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ERTMS USERS GROUP – ENGINEERING GUIDELINE

23. Balise Engineering for L2 and L3

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1. Introduction

1.1 Foreword

1.1.1.1 In ETCS Level 2 or 3, the use of Balise Groups (BGs) is required to allow the movement of trains, to prevent accidents, to warn the driver or for other operational and safety reasons.

1.1.1.2 In order to take advantage of the experiences of the ESG (Engineering Support Group) members on this topic, the ESG has decided to create a guideline regarding the 'Balise Engineering Rules'.

1.1.1.3 This document intends to:

- give global implementation rules for balises;
- list and analyse the ETCS information (Packet) transmittable by balise;
- gather use cases in which functions are implemented by balise;
- give, if possible, advice and recommendations about the implementation of the BG (BG composition, BG location, Q_LOCACC definition, etc.); and
- provide a summary Table making the link between use cases and ETCS functions.

1.1.1.4 This analysis document is based on SUBSET-026 [1].

1.1.1.5 This guideline is part of a bundle of guidelines with the Overall ETCS guideline [10] being the main guideline which will redirect the reader to the relevant guidelines. Be aware that the Overall ETCS guideline may also include recommendations which are related to the topics addressed in this guideline.

1.2 Scope and Field of Application

1.2.1.1 The scope of this document is EU-wide on ETCS projects.

1.2.1.2 This document applies to Baseline 2 and 3 MR1 and R2.

1.2.1.3 The impact of the CRs in the ERA/OPI/2020-2 [9] on the balise engineering (CR994, CR1120, CR1295, CR1306, CR1312, CR1313, CR1334, CR1338, and CR1340) has been considered.

1.2.1.4 The document focuses on balise-transmitted packets applicable to Levels 2 and 3. These packets may be equally applicable to Level 1.

1.2.1.5 For each packet, the applicable System Version will be specified.

1.3 Document structure

1.3.1.1 The present guideline is structured in the following way:

- ETCS Packet – Transmission channel
- Analysis of the ETCS Packet only transmittable by balise
- Analysis of the ETCS Packet that can be transmitted by balise or other means
- Analyse by function

- Summary Table

2. References and Abbreviations

2.1 Abbreviations

2.1.1.1 The following table includes acronyms and abbreviations which are used in the current document:

Abbreviation	Description
BG	Balise Group
BTM	Balise Transmission Module
EOA	End of Authority
EOLM	End-of-Loop Marker
ETCS	European Train Control System
IM	Infrastructure Manager
L1, L2, L3	Level 1, 2, 3
LEU	Lineside Electronic Unit
LSSMA	Lowest Supervised Speed within the MA
LTO	Level Transition Order
LX	Level Crossing
MA	Movement Authority
minSRE	Min safe rear end
NV	National Values
P	ETCS Packet
PS	Passive Shunting (mode)
SB	Standby (mode)
STM	Specific Transmission Module
SV	System Version
TC	Track condition
TSR	Temporary Speed Restriction
VBC	Virtual Balise Cover

2.2 Definitions

2.2.1.1 The following table includes terms and definitions which are used in the current document:

Terminology	Definition

Relocation BG	BGs that are placed close to an EOA in order to reduce the confidence interval error on the approach thereto
Service trains	Trains that operate a commercial service

2.3 References

2.3.1.1 The following documents and versions apply:

Ref. N°	Document Reference	Title	Version
[1]	SUBSET-026	ERTMS/ETCS System Requirements Specification	3.6.0
[2]	SUBSET-036	FFFIS for Eurobalise	3.1.0
[3]	SUBSET-040	ERTMS/ETCS Dimensioning and Engineering rules	3.4.0
[4]	EUG_UNISIG_BCA	Baseline Compatibility Analysis. Final Report	1.0.0
[5]	SUBSET-104	ETCS System Version Management	3.3.0
[6]	SUBSET-113	ETCS Hazard Log	1.4.0
[7]	SUBSET-041	ERTMS/ETCS Performance Requirements for Interoperability	3.2.0
[8]	N/A	ERTMS Trackside Approval Issues Log	5
[9]	ERA/OPI/2020-2	Opinion of the European Union Agency for Railways to the European Commission regarding error corrections of current ERTMS baselines	2020-05-05
[10]	22E087	Overall ETCS	1-

3. General balise implementation recommendations

3.1 Introduction

3.1.1.1 When installing ETCS, it shall be checked if some changes must be foreseen in the infrastructure in order to:

- be able to install the new BGs;
- have the ETCS system behave as expected, without side effects

3.2 Relocation BG placement

3.2.1.1 In release speed monitoring, depending on how far in rear of the EOA the LRBG lies, the confidence interval may allow the actual train front end to overshoot the physical EOA by a significant distance before the EOA indicated on the DMI is reached and the train subsequently tripped. If there is no BG close to the EOA, which triggers the odometry inaccuracy to be reset, it is recommended to engineer and install additional BGs, also known as relocation BGs, on the approach to that EOA.

