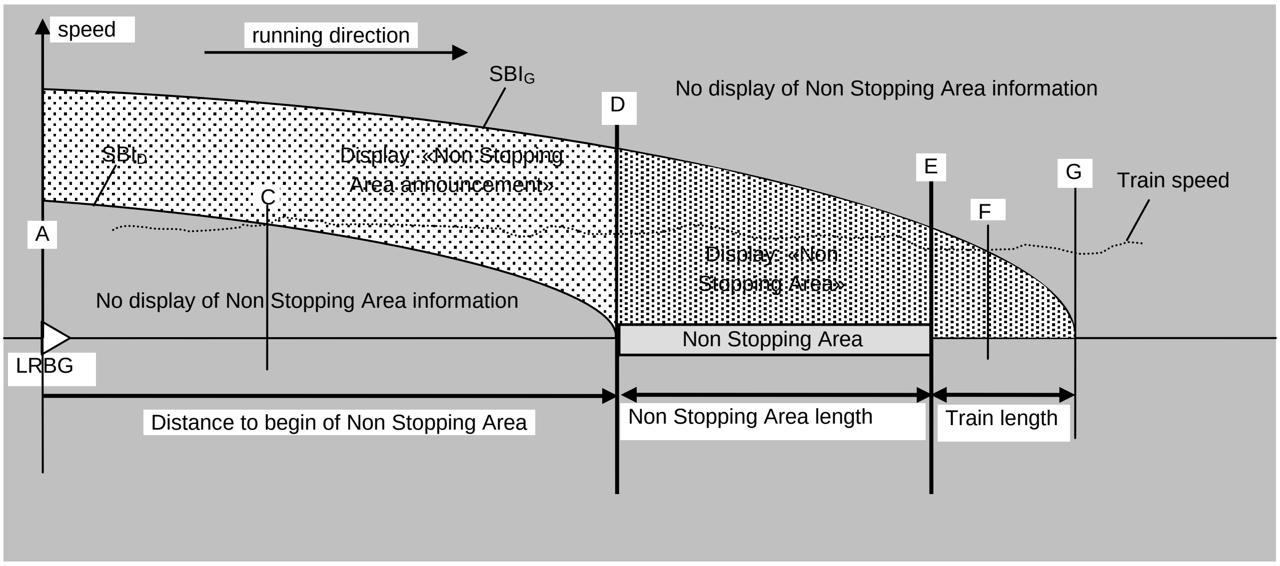

Figure 15: Passing a non stopping area

5.18.5 Passing a radio hole

5.18.5.1 This procedure is dealing with the automatic deactivation of the safe radio connection supervision inside an announced radio hole area.

5.18.5.2 When the max safe front end of the train passes the start location (point D) of the radio hole area, the "radio hole" indication shall be displayed to the driver.

5.18.5.3 When the min safe rear end of the train passes the end location (point E) of the radio hole area, the "radio hole" indication to the driver shall be removed.

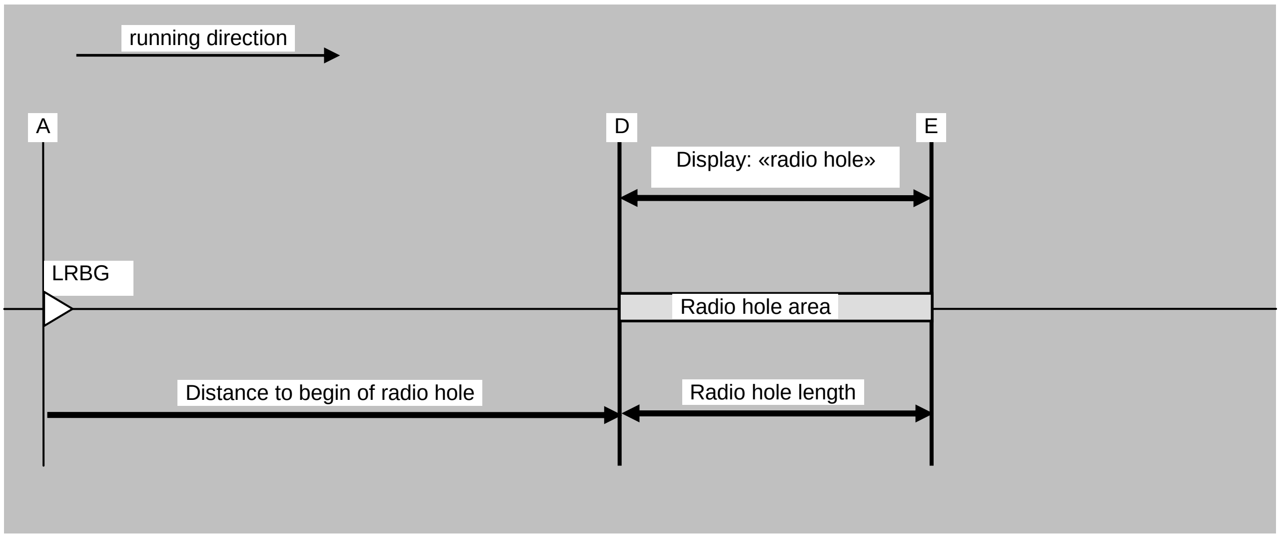

Figure 16: Passing an announced radio hole

5.18.6 Passing an "air tightness" area

5.18.6.1 This procedure is dealing with the announcement and indication to the driver of an air tightness area.

5.18.6.2 "Close air conditioning intake announcement" information shall be displayed to the driver when the max safe front end of the train reaches a location (point C) in rear of the beginning of the "air tightness" area.

5.18.6.2.1 This location (point C) shall be determined by the ERTMS/ETCS on-board equipment taking into account the time necessary for performing the required actions and the current train speed.

5.18.6.2.2 The displayed "Close air conditioning intake announcement" information shall also indicate if the related functionality is executed

- automatically, or
- if the driver is requested to act.

5.18.6.2.2.1 Note: Whether the operation is automatic or manual is application dependent.

5.18.6.3 When the max safe front end of the train reaches the start location (point D) of the air tightness area:

- "Close air conditioning intake announcement" information shall no longer be displayed.
- "Air conditioning intake closed" information shall be displayed to the driver.

5.18.6.4 When the min safe rear end of the train reaches the end location (point E) of the air tightness area:

- "Air conditioning intake closed" information shall no longer be displayed;

- “Open air conditioning intake” information shall be displayed to the driver.

5.18.6.4.1 The displayed “Open air conditioning intake” information shall also indicate if the related functionality is executed

- automatically, or
- If the driver is requested to act.

5.18.6.4.1.1 Note: Whether the operation is automatic or manual is application dependent.

5.18.6.5 The “Open Air Conditioning intake” information shall remain displayed for a fixed time (see Appendix A3.1) after the minimum safe rear end of the train has passed the end of the “Air tightness area”.

5.18.6.5.1 Note: The train front end position, when this information disappears, is shown as point G in the Figure 17.

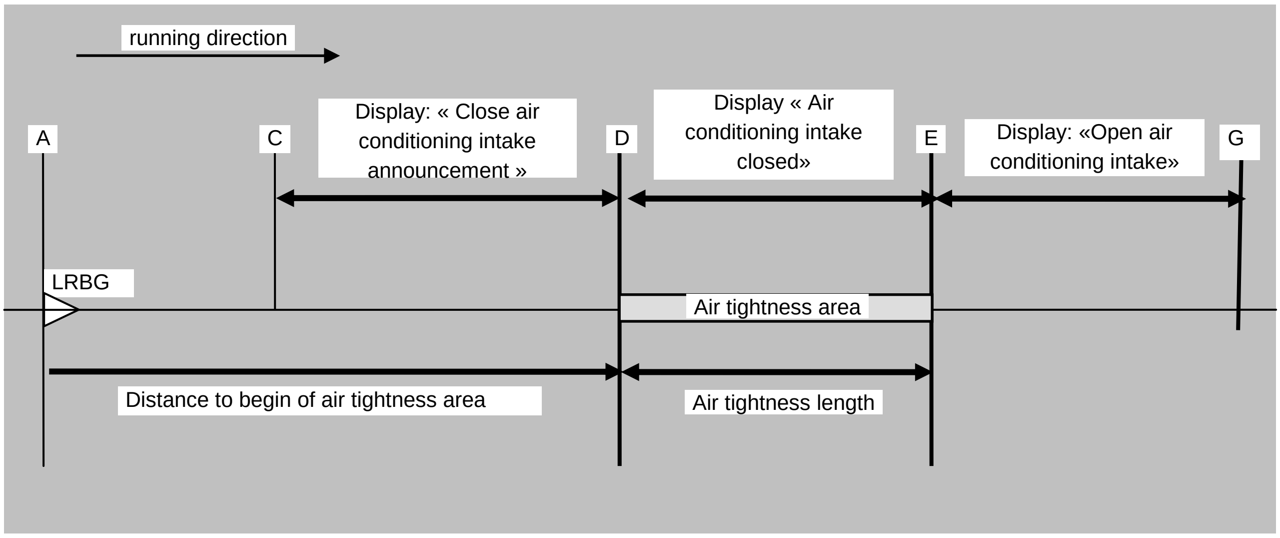

Figure 17: Passing an air tightness area

5.18.7 Inhibition of a defined type of brake

5.18.7.1 This procedure is dealing with the announcement and indication to the driver of the inhibition of defined types of brake systems.

5.18.7.2 The procedure shows the case of the regenerative brake. Regarding eddy current brake and magnetic shoe brake, the procedure is identical except that the displayed indications refer respectively eddy current brake or magnetic shoe brake.

5.18.7.3 “Inhibition of Regenerative Brake announcement” information shall be displayed to the driver when the max safe front end of the train reaches a location (Point C) in rear of the beginning of the regenerative brake inhibition area.

5.18.7.3.1 The displayed “Inhibition of Regenerative Brake announcement” information shall also indicate if the related functionality is executed

- automatically, or
- if the driver is requested to act.

5.18.7.3.1.1 Note: Whether the operation is automatic or manual is application dependent.

5.18.7.3.2 This location (point C) shall be determined by the On-Board equipment taking into account the time necessary for performing the required actions and the current train speed.

5.18.7.4 When the max safe front end of the train reaches the start location (point D) of the regenerative brake inhibition area:

- Indication “Inhibition of Regenerative Brake announcement” shall no longer be displayed,
- Indication “Inhibition of Regenerative Brake” shall be displayed to the driver.

5.18.7.5 When the min safe rear end of the train reaches the end location (point E) of the regenerative brake inhibition area the indication “Inhibition of Regenerative Brake” information shall no longer be displayed.

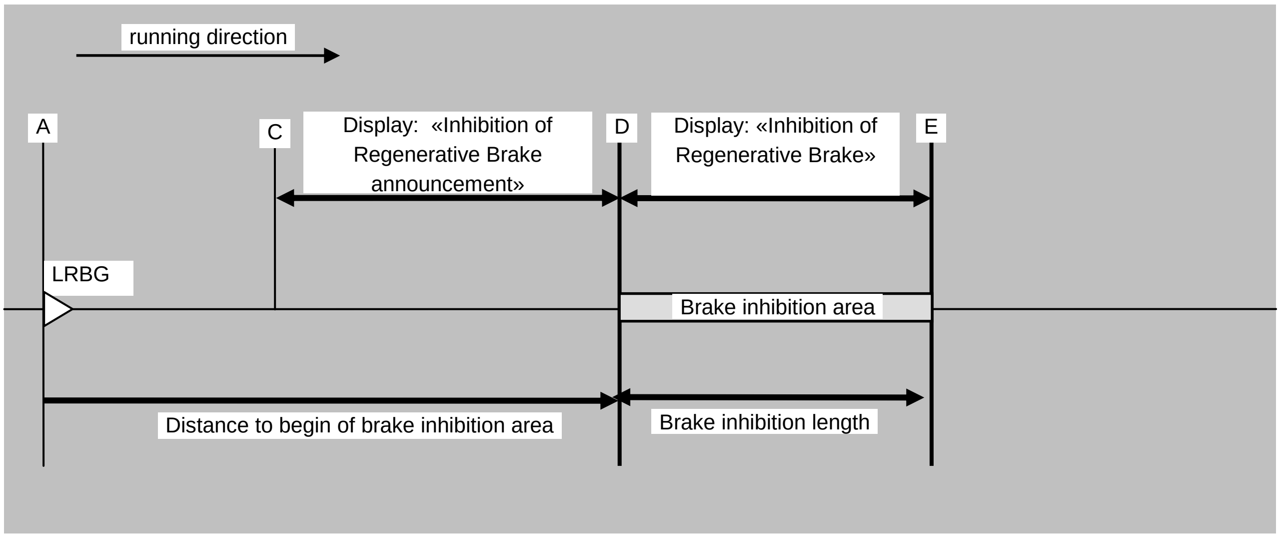

Figure 18: Passing an area where Regenerative Brake shall be inhibited

5.18.8 Advising a tunnel stopping area

5.18.8.1 This procedure is dealing with the indication to the driver of an area under a tunnel where stopping is permitted, and suitable escaping paths are provided.

5.18.8.1.1 Note: the tunnel stopping areas are designed in such a way that the passengers can step out, use a walkway along the track and reach the safe area, taking into account the longest admissible train in the tunnel stopped with its front end within the tunnel stopping area.

5.18.8.2 On driver request, the ERTMS/ETCS on-board equipment shall enable/disable the display of the tunnel stopping area related information (initial state: disabled).

5.18.8.3 As long as the display of the tunnel stopping areas is enabled (point C) and there are tunnel stopping areas stored on-board, the ERTMS/ETCS on-board equipment shall continuously check the current speed and position of the train to determine whether the driver can stop the train with the full service brake before reaching the end of the closest tunnel stopping area. This shall be achieved taking into account a virtual Permitted supervision limit (with no contribution of the GUI curve, if any), calculated at the estimated speed from an SBD curve of which the foot is the end location of the tunnel stopping area:

a) If the train front end is in rear of the Permitted supervision limit, the tunnel stopping area related information shall be displayed to the driver.

b) If the train front end is in advance of the Permitted supervision limit, no information related to this tunnel stopping area shall be displayed and the next tunnel stopping area stored on-board, if any, shall be checked.

5.18.8.4 Before the train reaches the start location (point D) of the tunnel stopping area, the “tunnel stopping area announcement” shall be displayed to the driver. This shall include the indication of the remaining distance to the start location of the tunnel stopping area.

5.18.8.5 When the train front end reaches the start location (point D) of the tunnel stopping area:

- “Tunnel stopping area announcement” shall no longer be displayed
- “Tunnel stopping area” information shall be displayed to the driver.

5.18.8.6 Note: the display of the “tunnel stopping area” information will always end before the point E is reached, because of the condition 5.18.8.3 b).

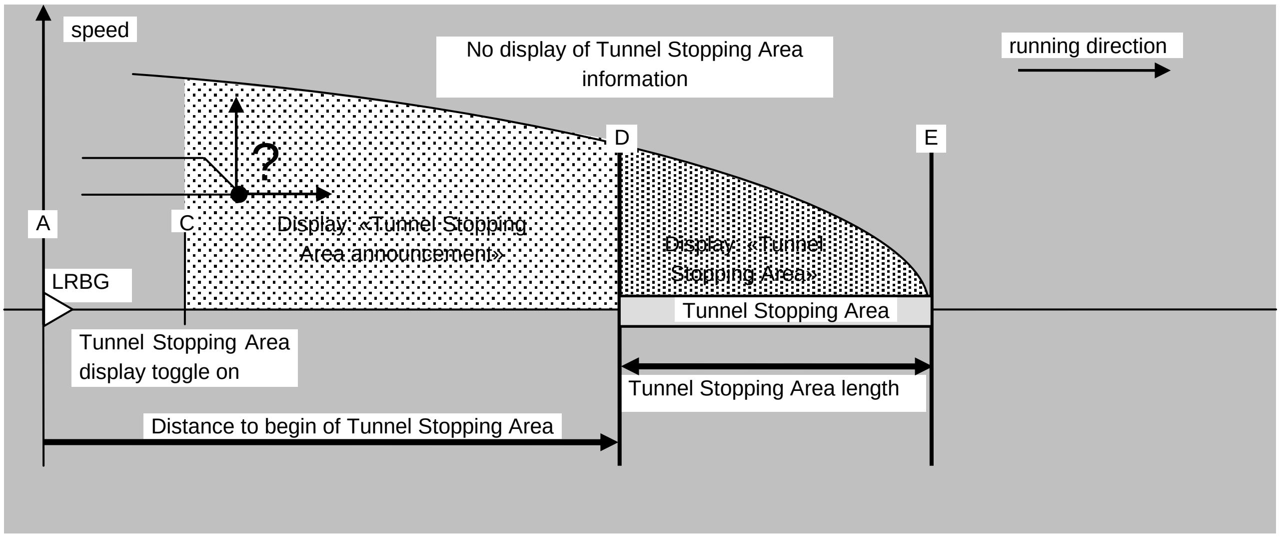

Figure 19: Advising a tunnel stopping area

5.18.9 Sounding the horn

5.18.9.1 This procedure is dealing with the indication to the driver of a request to sound the horn.

5.18.9.2 “Sound horn” shall be displayed to the driver when the estimated front end of the train reaches a location (point C) in rear of the beginning of the “sound horn” area (point D).

5.18.9.2.1 This location (point C) shall be determined by the ERTMS/ETCS on-board equipment taking into account the time necessary for the driver to perform the required action (see Appendix A3.1) and the current train speed.

5.18.9.3 When the estimated front end of the train reaches the end location (point E) of the “sound horn” area, the indication “Sound horn” information shall no longer be displayed.

5.18.9.4 Note: In order not to encourage the driver to stop sounding the horn too early, the track condition “sound horn” is defined as an area so that the display of the indication “Sound horn” continues during a certain distance sent by trackside (i.e. until point E), after the theoretical location of the board on the line (i.e. point D).

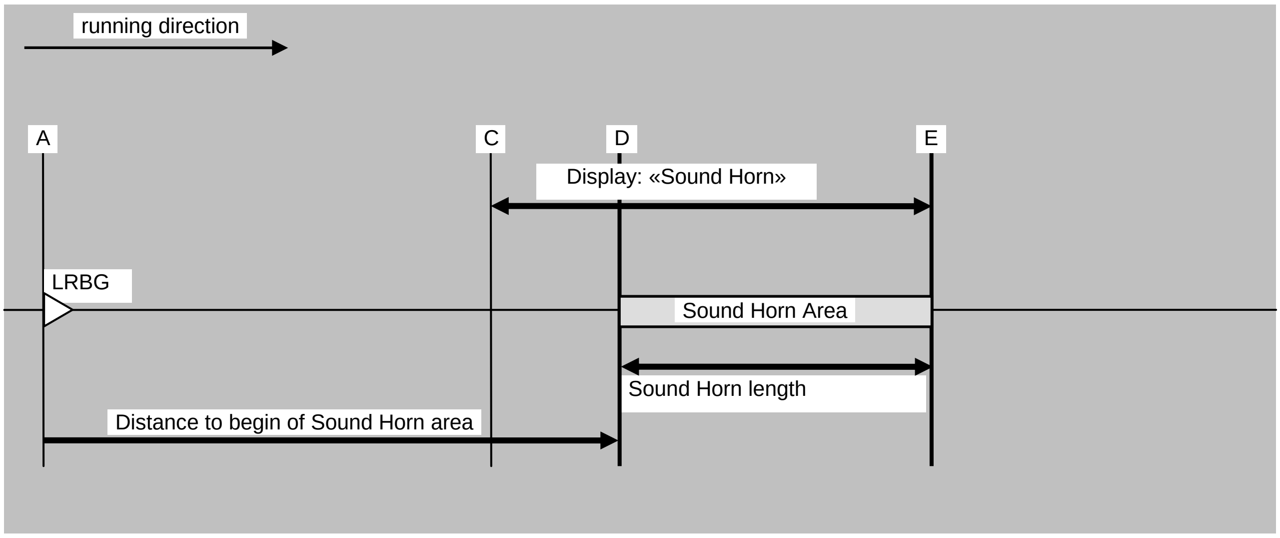

Figure 20: Sounding the Horn

5.18.10 Changing the traction system

5.18.10.1 This procedure is dealing with the announcement and indication to the driver of a change of traction system.

5.18.10.2 “Change of traction system announcement” shall be displayed to the driver when the max safe front end of the train reaches a location (point C) in rear of the location of change of traction system (point F).

5.18.10.3 This location (point C) shall be determined by the ERTMS/ETCS on-board equipment taking into account the time necessary for performing the required actions and the current train speed.

5.18.10.4 The displayed "Change of traction system announcement" information shall also indicate if the related functionality is executed

- automatically, or
- if the driver is requested to act.

5.18.10.4.1 Note: Whether the operation is automatic or manual is application dependent.

5.18.10.5 When the max safe front end of the train reaches the "Change of traction system" location (point F):

- the "Change of traction system announcement" information shall no longer be displayed to the driver,
- the "New traction system" information shall be displayed to the driver.

5.18.10.6 The "New traction system" information shall remain displayed for a fixed time (see Appendix A3.1) after the minimum safe rear end of the train has passed the "Change of traction system" location (point F).

5.18.10.6.1 Note: The train front end position when this information disappears is shown as point G in the Figure 21.

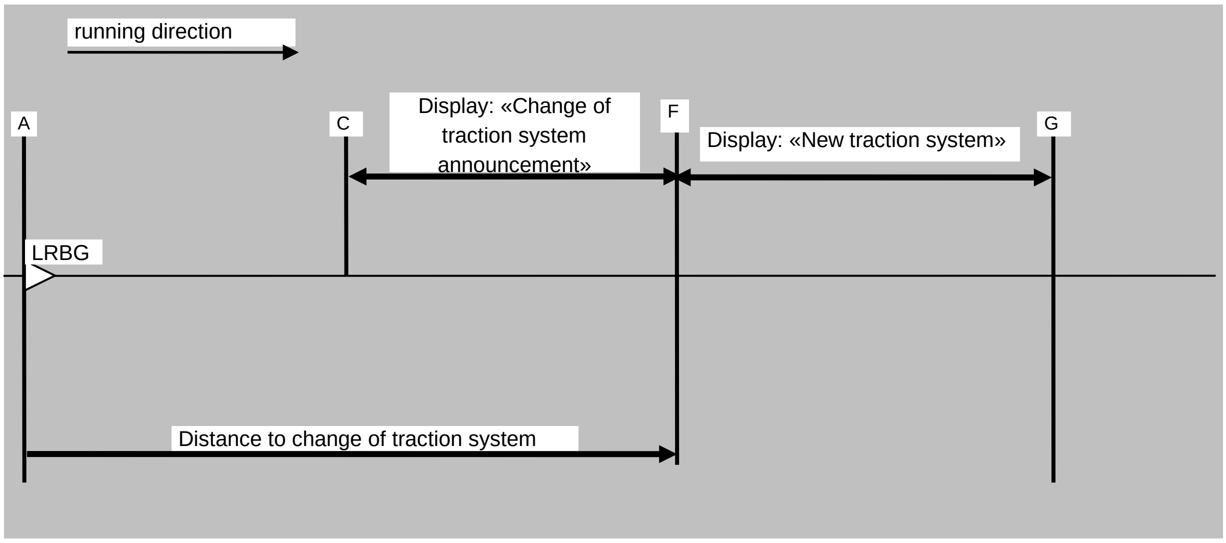

Figure 21: Changing the traction system

5.19 Procedure Limited Supervision

5.19.1 General Requirements

5.19.1.1 The order to switch to Limited Supervision mode shall be given by means of a mode profile.

5.19.1.2 An acknowledgement for running in Limited Supervision mode shall be requested from the driver. The conditions of the acknowledgement are specified below.

5.19.2 Limited Supervision is requested for current location (from modes different from Stand By and Post Trip)

5.19.2.1 In a level 1 area, the beginning of the Limited Supervision area can be the balise (group) that gives the Mode Profile. When the train passes the balise group and receives this information, the ERTMS/ETCS on-board equipment shall immediately switch to Limited Supervision mode.

5.19.2.2 In a level 2 or 3 area, the ERTMS/ETCS on-board equipment can receive a mode profile giving a Limited Supervision area which the train has already entered with its max safe front end. In this case, the ERTMS/ETCS on-board equipment shall immediately switch to Limited Supervision mode.

5.19.2.3 The driver must acknowledge the Limited Supervision mode. A request of acknowledgement shall be displayed to the driver.

5.19.2.4 If the driver has not acknowledged after the driver acknowledgement time (refer to Appendix A3.1), the service brake command shall be triggered. The brake command is released when the driver acknowledges, except if brakes are also applied for another reason(s).

5.19.2.5 **Note**: Once in Limited Supervision mode, the speed supervision is such that the train speed cannot exceed the LS mode speed limit. If, when entering the Limited Supervision mode, the train speed was higher than the LS mode speed limit (because a higher speed was allowed in Full Supervision mode, On Sight mode or in Staff Responsible mode) then an emergency brake command could be immediately triggered, independently of the acknowledgement of the driver, but because of the LS supervision (see Figure 22).

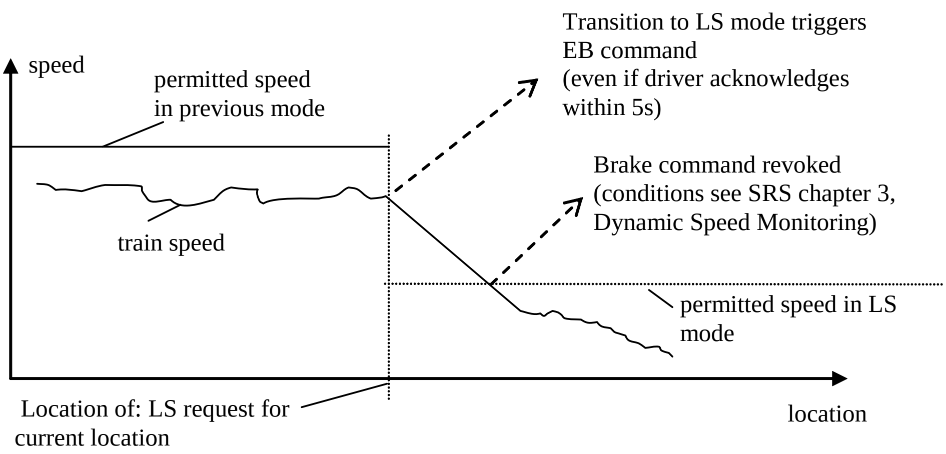

Figure 22: Train enters LS area with too high speed

5.19.2.6 **Note**: This sharp brake reaction can be avoided in Full Supervision or On Sight mode by giving with the previous MA an EOA (or a LOA = LS mode speed limit) at the location of transition to Limited Supervision mode.

5.19.2.7 If the ERTMS/ETCS on-board equipment is already in LS mode when receiving the LS mode profile, no further acknowledgement shall be requested from the driver.

5.19.3 Limited Supervision is requested for a further location

5.19.3.1 The beginning of the Limited Supervision area can be a location that the train has not reached yet. This occurs when:

a) In a level 1 area, a balise group gives a Mode Profile with an Limited Supervision area that is located at a further location.

b) In a level 2 or 3 area, the RBC gives a Mode Profile with an Limited Supervision area that is located at a further location.