3.2.1.1.1 Note: To further mitigate the scenario identified in 3.2.1.1, a mitigation is proposed in ETCS-H0103 of SUBSET-113 [6] (which describes the delay that can be applied on the entry in Trip mode in release speed monitoring).

3.2.1.2 Also, in terms of driver ergonomics, these relocation BGs reduce the confidence interval and any divergence between the right stop location marked by a Stop or Location Marker and the EOA displayed on the DMI. This is especially relevant when short block sections are applied, which are delimited by these Stop or Location Marker."

3.2.1.3 The placement of relocation BGs in rear of a specific location on the track (e.g. detection point of the following section, operational stopping point, EOA, track conditions, etc) should be chosen with care as it has a great impact on potential odometry related issues, according to the following considerations:

- Maximum odometric error (see SUBSET-041 [7])
- Presence and type of release speed
- Distance between EOA and SvL
- Presence of LX (especially if the train has to stop in case of unprotected LX)
- Presence of other infrastructure constraints (e.g. BMM, switches, etc)

3.3 Q_LOCACC value

3.3.1.1 Large values of the Q_LOCACC variable should be avoided for balises used to mark an EOA as this could lead to the train overpassing the EOA before being tripped.

3.3.1.1.1 Note: Defining the lowest possible Q_LOCACC values is recommended, but the right value is project specific and depends on installation requirements. However, a 2m value is feasible to be implemented.

3.4 Distance between BG

3.4.1.1 When the trackside requires that

- two BG have to be installed close to each other and
- the two BG have to be read sequentially (one after the other)

a minimum distance between BG has to be defined.

3.4.1.2 Clauses in SUBSET-036 [2] concerning distances between balises deal with balise clusters (which are list of balises physically close to each other), whereas SUBSET-026 [1] deals with balise groups, which are balises which are logically gathered using the balise header (NID_C/NID_BG/N_PIG).

3.4.1.3 The minimum time in seconds to read a BG composed of n balises is defined in section 4.2.9 of SUBSET-036 [2]: $t = \frac{1.3 * 3.6}{v} + n * 0.1$ where v is the speed in km/h allowed over the BG.

3.4.1.4 The distance in meters run by the train when reading the n-balises BG is $d = 1.3 + \frac{n*0.1*v}{3.6}$.

3.4.1.5 To be sure the antenna of the train is not yet energizing the closest balise of the next balise group, the electric centre of this balise should be located at least 1.3m further than the distance to read the n-balises BG (in Figure 1, d1 and d2 are the distance d defined in 3.4.1.4 for the BG in Figure 1).