5.19.3.2 A request for acknowledgement shall be displayed to the driver when the following conditions are fulfilled:

a) The distance between the estimated front end of the train and the beginning of Limited Supervision area is shorter than a value, contained in the mode profile.

b) The speed is lower than the Limited Supervision mode speed limit (national value, or value given in the mode profile).

c) The current mode is not Limited Supervision

5.19.3.3 **Note**: The first 2 conditions define the “rectangle of acknowledgement”.

5.19.3.4 Once the acknowledgement request is displayed, it is not taken back if the train leaves the “rectangle of acknowledgement” (for example: because the train accelerates).

5.19.3.5 Until the ERTMS/ETCS on-board equipment has switched to LS mode, according to the mode profile, the beginning of the Limited Supervision area shall be temporarily considered either as the EOA (keeping the SvL given by the MA) or as both the EOA and SvL (instead of the EOA and SvL given by the MA), with no Release Speed.

5.19.3.6 When the driver acknowledges the Limited Supervision mode, the ERTMS/ETCS on-board equipment shall immediately switch to the Limited Supervision mode.

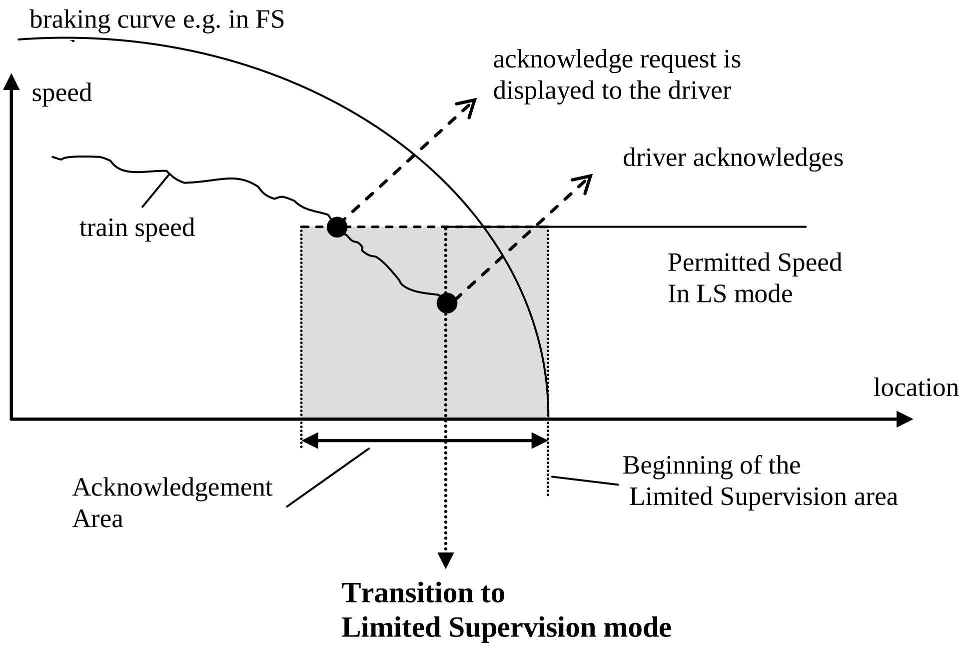

Figure 23: Transition to LS mode after driver acknowledgement

5.19.3.7 If the max safe front end of the train reaches the beginning of the Limited Supervision area according the mode profile and the driver has not yet acknowledged, the ERTMS/ETCS on-board equipment shall switch immediately to LS mode and a request for acknowledgement shall be displayed to the driver (refer to SRS chapter 4, transitions between modes).

5.19.3.8 If, in this case, the driver does not acknowledge within the driver acknowledgement time (refer to Appendix A3.1) after the change to LS mode, the service brake command shall be triggered. The command shall be released as soon as the driver acknowledges (unless the command was triggered also for other reasons).

5.19.4 Limited Supervision from Unfitted or SN mode

5.19.4.1 The mode profile with regards to an LS area is only evaluated in levels 1,2,3, although the mode profile may have been received in level 0 (Unfitted mode) or NTC (SN mode). A transition to Limited Supervision mode can therefore earliest occur at a transition of level: from level 0 or NTC to level 1 or 2 or 3.

5.19.4.2 Specifications of chapters 5.19.2 and 5.19.3 about the acknowledgement shall apply here.

5.19.5 Limited Supervision from Stand By or Post Trip mode

5.19.5.1 When performing a SoM or a Train Trip procedure and when the current level is 2 or 3, the ERTMS/ETCS on-board equipment can receive a mode profile giving an Limited Supervision area which the train has already entered with its max safe front end. In this case, the ERTMS/ETCS on-board equipment shall first require an acknowledgement from the driver.

5.19.5.2 When the driver acknowledges, the ERTMS/ETCS on-board equipment shall perform the transition to Limited Supervision mode.

5.19.6 Exit of Limited Supervision mode

5.19.6.1 General rule

5.19.6.1.1 The ERTMS/ETCS on-board equipment exits the Limited Supervision mode when the min safe front end of the train passes the end of the Limited supervision area.

5.19.6.2 First case: The Limited supervision area ends at the EOA of the current MA

5.19.6.2.1 This occurs when the end of the Limited Supervision area that is given by the Mode Profile has the same location as the EOA of the related MA.

5.19.6.2.2 In this case, the train must receive a new Movement Authority to be able to exit the Limited Supervision area.

5.19.6.3 Second case: The Limited Supervision area ends before the EOA of the current MA

5.19.6.3.1 In this case, the current Movement Authority already allows the train to exit the Limited Supervision area.

5.19.6.3.2 When exiting the Limited Supervision area, the ERTMS/ETCS on-board equipment switches either to Full Supervision, On Sight or to Shunting mode (refer to SRS chapter 4, transitions between modes).

5.19.7 Flowchart

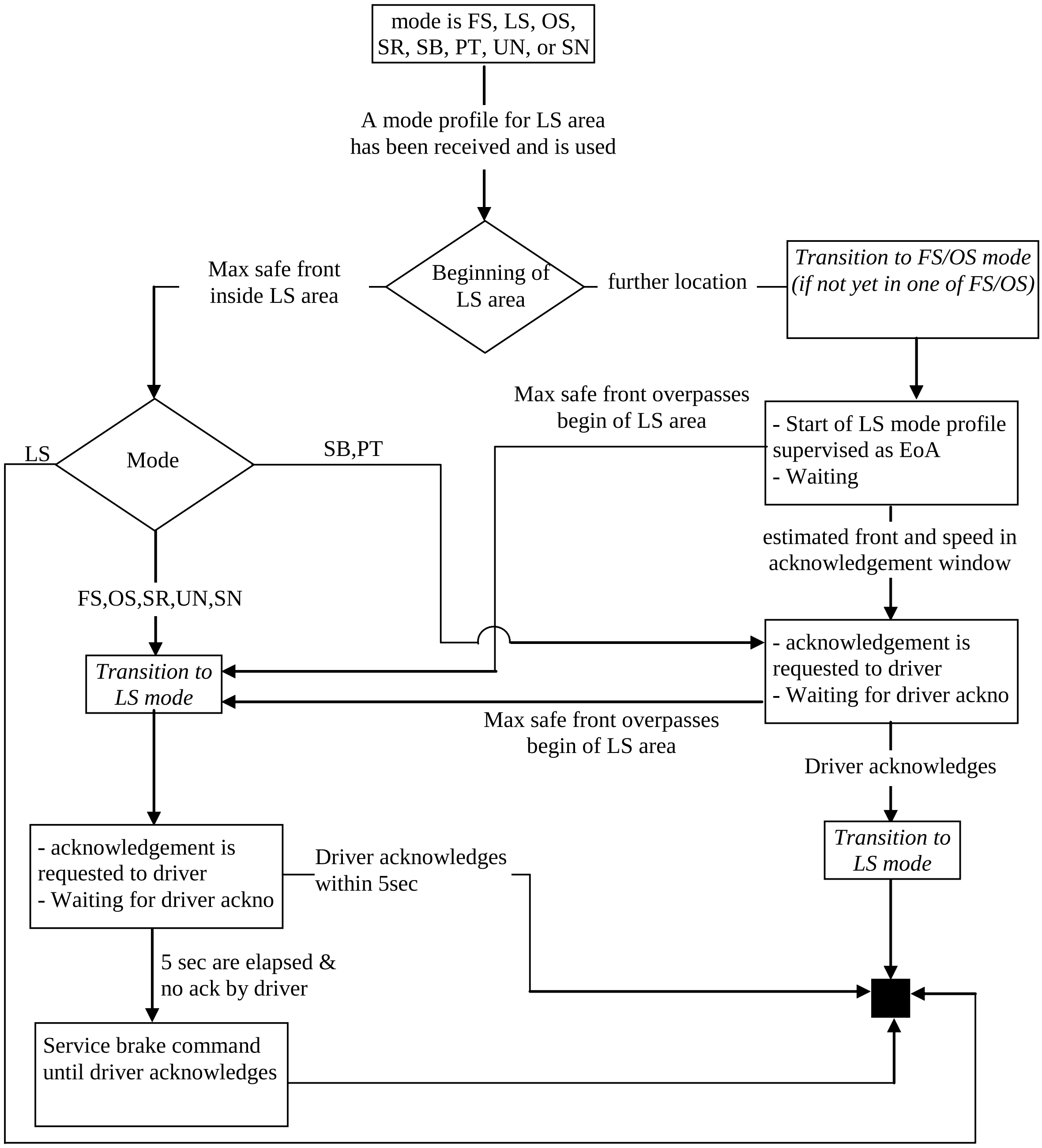

Figure 24: Flowchart for “Limited Supervision”

ERTMS/ETCS

System Requirements Specification

Chapter 6

Management of older System Versions

REF :	SUBSET-026-6
ISSUE :	3.3.0
DATE :	07/03/2012

6.1 Modification History

Issue Number Date	Modification / Description	Author
3.0.0 23/12/08	First and release version	Hougardy A.
3.0.1 22/12/09	Including the results of the editorial review of the SRS 3.0.0 and the other error CR's that are in state "Analysis completed" according to ERA CCM	Hougardy A.
3.1.0 22/02/10	Release version	Hougardy A.
3.1.1 08/11/10	Including all CR's that are in state "Analysis completed" according to ERA CCM, plus CR731.	Hougardy A.
3.2.0 22/12/10	Release version	Hougardy A.
3.2.1 13/12/11	Including all CR's that are in state "Analysis completed" according to ERA CCM.	Hougardy A.
3.3.0 07/03/12	Baseline 3 release version	Hougardy A.

6.2 Table of Contents

6.3 Scope

6.3.1.1 The chapter defines the composition of envelope of legally operated system versions, i.e. all the ERTMS/ETCS system versions that trackside shall be allowed to operate and that on-board equipment shall support.

6.3.1.2 By default, all the clauses listed in the other SRS chapters shall be applicable regardless of the system version operated; this chapter includes the exceptions to these clauses and the additional clauses, which shall apply when the system version of some trackside constituents and/or the system version operated relates to a version number older than the last one introduced.

6.4 Envelope of legally operated system versions

6.4.1 Incompatible versions

6.4.1.1 The system version number X, which a trackside infrastructure is allowed to operate with, shall be one of the following: 1 or 2

6.4.2 Compatible versions

6.4.2.1 Within system version number X = 1, the system version number Y that a trackside infrastructure is allowed to use shall be any of the following: 0 or 1

6.4.2.2 Within system version number X = 2, the system version number Y that a trackside infrastructure is allowed to use shall be 0

6.5 Trackside requirements in relation to older system versions

6.5.1 Trackside areas operated with system version number X = 1

6.5.1.1 Introduction

6.5.1.1.1 The section is applicable for trackside infrastructures that will be tendered and still operated with the system version number X = 1, after the entry into force of this release of the SRS.

6.5.1.1.2 Within a trackside infrastructure operated with the system version number X = 1, it shall be allowed to use the following values of M_VERSION: 1.0, and 1.1

6.5.1.1.3 Within a trackside area operated with an RBC certified to the system version number X = 1, it shall also be allowed to use the value M_VERSION = 2.0 for balises.

6.5.1.1.3.1 Note: this configuration is meaningful in case the trains operating on this RBC area support the system version number X = 2 and the on-board requirements related to the trackside information marked with 2.0 are applicable regardless of the operated version (i.e. they are applied by the on-board equipment even if this latter operates with the system version number X = 1 ordered by RBC).

6.5.1.2 Exceptions to chapter 3

6.5.1.2.1 Section 3.6.2.4 shall not apply.

6.5.1.2.2 Clause 3.7.1.1 b) shall be replaced with: “When needed, limitations related to the movement authority, i.e. Mode profile for On Sight or Shunting and signalling related speed restriction (see sections 3.12.4 and 3.11.6). Mode profile and Signalling related Speed restriction shall always be sent together with the MA to which the information belongs”

6.5.1.2.3 In clause 3.7.1.1 c), the bullet “Optionally Speed restriction to ensure a given permitted braking distance (see section 3.11. 11)” shall not apply.

6.5.1.2.4 In clause 3.7.2.4, the bullet “LX speed restrictions” shall not apply.

6.5.1.2.5 In clause 3.7.2.4, the bullet “Inhibition of revocable TSRs from balises in L2/3 (from RBC only)” shall not apply.

6.5.1.2.6 Clause 3.9.3.2 shall be replaced with: “The orders shall be sent via balise groups.”

6.5.1.2.7 Clause 3.9.3.8.1 shall not apply.

6.5.1.2.8 Clause 3.11.3.2.2 c) shall not apply.

6.5.1.2.9 Clause 3.11.3.2.3.1 shall be replaced with: “If at least one other specific SSP is less restrictive than any ”Cant Deficiency” SSP, it is the responsibility of the trackside engineering to ensure that for all possible combinations of international train categories a train might belong to, the ERTMS/ETCS on-board equipment will not replace the

”Cant Deficiency” SSP as selected in 3.11.3.2.3 leading to an unsafe situation by applying the requirement 3.11.3.2.6”

6.5.1.2.10 Clause 3.11.5.12 shall not apply.

6.5.1.2.11 Clauses 3.11.9.1, 3.12.5.1, 3.12.5.2, 3.12.5.4, 3.12.5.5, 3.12.5.6, 3.12.5.7, 3.15.1.2.3.1 o) shall not apply.

6.5.1.2.12 Clauses 3.11.11.1, 3.11.11.2 shall not apply

6.5.1.2.13 Clause 3.12.3.4.3.2 shall not apply.

6.5.1.2.14 Clauses 3.12.3.1.11 and 3.12.3.5.1 shall not apply.

6.5.1.2.15 Clause 3.12.4.1 shall be replaced with: “The Mode Profile can request On Sight mode and Shunting mode.”

6.5.1.2.16 Clause 3.12.4.2 shall be replaced with: “For OS mode the mode profile shall define the entry and the length of the On Sight area. For SH mode the mode profile only defines the entry location to SH mode, any length given shall be ignored by the on-board.”

6.5.1.2.17 Clause 3.15.1.2.3.1 p) shall not apply.

6.5.1.3 Exceptions to chapter 4

6.5.1.3.1 Void.

6.5.1.4 Exceptions to chapter 5

6.5.1.4.1 Void.

6.5.1.5 Exceptions to chapter 7

6.5.1.5.1 Clause 7.3.3.5 shall be replaced with: “Exception: Packet 255 “End of Telegram” does not follow the above defined structure.”

6.5.1.5.2 The table 7.4.1.1 shall be replaced with:

Packet Number	Packet Name	Page N°
2	System Version Order	
3	National Values	
5	Linking	
6	Virtual Balise Cover order	
12	Level 1 Movement Authority	
15	Level 2/3 Movement Authority	
16	Repositioning Information	
21	Gradient Profile	
27	International Static Speed Profile	
39	Track Condition Change of traction system {1}	
41	Level Transition Order	
42	Session Management	

Packet Number	Packet Name	Page N°
44	Data used by applications outside the ERTMS/ETCS system.	
45	Radio Network registration	
46	Conditional Level Transition Order	
49	List of balises for SH Area	
51	Axle load Speed Profile	
57	Movement Authority Request Parameters	
58	Position Report Parameters	
63	List of Balises in SR Authority	
65	Temporary Speed Restriction	
66	Temporary Speed Restriction Revocation	
67	Track Condition Big Metal Masses	
68	Track Condition {1}	
70	Route Suitability Data {1}	
71	Adhesion Factor	
72	Packet for sending plain text messages	
79	Geographical Position Information	
80	Mode profile	
90	Track Ahead Free up to level 2/3 transition location	
131	RBC transition order	
132	Danger for Shunting information	
133	Radio infill area information	
134	EOLM Packet	
135	Stop Shunting on desk opening	
136	Infill location reference	
137	Stop if in Staff Responsible	
138	Reversing area information	
139	Reversing supervision information	
140	Train running number from RBC	
141	Default Gradient for Temporary Speed Restriction	
145	Inhibition of balise group message consistency reaction	
200	Virtual Balise Cover marker	
203	National Values for braking curves	
206	Track Condition	
207	Route Suitability Data	
239	Track Condition Change of traction system	
254	Default balise, loop or RIU information	

{1}Note: used on lines where trains are operated with on-board equipment supporting only system version = 1.0.

6.5.1.5.3 Section 7.4.2.0 (Packet Number 0: Virtual Balise Cover marker) shall not apply.

6.5.1.5.4 Table 7.4.2.1.1 (Packet Number 3: National Values) shall be replaced with:

Description	Downloads a set of National Values to the train		
Transmitted by	Balise, RBC		
Content	**Variable**	**Length**	**Comment**

	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_VALIDNV	15	
	N_ITER	5	
	NID_C(k)	10	Identification of national area(s) to which the set applies
	V_NVSHUNT	7	
	V_NVSTFF	7	
	V_NVONSIGHT	7	
	V_NVUNFIT	7	
	V_NVREL	7	
	D_NVROLL	15	
	Q_NVSRBKTRG	1	
	Q_NVEMRRLS	1	
	V_NVALLOWOVTRP	7	
	V_NVSUPOVTRP	7	
	D_NVOVTRP	15	
	T_NVOVTRP	8	
	D_NVPOTRP	15	
	M_NVCONTACT	2	
	T_NVCONTACT	8	
	M_NVDERUN	1	
	D_NVSTFF	15	
	Q_NVDRIVER_ADHES	1	

6.5.1.5.5 Section 7.4.2.3.1 (Packet Number 13: Staff Responsible distance Information from loop) shall not apply.

6.5.1.5.6 Table 7.4.2.7 (Packet Number 27: International Static Speed Profile) shall be replaced with:

Description	Static speed profile and optionally speed limits depending on the international train category.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	

	L_PACKET	13	
	Q_SCALE	2	
	D_STATIC	15	
	V_STATIC	7	
	Q_FRONT	1	
	N_ITER	5	
	NC_DIFF(n)	4	
	V_DIFF(n)	7	
	N_ITER	5	
	D_STATIC(k)	15	
	V_STATIC(k)	7	
	Q_FRONT(k)	1	
	N_ITER(k)	5	
	NC_DIFF(k,m)	4	
	V_DIFF(k,m)	7	

6.5.1.5.7 Table 7.4.2.8 (Packet Number 39: Track Condition Change of traction system) shall be replaced with:

Description	The packet gives information about change of the traction system.		
Transmitted by	Any		
Content	Variable	Length	Comment
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_TRACTION	15	
	M_TRACTION	8	Identity of the traction system

6.5.1.5.8 Section 7.4.2.8.1 (Packet Number 40: Track Condition Change of allowed current consumption) shall not apply.

6.5.1.5.9 Table 7.4.2.11 (Packet Number 44: Data used by applications outside the ERTMS/ETCS system) shall be replaced with:

Description	Messages between trackside and on-board devices, which contain information used by applications outside the ERTMS/ETCS system.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	

	L_PACKET	13	
	NID_XUSER	9	
	Other data, depending on NID_XUSER		

6.5.1.5.10 Table 7.4.2.13 (Packet Number 51: Axle Load Speed Profile) shall be replaced with:

Description	This packet gives the speed restrictions for trains with axle load higher than or equal to the specified value for the speed restriction		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	Q_TRACKINIT	1	
	D_AXLELOAD	15	
	L_AXLELOAD	15	
	Q_FRONT	1	
	N_ITER	5	
	M_AXLELOAD(n)	7	
	V_AXLELOAD(n)	7	Speed restriction to be applied if the axle load of the train ≥ M_AXLELOAD(n)
	N_ITER	5	
	D_AXLELOAD(k)	15	
	L_AXLELOAD(k)	15	
	Q_FRONT(k)	1	
	N_ITER(k)	5	
	M_AXLELOAD(k,m)	7	
	V_AXLELOAD(k,m)	7	Speed restriction to be applied if the axle load of the train ≥ M_AXLELOAD(k,m)

6.5.1.5.11 Section 7.4.2.13.1 (Packet Number 52: Permitted Braking Distance Information) shall not apply.

6.5.1.5.12 Section 7.4.2.16.1 (Packet Number 64: Inhibition of revocable TSRs from balises in L2/3) shall not apply.

6.5.1.5.13 Section 7.4.2.20.1 (Packet Number 69: Track Condition Station Platforms) shall not apply.

6.5.1.5.14 Table 7.4.2.21 (Packet Number 70: Route Suitability data) shall be replaced with:

Description	The packet gives the characteristics needed to enter a route.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	Q_TRACKINIT	1	
	D_TRACKINIT	15	Only if Q_TRACKINIT = 1
	D_SUITABILITY	15	Only If Q_TRACKINIT = 0, D_SUITABILITY and the following variables follows
	Q_SUITABILITY	2	
	M_AXLELOAD	7	If Q_SUITABILITY = Max axle load.
	M_TRACTION	8	If Q_SUITABILITY = traction system
	N_ITER	5	
	D_SUITABILITY(k)	15	
	Q_SUITABILITY(k)	2	
	M_AXLELOAD(k)	7	If Q_SUITABILITY(k) = Max axle load.
	M_TRACTION(k)	8	If Q_SUITABILITY(k) = traction system

6.5.1.5.15 Table 7.4.2.23 (Packet Number 72: Packet for sending plain text messages) shall be replaced with:

Description			
Transmitted by	Balise, RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	Q_TEXTCLASS	2	
	Q_TEXTDISPLAY	1	
	D_TEXTDISPLAY	15	Start condition

	Variable	Length	Comment
	M_MODETEXTDISPLAY	4	Start condition
	M_LEVELTEXTDISPLAY	3	Start condition
	NID_NTC	8	If M_LEVELTEXTDISPLAY = 1 (NTC)
	L_TEXTDISPLAY	15	End condition
	T_TEXTDISPLAY	10	End condition
	M_MODETEXTDISPLAY	4	End condition
	M_LEVELTEXTDISPLAY	3	End condition
	NID_NTC	8	If M_LEVELTEXTDISPLAY = 1 (NTC)
	Q_TEXTCONFIRM	2	
	L_TEXT	8	
	X_TEXT(L_TEXT)	8	

6.5.1.5.16 Section 7.4.2.24 (Packet Number 76: Packet for sending fixed text messages) shall not apply.

6.5.1.5.17 Table 7.4.2.25 (Packet Number 79: Geographical Position Information) shall be replaced with:

Description	This packet gives geographical location information for one or multiple references to the train.		
Transmitted by	Balise, RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	Q_NEWCOUNTRY	1	
	NID_C	10	if Q_NEWCOUNTRY = 1
	NID_BG	14	Geographical Position Reference Balise Group
	D_POSOFF	15	
	Q_MPOSITION	1	Geographical Position counting direction
	M_POSITION	20	Track kilometre reference value
	N_ITER	5	
	Q_NEWCOUNTRY(k)	1	
	NID_C(k)	10	if Q_NEWCOUNTRY(k) = 1

	Variable	Length	Comment
	NID_BG(k)	14	Geographical Position Reference Balise Group
	D_POSOFF(k)	15	
	Q_MPOSITION(k)	1	Geographical Position counting direction
	M_POSITION(k)	20	Track kilometre reference value

6.5.1.5.18 Table 7.4.2.26 (Packet Number 80: Mode profile) shall be replaced with:

Description	Mode profile associated to an MA		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_MAMODE	15	
	M_MAMODE	2	OS, SH
	V_MAMODE	7	
	L_MAMODE	15	
	L_ACKMAMODE	15	
	N_ITER	5	
	D_MAMODE(k)	15	
	M_MAMODE(k)	2	OS, SH
	V_MAMODE(k)	7	
	L_MAMODE(k)	15	
	L_ACKMAMODE(k)	15	

6.5.1.5.19 Section 7.4.2.26.1 (Packet Number 88: Level Crossing information) shall not apply.

6.5.1.5.20 Section 7.4.2.37.1 (Packet Number 143: Session Management with neighbouring Radio Infill Unit) shall not apply.