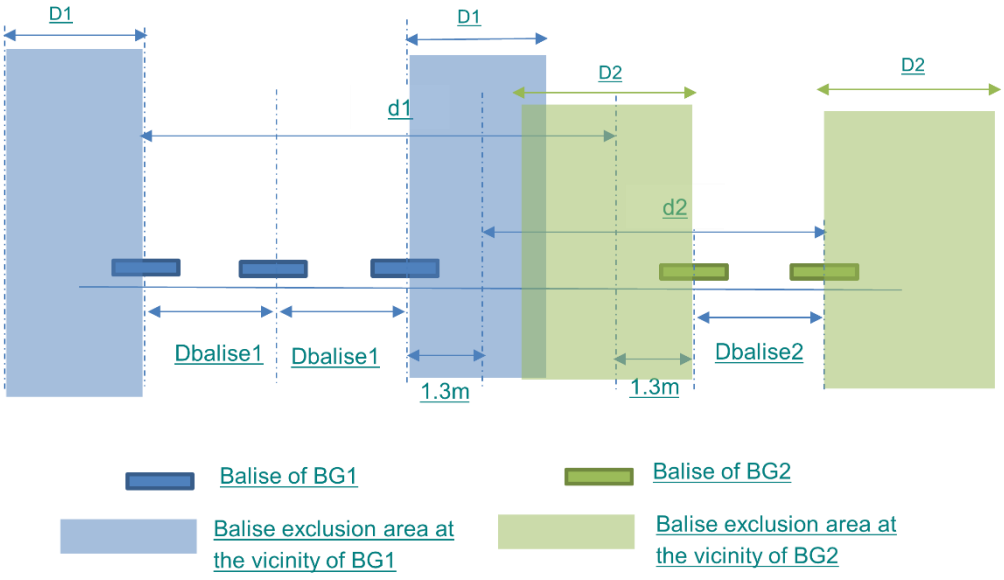

Figure 1: Installation distances to be respected between two BGs

3.4.1.6 In Figure 1, $d1 = 1.3 + \frac{3*0.1*v1}{3.6}$ and $d2 = 1.3 + \frac{2*0.1*v2}{3.6}$ where v1 is the maximum speed over BG1 and v2 is maximum speed over BG2.

3.4.1.7 For each balise group, we can define a balise exclusion area from the last balise of the group (for the concerned travel direction), in which no balise from another BG should be installed. For BG1, D1 defines the balise exclusion area, the formula

of D1 is in 3.4.1.8. The same way, the balise exclusion of BG2 is defined by D2 which formula is in 3.4.1.9.

3.4.1.8 To be sure BG1 is fully read before starting to read another BG, the closest balise of another balise group should be located at $D1 = 1.3 + d1 - 2 * Dbalise1 = 2.6 + \frac{3*0.1*v1}{3.6} - 2 * Dbalise1$ from the extreme balises of BG1.

3.4.1.9 To be sure BG2 is fully read before starting to read another BG, the closest balise of another balise group should be located at $D2 = 1.3 + d2 - Dbalise2 = 2.6 + \frac{2*0.1*v2}{3.6} - Dbalise2$ from the extreme balises of BG2.

3.4.1.9.1 Note: In case the travelling speed over a balise group is dependent on the travelling direction, an optimization of the balise exclusion area is possible considering the different speeds.

3.4.1.10 To be sure no balise of a close BG is in the exclusion area of a BG (no balise of BG1 is in exclusion area of BG2 and vice-versa), the minimum distance between the 2 closest balises of BG1 and BG2 should then be $D = 2.6 + \max\left(\frac{3*0.1*v1}{3.6} - 2 * Dbalise1, \frac{2*0.1*v2}{3.6} - Dbalise2\right)$

3.4.1.11 Assuming the speed over the 2 balise groups is constant, and that the balises of the 2 groups are the same type (all reduced size or all standard size), and the balises in the group are evenly spaced, the minimum distance between the closest balises of two consecutive balise groups is:

$$D = 2.6 + 0.1\frac{v * n}{3.6} - d_b(n-1)$$

Where *v* is the speed over the balise groups, *n* the maximum number of balises in both groups and d_b the distance between balises of the same group.

3.4.1.12 The distance d_b shall comply with the restrictions in Figure 27 and 28 of SUBSET-036 [2].

3.4.1.13 The distance D shall not prevent the respect of clause 4.1.1.6 of SUBSET-040 [3]. If D does not allow 4.1.1.6 to be respected, the distance between the groups shall be increased to allow this clause to be respected.

4. Balise implementation rules/advice depending on their ETCS content

4.1 ETCS Packet – Transmission channel

4.1.1 Section goal

4.1.1.1 The goal of this section is to identify the transmission channels of the existing ETCS Packets, based on SUBSET-026 [1].

4.1.1.2 Identification of the transmission channel allows Packets to be sorted into three categories:

- ETCS Packets only transmittable by balise
- ETCS Packets that can be transmitted by balise or other means
- ETCS Packets that cannot be transmitted by balise

4.1.1.3 This section uses a generic table giving the following information:

4.1.1.4	Packet Number	4.1.1.5	Packet Name	4.1.1.7	Relevant to L2/3
		4.1.1.6	*As defined in SUBSET-026* [1].	4.1.1.8	Yes/No