6.5.1.5.21 Added section 7.4.2.37.3 (Packet Number 200: Virtual Balise Cover marker) shall apply:

Packet Number 200: Virtual Balise Cover marker

Description	Indication to on-board that the telegram can be ignored according to a VBC.		
Transmitted by	Balise		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	

	Q_DIR	2	
	L_PACKET	13	
	NID_VBCMK	6	

6.5.1.5.22 Added section 7.4.2.37.4 (Packet Number 203: National Values for braking curves) shall apply:

Packet Number 203: National Values for braking curves

Description	Downloads a subset of National Values to the train, used for braking curves. This subset is a complement to the National Values included in packet 3.		
Transmitted by	Balise, RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_NVGUIPERM	1	
	Q_NVSBFBPERM	1	
	Q_NVINHSMICPERM	1	
	A_NVMAXREDADH1	6	
	A_NVMAXREDADH2	6	
	A_NVMAXREDADH3	6	
	M_NVAVADH	5	
	M_NVEBCL	4	
	Q_NVKINT	1	
	Q_NVKVINTSET	2	Only if Q_NVKINT = 1, Q_NVKVINTSET and the following variables follow
	A_NVP12	6	Only if Q_NVKVINTSET = 1
	A_NVP23	6	Only if Q_NVKVINTSET = 1
	V_NVKVINT	7	= 0km/h
	M_NVKVINT	7	Valid between V_NVKVINT and V_NVKVINT(1) If Q_NVKVINTSET = 1, gives the correction factor if maximum emergency brake deceleration is lower than A_NVP12

M_NVKVINT	7	Only if Q_NVKVINTSET = 1 Valid between V_NVKVINT and V_NVKVINT(1) Gives the correction factor if maximum emergency brake deceleration is higher than A_NVP23
N_ITER	5	
V_NVKVINT(n)	7	
M_NVKVINT(n)	7	Valid between V_NVKVINT(n) and V_NVKVINT(n+1) If Q_NVKVINTSET = 1, gives the correction factor if maximum emergency brake deceleration is lower than A_NVP12
M_NVKVINT(n)	7	Only if Q_NVKVINTSET = 1 Valid between V_NVKVINT(n) and V_NVKVINT(n+1) Gives the correction factor if maximum emergency brake deceleration is higher than A_NVP23
N_ITER	5	
Q_NVKVINTSET(k)	2	
A_NVP12(k)	6	Only if Q_NVKVINTSET(k) = 1
A_NVP23(k)	6	Only if Q_NVKVINTSET(k) = 1
V_NVKVINT(k)	7	= 0km/h
M_NVKVINT(k)	7	Valid between V_NVKVINT(k) and V_NVKVINT(k,1) If Q_NVKVINTSET(k) = 1, gives the correction factor if maximum emergency brake deceleration is lower than A_NVP12(k)

	M_NVKVINT(k)	7	Only if Q_NVKVINTSET(k) = 1 Valid between V_NVKVINT(k) and V_NVKVINT(k,1) Gives the correction factor if maximum emergency brake deceleration is higher than A_NVP23(k)
	N_ITER(k)	5	
	V_NVKVINT(k,m)	7	
	M_NVKVINT(k,m)	7	Valid between V_NVKVINT(k,m) and V_NVKVINT(k,m+1) If Q_NVKVINTSET(k) = 1, gives the correction factor if maximum emergency brake deceleration is lower than A_NVP12(k)
	M_NVKVINT(k,m)	7	Only if Q_NVKVINTSET(k) = 1 Valid between V_NVKVINT(k,m) and V_NVKVINT(k,m+1) Gives the correction factor if maximum emergency brake deceleration is higher than A_NVP23(k)
	L_NVKRINT	5	= 0m
	M_NVKRINT	5	Valid between L_NVKRINT and L_NVKRINT(1)
	N_ITER	5	
	L_NVKRINT(l)	5	
	M_NVKRINT(l)	5	Valid between L_NVKRINT(l) and L_NVKRINT(l+1)
	M_NVKTINT	5	

6.5.1.5.23 Added section 7.4.2.37.5 (Packet Number 206: Track Condition) shall apply:

Packet Number 206: Track Condition

Description	The packet gives details concerning the track ahead to support the driver when e.g. lower pantograph		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	Q_TRACKINIT	1	
	D_TRACKINIT	15	Only if Q_TRACKINIT = 1
	D_TRACKCOND	15	Only if Q_TRACKINIT = 0, D_TRACKCOND and the following variables follow
	L_TRACKCOND	15	
	M_TRACKCONDBC	4	
	N_ITER	5	
	D_TRACKCOND(k)	15	
	L_TRACKCOND(k)	15	
	M_TRACKCONDBC(k)	4	

6.5.1.5.24 Added section 7.4.2.37.6 (Packet Number 207: Route Suitability Data) shall apply:

Packet Number 207: Route Suitability Data

Description	The packet gives the characteristics needed to enter a route.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	Q_TRACKINIT	1	
	D_TRACKINIT	15	Only if Q_TRACKINIT = 1
	D_SUITABILITY	15	Only If Q_TRACKINIT = 0, D_SUITABILITY and the following variables follows
	Q_SUITABILITY	2	

	M_LINEGAUGE	8	If Q_SUITABILITY = loading gauge
	M_AXLELOADCAT	7	If Q_SUITABILITY = Max axle load.
	M_VOLTAGE	4	If Q_SUITABILITY = traction system
	NID_CTRACTION	10	If Q_SUITABILITY = traction system and M_VOLTAGE ≠ 0
	N_ITER	5	
	D_SUITABILITY(k)	15	
	Q_SUITABILITY(k)	2	
	M_LINEGAUGE(k)	8	If Q_SUITABILITY = loading gauge
	M_AXLELOADCAT(k)	7	If Q_SUITABILITY = Max axle load.
	M_VOLTAGE(k)	4	If Q_SUITABILITY = traction system
	NID_CTRACTION(k)	10	If Q_SUITABILITY = traction system and M_VOLTAGE ≠ 0

6.5.1.5.25 Added section 7.4.2.37.7 (Packet Number 239: Track Condition Change of traction system) shall apply:

Packet Number 239: Track Condition Change of traction system

Description	The packet gives information about change of the traction system.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_TRACTION	15	
	M_VOLTAGE	4	Identity of the traction system
	NID_CTRACTION	10	NID_CTRACTION given only if M_VOLTAGE ≠ 0

6.5.1.5.26 Table 7.5.1.36 (D_VALIDNV) shall be replaced with:

Name	Distance to start of validity of national values		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***

15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

6.5.1.5.27 Added section 7.5.1.62.2 (M_AXLELOAD) shall apply:

M_AXLELOAD

Name	Axle load		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 t	40 t	0.5 t
Special/Reserved Values	101 0001	Spare	
	…	…	
	111 1101	Spare	
	111 1110	Axle load above 40 t	
	111 1111	Spare	

6.5.1.5.28 Table 7.5.1.70 (M_MAMODE) shall be replaced with:

Name	Required mode for a part of the MA		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
2 bits			
Special/Reserved Values	00	On Sight	
	01	Shunting	
	10 – 11	Spare	

6.5.1.5.29 Table 7.5.1.73 (M_MODETEXTDISPLAY) shall be replaced with:

Name	Onboard operating mode for text display		
Description	The text is displayed when entering / as long as in the defined mode		
Length of variable	Minimum Value	Maximum Value	Resolution/formula
4 bits			
Special/Reserved Values	0	Full Supervision	
	1	On Sight	
	2	Staff Responsible	
	3	Spare	
	4	Unfitted	
	5	Spare	
	6	Stand By	
	7	Trip	
	8	Post Trip	
	9	Spare	
	10	Spare	

	11	Non Leading
	12	Spare
	13	Spare
	14	Reversing
	15	The display of the text shall not be limited by the mode.

6.5.1.5.30 Table 7.5.1.76 (M_POSITION) shall be replaced with:

Name	Track kilometre reference value		
Description	The geographical position reporting function uses this variables content as a reference value.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
20 bits	0 m	1'048'574 m	1 m
Special/Reserved Values	1'048'575	No more geographical position calculation after this reference location	

6.5.1.5.31 Table 7.5.1.77 (M_TRACKCOND) shall be replaced with:

Name	Type of track condition		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
4 bits			
Special/Reserved Values	0000	Non stopping area – tunnel. Initial state: stopping permitted (no tunnel)	
	0001	Non stopping area – bridge. Initial state: stopping permitted (no bridge)	
	0010	Non stopping area – other reasons. Initial state: stopping permitted	
	0011	Powerless section – lower pantograph. Initial state: not powerless section	
	0100	Radio hole (stop supervising T_NVCONTACT). Initial state: supervise T_NVCONTACT	
	0101	Air tightness. Initial state: no request for air tightness	
	0110	Switch off regenerative brake. Initial state: regenerative brake on	
	0111	Switch off eddy current brake for service brake. Initial state: eddy current brake for service brake on	
	1000	Switch off magnetic shoe brake. Initial state: magnetic shoe brake on	
	1001	Powerless section – switch off the main power switch. Initial state: not powerless section	
	1010 –1111	Spare	

6.5.1.5.32 Added section 7.5.1.77.1 (M_TRACKCONDBC) shall apply:

M_TRACKCONDBC

Name	Type of track condition		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
4 bits			
Special/Reserved Values	0000	Non stopping area. Initial state: stopping permitted	

	0001	Tunnel stopping area. Initial state: no tunnel stopping area
	0010	Sound horn. Initial state: no request for sound horn
	0011	Powerless section – lower pantograph. Initial state: not powerless section
	0100	Radio hole (stop supervising T_NVCONTACT). Initial state: supervise T_NVCONTACT
	0101	Air tightness. Initial state: no request for air tightness
	0110	Switch off regenerative brake. Initial state: regenerative brake on
	0111	Switch off eddy current brake for service brake. Initial state: eddy current brake for service brake on
	1000	Switch off magnetic shoe brake. Initial state: magnetic shoe brake on
	1001	Powerless section – switch off the main power switch. Initial state: not powerless section
	1010	Switch off eddy current brake for emergency brake. Initial state: eddy current brake for emergency brake on
	1011 –1111	Spare

6.5.1.5.33 Added section 7.5.1.77.1 (M_TRACTION) shall apply:

M_TRACTION

Name	Traction system		
Description	It indicates the traction system installed on a specific line		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
8 bits			
Special/Reserved Values	0	Line not fitted with any traction system	
	1	3 kV DC, Italy	
	2	25 kV AC 50 Hz, Conventional lines France	
	3	25 kV AC 50 Hz, High speed lines France	
	4	Non interoperable value (this is not a spare value)	
	5	1.5 kV DC, France	
	6	1.5 kV DC, Netherlands	
	7	25 kV AC 50 Hz, Conventional lines Netherlands	
	8	25 kV AC 50 Hz, High speed lines Netherlands	
	9-10	Non interoperable value (this is not a spare value)	
	11	15kV AC 16 2/3 Hz, max. train current 600A Germany	
	12	15kV AC 16 2/3 Hz, max. train current 780A Germany	
	13	15kV AC 16 2/3 Hz, max. train current 900A Germany	
	14	Non interoperable value (this is not a spare value)	
	15	15kV AC 16 2/3 Hz, max. train current 1500A Germany	
	16-25	Non interoperable value (this is not a spare value)	
	26	25 kV AC 50 Hz, Italy	
	27-30	Non interoperable value (this is not a spare value)	

	31	25 kV AC 50 Hz, 1600mm, High speed lines Spain
	32	3 kV DC, Conventional lines 220 km/h Spain
	33	3 kV DC, Conventional lines160 km/h Spain
	34	25 kV AC 50 Hz, 1600mm/1950mm, High speed lines Spain
	35-40	Non interoperable value (this is not a spare value)
	41	15 kV AC 16 2/3 Hz, 1320mm/1450 mm, Switzerland
	42	15 kV AC 16 2/3 Hz, 1450 mm/1600 mm, Switzerland
	43	15 kV AC 16 2/3 Hz, 1950 mm, Switzerland
	44	15 kV AC 16 2/3 Hz, 1320 mm/1450 mm/1600 mm, Switzerland
	45	15 kV AC 16 2/3 Hz, 1450 mm/1600mm/1950 mm, Switzerland
	46	15 kV AC 16 2/3 Hz, 1320 mm/1450mm/1600mm/1950 mm, Switzerland
	47-255	Non interoperable value (this is not a spare value)

6.5.1.5.34 Table 7.5.1.83 (NC_DIFF) shall be replaced with:

Name	Specific SSP category		
Description	It is the specific SSP category for which a differential value for the static line speed exists. Used together with V_DIFF to permit trains belonging to the corresponding international train category to go faster or lower than the “international basic static speed” given by V_STATIC. Value 0 of NC_DIFF corresponds to the LSB of NC_TRAIN, value 14 of NC_DIFF to MSB (15-bit variable) of NC_TRAIN.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
4 bits	0	15	Numbers
Special/Reserved Values	0	Specific SSP applicable to Cant Deficiency 275 mm	
	1	Specific SSP applicable to Cant Deficiency 80 mm	
	2	Specific SSP applicable to Cant Deficiency 100 mm	
	3	Specific SSP applicable to Cant Deficiency 130 mm	
	4	Specific SSP applicable to Cant Deficiency 150 mm	
	5	Specific SSP applicable to Cant Deficiency 165 mm	
	6	Specific SSP applicable to Cant Deficiency 180 mm	
	7	Specific SSP applicable to Cant Deficiency 225 mm	
	8	Specific SSP applicable to Cant Deficiency 300 mm	
	9	Specific SSP applicable to Freight train braked in “P” position	
	10	Specific SSP applicable to Freight train braked in “G” position	
	11	Specific SSP applicable to Passenger train	
	12	Specific SSP applicable to Cant Deficiency 245 mm	
	13	Specific SSP applicable to Cant Deficiency 210 mm	
	14-15	Spare	

6.5.1.5.35 Table 7.5.1.138 (Q_TEXTCONFIRM) shall be replaced with:

Name	Qualifies the need / reaction of text confirmation		
Description			
Length of variable	**_Minimum Value_**	**_Maximum Value_**	**_Resolution/formula_**
2 bits			
Special/Reserved Values	00	No confirmation required	
	01	Continue display until confirmed	
	10	Apply service brake if not confirmed when end conditions reached	
	11	Spare	

6.5.1.5.36 Note: the packets listed above, which are not allowed for use in balise telegrams/loop messages marked with system version number X = 1 or in messages from RBC/RIU operating with system version number X = 1, may contain variables that have been introduced in the system version number X = 2. These variables are not mentioned in this section, since their use is implicitly forbidden by the fact that the packets using them are not allowed.

6.5.1.6 Exceptions to chapter 8

6.5.1.6.1 Clause 8.4.1.4.5 shall not apply.

6.5.1.6.2 Clause 8.4.1.4.8 shall be replaced with “Exception 8: A message transmitted by a balise group can contain several packets 200 (Virtual Balise Cover marker).”

6.5.1.6.3 The table under clause 8.4.2.1 shall be replaced with:

General Format of Balise Telegram			
Field No.	VARIABLE	Length (bits)	Remarks
1	Q_UPDOWN	1	Defines the direction of the information: Down-link telegram (train to track) (0) Up-link telegram (track to train) (1)
2	M_VERSION	7	Version of the ERTMS/ETCS system.
3	Q_MEDIA	1	Defines the type of media: Balise (0)
4	N_PIG	3	Position in the group. Defines the position of the balise in the balise group.
5	N_TOTAL	3	Total number of balises in the balise group
6	M_DUP	2	Used to indicate whether the information of the balise is a duplicate of the balise before or after this one.
7	M_MCOUNT	8	Message counter (M_MCOUNT) - 8 bits. To enable detection of a change of balise group message during passage of the balise group.
8	NID_C	10	Country or region.
9	NID_BG	14	Identity of the balise group.
10	Q_LINK	1	Marks the balise group as linked (Q_LINK = 1) or unlinked (Q_LINK = 0)
	Packet 200 (optional)	29	Virtual Balise Cover marker
	Information	Variable	This information is composed according to the rules applicable for packets.
	Packet 255	8	Finishing flag of the telegram

6.5.1.6.4 Clause 8.4.2.3 shall be replaced with “When used, the packet 200 shall be transmitted as the first packet of the telegram (i.e. it is appended to the header).”

6.5.1.6.5 The table under clause 8.4.4.4.1 shall be replaced with:

Track to Train message	**Mess. ID**	**Optional packets**
SR Authorisation	2	63
Movement Authority	3	21, 27, 49, 80, plus common optional packets
Request To Shorten MA	9	80
General Message	24	From RBC: 21, 27, plus common optional packets From RIU: 45, 254
SH authorised	28	49, plus common optional packets
MA with Shifted Location Reference	33	21, 27, 80, plus common optional packets
Infill MA	37	5, 21, 27, 39, 41, 44, 51, 65, 66, 68, 70, 71, 80, 138, 139, 206, 207, 239

6.5.1.6.6 The table under clause 8.4.4.4.1.1 shall be replaced with:

Common optional packets
3, 5, 39, 51, 41, 42, 44, 45, 57, 58, 65, 66, 68, 70, 71, 72, 79, 131, 138, 139, 140, 203, 206, 207, 239

6.5.1.6.7 Table 8.7.6 (Message 15: Conditional Emergency Stop) shall be replaced with:

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	NID_EM	Identification Number of the Emergency Stop Message.
7	Q_SCALE	
8	Q_DIR	
9	D_EMERGENCYSTOP	Distance between LRBG and the position reference to the emergency stop.

6.5.1.6.8 Table 8.7.14 (Message 34: Track Ahead Free Request) shall be replaced with:

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	Q_SCALE	
7	Q_DIR	
8	D_TAFDISPLAY	
9	L_TAFDISPLAY	

6.5.1.7 Additional requirements

6.5.1.7.1 Any balise telegram, which includes the packet 2, the packet 6, the packet 135, the packet 145, the packet 200, the packet 203, the packet 206, the packet 207 or the packet 239, shall be marked with the system version number 1.1.

6.5.1.7.2 An RBC that uses the packet 203, the packet 206, the packet 207 or the packet 239 shall transmit a system version number equal to 1.1, when negotiating the establishment of the communication session.

6.5.1.7.3 Any message transmitted by loop, which includes the packet 206, the packet 207 or the packet 239, shall be marked with the system version number 1.1.

6.5.1.7.4 An RIU that uses the packet 206, the packet 207 or the packet 239 shall transmit a system version number equal to 1.1, when negotiating the establishment of the communication session.

6.5.1.7.5 A balise group or RBC message including the packet 203 shall also include the packet 3 (i.e. in a message, the packet 203 cannot be transmitted without the packet 3).

6.5.1.7.6 In the packet 70, the use of the value “00” of the variable Q_SUITABILITY shall be forbidden.

6.5.2 Trackside areas operated with system version number X = 2

6.5.2.1 General

6.5.2.1.1 This section is applicable for trackside infrastructures that were operated with the system version number X = 1, before the migration to the system version number X = 2.

6.5.2.1.2 Within a trackside infrastructure operated with the system version number X =2, it shall be allowed to use the following values of M_VERSION: 1.0, 1.1 and 2.0

6.5.2.2 Exceptions to chapter 3, 4, 5

6.5.2.2.1 Void.

6.5.2.3 Exceptions to chapter 7, 8

6.5.2.3.1 For the balise telegrams/loop messages marked with the system version number 1.0 or 1.1 and for messages transmitted by RIUs certified to the system version number 1.0 or 1.1, the exceptions listed in sections 6.5.1.5 and 6.5.1.6 shall apply by analogy.

6.6 On-board requirements in relation to older system versions

6.6.1 Introduction

6.6.1.1 This section covers the following situations:

a) Train is running on a trackside infrastructure operated with system version number X = 1

b) Train is running on a trackside infrastructure operated with system version number X = 2, but still transmitting some balise/loop/RIU information related to system version number X = 1 (see section 6.5.1.7.6)

c) Train is running on a trackside infrastructure operated with system version number X = 2, but on-board equipment has established a communication session with a neighbouring RBC certified to system version number X = 1

6.6.2 Specific requirements for on-board operating with system version number X = 1

6.6.2.1 Exceptions to chapter 3

6.6.2.1.1 Clause 3.12.3.4.7.2 shall be replaced with: "If the driver acknowledges before the end condition is fulfilled, the on-board equipment shall consider the driver acknowledgement as always ending the text display, regardless of the end condition defined in 3.12.3.4.3.1".

6.6.2.2 Exceptions to chapter 4

6.6.2.2.1 Void

6.6.2.3 Exceptions to chapter 5

6.6.2.3.1 Void

6.6.2.4 Exceptions to chapter 7, 8

6.6.2.4.1 Void

6.6.3 Handling of air gap data related to system version number X = 1

6.6.3.1 General

6.6.3.1.1 For information received from trackside, the message consistency check shall be achieved taking into account the exceptions to chapters 7 and 8, as described in sections 6.5.1.5 and 6.5.1.6.

6.6.3.1.2 For information received from trackside, the ERTMS/ETCS on-board equipment shall use the translation tables defined here below, in order to use the information as if it had been elaborated in compliance with the current chapters 7 and 8.

6.6.3.2 Packets received from balise, loop, RIU, RBC

6.6.3.2.1 In the table below, the translation of information may depend on the on-board operated system version at the time the information is received and accepted on-board.

6.6.3.2.2 When a level transition or an RBC/RBC handover is announced, the information stored on-board in the transition buffer shall be translated according to system version operated on-board at the time the information is released from the transition buffer (i.e. the system version operated by the trackside infrastructure, towards which the train is running).

6.6.3.2.3 Depending on the packet, the action can be:

a) data is unchanged,

b) data is rejected,

c) data is translated,

d) not relevant

R = Rejected T = Translated U = Unchanged NR = Not relevant

Received information		Action	
Packet Number	Packet Name	Operated system version number X = 1	Operated system version number X = 2
2	System Version Order	U	U
3	National Values	T [1a] [2]	T [1b] [2]
5	Linking	U	U
6	Virtual Balise Cover order	U	U
12	Level 1 Movement Authority	U	U
15	Level 2/3 Movement Authority	U	U
16	Repositioning Information	U	U
21	Gradient Profile	U	U
27	International Static Speed Profile	U [3]	U [3]
39	Track Condition Change of traction system	T [13]	T [13]
41	Level Transition Order	U	U

Received information		**Action**	
Packet Number	Packet Name	Operated system version number X = 1	Operated system version number X = 2
42	Session Management	U	U
44	Data used by applications outside the ERTMS/ETCS system.	U	U
45	Radio Network registration	U	U
46	Conditional Level Transition Order	U	U
49	List of balises for SH Area	U	U
51	Axle load Speed Profile	T [4][5]	T [4][5]
57	Movement Authority Request Parameters	U	U
58	Position Report Parameters	U [10]	U [10]
63	List of Balises in SR Authority	U	U
65	Temporary Speed Restriction	U	U
66	Temporary Speed Restriction Revocation	U	U
67	Track Condition Big Metal Masses	U	U
68	Track Condition	U [8] [9]	U [8] [9]
70	Route Suitability Data	R [11] [12]	R [11] [12]
71	Adhesion Factor	U	U
72	Packet for sending plain text messages	U [6]	U [6]
76	Packet for sending fixed text messages	R	R
79	Geographical Position Information	U [14]	U [14]
80	Mode profile	T [7]	T [7]
90	Track Ahead Free up to level 2/3 transition location	U	U
131	RBC transition order	U	U
132	Danger for Shunting information	U	U
133	Radio infill area information	U	U
134	EOLM Packet	U	U
135	Stop Shunting on desk opening	U	U
136	Infill location reference	U	U
137	Stop if in Staff Responsible	U	U
138	Reversing area information	U	U
139	Reversing supervision information	U	U

Received information		Action	
Packet Number	Packet Name	Operated system version number X = 1	Operated system version number X = 2
140	Train running number from RBC	U	U
141	Default Gradient for Temporary Speed Restriction	U	U
145	Inhibition of balise group message consistency reaction	U	U
200	Virtual Balise Cover marker	T [15]	T [15]
203	National Values for braking curves	T [16]	T [16]
206	Track Condition	T [17]	T [17]
207	Route Suitability Data	T [18]	T [18]
239	Track Condition Change of traction system	T [19]	T [19]
254	Default balise, loop or RIU information	U	U

[1a] The National Values Q_NVLOCACC, V_NVLIMSUPERV (introduced in system version number X = 2) shall be set to their respective default value

[1b] The National Values Q_NVLOCACC, V_NVLIMSUPERV (introduced in system version number X = 2), if already stored on-board and applicable, shall not be affected by the content of the packet 3 (i.e. if these National Values were already applicable and 2nd bullet of clause 3.18.2.5 is not applied, they shall remain applicable with their country identifier(s) previously stored).

[2] If the packet 203 is not received in the same message, the National Values for braking curves Q_NVGUIPERM, Q_NVSBFBPERM, Q_NVINHSMICPERM, M_NVAVADH, M_NVEBCL, A_NVP12, A_NVP23, V_NVKVINT, M_NVKVINT, L_NVKRINT, M_NVKRINT, M_NVKTINT, A_NVMAXREDADH1, A_NVMAXREDADH2, A_NVMAXREDADH3 (introduced in system version number X.Y = 1.1), if already stored on-board and applicable, shall not be affected by the content of the packet 3 (i.e. if the National Values for braking curves were already applicable and 2nd bullet of clause 3.18.2.5 is not applied, they shall remain applicable with their country identifier(s) previously stored).

[3] Exception: if N_ITER (following Q_FRONT) $\neq$ 0, the variables Q_DIFF, NC_CDDIFF (introduced in system version number X = 2) and NC_DIFF (as specified in system version number X = 2) shall be set according to the following table:

Value received from X = 1 trackside	Translated values on-board		
NC_DIFF	Q_DIFF	NC_CDDIFF	NC_DIFF
0	0	9	-
1	0	0	-
2	0	1	-
3	0	2	-

4	0	3	-
5	0	4	-
6	0	5	-
7	0	7	-
8	0	10	-
9	1	-	0
10	1	-	1
11	1	-	2
12	0	8	-
13	0	6	-

[4] If Q_TRACKINIT = 1, D_TRACKINIT (introduced in system version number X = 2) shall be set to 0

[5] The variable M_AXLELOADCAT (introduced in system version number X = 2) shall be set according to the following table:

Value received from X = 1 trackside	Translated value on-board
M_AXLELOAD	M_AXLELOADCAT
M_AXLELOAD ≤ 16 t	A
16 t < M_AXLELOAD ≤ 17 t	HS17
17 t < M_AXLELOAD ≤ 18 t	B1
18 t < M_AXLELOAD ≤ 20 t	C2
20 t < M_AXLELOAD ≤ 22.5 t	D2
22.5 t < M_AXLELOAD ≤ 40 t or M_AXLELOAD = “Axle load above 40 t”	E4

[6] Exception: if Q_TEXTCONFIRM ≠ 0, then Q_CONFTEXTDISPLAY and Q_TEXTREPORT (introduced in system version number X = 2) shall be set to 0

[7] The variable Q_MAMODE (introduced in system version number X = 2) shall be set to 1

[8] Exception: If the packet 206 is not received in the same message and if M_TRACKCOND = 1 or 2, then M_TRACKCOND (modified in system version number X = 2) shall be set to 0

[9] Exception: If the packet 206 is received in the same message, the ERTMS/ETCS on-board shall ignore the packet 68.

[10] Exception: if M_LOC = 011, the packet shall be rejected

[11] Exception: If the packet 207 is not received in the same message and if Q_TRACKINIT = 1, the packet shall not be rejected.

[12] Exception: If the packet 207 is not received in the same message and if the value “10” of the variable Q_SUITABILITY is used with M_TRACTION equal to one of the values that are listed in the translation table [13], the variables M_VOLTAGE and NID_CTRACTION (introduced in system version X.Y = 1.1) shall be set according to the translation table [13]. The ERTMS/ETCS on-board shall ignore any other route suitability information not related to the traction system

[13] If the packet 239 is received in the same message or if M_TRACTION is not equal to one of the values that are listed here below, the ERTMS/ETCS on-board shall ignore the packet 39. If the packet 239 is not received in the same message and if M_TRACTION is equal to one of the values that are listed here below the variables M_VOLTAGE and NID_CTRACTION shall be set according to the following table:

Value received from X = 1 trackside	Translated values on-board	
M_TRACTION	M_VOLTAGE	NID_CTRACTION
0	0	-
1	3	10
2	1	12
3	1	13
5	4	14
6	4	1
7	1	2
8	1	3
11	2	19
12	2	20
13	2	21
15	2	22
26	1	11
31	1	18
32	3	15
33	3	16
34	1	17
41	2	4
42	2	5
43	2	6
44	2	7
45	2	8
46	2	9

[14] Exception: if M_POSITION = 1’048’575, then M_POSITION (modified in system version number X = 2) shall be set to 16’777’215

[15] The variable NID_PACKET shall be set to 0 and both the variables Q_DIR and L_PACKET shall be deleted

[16] The National Values included in the packet 203 shall be appended to the packet 3 received in the same message, in order to form a single set of National Values, to which apply the distance to start of validity and the list of national area identifiers given in the packet 3.

[17] The variable NID_PACKET shall be set to 68.