4.1.2 ETCS Packets only transmittable by balise

P#	Packet Name	Relevant to L2&L3
0	Virtual Balise Cover marker	Yes
2	System Version order	Yes
6	Virtual Balise Cover order	Yes
16	Repositioning information	No
46	Conditional Level Transition Order (CLTO)	Yes
67	Track condition Big Metal Masses (BMM)	Yes
90	Track ahead free up to Level 2/3 transition location	Yes
132	Danger for Shunting information	Yes
133	Radio infill area information	No
134	EOLM Packet	Yes
135	Stop Shunting on desk opening	Yes
137	Stop if in Staff Responsible (SiiSR)	Yes
141	Default Gradient for TSR	Yes
145	Inhibition of Balise Group message consistency reaction	Yes

181	Generic Limited Supervision (LS) function marker	Yes

Table 1: ETCS Packets - Balise only

4.1.3 ETCS Packet transmittable by balise or other means

P#	Packet Name	Relevant to L2/3
3	National Values (NV)	Yes
5	Linking	Yes (RBC) / No (Balise)
12	Level 1 Movement Authority (MA)	No
21	Gradient profile	Yes (RBC) / No (Balise)
27	International Static Speed Profile (SSP)	Yes (RBC) / No (Balise)
39	Track Condition Change of traction system	Yes (RBC) / No (Balise)
40	Track Condition Change of allowed current consumption	Yes (RBC) / No (Balise)
41	Level Transition Order (LTO)	Yes
42	Session Management	Yes
44	Data used by applications outside ERTMS/ETCS system	Yes
45	Radio Network registration	Yes
49	List of balises for Shunting (SH) Area	Yes (RBC) / No (Balise)
51	Axle load speed Profile	Yes (RBC) / No (Balise)
52	Permitted Braking distance information	Yes (RBC) / No (Balise)
65	Temporary Speed Restriction	Yes
66	Temporary Speed Restriction Revocation	Yes
68	Track Condition	Yes (RBC) / No (Balise)
69	Track Condition Station Platforms	Yes (RBC) / No (Balise)
70	Route suitability data	Yes (RBC) / No (Balise)
71	Adhesion factor	Yes (RBC) / No (Balise)
72	Packet for sending plain text messages	Yes
76	Packet for sending fixed text messages	Yes
79	Geographical position information	Yes
80	Mode profile	Yes (RBC) / No (Balise)
88	Level crossing information	Yes
131	RBC transition order	Yes

P#	Packet Name	Relevant to L2/3
136	Infill location reference	No
138	Reversing area information	Yes (RBC) / No (Balise)
139	Reversing supervision information	Yes (RBC) / No (Balise)
180	LSSMA display toggle order	Yes (RBC) / No (Balise)
254	Default balise, loop or Radio Infill Unit (RIU) information	Yes
255	End of Information	Yes

Table 2: ETCS Packet - Balise transmission possible

4.1.4 ETCS Packet that cannot be transmitted by balise

4.1.4.1 These packets are not covered by the guideline.

P#	Packet Name
13	Staff Responsible (SR) distance information from loop
15	L2/L3 Movement Authority
57	Movement Authority Request Parameters
58	Position Report Parameters
63	List of Balises in SR authority
64	Inhibition of revocable TSRs from balises in L2/L3
140	Train Running Number (TRN) from RBC
143	Session management with neighbouring Radio Infill Unit

Table 3: ETCS Packet - transmission by balise impossible

4.1.5 Constraints

4.1.5.1 Balise Groups must be positioned according to the rules laid down in SUBSET-040 [3] and SUBSET-036 [2].

4.1.5.2 Telegrams within a Balise Group must comply with the rules laid down in SUBSET-040 [3] and SUBSET-026 [1].

4.2 Analysis of ETCS Packet – Introduction

4.2.1.1 Depending on the possible transmission channel of the related Packet, the structure of the analysis varies.

4.2.1.2 The analysis of ETCS Packets transmittable by balise is structured as follows:

- Possible transmission channel: Balise
- Goals and functions linked to the Packet: …

4.2.1.3 This section describes the utility and functionality (-ies) of the Packet. Where a function linked to the Packet is realised via several Packets, the function

concerned is described separately in a specific point (see chapter 5). Otherwise, the function is described in the present section.

- Use cases

4.2.1.4 The ‘Use cases’ section gives examples of situations in which such Packet / functions are used. Where functions linked to the Packet are realised via several Packets, the use cases are listed in the section dedicated to the ETCS function (see chapter 5).

- Implementation advice and exported requirements from specification

4.2.1.5 Where possible, this section gives requirements, or at least advice, regarding the implementation of the ETCS Packet concerned. The advice / requirements may also provide information about the type of BG (i.e. fixed or switchable) and the BG location, etc.

- Packet content

4.2.1.6 This section contains the main information in the Packet, based on SUBSET-026 [1].

- System Version Applicability

4.2.1.7 This section defines the System Version in which the ETCS Packet concerned is applicable.

4.3 P0 – Virtual Balise Cover Marker

4.3.1 Possible transmission Channel

4.3.1.1 Balise

4.3.2 Goals and functions linked to the Packet

4.3.2.1 Packet 0 (P0) gives an indication to the on-board that the telegram can be considered as “not received” if the associated VBC is active on-board.

4.3.2.2 The function linked to this Packet is the function Virtual Balise Cover (see 5.1).

4.3.3 Use Cases

4.3.3.1 See 5.1.4.

4.3.4 Implementation advice / Requirements

4.3.4.1 Packet 0 has to be defined in each telegram that may, in a given situation, have to be ignored by the on-board system.

4.3.4.2 P0 is only applicable for one balise; therefore, all the balises in the BG should include P0 in order to avoid a message consistency error.

4.3.4.3 P0 cannot be defined as infill information.

4.3.4.3.1 Note: The NID_C of the telegram including P0 and the VBC marker value need to match the VBC code stored on-board for the balise to be ignored.

4.3.4.4 Since P0 does not contain L_PACKET and since, according to SUBSET-026 [1] 8.4.2.1, P0 has to be the first packet after the header of the telegram when it is used (it is optional), the presence of P0 may be incompatible with stand alone class B on-board system making use of Eurobalise telegram because they could not be able to detect packet 44. If this is the case, independently from the implemented trackside System Version, SV = 1.1 and P200 should be used instead.

4.3.4.4.1 Note: The implementation of different System Versions on trackside is allowed, see SUBSET-104 [5].

4.3.5 Packet content

4.3.5.1 The only information contained in this Packet is the Marker number of the VBC.

4.3.6 System Version applicability

4.3.6.1 P0 is available with System Version number X = 2.

4.3.6.2 In the previous System Version 1.1, P0 is replaced by a P200.

4.3.6.3 A Baseline 2 on-board will ignore P200.

4.4 P2 – System Version Order

4.4.1 Possible transmission Channel

4.4.1.1 Balise

4.4.2 Goals and functions linked to the Packet

4.4.2.1 The goal of P2 is to order the on-board to operate in a given System Version. By default, the on-board determines the system in operation to be Version X (see SUBSET-104 [5] for more details), as the System Version number X can be transmitted by any balise if this System Version X is higher than the currently operated one. Therefore, the only way in which a train can be ordered to operate in a System Version X lower than the currently operated one is by the transmission of a P2.

4.4.3 Use Cases

4.4.3.1 P2 shall be sent at the transition between two trackside areas, one operated with System Version number X = n and one operated with System Version number X lower than n.

4.4.3.2 Due to the differences between System Version X=2 and X=1, on-board will respond differently to ‘stop if in SR’ message. Where trains of different versions can operate P2 can be used to provide consistent system behaviours. P2 is used to force the transition to TR mode when the train reads a BG containing ‘stop if in SR’ packet 137 and the BG is announced in the list of authorised BG in SR.

4.4.4 Implementation advice / Requirements

4.4.4.1 As the information contained in P2 is managed immediately by the train, P2 can be sent in the first BG reached by the train in the areas operated by a lower System Version number X.

4.4.5 Packet content

4.4.5.1 The only information in P2 is the code of the System Version operated by the Trackside. The meaning of the value defined in this variable is given in SUBSET-026 [1], chapter 7.

4.4.6 System Version applicability

4.4.6.1 P2 is available with System Version number 1.1, 2.Y.

4.4.6.2 A Baseline 2 on-board will ignore P2.

4.5 P3 – National Values

4.5.1 Possible transmission Channel

4.5.1.1 Balise, RBC

4.5.2 Goals and functions linked to the Packet

4.5.2.1 P3 sends a set of National Values to the train.

4.5.3 Use Cases

4.5.3.1 National Values are a set of variables in ETCS application and used to configure the ETCS on-board so that it behaves in a specific manner within a national area (i.e. NID_C). These values are transmitted by either Balise or RBC at given locations, such as depot exits, and stored in the on-board for use in specific scenarios, such as where there are system constraints and parameters, e.g. Speed Limit in SR.