[18] The variable NID_PACKET shall be set to 70

[19] The variable NID_PACKET shall be set to 39

6.6.3.3 Messages received from RBC/RIU

6.6.3.3.1 This section applies for the parts of radio messages, excluding the packets themselves, which are received from an RBC/RIU certified to the system version number X = 1.

6.6.3.3.2 Depending on the received message, the action can be:

a) data is unchanged,

b) data is rejected

c) data is translated,

d) not relevant

R = Rejected T = Translated U = Unchanged NR = Not relevant

Message Number	Message Name	Action
2	SR Authorisation	U
3	Movement Authority	U
6	Recognition of exit from TRIP mode	U
8	Acknowledgement of Train Data	U
9	Request to Shorten MA	U
15	Conditional Emergency Stop	T [1]
16	Unconditional Emergency Stop	U
18	Revocation of Emergency Stop	U
24	General message	U
27	SH Refused	U
28	SH Authorised	U

Message Number	Message Name	Action
33	MA with Shifted Location Reference	U
34	Track Ahead Free Request	T [1]
37	Infill MA	U
40	Train Rejected	U
32	RBC/RIU system version	U
38	Initiation of a communication session	U
39	Acknowledgement of termination of a communication session	U
41	Train Accepted	U
43	SoM position report confirmed by RBC	U
45	Assignment of coordinate system	U

[1] Variable D_REF (introduced in system version number X = 2) shall be set to 0

6.6.3.4 Messages transmitted to RBC/RIU

6.6.3.4.1 This section applies for radio messages/packets, which are transmitted to an RBC or an RIU certified to the system version number X = 1.

6.6.3.4.2 Clause 3.18.4.5.4 shall be replaced with: “Only if valid Train Data is available: following any entry/modification of the train running number when a communication session is already established or following the successful establishment of a communication session when valid train running number is already available, the ERTMS/ETCS on-board equipment shall send the Train Data to the RBC.

6.6.3.4.3 Clause 3.18.4.5.4.1 shall be replaced with: “Exception: if the train running number has been received from the RBC, the Train Data shall not be sent back to the RBC by the ERTMS/ETCS on-board equipment.

6.6.3.4.4 The ERTMS/ETCS on-board equipment shall elaborate the information to be transmitted to the RBC/RIU certified to system version number X = 1, by applying the following translation table to the corresponding information intended for an RBC/RIU certified to the system version number X = 2.

6.6.3.4.5 Depending on the transmitted message/packet, the action can be:

a) data is unchanged,

b) data is deleted (i.e. it is not sent to the receiver)

c) data is translated,

d) not relevant (i.e. no corresponding requirement to trigger the sending is applicable)

D = Deleted T = Translated U = Unchanged NR = Not relevant

Mess $nb_{pck\ nb}$	Message name/packet name	Action
XXX_0	Position Report	U [1]
XXX_1	Position Report based on two balise groups	U [1]
159_3	On-board telephone numbers	U
XXX_4	Error Reporting	U [2]
XXX_5	Train Running Number	NR
132_9	Level 2/3 transition information	U
129_{11}	Validated Train Data (packet)	T [3]
129	Validated Train Data (message)	U
130	Request for Shunting	U
132	MA Request	T [4]
136	Train Position Report	U
137	Request to shorten MA is granted	U
138	Request to shorten MA is rejected	U
146	Acknowledgement	U
147	Acknowledgement of Emergency Stop	T [5]
149	Track Ahead Free Granted	U
150	End of Mission	U
153	Radio infill request	U
154	No compatible version supported	U
155	Initiation of a communication session	U
156	Termination of a communication session	U
157	SoM Position Report	U
159	Session Established	U

[1] Exception: if M_MODE (X=2) = 15 (PS), then M_MODE (X=1) = 3 (SH)

Note: if M_MODE (X=2) = 12 (LS), no translation is effected and the value 12 will be understood by RBC X = 1 as SE mode

[2] Exceptions: if M_ERROR (X=2) = 6, then M_ERROR (X=1) = 7; if M_ERROR (X=2) = 7 or 8, then the packet shall be deleted

[3] the packet 11 shall be translated as follows:

Description	Validated train data.
Transmitted to	RBC

Content	Variable	Length	Comment
	NID_PACKET	8	
	L_PACKET	13	
	NID_OPERATIONAL	32	See translation [3a]
	NC_TRAIN	15	See translation [3b]
	L_TRAIN	12	
	V_MAXTRAIN	7	
	M_LOADINGGAUGE	8	See translation [3c]
	M_AXLELOAD	7	See translation [3d]
	M_AIRTIGHT	2	
	N_ITER	5	See translation [3e]
	N_ITER	5	
	NID_NTC (k)	8	Type of National System available

[3a] NID_OPERATIONAL shall be set to the value stored on-board

[3b] NC_TRAIN shall be set according to the following table:

Value stored on-board	Transmitted value to X=1 RBC
NC_CDTRAIN	NC_TRAIN
0	xxx xxxx xxxx xx1x
1	xxx xxxx xxxx x1xx
2	xxx xxxx xxxx 1xxx
3	xxx xxxx xxx1 xxxx
4	xxx xxxx xx1x xxxx
5	xxx xxxx x1xx xxxx
6	x1x xxxx xxxx xxxx
7	xxx xxxx 1xxx xxxx
8	xx1 xxxx xxxx xxxx
9	xxx xxxx xxxx xxx1
10	xxx xxx1 xxxx xxxx
NC_TRAIN	
000 0000 0000 0000	No bit is set to 1
xxx xxxx xxxx xxx1	xxx xx1x xxxx xxxx
xxx xxxx xxxx xx1x	xxx x1xx xxxx xxxx
xxx xxxx xxxx x1xx	xxx 1xxx xxxx xxxx
Other values	No bit is set to 1

[3c] M_LOADINGGAUGE shall be set to 0

[3d] M_AXLELOAD shall be set according to the following table:

Value stored on-board	Transmitted value to X=1 RBC
A	16 t
HS17	17 t
B1	18 t
B2	18 t
C2	20 t
C3	20 t
C4	20 t
D2	22,5 t
D3	22,5 t
D4	22,5 t
D4xL	22,5 t
E4	25 t
E5	25 t

[3e] N_ITER shall be set to 0

[4] Q_MARQSTREASON shall be replaced with Q_TRACKDEL (1 bit) as follows: if Q_MARQSTREASON = x1xxx, Q_TRACKDEL shall be set to 1, otherwise Q_TRACKDEL shall be set to 0

[5] The variable Q_EMERGENCYSTOP (modified in system version number X = 2) shall be set according to the following table:

Value that would be transmitted to X=2 RBC	Transmitted value to X=1 RBC
Q_EMERGENCYSTOP	Q_EMERGENCYSTOP
0	0
1	0
2	2
3	1 (if rejection of CES) or 2 (if rejection of UES)

ERTMS/ETCS

System Requirements Specification

Chapter 7

ERTMS/ETCS language

REF : SUBSET-026-7

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7.1 Modification History

Issue Number Date	Section Number	Modification / Description	Author
0.0.1 990422	All	Creation of document	OG/DD
0.0.2 990423	All	Changed according to Siemens comments	OG/DD
1.1.0 990423	All	Class P Official Issue	OG/DD
1.1.1 990525	All	Add review comments UNISIG_All_COM_006_7.doc	BRO
1.1.2	All	Some minor corrections	SAB
1.1.3	All	First draft for class 1	SAB
1.1.4	All	Update according to review comments	SAB
1.1.5	All	Some minor modifications (see revision marks) + Addition of length of variables in the packets.	OG
1.1.6	Version number and editorial changes.	Finalisation meeting in Stuttgart 990729	HE
1.2.0 990730	Version Number	Release Version	HE
1.2.1 991209	All	Changes according to WPs for SRS upgrade + editorial changes due to ECSAG / UNISIG agreed questions	OG
1.3.0 991217	All	Changed according to review comments	OG
2.0.0 991222	Minor editorial changes	Release version	OG
2.0.1 000926	All	Corrections after UNISIG review 15 June 00	OG
2.1.0 001012	All	Corrections according to “ nisig_all_com_SRS_ 2.0.1” document	OG
2.2.0	Packet 71 deleted, NID_C 10 bit	UNISIG release	SAB

<table>
<tr><td>2.2.2</td><td>see revision marks</td><td>Corrections according to SUBSET-026 Corrected Paragraphs, issue 2.2.2.
Mainly, Packet 71 and Q_NVDRIVER_ADHES added</td><td>OG</td></tr>
<tr><td>2.2.4
24.05.2004</td><td></td><td>Update after cross checking and comments from Alain</td><td>B. Stamm</td></tr>
<tr><td>2.2.4 SG checked
28/05/04</td><td colspan="2">Including all CLRs agreed with the EEIG (see “List of CLRs agreed with EEIG for SRS v2.2.4” dated 28/05/04)
Affected clauses see change marks</td><td>H. Kast</td></tr>
<tr><td>2.2.5
04/01/05</td><td colspan="2">Incorporation of solution proposal for CLR 007 with EEIG users group comments</td><td>A. Hougardy</td></tr>
<tr><td>2.2.6</td><td colspan="2">Incorporation of all CRs and CLRs submitted to the EEIG until 21.01.2005</td><td>B. Stamm</td></tr>
<tr><td>2.2.7</td><td colspan="2">Incorporation of all CRs and CLRs extracted from “CR-Report_10.6.05-by number.rtf” and mentioned in column 2.2.7 in “CR status 13.6.05 _rmk_chap_3_4_220605.xls”</td><td>B. Stamm</td></tr>
<tr><td>2.2.8</td><td colspan="2">Change marks cleaned up and updated according to last CRs decisions (including split of CRs7&126)</td><td>J. Liesche</td></tr>
<tr><td>2.2.9
24/02/06</td><td colspan="2">Including all CRs that are classified as “IN” as per SUBSET-108 version 1.0.0
Removal of all CRs that are not classified as “IN” as per SUBSET-108 version 1.0.0, with the exception of CRs 63,98,120,158,538</td><td>J. Liesche</td></tr>
<tr><td>2.3.0
24/02/06</td><td colspan="2">Release version</td><td>HK</td></tr>
<tr><td>2.3.1</td><td colspan="2">Including SG CR decision made since SRS 2.2.8, correct errors in 2.2.8 detected when creating SRS 2.3.0</td><td>J. Liesche</td></tr>
<tr><td>2.3.2
17/03/08</td><td colspan="2">Including all CRs that are classified as “IN” as per SUBSET-108 version 1.2.0 and all CRs that are in state “Analysis completed” according to ERA CCM</td><td>A. Hougardy</td></tr>
</table>

2.9.1 06/10/08	Including all enhancement CR's retained for 3.0.0 baseline and all other error CR's that are in state "Analysis completed" according to ERA CCM For editorial reasons, the following CR's are also included: CR656, CR804, CR821	A. Hougardy
3.0.0 23/12/08	Release version	A. Hougardy
3.0.1 22/12/09	Including the results of the editorial review of the SRS 3.0.0 and the other error CR's that are in state "Analysis completed" according to ERA CCM	A. Hougardy
3.1.0 22/02/10	Release version	A. Hougardy
3.1.1 08/11/10	Including all CR's that are in state "Analysis completed" according to ERA CCM, plus CR731, 972 and 1000.	A. Hougardy
3.2.0 22/12/10	Release version	A. Hougardy
3.2.1 13/12/11	Including all CR's that are in state "Analysis completed" according to ERA CCM.	A. Hougardy
3.3.0 07/03/12	Baseline 3 release version	A. Hougardy

7.2 Table of Contents

7.3 Components of ERTMS/ETCS Language

7.3.1 Introduction

7.3.1.1 The ERTMS/ETCS language is used in transmitting information over the radio, balise and loop airgaps.

7.3.1.2 The ERTMS/ETCS language is based on variables, packets, messages and telegrams (variables and packets are described in this section, while telegrams and messages are described in chapter 8).

7.3.1.3 Note: A number of variables contain values which have to be assigned. Some of these values have to be unique to ensure that the system functions properly. A centralised handling of this assignment is therefore required (nationally or internationally, depending on the variable). The variables concerned have been marked. The values included in this document for these variables are therefore not to be used without prior verification of their validity. See SUBSET-054 for further details.

7.3.2 Definition of Variables

7.3.2.1 Variables shall be used to encode single data values. Variables cannot be split in minor units. The whole variable has one type (meaning).

7.3.2.2 Variables may have special values which are related to the basic meaning of the variable.

7.3.2.3 Special values have always the highest values in a variable (eg. 11...111 = "unknown").

7.3.2.4 Spare values shall be located between the normal and special values in the variable range

7.3.2.5 Names of variables are unique. A variable is used in context with the meaning as described in the variable definition. Variables with different meanings have different names.

7.3.2.6 All variable definitions shall be independent of the transport media over which they are used, if used in more than one media.

7.3.2.7 Signed values shall be encoded as 2's complement.

7.3.2.8 One bit variables (Boolean) shall always use 0 for false and 1 for true.

7.3.2.9 Offsets for numerical values shall be avoided (0 shall be used for 0, 1 for 1, etc.) except where justified.

7.3.2.10 When transmitting over the different transmission media, the most significant bit shall be transmitted first.

7.3.2.11 All Variables have one of the following prefixes:

A_	Acceleration
D_	distance
G_	Gradient
L_	length
M_	Miscellaneous
N_	Number
NC_	class number
NID_	identity number
Q_	Qualifier
T_	time/date
V_	Speed
X_	Text

7.3.3 Definition of Packets

7.3.3.1 Packets are multiple variables grouped into a single unit, with a defined internal structure.

7.3.3.2 This structure consists of a packet header with:

- Track to Train: a unique packet number, the length of the packet in bits, the orientation information, optionally the distance scale and an information section containing a defined set of variables. The packet structure is as follows:

Number	NID_PACKET	Packet identifier
Direction	Q_DIR	Specifies the validity direction of transmitted data
Length	L_PACKET	Number of bits in the packet
Scale	Q_SCALE	Specifies which distance scale is used for all distance information within the packet. There is no Q_SCALE variable in packets which do not contain distance information.
Information	......	Well defined set(s) of variables.

- Train to Track: a unique packet number, the length of the packet in bits, optionally the distance scale and an information section containing a defined set of variables. The packet structure is as follows:

Number	NID_PACKET	Packet identifier
Length	L_PACKET	Number of bits in the packet
Scale	Q_SCALE	Specifies which distance scale is used for all distance information within the packet.

		There is no Q_SCALE variable in packets which do not contain distance information.
Information	......	Well defined set(s) of variables.

7.3.3.3 The packet definition does not change when transmitted over different transmission media.

7.3.3.4 All currently not defined packet identifiers are reserved for future use and shall be considered as invalid values (i.e. like spare values). Exception: reception of information only differing by Y with regards to the highest system version number X supported by on-board (refer to section 3.17.3.11). All future packet definitions shall follow the above defined structure.

7.3.3.5 Exception: Packet 0 “Virtual Balise Cover marker” and Packet 255: “End of Telegram” do not follow the above defined structure.

7.3.3.6 N_ITER specifies the number of iterations of a variable or group of variables which follow.

7.3.3.7 If N_ITER is 0 then no variables follow.

7.3.3.8 Two nested levels of iterations can exist.

7.3.3.9 If, depending on the value of a previous qualifier variable in the packet, a variable is optional, it is written indented in the packet definition

7.3.3.10 Note: Row “Transmitted by” in the description of a packet specifies which ERTMS/ETCS trackside device (balise, loop, RIU, RBC) can transmit this packet. “Any” means that the packet can be transmitted by a balise, a loop, an RBC and a RIU.

7.3.3.10.1 Note: Row “Transmitted to” in the description of a packet specifies to which ERTMS/ETCS trackside device the packet can be transmitted.

7.4 PACKETS

7.4.1 List of Packets

7.4.1.1 Track to Train

Packet Number	Packet Name	Page N°
0	Virtual Balise Cover marker	11
2	System Version order	11
3	National Values	11
5	Linking	14
6	Virtual Balise Cover order	15
12	Level 1 Movement Authority	15
13	Staff Responsible distance information from loop	17
15	Level 2/3 Movement Authority	17
16	Repositioning Information	18
21	Gradient Profile	18
27	International Static Speed Profile	19
39	Track Condition Change of traction system	19
40	Track Condition Change of allowed current consumption	20
41	Level Transition Order	20
42	Session Management	21
44	Data used by applications outside the ERTMS/ETCS system.	21
45	Radio Network registration	21
46	Conditional Level Transition Order	22
49	List of balises for SH Area	22
51	Axle load Speed Profile	22
52	Permitted Braking Distance Information	23
57	Movement Authority Request Parameters	24
58	Position Report Parameters	24
63	List of Balises in SR Authority	25
64	Inhibition of revocable TSRs from balises in L2/3	25
65	Temporary Speed Restriction	25
66	Temporary Speed Restriction Revocation	26
67	Track Condition Big Metal Masses	26
68	Track Condition	26
69	Track Condition Station Platforms	27
70	Route Suitability Data	27
71	Adhesion Factor	28
72	Packet for sending plain text messages	29
76	Packet for sending fixed text messages	29
79	Geographical Position Information	30
80	Mode profile	31
88	Level crossing information	32
90	Track Ahead Free up to level 2/3 transition location	32

Packet Number	Packet Name	Page N°
131	RBC transition order	32
132	Danger for Shunting information	33
133	Radio infill area information	33
134	EOLM Packet	33
135	Stop Shunting on desk opening	34
136	Infill location reference	34
137	Stop if in Staff Responsible	34
138	Reversing area information	35
139	Reversing supervision information	35
140	Train running number from RBC	35
141	Default Gradient for Temporary Speed Restriction	35
143	Session Management with neighbouring Radio Infill Unit	36
145	Inhibition of balise group message consistency reaction	36
254	Default balise, loop or RIU information	36

7.4.1.2 Train to Track

Packet Number	Packet Name	Page N°
0	Position Report	37
1	Position Report based on two balise groups	37
3	Onboard telephone numbers	38
4	Error Reporting	38
5	Train running number	39
9	Level 2/3 transition information	39
11	Validated train data	39
44	Data used by applications outside the ERTMS/ETCS system.	40

7.4.1.3 Track to Train or Train to Track

Packet Number	Packet Name	Page N°
255	End of information	41

7.4.2 PACKETS: TRACK TO TRAIN

7.4.2.0 Packet Number 0: Virtual Balise Cover marker

Description	Indication to on-board that the telegram can be ignored according to a VBC		
Transmitted by	Balise		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	NID_VBCMK	6	

7.4.2.1 Packet Number 2: System Version order

Description	This packet is used to tell the on-board which is the operated system version		
Transmitted by	Balise		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	M_VERSION	7	

7.4.2.1.1 Packet Number 3: National Values

Description	Downloads a set of National Values to the train		
Transmitted by	Balise, RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_VALIDNV	15	
	NID_C	10	Identification of national areas to which the set applies
	N_ITER	5	
	NID_C(k)	10	Identification of additional national area(s) to which the set applies
	V_NVSHUNT	7	
	V_NVSTFF	7	
	V_NVONSIGHT	7	
	V_NVLIMSUPERV	7	
	V_NVUNFIT	7	

V_NVREL	7	
D_NVROLL	15	
Q_NVSBTSMPERM	1	
Q_NVEMRRLS	1	
Q_NVGUIPERM	1	
Q_NVSBFBPERM	1	
Q_NVINHSMICPERM	1	
V_NVALLOWOVTRP	7	
V_NVSUPOVTRP	7	
D_NVOVTRP	15	
T_NVOVTRP	8	
D_NVPOTRP	15	
M_NVCONTACT	2	
T_NVCONTACT	8	
M_NVDERUN	1	
D_NVSTFF	15	
Q_NVDRIVER_ADHES	1	
A_NVMAXREDADH1	6	
A_NVMAXREDADH2	6	
A_NVMAXREDADH3	6	
Q_NVLOCACC	6	
M_NVAVADH	5	
M_NVEBCL	4	
Q_NVKINT	1	
Q_NVKVINTSET	2	Only if Q_NVKINT = 1, Q_NVKVINTSET and the following variables follow
A_NVP12	6	Only if Q_NVKVINTSET = 1
A_NVP23	6	Only if Q_NVKVINTSET = 1
V_NVKVINT	7	= 0 km/h
M_NVKVINT	7	Valid between V_NVKVINT and V_NVKVINT(1) If Q_NVKVINTSET = 1, gives the correction factor if maximum emergency brake deceleration is lower than A_NVP12

M_NVKVINT	7	Only if Q_NVKVINTSET = 1 Valid between V_NVKVINT and V_NVKVINT(1) Gives the correction factor if maximum emergency brake deceleration is higher than A_NVP23
N_ITER	5	
V_NVKVINT(n)	7	
M_NVKVINT(n)	7	Valid between V_NVKVINT(n) and V_NVKVINT(n+1) If Q_NVKVINTSET = 1, gives the correction factor if maximum emergency brake deceleration is lower than A_NVP12
M_NVKVINT(n)	7	Only if Q_NVKVINTSET = 1 Valid between V_NVKVINT(n) and V_NVKVINT(n+1) Gives the correction factor if maximum emergency brake deceleration is higher than A_NVP23
N_ITER	5	
Q_NVKVINTSET(k)	2	
A_NVP12(k)	6	Only if Q_NVKVINTSET(k) = 1
A_NVP23(k)	6	Only if Q_NVKVINTSET(k) = 1
V_NVKVINT(k)	7	= 0km/h
M_NVKVINT(k)	7	Valid between V_NVKVINT(k) and V_NVKVINT(k,1) If Q_NVKVINTSET(k) = 1, gives the correction factor if maximum emergency brake deceleration is lower than A_NVP12(k)
M_NVKVINT(k)	7	Only if Q_NVKVINTSET(k) = 1 Valid between V_NVKVINT(k) and V_NVKVINT(k,1) Gives the correction factor if maximum emergency brake deceleration is higher than A_NVP23(k)

	N_ITER(k)	5	
	V_NVKVINT(k,m)	7	
	M_NVKVINT(k,m)	7	Valid between V_NVKVINT(k,m) and V_NVKVINT(k,m+1) If Q_NVKVINTSET(k) = 1, gives the correction factor if maximum emergency brake deceleration is lower than A_NVP12(k)
	M_NVKVINT(k,m)	7	Only if Q_NVKVINTSET(k) = 1 Valid between V_NVKVINT(k,m) and V_NVKVINT(k,m+1) Gives the correction factor if maximum emergency brake deceleration is higher than A_NVP23(k)
	L_NVKRINT	5	= 0m
	M_NVKRINT	5	Valid between L_NVKRINT and L_NVKRINT(1)
	N_ITER	5	
	L_NVKRINT(l)	5	
	M_NVKRINT(l)	5	Valid between L_NVKRINT(l) and L_NVKRINT(l+1)
	M_NVKTINT	5	

7.4.2.2 Packet Number 5: Linking

Description	Linking Information.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_LINK	15	
	Q_NEWCOUNTRY	1	
	NID_C	10	if Q_NEWCOUNTRY = 1
	NID_BG	14	
	Q_LINKORIENTATION	1	
	Q_LINKREACTION	2	
	Q_LOCACC	6	

	N_ITER	5	
	D_LINK (k)	15	
	Q_NEWCOUNTRY(k)	1	
	NID_C (k)	10	if Q_NEWCOUNTRY(k) = 1
	NID_BG (k)	14	
	Q_LINKORIENTATION (k)	1	
	Q_LINKREACTION (k)	2	
	Q_LOCACC (k)	6	

7.4.2.2.1 Packet Number 6: Virtual Balise Cover order

Description	The packet sets/removes a Virtual Balise Cover.		
Transmitted by	Balise		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_VBCO	1	
	NID_VBCMK	6	
	NID_C	10	
	T_VBC	8	Only if Q_VBCO = 1

7.4.2.3 Packet Number 12: Level 1 Movement Authority

Description	Transmission of a movement authority for level 1.		
Transmitted by	Balise, loop, RIU		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	V_MAIN	7	
	V_LOA	7	
	T_LOA	10	Can be set to “no time-out”
	N_ITER	5	Set to zero if V_MAIN = 0 or if only one section in the MA
	L_SECTION(k)	15	
	Q_SECTIONTIMER(k)	1	
	T_SECTIONTIMER(k)	10	

	D_SECTIONTIMERSTOPLOC(k)	15	
	L_ENDSECTION	15	
	Q_SECTIONTIMER	1	
	T_SECTIONTIMER	10	
	D_SECTIONTIMERSTOPLOC	15	
	Q_ENDTIMER	1	
	T_ENDTIMER	10	
	D_ENDTIMERSTARTLOC	15	
	Q_DANGERPOINT	1	
	D_DP	15	
	V_RELEASEDP	7	
	Q_OVERLAP	1	
	D_STARTOL	15	
	T_OL	10	
	D_OL	15	
	V_RELEASEOL	7	

7.4.2.3.1 Packet Number 13: Staff Responsible distance Information from loop

Description	Information for trains in staff responsible mode		
Transmitted by	Loop		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	Q_NEWCOUNTRY	1	
	NID_C	10	If Q_NEWCOUNTRY = 1
	NID_BG	14	Main signal balise group
	Q_NEWCOUNTRY	1	
	NID_C	10	If Q_NEWCOUNTRY = 1
	NID_BG	14	Reference balise
	D_SR	15	
	N_ITER	5	
	Q_NEWCOUNTRY (k)	1	
	NID_C (k)	10	If Q_NEWCOUNTRY (k) = 1
	NID_BG (k)	14	Reference balise
	D_SR (k)	15	

7.4.2.4 Packet Number 15: Level 2/3 Movement Authority

Description	Transmission of a movement authority for levels 2/3.		
Transmitted by	RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	V_LOA	7	
	T_LOA	10	Can be set to “no time-out”
	N_ITER	5	Set to zero if only one section in the MA
	L_SECTION(k)	15	
	Q_SECTIONTIMER(k)	1	
	T_SECTIONTIMER(k)	10	

	D_SECTIONTIMERSTOPLOC(k)	15	
	L_ENDSECTION	15	
	Q_SECTIONTIMER	1	
	T_SECTIONTIMER	10	
	D_SECTIONTIMERSTOPLOC	15	
	Q_ENDTIMER	1	
	T_ENDTIMER	10	
	D_ENDTIMERSTARTLOC	15	
	Q_DANGERPOINT	1	
	D_DP	15	
	V_RELEASEDP	7	
	Q_OVERLAP	1	
	D_STARTOL	15	
	T_OL	10	
	D_OL	15	
	V_RELEASEOL	7	

7.4.2.5 Packet Number 16: Repositioning Information

Description	Transmission of the update of the current distance		
Transmitted by	Balise		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	L_SECTION	15	

7.4.2.6 Packet Number 21: Gradient Profile

Description	Transmission of the gradient. D_GRADIENT gives the distance to the next change of the gradient value. The gradient value is the minimum gradient for the given distance.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_GRADIENT	15	

	Q_GDIR	1	0 = downhill 1= uphill
	G_A	8	
	N_ITER	5	
	D_GRADIENT(k)	15	
	Q_GDIR(k)	1	0 = downhill 1= uphill
	G_A(k)	8	

7.4.2.7 Packet Number 27: International Static Speed Profile

Description	Static speed profile and optionally speed limits depending on the international train category.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_STATIC	15	
	V_STATIC	7	Basic SSP
	Q_FRONT	1	
	N_ITER	5	
	Q_DIFF(n)	2	
	NC_CDDIFF(n)	4	If Q_DIFF(n) = 0
	NC_DIFF(n)	4	If Q_DIFF(n) = 1 or 2
	V_DIFF(n)	7	
	N_ITER	5	
	D_STATIC(k)	15	
	V_STATIC(k)	7	Basic SSP
	Q_FRONT(k)	1	
	N_ITER(k)	5	
	Q_DIFF(k,m)	2	
	NC_CDDIFF(k,m)	4	If Q_DIFF(k,m) = 0
	NC_DIFF(k,m)	4	If Q_DIFF(k,m) = 1 or 2
	V_DIFF(k,m)	7	

7.4.2.8 Packet Number 39: Track Condition Change of traction system

Description	The packet gives information about change of the traction system.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**

	Variable	Length	Comment
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_TRACTION	15	
	M_VOLTAGE	4	Identity of the traction system
	NID_CTRACTION	10	NID_CTRACTION given only if M_VOLTAGE ≠ 0

7.4.2.8.1 Packet Number 40: Track Condition Change of allowed current consumption

Description	The packet gives information about change of the allowed current consumption.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_CURRENT	15	
	M_CURRENT	10	Allowed current consumption.

7.4.2.9 Packet Number 41: Level Transition Order

Description	Packet to identify where a level transition shall take place. In case of mixed levels, the successive M_LEVELTR's go from the highest priority level to the lowest one.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_LEVELTR	15	
	M_LEVELTR	3	
	NID_NTC	8	If M_LEVELTR = 1 (NTC)
	L_ACKLEVELTR	15	
	N_ITER	5	
	M_LEVELTR(k)	3	
	NID_NTC(k)	8	If M_LEVELTR(k) = 1 (NTC)

	L_ACKLEVELTR(k)	15	

7.4.2.10 Packet Number 42: Session Management

Description	Packet to give the identity and telephone number of the RBC with which a session shall be established or terminated.		
Transmitted by	Balise, RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_RBC	1	
	NID_C	10	RBC ETCS identity : NID_C not relevant if NID_RBC has value "Contact last known RBC"
	NID_RBC	14	
	NID_RADIO	64	not relevant if NID_RBC has value "Contact last known RBC"
	Q_SLEEPSESSION	1	

7.4.2.11 Packet Number 44: Data used by applications outside the ERTMS/ETCS system.

Description	Messages between trackside and on-board devices, which contain information used by applications outside the ERTMS/ETCS system.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	NID_XUSER	9	
	NID_NTC	8	Only if NID_XUSER = 102 (National System functions)
	Other data, depending on NID_XUSER		

7.4.2.11.1 Packet Number 45: Radio Network registration

Description	Packet to give the identity of the Radio Network to which a registration shall be enforced.		
Transmitted by	Balise, RBC, RIU		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	

	Q_DIR	2	
	L_PACKET	13	
	NID_MN	24	

7.4.2.11.2 Packet Number 46: Conditional Level Transition Order

Description	Packet for a conditional level transition. The successive M_LEVELTR's go from the highest priority level to the lowest one.		
Transmitted by	Balise		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	M_LEVELTR	3	
	NID_NTC	8	If M_LEVELTR = 1 (NTC)
	N_ITER	5	
	M_LEVELTR(k)	3	
	NID_NTC(k)	8	If M_LEVELTR(k) = 1 (NTC)

7.4.2.12 Packet Number 49: List of balises for SH Area

Description	Used to list balise group(s) which the train can pass over in SH mode		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	N_ITER	5	
	Q_NEWCOUNTRY(k)	1	
	NID_C(k)	10	if Q_NEWCOUNTRY(k) = 1
	NID_BG(k)	14	

7.4.2.13 Packet Number 51: Axle Load Speed Profile

Description	This packet gives the speed restrictions for trains with axle load category higher than or equal to the specified value for the speed restriction		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	

	Q_SCALE	2	
	Q_TRACKINIT	1	
	D_TRACKINIT	15	Only if Q_TRACKINIT = 1
	D_AXLELOAD	15	Only if Q_TRACKINIT = 0, D_AXLELOAD and the following variables follow
	L_AXLELOAD	15	
	Q_FRONT	1	
	N_ITER	5	
	M_AXLELOADCAT(n)	7	
	V_AXLELOAD(n)	7	Speed restriction to be applied if the axle load category of the train ≥ M_AXLELOADCAT(n)
	N_ITER	5	
	D_AXLELOAD(k)	15	
	L_AXLELOAD(k)	15	
	Q_FRONT(k)	1	
	N_ITER(k)	5	
	M_AXLELOADCAT(k,m)	7	
	V_AXLELOAD(k,m)	7	Speed restriction to be applied if the axle load category of the train ≥ M_AXLELOADCAT(k,m)

7.4.2.13.1 Packet Number 52: Permitted Braking Distance Information

Description	This packet requests the on-board calculation of speed restrictions which ensure a given permitted brake distance in case of an EB, or SB, intervention		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	Q_TRACKINIT	1	
	D_TRACKINIT	15	Only if Q_TRACKINIT = 1
	D_PBD	15	Only if Q_TRACKINIT = 0, D_PBD and the following variables follow
	Q_GDIR	1	0 = downhill, 1 = uphill
	G_PBDSR	8	Gradient value to be used for the calculation

	Variable	Length	Comment
	Q_PBDSR	1	
	D_PBDSR	15	
	L_PBDSR	15	
	N_ITER	5	
	D_PBD(k)	15	
	Q_GDIR(k)	1	0 = downhill, 1 = uphill
	G_PBDSR(k)	8	Gradient value to be used for the calculation
	Q_PBDSR(k)	1	
	D_PBDSR(k)	15	
	L_PBDSR(k)	15	

7.4.2.14 Packet Number 57: Movement Authority Request Parameters

Description	This packet is intended to give parameters telling when and how often the train has to ask for a movement authority.		
Transmitted by	RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	T_MAR	8	
	T_TIMEOUTRQST	10	
	T_CYCRQST	8	

7.4.2.15 Packet Number 58: Position Report Parameters

Description	This packet is intended to give parameters telling when and how often the position has to be reported.		
Transmitted by	RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	T_CYCLOC	8	
	D_CYCLOC	15	
	M_LOC	3	
	N_ITER	5	
	D_LOC(k)	15	

	Q_LGTLOC(k)	1	

7.4.2.16 Packet Number 63: List of Balises in SR Authority

Description	Used to list balise group(s) which the train can pass over in SR mode		
Transmitted by	RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	*2*	
	L_PACKET	13	
	N_ITER	5	
	Q_NEWCOUNTRY(k)	1	
	NID_C(k)	10	if Q_NEWCOUNTRY(k) = 1
	NID_BG(k)	14	

7.4.2.16.1 Packet Number 64: Inhibition of revocable TSRs from balises in L2/3

Description	This packet is used to inhibit revocable TSRs from balises in level 2 or 3.		
Transmitted by	RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	

7.4.2.17 Packet Number 65: Temporary Speed Restriction

Description	Transmission of temporary speed restriction.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	NID_TSR	8	
	D_TSR	15	
	L_TSR	15	
	Q_FRONT	1	
	V_TSR	7	

7.4.2.18 Packet Number 66: Temporary Speed Restriction Revocation

Description	Transmission of temporary speed restriction revocation.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	NID_TSR	8	Identity of TSR to be revoked

7.4.2.19 Packet Number 67: Track Condition Big Metal Masses

Description	The packet gives details concerning where to ignore integrity check alarms of balise transmission due to big metal masses trackside.		
Transmitted by	Balise		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_TRACKCOND	15	
	L_TRACKCOND	15	The distance for which integrity check alarms of balise transmission shall be ignored
	N_ITER	5	
	D_TRACKCOND(k)	15	
	L_TRACKCOND(k)	15	The distance for which integrity check alarms of balise transmission shall be ignored

7.4.2.20 Packet Number 68: Track Condition

Description	The packet gives details concerning the track ahead to support the driver when e.g. lower pantograph		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	Q_TRACKINIT	1	

	D_TRACKINIT	15	Only if Q_TRACKINIT = 1
	D_TRACKCOND	15	Only if Q_TRACKINIT = 0, D_TRACKCOND and the following variables follow
	L_TRACKCOND	15	
	M_TRACKCOND	4	
	N_ITER	5	
	D_TRACKCOND(k)	15	
	L_TRACKCOND(k)	15	
	M_TRACKCOND(k)	4	

7.4.2.20.1 Packet Number 69: Track Condition Station Platforms

Description	The packet gives details concerning the location and height of station platforms for use by the train's door control system		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	Q_TRACKINIT	1	
	D_TRACKINIT	15	Only if Q_TRACKINIT = 1
	D_TRACKCOND	15	Only if Q_TRACKINIT = 0, D_TRACKCOND and the following variables follow
	L_TRACKCOND	15	
	M_PLATFORM	4	
	Q_PLATFORM	2	
	N_ITER	5	
	D_TRACKCOND(k)	15	
	L_TRACKCOND(k)	15	
	M_PLATFORM(k)	4	
	Q_PLATFORM(k)	2	

7.4.2.21 Packet Number 70: Route Suitability Data

Description	The packet gives the characteristics needed to enter a route.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**

	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	Q_TRACKINIT	1	
	D_TRACKINIT	15	Only if Q_TRACKINIT = 1
	D_SUITABILITY	15	Only If Q_TRACKINIT = 0, D_SUITABILITY and the following variables follows
	Q_SUITABILITY	2	
	M_LINEGAUGE	8	If Q_SUITABILITY= loading gauge
	M_AXLELOADCAT	7	If Q_SUITABILITY= Max axle load.
	M_VOLTAGE	4	If Q_SUITABILITY = traction system
	NID_CTRACTION	10	If Q_SUITABILITY = traction system and M_VOLTAGE ≠0
	N_ITER	5	
	D_SUITABILITY(k)	15	
	Q_SUITABILITY(k)	2	
	M_LINEGAUGE(k)	8	If Q_SUITABILITY(k) = loading gauge
	M_AXLELOADCAT(k)	7	If Q_SUITABILITY(k) = Max axle load.
	M_VOLTAGE(k)	4	If Q_SUITABILITY(k) = traction system
	NID_CTRACTION(k)	10	If Q_SUITABILITY(k) = traction system and M_VOLTAGE(k) ≠0

7.4.2.22 Packet number 71: Adhesion factor

Description	This packet is used when the trackside requests a change of the adhesion factor to be used in the brake model.		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_ADHESION	15	

	L_ADHESION	15	
	M_ADHESION	1	

7.4.2.23 Packet Number 72: Packet for sending plain text messages

Description			
Transmitted by	Balise, RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	Q_TEXTCLASS	2	
	Q_TEXTDISPLAY	1	Start/end events relation
	D_TEXTDISPLAY	15	Start event
	M_MODETEXTDISPLAY	4	Start event
	M_LEVELTEXTDISPLAY	3	Start event
	NID_NTC	8	If M_LEVELTEXTDISPLAY = 1 (NTC)
	L_TEXTDISPLAY	15	End event
	T_TEXTDISPLAY	10	End event
	M_MODETEXTDISPLAY	4	End event
	M_LEVELTEXTDISPLAY	3	End event
	NID_NTC	8	If M_LEVELTEXTDISPLAY = 1 (NTC)
	Q_TEXTCONFIRM	2	
	Q_CONFTEXTDISPLAY	1	If Q_TEXTCONFIRM ≠ 0
	Q_TEXTREPORT	1	If Q_TEXTCONFIRM ≠ 0
	NID_TEXTMESSAGE	8	Only If Q_TEXTREPORT = 1
	NID_C	10	Only If Q_TEXTREPORT = 1
	NID_RBC	14	Only If Q_TEXTREPORT = 1
	L_TEXT	8	
	X_TEXT(L_TEXT)	8	

7.4.2.24 Packet Number 76: Packet for sending fixed text messages

Description			
Transmitted by	Balise, RBC		
Content	**Variable**	**Length**	**Comment**

NID_PACKET	8	
Q_DIR	2	
L_PACKET	13	
Q_SCALE	2	
Q_TEXTCLASS	2	
Q_TEXTDISPLAY	1	Start/end events relation
D_TEXTDISPLAY	15	Start eventcondition
M_MODETEXTDISPLAY	4	Start event
M_LEVELTEXTDISPLAY	3	Start event
NID_NTC	8	If M_LEVELTEXTDISPLAY = 1 (NTC)
L_TEXTDISPLAY	15	End event
T_TEXTDISPLAY	10	End event
M_MODETEXTDISPLAY	4	End event
M_LEVELTEXTDISPLAY	3	End event
NID_NTC	8	If M_LEVELTEXTDISPLAY = 1 (NTC)
Q_TEXTCONFIRM	2	
Q_CONFTEXTDISPLAY	1	If Q_TEXTCONFIRM ≠ 0
Q_TEXTREPORT	1	If Q_TEXTCONFIRM ≠ 0
NID_TEXTMESSAGE	8	Only If Q_TEXTREPORT = 1
NID_C	10	Only If Q_TEXTREPORT = 1
NID_RBC	14	Only If Q_TEXTREPORT = 1
Q_TEXT	8	

7.4.2.25 Packet Number 79: Geographical Position Information

Description	This packet gives geographical location information for one or multiple references to the train.		
Transmitted by	Balise, RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	Q_NEWCOUNTRY	1	
	NID_C	10	if Q_NEWCOUNTRY = 1
	NID_BG	14	Geographical Position Reference Balise Group

	D_POSOFF	15	
	Q_MPOSITION	1	Geographical Position counting direction
	M_POSITION	24	Track kilometre reference value
	N_ITER	5	
	Q_NEWCOUNTRY(k)	1	
	NID_C(k)	10	if Q_NEWCOUNTRY(k) = 1
	NID_BG(k)	14	Geographical Position Reference Balise Group
	D_POSOFF(k)	15	
	Q_MPOSITION(k)	1	Geographical Position counting direction
	M_POSITION(k)	24	Track kilometre reference value

7.4.2.26 Packet Number 80: Mode profile

Description	Mode profile associated to an MA		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_MAMODE	15	
	M_MAMODE	2	OS, LS, SH
	V_MAMODE	7	
	L_MAMODE	15	
	L_ACKMAMODE	15	
	Q_MAMODE	1	
	N_ITER	5	
	D_MAMODE(k)	15	
	M_MAMODE(k)	2	OS, LS, SH
	V_MAMODE(k)	7	
	L_MAMODE(k)	15	
	L_ACKMAMODE(k)	15	
	Q_MAMODE(k)	1	

7.4.2.26.1 Packet Number 88: Level Crossing information

Description	Level Crossing information		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	NID_LX	8	
	D_LX	15	
	L_LX	15	
	Q_LXSTATUS	1	
	V_LX	7	Only if Q_LXSTATUS = 1
	Q_STOPLX	1	Only if Q_LXSTATUS = 1
	L_STOPLX	15	Only if Q_STOPLX = 1

7.4.2.26.2 Packet Number 90: Track Ahead Free up to level 2/3 transition location

Description	Notification to on-board that track ahead is free from the balise group transmitting this information up to the level 2/3 transition location		
Transmitted by	Balise		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_NEWCOUNTRY	1	
	NID_C	10	If Q_NEWCOUNTRY = 1
	NID_BG	14	Level 2/3 transition location balise group

7.4.2.27 Packet Number 131: RBC transition order

Description	Packet to order an RBC transition		
Transmitted by	Balise, RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_RBCTR	15	

	NID_C	10	"Accepting" RBC identity
	NID_RBC	14	
	NID_RADIO	64	"Accepting" RBC radio subscriber number
	Q_SLEEPSESSION	1	

7.4.2.28 Packet Number 132: Danger for Shunting information

Description	Transmission of the aspect of a shunting signal		
Transmitted by	Balise		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_ASPECT	1	

7.4.2.29 Packet Number 133: Radio infill area information

Description			
Transmitted by	Balise		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	Q_RIU	1	
	NID_C	10	RIU ETCS identity
	NID_RIU	14	
	NID_RADIO	64	
	D_INFILL	15	
	NID_C	10	Refers to the next main signal balise group (relevant only for the case of establishing a communication session)
	NID_BG	14	

7.4.2.30 Packet Number 134: EOLM Packet

Description	This packet announces a loop.		
Transmitted by	Balise		
Content	**Variable**	**Length**	**Comment**

	Variable	Length	Comment
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	NID_LOOP	14	
	D_LOOP	15	
	L_LOOP	15	
	Q_LOOPDIR	1	
	Q_SSCODE	4	

7.4.2.31 Packet Number 135: Stop Shunting on desk opening

Description	Packet to stop Shunting on desk opening.		
Transmitted by	Balise		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	

7.4.2.32 Packet Number 136: Infill location reference

Description	Defines location reference for all data contained in the same radio message or balise/loop telegram respectively, following this packet.		
Transmitted by	Balise, loop, RIU		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_NEWCOUNTRY	1	
	NID_C	10	If Q_NEWCOUNTRY = 1
	NID_BG	14	

7.4.2.33 Packet Number 137: Stop if in Staff Responsible

Description	Information to stop a train in staff responsible.		
Transmitted by	Balise		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	

	Q_SRSTOP	1	

7.4.2.34 Packet Number 138: Reversing area information

Description	Used to send start and length of reversing area to the on-board		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_STARTREVERSE	15	
	L_REVERSEAREA	15	

7.4.2.35 Packet Number 139: Reversing supervision information

Description	Used to send supervision parameters (distance to run, speed) of reversing area to the on-board		
Transmitted by	Any		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_SCALE	2	
	D_REVERSE	15	
	V_REVERSE	7	

7.4.2.36 Packet Number 140: Train running number from RBC

Description	Train running number from RBC		
Transmitted by	RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	NID_OPERATIONAL	32	

7.4.2.37 Packet Number 141: Default Gradient for Temporary Speed Restriction

Description	It defines a default gradient to be used for TSR supervision when no gradient profile (packet 21) is available
Transmitted by	Balise

Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_GDIR	1	0 = downhill 1= uphill
	G_TSR	8	

7.4.2.37.1 Packet Number 143: Session Management with neighbouring Radio Infill Unit

Description	Packet to give the identity and telephone number of the neighbouring Radio Infill Unit with which a session shall be established or terminated.		
Transmitted by	RIU		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	
	Q_RIU	1	
	NID_C	10	RIU ETCS identity
	NID_RIU	14	
	NID_RADIO	64	

7.4.2.37.2 Packet Number 145: Inhibition of balise group message consistency reaction

Description	Indication to on-board that the balise group message consistency reaction (service brake command) can be inhibited for this balise group message only, in case one or more balise telegram(s) of the group is/are missed or is/are detected but not decoded.		
Transmitted by	Balise		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	

7.4.2.38 Packet Number 254: Default balise, loop or RIU information

Description	Indication to on-board that balise telegram, loop message or RIU information contains default information due to a fault of the trackside equipment.		
Transmitted by	Balise, loop, RIU		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	Q_DIR	2	
	L_PACKET	13	

7.4.3 PACKETS: TRAIN TO TRACK

7.4.3.1 Packet Number 0: Position Report

Description	This packet is used to report the train position and speed as well as some additional information (e.g. mode, level, etc.)		
Transmitted to	RBC, RIU		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	L_PACKET	13	
	Q_SCALE	2	
	NID_LRBG	10 + 14	
	D_LRBG	15	
	Q_DIRLRBG	2	
	Q_DLRBG	2	
	L_DOUBTOVER	15	
	L_DOUBTUNDER	15	
	Q_LENGTH	2	
	L_TRAININT	15	If Q_LENGTH = “Train integrity confirmed by integrity monitoring device” or “Train integrity confirmed by driver”
	V_TRAIN	7	
	Q_DIRTRAIN	2	
	M_MODE	4	
	M_LEVEL	3	
	NID_NTC	8	If M_LEVEL = NTC

7.4.3.2 Packet Number 1: Position Report based on two balise groups

Description	This packet is an extension of the “standard position report “ packet 0. It is used in case of single balise groups if the orientation of the LRBG is unknown but the on-board equipment is able to report a second balise group (the one detected before) to give a direction reference for the directional information in the position report.		
Transmitted to	RBC, RIU		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	L_PACKET	13	
	Q_SCALE	2	

	NID_LRBG	10 + 14	
	NID_PRVLRBG	10 + 14	Used as reference for all directional information in the packet: a move from PRVLRBG towards the LRBG defines the "nominal" direction
	D_LRBG	15	
	Q_DIRLRBG	2	Train orientation according to reference direction
	Q_DLRBG	2	Train front position according to reference direction
	L_DOUBTOVER	15	
	L_DOUBTUNDER	15	
	Q_LENGTH	2	
	L_TRAININT	15	If Q_LENGTH = "Train integrity confirmed by integrity monitoring device" or "Train integrity confirmed by driver"
	V_TRAIN	7	
	Q_DIRTRAIN	2	Actual running direction according to reference direction
	M_MODE	4	
	M_LEVEL	3	
	NID_NTC	8	If M_LEVEL = NTC

7.4.3.3 Packet Number 3: Onboard telephone numbers

Description	Telephone numbers associated to the onboard equipment		
Transmitted to	RBC, RIU		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	L_PACKET	13	
	N_ITER	5	
	NID_RADIO (k)	64	

7.4.3.4 Packet Number 4: Error reporting

Description	Error reporting to the RBC		
Transmitted to	RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	L_PACKET	13	

	M_ERROR	8	error type identifier

7.4.3.4.1 Packet Number 5: Train running number

Description	Train running number		
Transmitted to	RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	L_PACKET	13	
	NID_OPERATIONAL	32	

7.4.3.4.2 Packet Number 9: Level 2/3 transition information

Description	Identity of the level 2/3 transition balise group		
Transmitted to	RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	L_PACKET	13	
	NID_LTRBG	10 + 14	

7.4.3.5 Packet Number 11: Validated train data

Description	Validated train data.		
Transmitted to	RBC		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	L_PACKET	13	
	NC_CDTRAIN	4	
	NC_TRAIN	15	
	L_TRAIN	12	
	V_MAXTRAIN	7	
	M_LOADINGGAUGE	8	
	M_AXLELOADCAT	7	
	M_AIRTIGHT	2	
	N_AXLE	10	
	N_ITER	5	
	M_VOLTAGE(k)	4	Identity of the traction system
	NID_CTRACTION(k)	10	NID_CTRACTION(k) given only if M_VOLTAGE(k) ≠ 0
	N_ITER	5	
	NID_NTC(k)	8	Type of National System available

7.4.3.6 Packet Number 44: Data used by applications outside the ERTMS/ETCS system.

Description	Messages between on-board and trackside devices, which contain information used by applications outside the ERTMS/ETCS system.		
Transmitted to	RBC, RIU		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	
	L_PACKET	13	
	NID_XUSER	9	
	Other data, depending on NID_XUSER		

7.4.4 PACKETS: TRACK TO TRAIN or TRAIN TO TRACK

7.4.4.1 Packet Number 255: End of Information

Description	This packet consists only of NID_PACKET containing 8 bit 1s It acts as a finish flag; the receiver will stop reading the remaining part of the message/telegram when receiving eight bits set to one in the NID_PACKET field.		
Transmitted by/to	Balise, Loop		
Content	**Variable**	**Length**	**Comment**
	NID_PACKET	8	= 255 (1111 1111)

7.5 Definitions of Variables

7.5.0.1 A_NVMAXREDADH1

Name	Maximum deceleration under reduced adhesion conditions (1)		
Description	Maximum deceleration under reduced adhesion conditions applicable for trains: • With brake position "Passenger train in P", and • with special/additional brakes independent from wheel/rail adhesion. This variable is part of the National Values		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
6 bits	0 m/s^2	3.15 m/s^2	0.05 m/s^2

7.5.0.2 A_NVMAXREDADH2

Name	Maximum deceleration under reduced adhesion conditions (2)		
Description	Maximum deceleration under reduced adhesion conditions applicable for trains: • with brake position "Passenger train in P", and • without special/additional brakes independent from wheel/rail adhesion. This variable is part of the National Values		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
6 bits	0 m/s^2	3.15 m/s^2	0.05 m/s^2

7.5.0.3 A_NVMAXREDADH3

Name	Maximum deceleration under reduced adhesion conditions (3)		
Description	Maximum deceleration under reduced adhesion conditions applicable for trains: • with brake position "Freight train in P", or • with brake position "Freight train in G". This variable is part of the National Values		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
6 bits	0 m/s^2	3.15 m/s^2	0.05 m/s^2

7.5.0.4 A_NVP12

Name	Lower deceleration limit to determine the set of Kv to be used		
Description	Lower deceleration limit to determine the set of correction factor Kv to be used for Conventional Passenger trains. This variable is part of the National Values.		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
6 bits	0 m/s^2	3.15 m/s^2	0.05 m/s^2

7.5.0.5 A_NVP23

Name	Upper deceleration limit to determine the set of Kv to be used		
Description	Upper deceleration limit to determine the set of correction factor Kv to be used for Conventional Passenger trains. This variable is part of the National Values.		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
6 bits	0 m/s^2	3.15 m/s^2	0.05 m/s^2

7.5.1.1 D_ADHESION

Name	Distance to start of area with reduced adhesion factor		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1 m or 10 m depending on Q_SCALE

7.5.1.2 D_AXLELOAD

Name	Incremental distance to the start of the next Axle load speed profile		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 m	327.670 km	10 cm, 1m or 10 m depending on Q_SCALE

7.5.1.2.1 D_CURRENT

Name	Distance to change of allowed current consumption		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1 m or 10 m depending on Q_SCALE

7.5.1.3 D_CYCLOC

Name	Distance between two position reports from the train		
Description	The train has to report its position every D_CYCLOC meters.		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.660 km	10 cm, 1m or 10 m depends on Q_SCALE
Special/Reserved Values	1111 … 1111	The train has not to report cyclically its position.	

7.5.1.4 D_DP

Name	Distance from the End of Authority to danger point		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE.

7.5.1.5 D_EMERGENCYSTOP

Name	Distance to emergency stop location		
Description	Distance between the LRBG and the emergency stop location		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE.

7.5.1.6 D_ENDTIMERSTARTLOC

Name	Distance from End section timer start location to End of Authority		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.7 D_GRADIENT

Name	Incremental distance to next change of gradient.

Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE.

7.5.1.8 D_INFILL

Name	Distance to location where to connect/disconnect to a radio infill unit		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.9 D_LEVELTR

Name	Distance to level transition		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.660 km	10 cm, 1m or 10 m depends on Q_SCALE.
Special/Reserved Values	32767	Now (The level transition is performed upon receipt of the order)	

7.5.1.10 D_LINK

Name	Incremental linking distance to next linked balise group		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.11 D_LOC

Name	Incremental distance between locations where the train has to report its position.		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.12 D_LOOP

Name	Distance between EOLM and start of loop		
Description	The EOLM specifies the distance to the beginning of the loop transmission		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.660 km	10 cm, 1m or 10 m depends on Q_SCALE
Special/Reserved Values	1111 … 1111	Distance not known	

7.5.1.13 D_LRBG

Name	Distance between the last relevant balise group and the estimated front end of the train (the side of the active cab).		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.660 km	10 cm, 1m or 10 m depends on Q_SCALE
Special/Reserved Values	32767	Unknown	

7.5.1.13.1 D_LX

Name	Distance to LX start location		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.14 D_MAMODE

Name	Incremental distance to the start of the next Mode Profile		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.15 D_NVOVTRP

Name	Maximum distance for overriding the train trip		
Description	This variable is part of the National Values		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.16 D_NVPOTRP

Name	Maximum distance for reversing in Post Trip mode		
Description	This variable is part of the National Values		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.17 D_NVROLL

Name	Roll away distance limit		
Description	This variable is part of the National Values and is used for Roll Away Protection and Reverse Movement Protection. Within the (national/default) limits of D_NVROLL the train may be moved for uncoupling.		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.660 km	10 cm, 1m or 10 m depends on Q_SCALE
Special/Reserved Values	32767	∞	

7.5.1.18 D_NVSTFF

Name	Maximum distance for running in Staff Responsible mode		
Description	This variable is part of the National Values		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.660 km	10 cm, 1m or 10 m depends on Q_SCALE
Special/Reserved Values	32767	∞	

7.5.1.19 D_OL

Name	The distance from the End of Authority to the end of overlap		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE.

7.5.1.19.1 D_PBD

Name	Permitted Braking Distance		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE.

7.5.1.19.2 D_PBDSR

Name	Incremental distance to the start of the next speed restriction to ensure permitted braking distance		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE.

7.5.1.20 D_POSOFF

Name	Offset from the location reference of the geographical position reference balise group to the related track kilometre reference.		
Description	The geographical position reporting function uses this variables content as an offset from the location reference of the geographical position reference balise group to the related track kilometre reference.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 m	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE.

7.5.1.21 D_RBCTR

Name	Distance to RBC transition		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE.

7.5.1.22 D_REF

Name	Reference distance		
Description	Distance between the LRBG and the new shifted location reference. The positive values are in the nominal direction of the LRBG		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
16 bits	-327.680 km	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE.
Special/Reserved Values	The negative value are coded in 2's complement		

7.5.1.23 D_REVERSE

Name	Maximum distance to run in RV mode		
Description	Distance from reference location to end location of the distance to run in RV mode		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.660 km	10 cm, 1m or 10 m depends on Q_SCALE
Special/Reserved Values	32767	represents ∞	

7.5.1.24 D_SECTIONTIMERSTOPLOC

Name	Distance from beginning of section to the Section Time-out stop location		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***

15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.25 D_SR

Name	Distance in SR mode		
Description	Distance that can be run in SR mode		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.660 km	10 cm, 1m or 10 m depends on Q_SCALE
Special/Reserved Values	32767	Represents ∞	

7.5.1.26 D_STARTOL

Name	Distance from overlap timer start location to End of Authority		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.27 D_STARTREVERSE

Name	Distance to start of reversing permitted area		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.28 D_STATIC

Name	Incremental distance to next discontinuity in a international SSP profile		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.29 D_SUITABILITY

Name	Distance to change in route suitability		
Description	The incremental distance to where the route suitability data changes.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 m	327.670 km	10 cm, 1m or 10 m depending on Q_SCALE

7.5.1.30 D_TAFDISPLAY

Name	Distance from where on a track ahead free request shall be displayed		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.31 D_TEXTDISPLAY

Name	Distance from where on a text shall be displayed		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.660 km	10 cm, 1m or 10 m depends on Q_SCALE
Special/Reserved Values	1111 … 1111	The display of the text shall not be distance limited.	

7.5.1.32 D_TRACKINIT

Name	Distance to start of empty profile		
Description	Distance to where initial states of the related track description in the packet shall be resumed		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 m	327.670 km	10 cm, 1m or 10 m depending on Q_SCALE

7.5.1.33 D_TRACKCOND

Name	Track condition distance		
Description	The incremental distance to where the track conditions change.		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 m	327.670 km	10 cm, 1m or 10 m depending on Q_SCALE

7.5.1.34 D_TRACTION

Name	Distance to change of traction		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 m	327.670 km	10 cm, 1m or 10 m depending on Q_SCALE

7.5.1.35 D_TSR

Name	Distance to beginning of temporary speed restriction		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.36 D_VALIDNV

Name	Distance to start of validity of national values		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.660 km	10 cm, 1m or 10 m depends on Q_SCALE
Special/Reserved Values	32767	Now (National Values are immediately applicable)	

7.5.1.37 G_A

Name	Safe gradient		
Description	This is the absolute value of the minimum gradient between two defined locations.		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
8 bits	0	254‰	1‰
Special/Reserved Values	255	Non numerical value telling that the current gradient description ends at D_GRADIENT(n)	

7.5.1.37.1 G_PBDSR

Name	Default gradient for PBD Speed restriction		
Description	Defines a default gradient to be used for calculation of speed restriction to ensure permitted braking distance		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
8 bits	0	255‰	1‰

7.5.1.38 G_TSR

Name	Default gradient for TSR supervision		
Description	defines a default gradient to be used for TSR supervision when no gradient profile (packet 21) is available.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
8 bits	0	255‰	1‰

7.5.1.39 L_ACKLEVELTR

Name	Length of the acknowledgement area in rear of the required level		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.40 L_ACKMAMODE

Name	Length of the acknowledgement area in rear of the start of the required mode		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.41 L_ADHESION

Name	Length of reduced adhesion		
Description	Length for which the reduced adhesion factor apply.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.670 km	10 cm, 1 m or 10 m depending on Q_SCALE

7.5.1.42 L_AXLELOAD

Name	Length of speed restriction due to Axle load		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 m	327.670 km	10 cm, 1m or 10 m depending on Q_SCALE

7.5.1.43 L_DOUBTOVER

Name	L_DOUBTOVER		
Description	L_DOUBTOVER is the over-reading amount plus the Q_LOCACC of the LRBG		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.660 km	10 cm, 1m or 10 m depends on Q_SCALE
Special/Reserved Values	32767	Unknown	

7.5.1.44 L_DOUBTUNDER

Name	L_DOUBTUNDER		
Description	L_DOUBTUNDER is the under-reading amount plus the Q_LOCACC of the LRBG		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits	0 cm	327.660 km	10 cm, 1m or 10 m depends on Q_SCALE
Special/Reserved Values	32767	Unknown	

7.5.1.45 L_ENDSECTION

Name	Length of the End section in the MA		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE.

7.5.1.46 L_LOOP

Name	Length of loop		
Description	L_LOOP specifies the length of the loop starting from the distance indicated by D_LOOP		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.660 km	10 cm, 1m or 10 m depends on Q_SCALE
Special/Reserved Values	1111 … 1111	Length not known	

7.5.1.46.1 L_LX

Name	Length of the LX area		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.47 L_MAMODE

Name	Length of the area of the required mode		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 m	327.660 km	10 cm, 1m or 10 m depending on Q_SCALE
Special/Reserved Values	1111…111	Infinite length	

7.5.1.48 L_MESSAGE

Name	Message length		
Description	L_MESSAGE indicates the length of the message in bytes, including all packets and all variables defined in the message header (NID_MESSAGE and L_MESSAGE also).		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
10 bits	0	1023	1 Byte

7.5.1.48.1 L_NVKRINT

Name	Train length step used to define the integrated correction factor Kr		
Description	This variable is part of the National Values		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
5 bits			
Special/Reserved Values	0	0m	
	1	25m	
	2	50m	
	3	75m	
	4	100m	
	5	150m	
	6	200m	

	7	300m
	....	.... (steps of 100m)
	31	2700m

7.5.1.49 L_PACKET

Name	Packet length		
Description	L_PACKET indicates the length of the packet in bits, including all bits of the packet header		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
13 bits	0	8191	1 bit

7.5.1.49.1 L_PBDSR

Name	Length of speed restriction to ensure permitted braking distance		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE.

7.5.1.50 L_REVERSEAREA

Name	Length of the reversing permitted area		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.51 L_SECTION

Name	Length of section in the MA		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.51.1 L_STOPLX

Name	Length of the stopping area in rear of the start location of the LX area		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.52 L_TAFDISPLAY

Name	Length on which a track ahead free request shall be displayed		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.53 L_TEXT

Name	Length of text string		
Description	L_TEXT defines the length of a text string (L_TEXT * X_TEXT)		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
8 bits	0	255	1 Text String Element

7.5.1.54 L_TEXTDISPLAY

Name	Length on which a text shall be displayed		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.660 km	10 cm, 1m or 10 m depends on Q_SCALE
Special/Reserved Values	32767	The display of the text shall not be distance limited.	

7.5.1.55 L_TRACKCOND

Name	Length for which the defined track condition is valid		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 m	327.670 km	10 cm, 1m or 10 m depending on Q_SCALE

7.5.1.56 L_TRAIN

Name	Train length		
Description	This is the absolute real length of the train.		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
12 bits	0 m	4095 m	1 m

7.5.1.57 L_TRAININT

Name	Safe Train length		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 m	32767 m	1 m

7.5.1.58 L_TSR

Name	Length of the temporary speed restriction		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
15 bits	0 cm	327.670 km	10 cm, 1m or 10 m depends on Q_SCALE

7.5.1.59 M_ACK

Name	Qualifier for acknowledgement request		
Description	Indicates whether the telegram must be acknowledged or not		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
1 bit			
Special/Reserved Values	0	No acknowledgement required	
	1	Acknowledgement required	

7.5.1.60 M_ADHESION

Name	Adhesion factor		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
1 bit			

Special/Reserved Values	0	Slippery rail
	1	Non slippery rail

7.5.1.61 M_AIRTIGHT

Name	airtight system presence		
Description	indicates whether the train is fitted with an airtight system or not.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
2 bits			
Special/Reserved Values	00	Not fitted	
	01	Fitted	
	10	Spare	
	11	Spare	

7.5.1.62 M_AXLELOADCAT

Name	Axle load category		
Description	The values allocated below correspond to a list of increasing axle load categories (i.e. B1 > HS17, B2 > B1, D2 > C4, ….etc) and it is used by the on-board equipment to compare its axle load category with the axle load category sent by trackside. For the underlying meaning of the axle load categories listed below (with the exception of HS17) refer to CR INF TSI. The category HS17 (axle load <= 17t) corresponds to a static load per axle only, as specified in HS RST TSI clause 4.2.3.2. The introduction of this artefact is necessary to ensure backward compatibility, without any negative performance impact, in case ASPs are used on lines operated with system version X = 1.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits			
Special/Reserved Values	0	A	
	1	HS17	
	2	B1	
	3	B2	
	4	C2	
	5	C3	
	6	C4	
	7	D2	
	8	D3	
	9	D4	
	10	D4XL	
	11	E4	
	12	E5	
	13-127	Spare	

7.5.1.62.1 M_CURRENT

Name	Allowed current consumption		
Description	It defines the allowed current consumption to be used by the train		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
10 bits	0 A	10000 A	10 A

Special/Reserved Values	1001 - 1022	Spare
	1023	No restriction for current consumption

7.5.1.63 M_DUP

Name	Duplicate balise		
Description	Flags to tell whether the balise is a duplicate of one of the adjacent balises.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
2 bits			
Special/Reserved Values	00	No duplicates	
	01	This balise is a duplicate of the next balise (seen in the nominal direction of the balise group).	
	10	This balise is a duplicate of the previous balise (seen in the nominal direction of the balise group).	
	11	Spare	

7.5.1.64 M_ERROR

Name	Identifier of the type of error		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
8 bits			
Special/Reserved Values	0	Balise group: linking consistency error (ref. 3.16.2.3)	
	1	Linked balise group: message consistency error(ref. 3.16.2.4.1/4)	
	2	Unlinked balise group: message consistency error (ref. 3.16.2.5)	
	3	Radio: message consistency error (ref. 3.16.3.1.1a,c)	
	4	Radio: sequence error (ref. 3.16.3.1.1b)	
	5	Radio: safe radio connection error (ref. 3.16.3.4, to be sent when communication links re-established)	
	6	Safety critical failure (ref 4.4.6.1.6 , 4.4.15.1.5)	
	7	Double linking error (3.16.2.7.1)	
	8	Double repositioning error (3.16.2.7.2)	
	9-255	Spare	

7.5.1.65 M_LEVEL

Name	Current Operating Level		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
3 bits			
Special/Reserved Values	0	Level 0	
	1	Level NTC specified by NID_NTC	
	2	Level 1	
	3	Level 2	
	4	Level 3	
	5-7	Spare	

7.5.1.66 M_LEVELTEXTDISPLAY

Name	Onboard operating level for text display		
Description	The text is displayed when entering / as long as in the defined level		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
3 bits			
Special/Reserved Values	0	Level 0	
	1	Level NTC specified by NID_NTC	
	2	Level 1	
	3	Level 2	
	4	Level 3	
	5	The display of the text shall not be limited by the level	
	6-7	Spare	

7.5.1.67 M_LEVELTR

Name	Required level		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
3 bits			Bitset
Special/Reserved Values	0	Level 0	
	1	Level NTC specified by NID_NTC	
	2	Level 1	
	3	Level 2	
	4	Level 3	
	5-7	Spare	

7.5.1.67.1 M_LINEGAUGE

Name	Line gauge		
Description	Defining which loading gauge(s) are permitted on a line (refer to TSI INF)		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
8 bits			Bitset
Special/Reserved Values	xxxx xxx1	G1	
	xxxx xx1x	GA	
	xxxx x1xx	GB	
	xxxx 1xxx	GC	
	00000000	Spare	
	xxx1 xxxx	Spare	
	xx1x xxxx	Spare	
	x1xx xxxx	Spare	
	1xxx xxxx	Spare	

7.5.1.68 M_LOADINGGAUGE

Name	Loading gauge
Description	Defining the loading gauge profile of a train (refer to TSI RST)

Length of variable	Minimum Value	Maximum Value	Resolution/formula
8 bits			
Special/Reserved Values	0	The train does not fit to any of the interoperable loading gauge profiles	
	1	G1	
	2	GA	
	3	GB	
	4	GC	
	5-255	Spare	

7.5.1.69 M_LOC

Name	Special location/moment where the train has to report its position		
Description			
Length of variable	Minimum Value	Maximum Value	Resolution/formula
3 bits			
Special/Reserved Values	000	Now (The position report is sent upon receipt of the order)	
	001	Every LRBG compliant balise group.	
	010	Do not send position report on passage of LRBG compliant balise group.	
	011 - 111	Spare	

7.5.1.70 M_MAMODE

Name	Required mode for a part of the MA		
Description			
Length of variable	Minimum Value	Maximum Value	Resolution/formula
2 bits			
Special/Reserved Values	00	On Sight	
	01	Shunting	
	10	Limited Supervision	
	11	Spare	

7.5.1.71 M_MCOUNT

Name	Message counter		
Description	The purpose of this counter is to make it possible for the ERTMS/ETCS on-board to detect which balise group message the telegram belongs to.		
Length of variable	Minimum Value	Maximum Value	Resolution/formula
8 bits	0	253	Numbers
Special/Reserved Values	254	The telegram never fits any message of the group	
	255	The telegram fits with all telegrams of the same balise group	

7.5.1.72 M_MODE

Name	Onboard operating mode		
Description			
Length of variable	Minimum Value	Maximum Value	Resolution/formula
4 bits			

Special/Reserved Values	0	Full Supervision
	1	On Sight
	2	Staff Responsible
	3	Shunting
	4	Unfitted
	5	Sleeping
	6	Stand By
	7	Trip
	8	Post Trip
	9	System Failure
	10	Isolation
	11	Non Leading
	12	Limited Supervision
	13	National System
	14	Reversing
	15	Passive Shunting

7.5.1.73 M_MODETEXTDISPLAY

Name	Onboard operating mode for text display		
Description	The text is displayed when entering / as long as in the defined mode		
Length of variable	Minimum Value	Maximum Value	Resolution/formula
4 bits			
Special/Reserved Values	0	Full Supervision	
	1	On Sight	
	2	Staff Responsible	
	3	Spare	
	4	Unfitted	
	5	Spare	
	6	Stand By	
	7	Trip	
	8	Post Trip	
	9	Spare	
	10	Spare	
	11	Non Leading	
	12	Limited Supervision	
	13	Spare	
	14	Reversing	
	15	The display of the text shall not be limited by the mode.	

7.5.1.73.1 M_NVAVADH

Name	Weighting factor for available wheel/rail adhesion		
Description	This variable is part of the National Values.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
5 bits	0	1.00	0.05

Special/Reserved Values	1.05 – 1.55	Spare

7.5.1.74 M_NVCONTACT

Name	T_NVCONTACT reaction		
Description	Indicates the reaction to be performed when T_NVCONTACT timer elapses This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
2 bits			
Special/Reserved Values	00	Train trip	
	01	Apply service brake	
	10	No Reaction	
	11	Spare	

7.5.1.75 M_NVDERUN

Name	Entry of Driver ID permitted while running		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	No	
	1	Yes	

7.5.1.75.1 M_NVEBCL

Name	Confidence level for emergency brake safe deceleration on dry rails		
Description	This variable is part of the National Values. Based on the required confidence level, the on-board equipment selects its corresponding rolling stock correction factor Kdry_rst(V). The confidence level on emergency brake safe deceleration represents the probability of the following individual event: the rolling stock emergency brake subsystem of the train does ensure a deceleration at least equal to A_brake_emergency(V) * Kdry_rst(V), when the emergency brake is commanded on dry rails.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
4 bits			
Special/Reserved Values	0	Confidence level = 50 %	
	1	Confidence level = 90 %	
	2	Confidence level = 99 %	
	3	Confidence level = 99.9 %	
	4	Confidence level = 99.99%	
	5	Confidence level = 99.999 %	
	6	Confidence level = 99.9999 %	
	7	Confidence level = 99.99999 %	
	8	Confidence level = 99.999999 %	
	9	Confidence level = 99.9999999 %	
	10-15	Spare	

7.5.1.75.2 M_NVKRINT

Name	Integrated correction factor Kr

Description	This is the train length dependent integrated correction factor. M_NVKRINT(l) is valid for a train length between L_NVKRINT(l) and L_NVKRINT(l+1). M_NVKRINT is valid between 0m and L_NVKRINT(1) This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
5 bits	0	1.55	0.05

7.5.1.75.3 M_NVKTINT

Name	Integrated correction factor Kt		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
5 bits	0	1.55	0.05

7.5.1.75.4 M_NVKVINT

Name	Integrated correction factor Kv		
Description	This is the speed dependent integrated correction factor. M_NVKVINT(n) is valid for an estimated speed between V_NVKVINT(n) and V_NVKVINT(n+1). M_NVKVINT is valid between 0 km/h and V_NVKVINT(1) This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0	2.54	0.02

7.5.1.75.5 M_PLATFORM

Name	Type of platform		
Description	Nominal height of platform above rail level (refer to TSI infrastructure)		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
4 bits			
Special/Reserved Values	0000	200 mm	
	0001	300-380 mm	
	0010	550 mm	
	0011	580 mm	
	0100	680 mm	
	0101	685 mm	
	0110	730 mm	
	0111	760 mm	
	1000	840 mm	
	1001	900 mm	
	1010	915 mm	
	1011	920 mm	
	1100	960 mm	
	1101	1100 mm	
	1110 – 1111	Spare	

7.5.1.76 M_POSITION

Name	Track kilometre reference value		
Description	The geographical position reporting function uses this variables content as a reference value.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
24 bits	0 m	9’999’999 m	1 m
Special/Reserved Values	10’000’000-16’777’214	Spare	
	16’777’215	No more geographical position calculation after this reference location	

7.5.1.77 M_TRACKCOND

Name	Type of track condition		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
4 bits			
Special/Reserved Values	0000	Non stopping area. Initial state: stopping permitted	
	0001	Tunnel stopping area. Initial state: no tunnel stopping area	
	0010	Sound horn. Initial state: no request for sound horn	
	0011	Powerless section – lower pantograph. Initial state: not powerless section	
	0100	Radio hole (stop supervising T_NVCONTACT). Initial state: supervise T_NVCONTACT	
	0101	Air tightness. Initial state: no request for air tightness	
	0110	Switch off regenerative brake. Initial state: regenerative brake on	
	0111	Switch off eddy current brake for service brake. Initial state: eddy current brake for service brake on	
	1000	Switch off magnetic shoe brake. Initial state: magnetic shoe brake on	
	1001	Powerless section – switch off the main power switch. Initial state: not powerless section	
	1010	Switch off eddy current brake for emergency brake. Initial state: eddy current brake for emergency brake on	
	1011 –1111	Spare	

7.5.1.78 M_VOLTAGE

Name	Traction System voltage		
Description	It indicates the voltage of the traction system installed on a specific line or respectively that can be used by an engine The identity of the traction system is given by M_VOLTAGE and, if M_VOLTAGE ≠ 0, by the country identifier of the traction system (NID_CTRACTION)		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
4 bits			
Special/Reserved Values	0	Line not fitted with any traction system	
	1	AC 25 kV 50 Hz	
	2	AC 15 kV 16.7 Hz	
	3	DC 3 kV	
	4	DC 1.5 kV	
	5	DC 600/750 V	
	6-15	Spare	

7.5.1.79 M_VERSION

Name	Version of ETCS system		
Description	This gives the version of the ETCS system Each part indicates the first and second number of the version respectively. - The first number distinguishes not compatible versions. (The three MSB's) - The second number indicates compatibility within a version X. (The four LSB's)		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits			
Special/Reserved Values	000 XXXX	Previous versions according to e.g. EEIG SRS, UIC A200 SRS	
	001 0000	Version 1.0, introduced in SRS 1.2.0 and re-used in SRSs 2.0.0, 2.2.2, 2.3.0	
	001 0001	Version 1.1, introduced in SRS 3.3.0	
	001 0010	Not valid	
	….		
	001 1111	Not valid	
	010 0000	Version 2.0, introduced in SRS 3.3.0	
	010 0001	Reserved for future use (this is a valid value)	
	…	…	
	111 1111	Reserved for future use (this is a valid value)	

7.5.1.79.1 N_AXLE

Name	Axle number of the engine		
Description	This gives the number of axles of the single unit (fixed train set or locomotive) in which the onboard equipment is fitted		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
10 bits	0	1022	integers
Special/Reserved Values	1023	Unknown	

7.5.1.80 N_ITER

Name	Number of iterations of a data set following this variable in a packet		
Description	If N_ITER is 0 then no data set is following. Two nested levels of iterations can exist.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
5 bits	0	31	integers

7.5.1.81 N_PIG

Name	Position in Group		
Description	Defines the relative position in a balise group		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
3 bits			
Special/Reserved Values	0	I am the 1st	
	…	…	
	7	I am the 8th	

7.5.1.82 N_TOTAL

Name	Total number of balise(s) in the group

Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
3 bits			
Special/Reserved Values	0	1 balise in the group	
	…		
	7	8 balises in the group	

7.5.1.82.1 NC_CDDIFF

Name	Cant Deficiency SSP category		
Description	It is the "Cant Deficiency" SSP category for which a different value for the static line speed exists. Used together with V_DIFF to permit certain trains to go faster or lower than the "international basic static speed" given by V_STATIC.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
4 bits	0	15	
Special/Reserved Values	0	Specific SSP applicable to Cant Deficiency 80 mm	
	1	Specific SSP applicable to Cant Deficiency 100 mm	
	2	Specific SSP applicable to Cant Deficiency 130 mm	
	3	Specific SSP applicable to Cant Deficiency 150 mm	
	4	Specific SSP applicable to Cant Deficiency 165 mm	
	5	Specific SSP applicable to Cant Deficiency 180 mm	
	6	Specific SSP applicable to Cant Deficiency 210 mm	
	7	Specific SSP applicable to Cant Deficiency 225 mm	
	8	Specific SSP applicable to Cant Deficiency 245 mm	
	9	Specific SSP applicable to Cant Deficiency 275 mm	
	10	Specific SSP applicable to Cant Deficiency 300 mm	
	11 - 15	Spare	

7.5.1.82.2 NC_CDTRAIN

Name	Cant Deficiency Train Category		
Description	Cant Deficiency Train category to which the train belongs. Thanks to NC_CDTRAIN, the train knows the "Cant Deficiency" SSP it must obey. By receiving a list of static speed profile, thanks to NC_CDDIFF, the train can select the "Cant Deficiency" SSP best suiting its NC_CDTRAIN. A train belongs to one and only one category of Cant Deficiency.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
4 bits	0	15	
Special/Reserved Values	0	Cant Deficiency 80 mm	
	1	Cant Deficiency 100 mm	
	2	Cant Deficiency 130 mm	
	3	Cant Deficiency 150 mm	
	4	Cant Deficiency 165 mm	
	5	Cant Deficiency 180 mm	
	6	Cant Deficiency 210 mm	
	7	Cant Deficiency 225 mm	

	8	Cant Deficiency 245 mm
	9	Cant Deficiency 275 mm
	10	Cant Deficiency 300 mm
	11 - 15	Spare

7.5.1.83 NC_DIFF

Name	Other specific SSP category		
Description	It is the "other specific" SSP category for which a different value for the static line speed exists. Used together with V_DIFF to permit trains belonging to the corresponding "other international" train category to go faster or lower than the "international basic static speed" given by V_STATIC. Value 0 of NC_DIFF corresponds to the LSB of NC_TRAIN, value 14 of NC_DIFF to MSB (15-bit variable) of NC_TRAIN.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
4 bits	0	15	Numbers
Special/Reserved Values	0	Specific SSP applicable to Freight train braked in "P" position	
	1	Specific SSP applicable to Freight train braked in "G" position	
	2	Specific SSP applicable to Passenger train	
	3-15	Spare	

7.5.1.84 NC_TRAIN

Name	Other International Train Category.		
Description	Other train category (different from Cant Deficiency) to which the train belongs. Thanks to NC_TRAIN, the train knows the "Other specific" SSP category it must consider. By receiving a list of static speed profile, thanks to NC_DIFF, the train can select the SSP it must obey. Each bit represents one category. A train can belong to various categories.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
15 bits			Bitset
Special/Reserved Values	000 0000 0000 0000	Train does not belong to any of the "Other International" Train Category	
	Xxx xxxx xxxx xxx1	Freight train braked in "P" position	
	Xxx xxxx xxxx xx1x	Freight train braked in "G" position	
	Xxx xxxx xxxx x1xx	Passenger train	
	Xxx xxxx xxx 1xxx	Spare	
	Xxx xxxx xxx1 xxxx	Spare	
	Xxx xxxx xx1x xxxx	Spare	
	Xxx xxxx x1xx xxxx	Spare	
	Xxx xxxx 1xxx xxxx	Spare	
	Xxx xxx1 xxxx xxxx	Spare	
	Xxx xx1x xxxx xxxx	Spare	
	Xxx x1xx xxxx xxxx	Spare	
	Xxx 1xxx xxxx xxxx	Spare	
	Xx1 xxxx xxxx xxxx	Spare	
	X1x xxxx xxxx xxxx	Spare	
	1xx xxxx xxxx xxxx	Spare	

7.5.1.85 NID_BG (Values to be assigned according to 7.3.1.3)

Name	Identity number of the balise group		
Description	Identity number of a balise group or loop within the country or region defined by NID_C.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
14 bits	0	16382	Numbers
Special/Reserved Values	16383	Identity is unknown (only to be used for Linking information)	

7.5.1.86 NID_C (Values to be assigned according to 7.3.1.3)

Name	Identity number of the country or region		
Description	Code used to identify the country or region in which the balise group, the RBC or the RIU is situated. These need not necessarily follow administrative or political boundaries.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
10 bits	0	1023	Numbers

7.5.1.86.1 NID_CTRACTION (Values to be assigned according to 7.3.1.3)

Name	Country identifier of the traction system		
Description	It identifies the information, additional to M_VOLTAGE, required to fully define the traction system.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
10 bits	0	1023	Numbers

7.5.1.87 NID_EM

Name	Emergency message identity		
Description	Identifies the number of the emergency message		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
4 bits			

7.5.1.88 NID_ENGINE (Values to be assigned according to 7.3.1.3)

Name	Onboard ETCS identity		
Description	The ETCS identity number is uniquely defined for ERTMS/ETCS purposes		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
24 bits			

7.5.1.89 NID_LOOP (Values to be assigned according to 7.3.1.3)

Name	Identity number of the loop		
Description	Identity number of a loop within the country or region defined by NID_C given in the EOLM balise header.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
14 bits	0	16383	Numbers

7.5.1.90 NID_LRBG

Name	Identity of last relevant balise group		
Description	Country/region identity (NID_C) + balise identity number of last relevant balise group (NID_BG).		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
10 + 14 bits			
Special/Reserved Values	16777215	Unknown	

7.5.1.90.1 NID_LTRBG

Name	Identity of the level 2/3 transition balise group		
Description	Identity of the balise group at the level 2/3 transition location towards which the train is running. Country/region identity (NID_C) + balise identity number of the level 2/3 transition location balise group (NID_BG).		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
10 + 14 bits			

7.5.1.90.2 NID_LX

Name	Identity number of the Level Crossing.		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
8 bits	0	255	Number
Special/Reserved Values	0-126	Reserved for non RBC transmission (balise, loop or radio infill)	
	127-255	Reserved for RBC transmission	

7.5.1.91 NID_MESSAGE

Name	Message identifier		
Description	Message identifier. Regards defined values of NID_MESSAGE, refer to chapters 8.5.2 and 8.5.3		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
8 bits	0	255	Numbers

7.5.1.91.1 NID_MN (Values to be assigned according to 7.3.1.3)

Name	Identity of Radio Network		
Description	The NID_MN identifies the GSM-R network the calling mobile station has to register with. The NID_MN consists of up to 6 digits which are entered left adjusted into the data field, the leftmost digit is the digit to be dialled first. In case the NID_MN is shorter than 6 digits, the remaining space is to be filled with special character “F”. For further information about NID_MN refer to Subset-54.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
24 bits	0	999999	Binary Coded Decimal
Special/Reserved Values	For each digit ;		
	Values A – E	Not Used	
	F	Use value F for digit to indicate no digit (if number shorter than 6 digits)	

7.5.1.92 NID_OPERATIONAL

Name	Train Running Number		
Description	This is the operational train running number. The NID_OPERATIONAL consists of up to 8 digits which are entered left adjusted into the data field, the leftmost digit is the digit to be entered first. In case the NID_OPERATIONAL is shorter than 8 digits, the remaining space is to be filled with special character “F”.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
32 bits	0	9999 9999	Binary Coded Decimal
Special/Reserved Values	For each digit ;		
	Values A – E	Spare	
	F	Use value F for digit to indicate no digit (if number shorter than 8 digits)	

	FFFF FFFF	Spare

7.5.1.93 NID_PACKET

Name	Packet identifier		
Description	This is used in the header for each packet, allowing the receiving equipment to identify the data which follows. Regards defined values of NID_PACKET,.refer to “packet numbers” in the tables in chapter 7.4.1.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
8 bits	0	255	Numbers

7.5.1.94 NID_PRVLRBG

Name	Identity of previous LRBG		
Description	Previous LRBG detected when running towards the balise group identified as LRBG with no change of direction in-between. Country/region identity (NID_C) + balise identity number of the previous LRBG (NID_BG).		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
10 + 14 bits			
Special/Reserved Values	16777215	unknown	

7.5.1.95 NID_RADIO (Values to be assigned according to 7.3.1.3)

Name	Radio subscriber number.		
Description	Quoted as a 16 digit decimal number. The number is to be entered “left adjusted” starting with the first digit to be dialled. Padding by the special value F shall be added after the least significant digit of the number. For further information about NID_RADIO refer to SUBSET-054.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
64 bits	0	9999 9999 9999 9999	Binary Coded Decimal
Special/Reserved Values	For each digit ;		
	Values A – E	Not Used	
	F	Use value F for digit to indicate no digit (if number shorter than 16 digits)	
	FFFF FFFF FFFF FFFF	Use the short number stored onboard	

7.5.1.96 NID_RBC (Values to be assigned according to 7.3.1.3)

Name	RBC ETCS identity number		
Description	This variable provides the identity of the RBC belonging to NID_C. The RBC ETCS identity is given by NID_C + NID_RBC.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
14 bits	0	16 382	Number
Special/Reserved Values	16 383	Contact last known RBC	

7.5.1.97 NID_RIU (Values to be assigned according to 7.3.1.3)

Name	Identity of radio infill unit		
Description	This variable provides the identity of the RIU belonging to NID_C. The RIU ETCS identity is given by NID_C + NID_RIU.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
14 bits	0	16 383	Number

7.5.1.98 NID_NTC (Values to be assigned according to 7.3.1.3)

Name	National System identity		
Description	Each value of this variable represents the identity of a National System.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
8 bits	0	255	

7.5.1.98.1 NID_TEXTMESSAGE

Name	Text message identifier		
Description	Identity of a text message from trackside to be used in a report of driver acknowledgement to the RBC		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
8 bits	0	255	Number

7.5.1.99 NID_TSR

Name	Identity number of Temporary Speed Restriction.		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
8 bits	0	255	Number
Special/Reserved Values	0-126	Reserved for non RBC transmission (balise, loop or radio infill)	
	127-254	Reserved for RBC transmission	
	255	Non-revocable speed restriction (applicable for all transmission media)	

7.5.1.99.1 NID_VBCMK

Name	Marker for Virtual Balise Cover		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
6 bits	0	63	Number

7.5.1.100 NID_XUSER (Values to be assigned according to 7.3.1.3)

Name	Identity of user system		
Description	Identity of user system for which remainder of packet is intended.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
9 bits	0	511	Numbers

7.5.1.101 Q_ASPECT

Name	Aspect of “danger for shunting” signal		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	Stop if in SH mode	
	1	Go if in SH mode	

7.5.1.101.1 Q_CONFTEXTDISPLAY

Name	Qualifier for text confirmation versus end of text display
Description	Gives the relationship between the event “driver acknowledgement” and the list of events “location”, “time”, “mode”, “level” defining the end condition for text display

Length of variable	*Minimum Value*	*Maximum Value*	*Resolution/formula*
1 bit			
Special/Reserved Values	0	Driver acknowledgement always ends the text display, regardless of the end condition	
	1	Driver acknowledgement is an additional condition to end the display	

7.5.1.102 Q_DANGERPOINT

Name	Qualifier for danger point description.		
Description	This variable is set to 1 if either a danger point exists or a release speed has to be specified		
Length of variable	*Minimum Value*	*Maximum Value*	*Resolution/formula*
1 bit			
Special/Reserved Values	0	No danger point information	
	1	Danger point information to follow	

7.5.1.102.1 Q_DIFF

Name	Qualifier for specific SSP categories.		
Description	Indicates the type of specific SSP category In case of “other specific” SSP, it tells ERTMS/ETCS on-board equipment whether it replaces or not the Cant Deficiency SSP as selected by on-board (ref. 3.11.3.2.3), when the train belongs to an “other international” train category to which the “other specific” SSP applies		
Length of variable	*Minimum Value*	*Maximum Value*	*Resolution/formula*
2 bits			
Special/Reserved Values	0	Cant Deficiency specific category	
	1	Other specific category, replaces the Cant Deficiency SSP	
	2	Other specific category, does not replace the Cant Deficiency SSP	
	3	Spare	

7.5.1.103 Q_DIR

Name	Validity direction of transmitted data		
Description	Qualifier to indicate the relevant validity direction of transmitted data, with reference to directionality of the balise group sending the information or to directionality of the LRBG, in case of information sent via radio.		
Length of variable	*Minimum Value*	*Maximum Value*	*Resolution/formula*
2 bits			
Special/Reserved Values	00	Reverse	
	01	Nominal	
	10	Both directions	
	11	Spare	

7.5.1.104 Q_DIRLRBG

Name	Orientation of the train in relation to the direction of the LRBG		
Description			
Length of variable	*Minimum Value*	*Maximum Value*	*Resolution/formula*
2 bits			
Special/Reserved Values	0	Reverse	

	1	Nominal
	2	Unknown
	3	Spare

7.5.1.105 Q_DIRTRAIN

Name	Direction of train movement in relation to the LRBG orientation		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
2 bits			
Special/Reserved Values	0	Reverse	
	1	Nominal	
	2	Unknown	
	3	Spare	

7.5.1.106 Q_DLRBG

Name	Qualifier telling on which side of the LRBG the estimated front end is		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
2 bits			
Special/Reserved Values	0	Reverse	
	1	Nominal	
	2	Unknown	
	3	Spare	

7.5.1.107 Q_EMERGENCYSTOP

Name	Qualifier for emergency stop acknowledgement		
Description	Qualifier to inform the RBC about the use of emergency stop by on-board equipment.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
2 bit			
Special/Reserved Values	0	Conditional Emergency Stop accepted, with update of EOA	
	1	Conditional Emergency Stop accepted, with no update of EOA	
	2	Unconditional Emergency Stop accepted	
	3	Emergency stop (Conditional or Unconditional) rejected, whatever the reason	

7.5.1.108 Q_ENDTIMER

Name	Qualifier to indicate whether end section timer information exists for the End section in the MA		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	No End section timer information	
	1	End section timer information to follow	

7.5.1.109 Q_FRONT

Name	Qualifier for validity end point of profile element		
Description	Qualifier to indicate if a speed limit given for a profile element is to be applied until the front of the train (no train length delay) or the end of the train (train length delay) has left the element		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	Train length delay on validity end point of profile element.	
	1	No train length delay on validity end point of profile element	

7.5.1.110 Q_GDIR

Name	Qualifier for gradient slope.		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	downhill	
	1	uphill	

7.5.1.111 Q_INFILL

Name	Qualifier to indicate whether a train is entering or exiting the radio infill area.		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	Enter	
	1	Exit	

7.5.1.112 Q_LENGTH

Name	Qualifier for train integrity status		
Description	Qualifier, identifying the train integrity information available. The related safe train length information is given by L_TRAININT		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
2 bits			
Special/Reserved Values	0	No train integrity information available	
	1	Train integrity confirmed by integrity monitoring device	
	2	Train integrity confirmed by driver	
	3	Train integrity lost	

7.5.1.113 Q_LGTLOC

Name	Qualifier for the specified report location		
Description	This qualifier tells whether the train has to report its position when the max safe front end or when the min safe rear end has over passed the location defined by D_LOC		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	Min safe rear end	
	1	Max safe front end	

7.5.1.114 Q_LINK

Name	Link Qualifier		
Description	This qualifier is used to mark a balise group as linked or unlinked.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	Unlinked	
	1	Linked	

7.5.1.115 Q_LOCACC

Name	Accuracy of the balise location		
Description	This Qualifier defines the absolute value of the accuracy of the Balise location (i.e., the value 63m identifies a location accuracy of +/- 63m)		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
6 bits	0 m	63 m	1 m

7.5.1.116 Q_LINKORIENTATION

Name	Qualifier for the direction of the linked balise group		
Description	Indicates whether the linked balise group will be overpassed by the train in nominal or reverse direction.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	The balise group is seen by the train in reverse direction	
	1	The balise group is seen by the train in nominal direction	

7.5.1.117 Q_LINKREACTION

Name	linking reaction		
Description	Qualifier for the reaction to be performed if a linking or a balise group message consistency problem occurs with the balise group linked to.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
2 bits			
Special/Reserved Values	00	Train trip	
	01	Apply service brake	
	10	No Reaction	
	11	Spare	

7.5.1.118 Q_LOOPDIR

Name	Qualifier to indicate the direction of the loop		
Description	Indicates LOOP-reference direction in relation to EOLM direction		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	Opposite	
	1	Same	

7.5.1.118.1 Q_LXSTATUS

Name	LX Protection Status
Description	Indicates whether the LX is protected or not

Length of variable	Minimum Value	Maximum Value	Resolution/formula
1 bit			
Special/Reserved Values	0	LX is protected	
	1	LX is not protected	

7.5.1.118.2 Q_MAMODE

Name	Qualifier to indicate the supervision of the beginning of the mode profile		
Description	This qualifier defines whether the beginning of the mode profile shall be considered either as the EOA (keeping the SvL given by the MA) or as both the EOA and SvL (instead of the EOA and SvL given by the MA).		
Length of variable	Minimum Value	Maximum Value	Resolution/formula
1 bit			
Special/Reserved Values	0	as the EOA (keeping the SvL given by the MA)	
	1	as both the EOA and SvL (instead of the EOA and SvL given by the MA)	

7.5.1.118.3 Q_MARQSTREASON

Name	Reason for MA request sending		
Description	Qualifier to indicate the reason why the MA request is sent to the RBC		
Length of variable	Minimum Value	Maximum Value	Resolution/formula
5 bits			Bitset
Special/Reserved Values	xxxx1	Start selected by driver	
	xxx1x	Time before reaching pre-indication location for the EOA/LOA reached	
	xx1xx	Time before a section timer/LOA speed timer expires reached	
	x1xxx	Track description deleted	
	1xxxx	TAF up to level 2/3 transition location	

7.5.1.119 Q_MEDIA

Name	Qualifier to indicate the type of media		
Description	Indicates whether it is a balise telegram or a loop message		
Length of variable	Minimum Value	Maximum Value	Resolution/formula
1 bit			
Special/Reserved Values	0	Balise	
	1	Loop	

7.5.1.120 Q_MPOSITION

Name	Qualifier for track kilometre direction.		
Description	Qualifier to indicate the direction of counting of the geographical position track kilometre in relation to the geographical position reference balise group directionality.		
Length of variable	Minimum Value	Maximum Value	Resolution/formula
1 bit	0	1	
Special/Reserved Values	0	Opposite (counting downwards if passed in nominal direction or counting upwards if passed in reverse direction)	
	1	Same (counting upwards if passed in nominal direction or counting downwards if passed in reverse direction)	

7.5.1.121 Q_NEWCOUNTRY

Name	New Country Qualifier		
Description	Qualifier to indicate whether the next balise group is in the same country / railway administration as the one before inside the packet or not. For the first balise group in the packet, if Q_NEWCOUNTRY = 0, it is the same country / railway administration as the one of the LRBG within the radio message, the one of balise group within the balise telegram giving the packet, or the one of the loop within the loop message giving the packet.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	Same country / railway administration, no NID_C follows	
	1	Not the same country / railway administration, NID_C follows	

7.5.1.122 Q_NVDRIVER_ADHES

Name	Qualifier for the modification of trackside adhesion factor by driver		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	Not allowed	
	1	Allowed	

7.5.1.123 Q_NVEMRRLS

Name	Qualifier Emergency Brake Release		
Description	Permission to revoke the emergency brake command when the Permitted Speed limit is no longer exceeded or at standstill (for ceiling speed and target speed monitoring). This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	Revoke emergency brake command at standstill	
	1	Revoke emergency brake command when permitted speed supervision limit is no longer exceeded	

7.5.1.123.1 Q_NVGUIPERM

Name	Permission to use the guidance curve		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	No	
	1	Yes	

7.5.1.123.2 Q_NVINHSMICPERM

Name	Permission to inhibit the compensation of the speed measurement inaccuracy		
Description	Qualifier to inhibit the compensation of the speed measurement inaccuracy for the calculation of the EBI related supervision limits. This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			

Special/Reserved Values	0	No
	1	Yes

7.5.1.123.3 Q_NVKINT

Name	Qualifier for integrated correction factors		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	No integrated correction factors follow	
	1	Integrated correction factors follow	

7.5.1.123.4 Q_NVKVINTSET

Name	Type of Kv_int set		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
2 bits			
Special/Reserved Values	00	Freight trains	
	01	Conventional passenger trains	
	10-11	Spare	

7.5.1.123.5 Q_NVLOCACC

Name	Default accuracy of the balise location (absolute value)		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
6 bits	0 m	63 m	1 m

7.5.1.123.6 Q_NVSBFBPERM

Name	Permission to use the service brake feedback		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	No	
	1	Yes	

7.5.1.124 Q_NVSBTSMPERM

Name	Permission to use service brake in target speed monitoring		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	No	
	1	Yes	

7.5.1.125 Q_ORIENTATION

Name	Co-ordinate system assigned to a single balise group
Description	The co-ordinate system is assigned by the RBC to a balise group reported by the on-board equipment

	as LRBG. The information reverse/nominal (i.e., the assigned co-ordinate system) is given in relation to the direction in which the balise has been passed when reading it.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	The balise group has been passed by the train in reverse direction	
	1	The balise group has been passed by the train in nominal direction	

7.5.1.126 Q_OVERLAP

Name	Qualifier to tell whether there is an overlap		
Description	This variable is set to 1 if either an overlap exists or a release speed has to be specified		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	No overlap information	
	1	Overlap information to follow	

7.5.1.126.1 Q_PBDSR

Name	Qualifier for Permitted Braking Distance		
Description	Qualifier defining whether the permitted braking distance is to be achieved with the Service Brake or Emergency Brake		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	EB intervention requested	
	1	SB intervention requested	

7.5.1.126.2 Q_PLATFORM

Name	Platform position (relative to direction of authorised movement)		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
2 bits			
Special/Reserved Values	00	Platform on left side	
	01	Platform on right side	
	10	Platform on both sides	
	11	Spare	

7.5.1.127 Q_RBC

Name	Qualifier for communication session order		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	Terminate communication session	
	1	Establish communication session	

7.5.1.128 Q_RIU

Name	Qualifier for communication session order
Description	

Length of variable	Minimum Value	Maximum Value	Resolution/formula
1 bit			
Special/Reserved Values	0	Terminate communication session	
	1	Establish communication session	

7.5.1.129 Q_SCALE

Name	Qualifier for the distance scale.		
Description	Qualifier to indicate the same scale used for describing all distances inside the packet that contains Q_SCALE.		
Length of variable	Minimum Value	Maximum Value	Resolution/formula
2 bits			
Special/Reserved Values	0	10 cm scale	
	1	1 m scale	
	2	10 m scale	
	3	Spare	

7.5.1.130 Q_SECTIONTIMER

Name	Qualifier to indicate whether there is a Section Time-Out related to the section		
Description			
Length of variable	Minimum Value	Maximum Value	Resolution/formula
1 bit			
Special/Reserved Values	0	No Section Timer information	
	1	Section Timer information to follow	

7.5.1.131 Q_SLEEPSESSION

Name	Session management for sleeping equipment		
Description	Qualifier for a Sleeping onboard equipment to execute or not the “session establishment” order		
Length of variable	Minimum Value	Maximum Value	Resolution/formula
1 bit			
Special/Reserved Values	0	Ignore session establishment order	
	1	Execute session establishment order	

7.5.1.132 Q_SRSTOP

Name	“Stop if in Staff Responsible” information		
Description	Specifies whether an onboard equipment in staff responsible has to stop or not		
Length of variable	Minimum Value	Maximum Value	Resolution/formula
1 bit			
Special/Reserved Values	0	Stop if in SR mode	
	1	Go if in SR mode	

7.5.1.133 Q_SSCODE

Name	Spread Spectrum Code for Euroloop		
Description	Specifies the code required to receive telegrams from a specific Euroloop installation.		
Length of variable	Minimum Value	Maximum Value	Resolution/formula
4 bits	0	14	

Special/Reserved Values	15	Code reserved for test purposes

7.5.1.134 Q_STATUS

Name	status of SoM position report		
Description	It provides the status of the position report		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
2 bits			
Special/Reserved Values	00	Invalid	
	01	Valid	
	10	Unknown	
	11	spare	

7.5.1.134.1 Q_STOPLX

Name	Qualifier for stopping in rear of the LX		
Description	Indicates whether stopping the train in rear of a non protected LX is required		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	No stop required	
	1	Stop required	

7.5.1.135 Q_SUITABILITY

Name	Type of route suitability data		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
2 bits			
Special/Reserved Values	00	Loading gauge	
	01	Max axle load	
	10	Traction system	
	11	Spare	

7.5.1.136 Q_TEXT

Name	Fixed message to be displayed.		
Description	Q_TEXT is a pointer to select a fixed text message from the defined table. The language selected by the driver for the DMI shall be used additionally as a qualifier to choose the appropriate language table.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
8 bits	0	255	
Special/Reserved Values	0	“Level crossing not protected”	
	1	“Acknowledgement”	
	2-255	Spare	

7.5.1.137 Q_TEXTCLASS

Name	Class of message to be displayed.		
Description	Q_TEXTCLASS specifies the class of the text message included in the same packet (either plain or fixed message)		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***

2 bits			
Special/Reserved Values	00	Auxiliary Information	
	01	Important Information	
	10	Spare	
	11	Spare	

7.5.1.138 Q_TEXTCONFIRM

Name	Qualifier for text confirmation		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
2 bits			
Special/Reserved Values	00	No confirmation required	
	01	Confirmation required	
	10	Confirmation required: command application of the service brake when display end condition is fulfilled, unless the text has already been acknowledged by the driver	
	11	Confirmation required: command application of the emergency brake when display end condition is fulfilled, unless the text has already been acknowledged by the driver	

7.5.1.139 Q_TEXTDISPLAY

Name	Qualifier for the combination of text message eventss		
Description	Q_TEXTDISPLAY defines whether the start/end events for text message are to be combined or not		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	No, display as soon as / until one of the events is fulfilled	
	1	Yes, display as soon as / until all events are fulfilled	

7.5.1.140 Q_TEXTREPORT

Name	Qualifier for reporting acknowledgement of text by driver		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	No driver acknowledgement report required	
	1	Driver acknowledgement report required	

7.5.1.141 Q_TRACKINIT

Name	Qualifier for resuming the initial states of the related track description of the packet.		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	No initial states to be resumed, profile to follow	
	1	Empty profile, initial states to be resumed	

7.5.1.142 Q_UPDOWN

Name	Balise telegram transmission direction

Description	It defines the direction of the information in the balise telegram		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	Down link telegram	
	1	Up link telegram	

7.5.1.142.1 Q_VBCO

Name	Qualifier for Virtual Balise Cover order		
Description	Qualifier to set or remove a VBC		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
1 bit			
Special/Reserved Values	0	Remove the Virtual Balise Cover	
	1	Set the Virtual Balise Cover	

7.5.1.143 T_CYCLOC

Name	Time Interval between two position reports sent by the train		
Description	The train must send its position every T_CYCLOC		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
8 bits	0 seconds	254 s	1s
Special/Reserved Values	255	∞	

7.5.1.144 T_CYCRQST

Name	Time between two cyclic requests for a movement authority		
Description	When the train asks for a movement authority request, it will repeat its request every T_CYCRQST seconds until it receives a new MA		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
8 bits	0 seconds	254 s	1s
Special/Reserved Values	255	No repetition	

7.5.1.145 T_ENDTIMER

Name	Validity time for the End section in the MA		
Description	Time for which the End section is valid measured from the moment the train reaches the location defined by D_ENDTIMERSTARTLOC.		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
10 bits	0	1022	1 s
Special/Reserved Values	1023	∞	

7.5.1.146 T_LOA

Name	Validity time for the target speed at the LOA		
Description	Time for which the target speed is valid measured from the moment information is received		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
10 bits	0	1022	1 s
Special/Reserved Values	1023	∞	

7.5.1.147 T_MAR

Name	Time before reaching pre-indication location for the EOA/LOA		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
8 bits	0	254	1 s
Special/Reserved Values	255	No MA request triggering with regards to this function	

7.5.1.148 T_NVCONTACT

Name	Maximal time without new “safe” message.		
Description	If no “safe” message has been received from the track for more than T_NVCONTACT seconds, an appropriate action according to M_NVCONTACT must be triggered. This variable is part of the National Values		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
8 bits	0s	254s	1s
Special/Reserved Values	1111 1111	T_NVCONTACT = ∞.	

7.5.1.149 T_NVOVTRP

Name	Maximum time for overriding the train trip		
Description	This variable is part of the National Values		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
8 bits	0 s	255 s	1 s

7.5.1.150 T_OL

Name	Overlap validity time		
Description	The time span the train can expect the overlap to be available, measured from the moment the train reaches the location defined by D_STARTOL.		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
10 bits	0	1022 s	1 s
Special/Reserved Values	1023	∞	

7.5.1.151 T_SECTIONTIMER

Name	Validity time of a section in the MA		
Description	Time for which the section is valid.		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
10 bits	0	1022	1 s
Special/Reserved Values	1023	∞	

7.5.1.152 T_TEXTDISPLAY

Name	Duration for which a text shall be displayed		
Description			
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
10 bits	0	1022 s	1 s
Special/Reserved Values	1023	Display of text not limited by time.	

7.5.1.153 T_TIMEOUTRQST

Name	Time before any section timer expires or the LOA speed timer expires		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
10 bits	0	1022	1 s
Special/Reserved Values	1023	No MA request triggering with regards to this function	

7.5.1.154 T_TRAIN

Name	Trainborne clock		
Description	Time, according to trainborne clock, at which message is sent		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
32 bits	0	42949672.94 s	10 ms
Special/Reserved Values	4294967295	Unknown	

7.5.1.154.1 T_VBC

Name	VBC validity period		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
8 bits	0	255 days	1 day

7.5.1.155 V_AXLELOAD

Name	Speed restriction related to axleload		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600 km/h	5 km/h
Special/Reserved Values	121 –127	Spare	

7.5.1.156 V_DIFF

Name	Absolute Positive Speed associated to a train category.		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600 km/h	5 km/h
Special/Reserved Values	121 – 127	Spare	

7.5.1.157 V_LOA

Name	Permitted speed at the limit of authority		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600 km/h	5 km/h
Special/Reserved Values	121-127	Spare	

7.5.1.157.1 V_LX

Name	Permitted speed for the LX speed restriction		
Description	Speed at which the LX can be passed when it is not protected		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***

7 bits	0 km/h	600 km/h	5 km/h
Special/Reserved Values	121 – 127	Spare	

7.5.1.158 V_MAIN

Name	Signalling related speed restriction		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600 km/h	5 km/h
Special/Reserved Values	121-127	Spare	
	V_MAIN = 0 means “trip order”		

7.5.1.159 V_MAMODE

Name	Required mode related speed		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0	600 km/h	5 km/h
Special/Reserved Values	121 – 126	Spare	
	127	Use the national speed value of the required mode	

7.5.1.160 V_MAXTRAIN

Name	Maximum train speed.		
Description			
Length of variable	Minimum Value	Maximum Value	Resolution/formula
7 bits	0	600 km/h	5 km/h
Special/Reserved Values	121 – 127	Spare	

7.5.1.161 V_NVALLOWOVTRP

Name	Speed limit allowing the driver to select the “override” function		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600km/h	5 km/h
Special/Reserved Values	121 – 127	Spare	

7.5.1.161.1 V_NVKVINT

Name	Speed step used to define the integrated correction factor Kv		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600km/h	5 km/h
Special/Reserved Values	121 – 127	Spare	

7.5.1.161.2 V_NVLIMSUPERV

Name	Limited Supervision mode speed limit		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600km/h	5 km/h

Special/Reserved Values	121 – 127	Spare

7.5.1.162 V_NVONSIGHT

Name	On Sight mode speed limit		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600 km/h	5 km/h
Special/Reserved Values	121-127	Spare	

7.5.1.163 V_NVSUPOVTRP

Name	Override speed limit to be supervised when the “override” function is active		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600km/h	5 km/h
Special/Reserved Values	121 – 127	Spare	

7.5.1.164 V_NVREL

Name	Release Speed		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600 km/h	5 km/h
Special/Reserved Values	121-127	Spare	

7.5.1.165 V_NVSHUNT

Name	Shunting mode speed limit		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600 km/h	5 km/h
Special/Reserved Values	121-127	Spare	

7.5.1.166 V_NVSTFF

Name	Staff Responsible mode speed limit		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600 km/h	5 km/h
Special/Reserved Values	121-127	Spare	

7.5.1.167 V_NVUNFIT

Name	Unfitted mode speed limit		
Description	This variable is part of the National Values		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600 km/h	5 km/h
Special/Reserved Values	121-127	Spare	

7.5.1.168 V_RELEASEDP

Name	Release speed associated with the danger point		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600 km/h	5 km/h
Special/Reserved Values	121-125	Spare	
	126	Use onboard calculated release speed	
	127	Use national value	

7.5.1.169 V_RELEASEOL

Name	Release speed associated with the overlap		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600 km/h	5 km/h
Special/Reserved Values	121-125	Spare	
	126	Use onboard calculated release speed	
	127	Use national value	

7.5.1.170 V_REVERSE

Name	Reversing mode speed limit		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0 km/h	600 km/h	5 km/h
Special/Reserved Values	121-127	Spare	

7.5.1.171 V_STATIC

Name	Basic static speed profile		
Description	Basic static speed profile speed after discontinuity (k).		
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0	600 km/h	5 km/h
Special/Reserved Values	121-126	Spare	
	127	Non numerical value telling that the static speed profile description ends at D_STATIC(n)	

7.5.1.172 V_TRAIN

Name	Train speed		
Description			
Length of variable	***Minimum Value***	***Maximum Value***	***Resolution/formula***
7 bits	0	600 km/h	5 km/h
Special/Reserved Values	121-127	Spare	

7.5.1.173 V_TSR

Name	Permitted speed for the temporary speed restriction
Description	

Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
7 bits	0 km/h	600 km/h	5 km/h
Special/Reserved Values	121 – 127	Spare	

7.5.1.174 X_TEXT

Name	Text String Element		
Description	Text strings are used to transmit plain text messages. Each element of a text string contains a single character encoded as ISO 8859-1, also known as Latin Alphabet #1.		
Length of variable	**Minimum Value**	**Maximum Value**	**Resolution/formula**
8 bits			

ERTMS/ETCS

System Requirements Specification

Chapter 8

Messages

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2.0.1 001002	All	Corrections after UNISIG review 15 June 00	P. Rimbaud
2.1.0 001026	Sections 8.4.1, 8.4.2, 8.4.3, 8.4.4, 8.5.1, 8.5.2, 8.5.3, 8.6, 8.7	Corrections after UNISIG review 10/11 October 00	P. Rimbaud
2.2.0	Packet 71 deleted, NID_C 10 bit	UNISIG release	SAB
2.2.2	Packet 71 added, messages 42 and 158 deleted	SUBSET-026 Corrected Paragraphs, Issue 2.2.2	JY. Riou
2.2.4 – 040512		UNISIG Change Request according the scope	JY. RIOU

Issue Number Date	Section Number	Modification / Description	Author
		defined in the 06/05/2004 e-mail	
2.2.4 SG checked 28/05/04	Including all CLRs agreed with EEIG (see "List of CLRs agreed with EEIG for SRS v2.2.4" dated 28/05/04) Affected clauses see change marks		H. Kast
2.2.5 21/01/05	Incorporation of solution proposal for CLR 007 with EEIG users group comments		A. Hougardy
2.2.6 04/02/05	§ 8.4.2.1, § 8.4.3.1, § 8.7.12 according to CR242 § 8.4.4.4.1.1, § 8.5.3, § 8.7.22 according to CR458 § 8.6.3 according to CR 487		JY. RIOU
2.2.7 01/08/05	§ 8.7.22 error correction (Q_ORIENTATION) according to CR458, § 8.4.4.4.2 according to CR 126 §8.4.4.4.3 b), § 8.6.17 according to CR 299 § 8.4.1.4.5, § 8.4.4.4.1 according to CR 413 § 8.4.1.4.6 according to CR 633		JY.RIOU
2.2.8 30/11/05	Change marks cleaned up and updated according to last CR decisions (including split of CRs 7 and 126)		JY. RIOU
2.2.9 24/02/06	Including all CR s that are classified as "IN" per Subset-108 version 1.0.0 Removal of all CRs that are not classified as "IN" as per SUBSET-108 version 1.0.0 with the exception of the CR 63, 98, 120, 158 and 538		JY. RIOU
2.3.0 24/02/06	Release version		HK
2.3.1 14/06/2006	§ 8.4.4.4.1 and § 8.7.5: "SRS v2.3.0 Release Note CR 382" point, § 8.4.4.4.3 b) and 8.6.17: removing of premature CR299 update		JY. RIOU
2.3.2 17/03/08	Including all CRs that are in state "Analysis completed" according to ERA CCM		A. Hougardy
2.9.1 06/10/08	Including all enhancement CR's retained for 3.0.0 baseline and all other error CR's that are in state "Analysis completed" according to ERA CCM For editorial reasons, the following CR's are also included: CR656, CR804, CR821		A. Hougardy

Issue Number Date	Section Number	Modification / Description	Author
3.0.0 23/12/08	Release version		A. Hougardy
3.0.1 22/12/09	Including the results of the editorial review of the SRS 3.0.0 and the other error CR's that are in state "Analysis completed" according to ERA CCM		A. Hougardy
3.1.0 22/02/10	Release version		A. Hougardy
3.1.1 08/11/10	Including all CR's that are in state "Analysis completed" according to ERA CCM, plus CR731.		A. Hougardy
3.2.0 22/12/10	Release version		A. Hougardy
3.2.1 13/12/11	Including all CR's that are in state "Analysis completed" according to ERA CCM		A. Hougardy
3.3.0 07/03/12	Baseline 3 release version		A. Hougardy

8.2 Table of Contents

8.3 Introduction

8.3.1 Scope and Purpose

8.3.1.1 This chapter defines the format and content of messages necessary for ERTMS/ETCS functions.

8.3.1.2 Concerning the transmission media, this chapter does not cover considerations such as medium-specific use constraints (e.g. distance between track-circuit and balise…), as well as functions (e.g. detection of balise reference, time and location stamp, identifying type of receiving balise, Key Management, Releasing/maintaining a radio connection…) and performance of the transmission media.

8.3.2 Definitions

8.3.2.1 Transmission media considered hereafter are standard ERTMS/ETCS transmission media used for ETCS (Eurobalise, Euroradio and Euroloop).

8.3.2.2 A message includes user data (application level) and protocol data (depending on the transmission medium).

8.3.2.3 A Eurobalise message is the information sent by a balise group (i.e. the message is composed of one or several telegrams, sorted by balise number in the group (telegram from balise number 1 first), each telegram is transmitted by a Eurobalise). A Eurobalise telegram contains one header and an identified and coherent set of Packets.

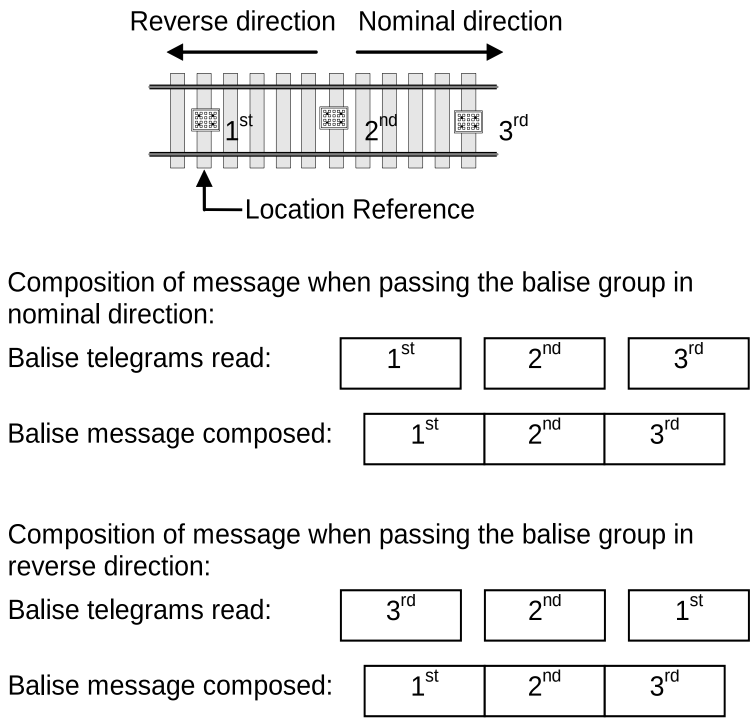

Figure 1: Composition of a balise group message

8.3.2.4 A Euroradio message contains one header and an identified and coherent set of variables (if needed) and Packets.

8.3.2.5 A Euroloop message contains one header and an identified and coherent set of Packets.

8.4 Rules

8.4.1 Common Rules

8.4.1.1 A message (Euroradio/Euroloop) or telegram (Eurobalise) shall be composed of

1. One Header,
2. When needed, a predefined set of variables (only for Radio),
3. When needed, a predefined set of Packets (only for Radio),
4. Optional Packets as needed by application.

8.4.1.2 The transmission order shall respect the order of data elements listed in the message format (from top to bottom).

8.4.1.3 The behaviour of the receiver shall not depend on the sequence of the Packets given by the message.

8.4.1.3.1 Exception for Infill information: The locations given in the packets following packet 136 (Infill Location Reference) shall be referred to the balise group indicated in such packet.

8.4.1.3.2 Note: orientations are in any case always referred to the directionality of balise group (balise transmission), directionality of loop (Euroloop transmission) or directionality of LRBG (radio transmission).

8.4.1.4 It shall be forbidden to send more instances of the same packet type for the same direction in the same message.

8.4.1.4.1 Exception 1: A message can contain several packets 44 (Data used by applications outside the ERTMS/ETCS system).

8.4.1.4.2 Exception 2: A message can contain several packets 65 (Temporary Speed Restriction). In case of revocable TSRs, the identities of the corresponding temporary speed restrictions (variable NID_TSR) transmitted in the same message shall be different.

8.4.1.4.3 Exception 3: A message can contain several packets 66 (TSR Revocation). The identities of the corresponding temporary speed restrictions (variable NID_TSR) transmitted in the same message shall be different.

8.4.1.4.4 Exception 4: A message transmitted by a balise group can contain one packet 136 per balise telegram per direction. Each packet 136 indicates which part of that telegram is to be considered as part of the infill information. Multiple packets 136 in balises of a balise group shall have identical content per direction.

8.4.1.4.5 Exception 5: A message can contain several packets 88 (Level Crossing information). The identities of the corresponding Level Crossings (variable NID_LX) transmitted in the same message shall be different.

8.4.1.4.6 Exception 6: A message transmitted by a balise group can contain several packets 254 (default balise, loop or RIU information).

8.4.1.4.7 Exception 7: A message transmitted by a balise group can contain several packets 145 (Inhibition of balise group message consistency reaction).

8.4.1.4.8 Exception 8: A message transmitted by a balise group can contain several packets 0 (Virtual Balise Cover marker).

8.4.1.4.9 Exception 9: A message transmitted by a balise group can contain several packets 6 (Virtual Balise Cover order). The identities (pairs of variables NID_VBCMK and NID_C) of the corresponding VBC transmitted in the same message shall be different.

8.4.2 Rules for Eurobalise telegrams

8.4.2.1 The format of the telegram to be transmitted by each balise is as follows:

General Format of Balise Telegram			
Field No.	VARIABLE	Length (bits)	Remarks
1	Q_UPDOWN	1	Defines the direction of the information: Down-link telegram (train to track) (0) Up-link telegram (track to train) (1)
2	M_VERSION	7	Version of the ERTMS/ETCS system.
3	Q_MEDIA	1	Defines the type of media: Balise (0)
4	N_PIG	3	Position in the group. Defines the position of the balise in the balise group.
5	N_TOTAL	3	Total number of balises in the balise group
6	M_DUP	2	Used to indicate whether the information of the balise is a duplicate of the balise before or after this one.
7	M_MCOUNT	8	Message counter (M_MCOUNT) - 8 bits. To enable detection of a change of balise group message during passage of the balise group.
8	NID_C	10	Country or region.
9	NID_BG	14	Identity of the balise group.
10	Q_LINK	1	Marks the balise group as linked (Q_LINK = 1) or unlinked (Q_LINK = 0)
	Packet 0 (optional)	14	Virtual Balise Cover marker
	Information	Variable	This information is composed according to the rules applicable for packets.
	Packet 255	8	Finishing flag of the telegram

Number of bits in balise header: 50

8.4.2.2 The user information transmitted by a balise shall contain complete packets, i.e. splitting a packet between two balises is forbidden.

8.4.2.3 When used, the packet 0 shall be transmitted as the first packet of the telegram (i.e. it is appended to the header).

8.4.3 Rules for Euroloop messages

8.4.3.1 The format of the message to be transmitted by each loop is as follows:

General Format of Loop Message			
Field No.	VARIABLE	Length (bits)	Remarks
1	Q_UPDOWN	1	Defines the direction of the information: Down-link message (train to track) (0) Up-link message (track to train) (1)
2	M_VERSION	7	Version of the ERTMS/ETCS system.
3	Q_MEDIA	1	Defines the type of media: Loop (1)
4	NID_C	10	Country or region.
5	NID_LOOP	14	Identity of Euroloop.
	Information	Variable	This information is composed according to the rules applicable for packets.
	Packet 255	8	Finishing flag of the message

Number of bits in loop header: 33

8.4.3.2 Intentionally deleted.

8.4.4 Rules for Euroradio messages

8.4.4.1 The message identifier is unique (variable NID_MESSAGE).

8.4.4.1.1 All currently not defined message identifiers are reserved for future use and shall be considered as invalid values (i.e. like spare values). Exception: reception of information only differing by Y with regards to the highest system version number X supported by on-board (refer to section 3.17.3.11 b)).

8.4.4.2 Each message shall indicate its own length through the use of the variable L_MESSAGE.

8.4.4.2.1 If the computed length of the message is not equal to the length given by L_MESSAGE, the entire message shall be rejected.

8.4.4.3 The messages shall be composed of predefined variables and packets.

8.4.4.4 For some messages, it shall be possible to add optional packets at the end of the message.

8.4.4.4.1 The track to train messages possibly including optional packets are listed hereafter:

Track to Train message	Mess. ID	Optional packets
SR Authorisation	2	63
Movement Authority	3	21, 27, 49, 80, plus common optional packets
Request To Shorten MA	9	49, 80
General Message	24	From RBC: 21, 27, plus common optional packets From RIU: 45, 143, 254
SH authorised	28	3, 44, 49
MA with Shifted Location Reference	33	21, 27, 49, 80, plus common optional packets
Infill MA	37	5, 21, 27, 39, 40, 41, 44, 49, 51, 65, 66, 68, 69, 70, 71, 80, 88, 138, 139

8.4.4.4.1.1 The common optional packets are the following ones:

Common optional packets
3, 5, 39, 40, 51, 41, 42, 44, 45, 52, 57, 58, 64, 65, 66, 68, 69, 70, 71, 72, 76, 79, 88, 131, 138, 139, 140

8.4.4.4.2 The train to track message 136 (Train Position Report) and 157 (SoM Position Report) may optionally include the following packets:

a) Packet 4 (Error Reporting),

b) Packet 5 (Train running number),

c) Packet 44 (Data used by applications outside the ERTMS/ETCS system).

8.4.4.4.3 The train to track message 159 (Session Established) may optionally include the following packets:

a) Packet 3 (Onboard Telephone Numbers)

8.4.4.4.4 The train to track message 132 (MA request) may optionally include the following packet:

a) Packet 9 (Level 2/3 transition information)

8.4.4.5 If needed to obtain an integer number of bytes, padding shall be added at the end of the message.

8.4.4.6 Standard format of a radio message from track to train :

8.4.4.6.1 Format:

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	Message Identification Number
2	L_MESSAGE	Message length including everything (from field 1 to padding inclusive).
3	T_TRAIN	Time Stamp from RBC (see sections 3.16.3.2 & 3.16.3.3).
4	M_ACK	Indicates whether the message must be acknowledged (or not) by the on-board equipment (message n° 146).
5	NID_LRBG	Identification Number of LRBG.
…	variables as required by NID_MESSAGE	If needed for this message. Used when sending variables which are not included in a packet.
…	packets as required by NID_MESSAGE	If needed for this message.
	Optional packets	Refer to section 8.4.4.4 of this document.
	Padding	If required.

8.4.4.6.2 Note: In section 8.7 giving the contents of the messages, the padding information is intentionally omitted.

8.4.4.6.3 The track to train message 39 (Acknowledgement of termination of a communication session) shall include the variable M_ACK set to 0. Justification: see 3.5.5.3.

8.4.4.7 Standard format of a radio message from train to track:

8.4.4.7.1 Format:

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	Message Identification Number
2	L_MESSAGE	Message length including everything (from field 1 to padding inclusive).
3	T_TRAIN	Time Stamp from Train (see chapter 3 – Data Consistency).
4	NID_ENGINE	Identity of the train.
5	variables as required by NID_MESSAGE	If needed for this message. Used when sending variables which are not included in a packet.
6	Packet 0 or 1	Train-to-track packet type 0 – Position report, or packet type 1 - Position report based on two balise groups. Not included in messages 146, 154, 155, 156 and 159.
7	Other Packets as required by NID_MESSAGE	(only for message 129)
8	Optional packets	
	Padding	If required.

8.4.4.7.2 Exception: The position report (packet 0 or packet 1) shall not be included in the following messages:

a) Message 146 (Acknowledgement),

b) Message 154 (No compatible version supported),

c) Message 155 (Initiation of a communication session),

d) Message 156 (Termination of a communication session),

e) Intentionally deleted

f) Message 159 (Session Established).

8.4.4.7.3 Note: In section 8.6 giving the contents of the messages, the padding information is intentionally omitted.

8.5 List of radio Messages

8.5.1 Introduction

8.5.1.1 This section identifies the radio messages with corresponding Message Identifier ("Mes. Id.") and Message Name. It also gives a list of the version-invariant messages.

8.5.1.2 "Type" defines whether a message is to be sent as normal priority (N) or as high priority data (E), as defined in Euroradio specifications.

8.5.2 Train to Track radio messages

Mes. Id.	Message Name	Type	Invariant	Transmitted to
129	Validated Train Data	N	No	RBC
130	Request for Shunting	N	No	RBC
132	MA Request	N	No	RBC
136	Train Position Report	N	No	RBC, RIU
137	Request to shorten MA is granted	N	No	RBC
138	Request to shorten MA is rejected	N	No	RBC
146	Acknowledgement	N	No	RBC, RIU
147	Acknowledgement of Emergency Stop	N	No	RBC
149	Track Ahead Free Granted	N	No	RBC
150	End of Mission	N	No	RBC
153	Radio infill request	N	No	RIU
154	No compatible version supported	N	Yes	RBC, RIU
155	Initiation of a communication session	N	Yes	RBC, RIU
156	Termination of a communication session	N	Yes	RBC, RIU
157	SoM Position Report	N	No	RBC
158	Text message acknowledged by driver	N	No	RBC
159	Session Established	N	No	RBC, RIU

8.5.3 Track to Train radio messages

Mes. Id.	Message Name	Type	Invariant	Transmitted by
2	SR Authorisation	N	No	RBC
3	Movement Authority	N	No	RBC
6	Recognition of exit from TRIP mode	N	No	RBC
8	Acknowledgement of Train Data	N	No	RBC
9	Request to Shorten MA	N	No	RBC
15	Conditional Emergency Stop	E or N	No	RBC
16	Unconditional Emergency Stop	E or N	No	RBC
18	Revocation of Emergency Stop	N	No	RBC
24	General message	N	No	RBC, RIU
27	SH Refused	N	No	RBC
28	SH Authorised	N	No	RBC
33	MA with Shifted Location Reference	N	No	RBC
34	Track Ahead Free Request	N	No	RBC
37	Infill MA	N	No	RIU
40	Train Rejected	N	No	RBC
32	RBC/RIU System Version	N	Yes	RBC, RIU
38	Initiation of a communication session	N	Yes	RBC
39	Acknowledgement of termination of a communication session	N	Yes	RBC, RIU
41	Train Accepted	N	No	RBC
43	SoM position report confirmed by RBC	N	No	RBC
45	Assignment of coordinate system	N	No	RBC

8.6 Definition of Radio Messages from Train to Track

8.6.1 Message 129: Validated Train Data

Field No.	VARIABLE/ PACKET	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	
5	Packet 0 or 1	
6	Train data	Train - track packet type 11.

8.6.2 Message 130: Request for Shunting

Field No.	VARIABLE/ PACKET	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	
5	Packet 0 or 1	

8.6.3 Message 132: MA Request

Field No.	VARIABLE/ PACKET	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	
5	Q_MARQSTREAS ON	
6	Packet 0 or 1	
7	Optional packets	

8.6.4 Message 136: Train Position Report

Field No.	VARIABLE/ PACKET	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	
5	Packet 0 or 1	
6	Optional packets	

8.6.5 Message 137: Request to Shorten MA is granted

Field No.	VARIABLE/ PACKET	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	
5	T_TRAIN	Time stamp contained in the request.
6	Packet 0 or 1	

8.6.6 Message 138: Request to Shorten MA is rejected

Field No.	VARIABLE/ PACKET	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	
5	T_TRAIN	Time stamp contained in the request.
6	Packet 0 or 1	

8.6.7 Message 146: Acknowledgement

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	
5	T_TRAIN	Time stamp contained in the message that is acknowledged.

8.6.8 Message 147: Acknowledgement of Emergency Stop

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	
5	NID_EM	Identification Number of the acknowledged Emergency Message.
6	Q_EMERGENCYSTOP	
7	Packet 0 or 1	

8.6.9 Message 149: Track Ahead Free Granted

Field No.	VARIABLE/ PACKET	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	
5	Packet 0 or 1	

8.6.10 Message 150: End of Mission

Field No.	VARIABLE/ PACKET	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	
5	Packet 0 or 1	

8.6.11 Message 153: Radio infill request

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	
5	NID_C	identity of the country of the “target” main balise group
6	NID_BG	identity of the “target” main balise group
7	Q_INFILL	start; end of infill
8	Packet 0 or 1	

8.6.12 Message 154: No compatible version supported

Field No.	VARIABLE/ PACKET	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	

8.6.13 Message 155: Initiation of a communication session

Field No.	VARIABLE/ PACKET	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	

8.6.14 Message 156: Termination of a communication session

Field No.	VARIABLE/ PACKET	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	

8.6.15 Message 157: SoM Position Report

Field No.	VARIABLE/ PACKET	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	

4	NID_ENGINE	
5	Q_STATUS	
6	Packet 0 or 1	
7	Optional packets	

8.6.16 Message 158: Text Message Acknowledged by Driver

Field No.	VARIABLE/ PACKET	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	
5	NID_TEXTMESSAGE	Identity of the text message that the driver has acknowledged.
6	Packet 0 or 1	

8.6.17 Message 159: Session established

Field No.	VARIABLE/ PACKET	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	NID_ENGINE	
5	Optional Packet	

8.7 Definition of Radio Messages from Track to Train

8.7.1 Message 2: SR Authorisation

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	Q_SCALE	
7	D_SR	
8	Optional packets	

8.7.2 Message 3: Movement Authority

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	Level 2/3 Movement Authority	Packet 15
7	Optional packets	

8.7.3 Message 6: Recognition of exit from TRIP mode

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	

8.7.4 Message 8: Acknowledgement of Train Data

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	T_TRAIN	Reference to received train data message

8.7.5 Message 9: Request to Shorten MA

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	Level 2/3 Movement Authority	Packet 15
7	Optional packet	Packet 80

8.7.6 Message 15: Conditional Emergency Stop

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	NID_EM	Identification Number of the Emergency Stop Message.
7	Q_SCALE	
8	D_REF	
9	Q_DIR	
10	D_EMERGENCYSTOP	Distance between LRBG and the position reference to the emergency stop.

8.7.7 Message 16: Unconditional Emergency Stop

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	NID_EM	Identification Number of the Emergency Stop Message.

8.7.8 Message 18: Revocation of Emergency Stop

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	NID_EM	Identification Number of the Emergency Stop Message.

8.7.9 Message 24: General message

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	Optional packets	

8.7.10 Message 27: SH Refused

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	T_TRAIN	Time stamp of the shunting request.

8.7.11 Message 28: SH Authorised

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	T_TRAIN	Time stamp of the shunting request.
7	Optional packets	

8.7.12 Message 32: RBC/RIU System Version

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	M_VERSION	Version of the ERTMS/ETCS system.

8.7.13 Message 33: MA with Shifted Location Reference

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	Q_SCALE	
7	D_REF	Reference Distance
8	Level 2/3 Movement Authority	Packet 15
9	Optional packets	

8.7.14 Message 34: Track Ahead Free Request

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	Q_SCALE	
7	D_REF	
8	Q_DIR	
9	D_TAFDISPLAY	
10	L_TAFDISPLAY	

8.7.15 Message 37: Infill MA

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	Infill Location Reference	Packet 136
7	Level 1 Movement Authority	Packet 12
8	Optional packets	

8.7.16 Message 38: Initiation of a communication session

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	always set to unknown
4	M_ACK	
5	NID_LRBG	always set to unknown

8.7.17 Message 39: Acknowledgement of termination of a communication session

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	always set to 0
5	NID_LRBG	

8.7.18 Message 40: Train Rejected

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	

8.7.19 Message 41: Train Accepted

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	

8.7.20 Intentionally deleted

8.7.21 Message 43: SoM position report confirmed by RBC

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	

8.7.22 Message 45: Assignment of coordinate system

Field No.	VARIABLE	Remarks
1	NID_MESSAGE	
2	L_MESSAGE	
3	T_TRAIN	
4	M_ACK	
5	NID_LRBG	
6	Q_ORIENTATION	