4.5.4 Implementation advice / Requirements

4.5.4.1 The Trackside sends NV to ensure that the on-board has the appropriate values applicable to the current National Area and to avoid the train running at an unsafe higher speed.

4.5.5 Packet content

4.5.5.1 The packet contains the National Values applicable to the railway on which the train is operating. These include ceiling speeds and configuration of the on-board system. Each Infrastructure Manager is responsible for setting the values to be sent to the train.

4.5.6 System Version applicability

4.5.6.1 P3 is available with System Version number X = 1 or 2.

4.5.6.2 For System Version 1.1 P203 is used to send the new NV added in Baseline 3.

4.5.6.3 A Baseline 2 on-board will ignore P203.

4.5.6.4 Special attention is needed when using the special value “now” (32767), added in Baseline 3, for the parameter D_VALIDNV at tracksides where balise groups with different System Version Numbers X = 1 and 2 are mixed up. For balise groups with System Version X = 1, the value “0” shall be used for immediate valid National Values and only for balise groups with System Version X = 2, the special value “now” (32767) could be used instead.

4.5.6.4.1 Note: If using value 32767 in a balise group with X = 1, the NV will not become immediately applicable but after the distance corresponding to 32767 and the relevant Q_SCALE.

4.5.6.4.2 Note: Q_NVLOCACC and V_NVLIMSUPERV cannot be sent using p203. Therefore, the on-board will continue to use the relevant already stored values.

4.6 P6 – Virtual Balise Cover Order

4.6.1 Possible transmission Channel

4.6.1.1 Balise

4.6.2 Goals and functions linked to the Packet

4.6.2.1 The goal of Packet 6 is either:

- to order a virtual balise cover to be memorised, for a given duration, by the train; or,
- to delete a virtual balise cover previously memorised by the train.

4.6.2.2 The function linked to this Packet is ‘Virtual Balise Cover’ (see 5.1).

4.6.3 Use Cases

4.6.3.1 See Virtual Balise Cover function 5.1.

4.6.4 Implementation advice / Requirements

4.6.4.1 Packet 6 has to be transmitted to the train before reception of the corresponding Packet 0, except when a driver is setting a new VBC at Start of Mission (SoM).

4.6.4.2 Packet 6 should not be defined in an ETCS telegram containing a P0 characterised by the same VBC marker.

4.6.4.3 The on-board deletes the stored VBC information provided by P6 if the NID_C defined in it is different from a read BG.

4.6.5 Packet content

4.6.5.1 The packet contains the Marker of related VBC and validity period of the VBC if ‘set the virtual cover’ has been ordered.

4.6.5.1.1 Note: A validity period of 1 day can be interpreted by the on-board as a 24h-period from the moment the information is received or until the end of the day (midnight). This ambiguity is solved by CR1396 (outside field of application of this guideline) stating that 1 day corresponds with 24 hours from the moment the information is received.

4.6.6 System Version applicability

4.6.6.1 P6 is available with System Version number 1.1, 2.Y.

4.6.6.2 A Baseline 2 on-board will ignore P6.

4.7 P41- Level Transition Order

4.7.1 Possible transmission Channel

4.7.1.1 Any

4.7.2 Goals and functions linked to the Packet

4.7.2.1 The goal of P41 is to identify where a level transition will take place.

4.7.2.2 Where levels are mixed, the successive M_LEVELTR goes from the highest priority level to the lowest one.

4.7.3 Use Cases

4.7.3.1 Packet 41 may be used to announce a level transition at a future location and may be transmitted by Balise Group or RBC message.

4.7.3.2 Packet 41 may be used to cancel an announced level transition and may be transmitted by Balise Group or RBC message.

4.7.3.3 The Balise Group at a level transition will contain P41 or P46.

4.7.4 Implementation advices / Requirements

4.7.4.1 Implementation advices / Requirements are not provided in this guideline.

4.7.5 Packet content

4.7.5.1 The packet contains mainly the list (sorted by priorities) of permitted ETCS levels that the train will transition to unless the current level is in the list.

4.7.6 System Version applicability

4.7.6.1 P41 is available with System Version number X = 1 or 2.

4.8 P42 – Session Management

4.8.1 Possible transmission Channel

4.8.1.1 Balise, RBC

4.8.2 Goals and functions linked to the Packet

4.8.2.1 P42 is used to give the identity and telephone number of the RBC with which a session shall be established or terminated.

4.8.3 Use Cases

4.8.3.1 When a train enters a Level 2/3 ETCS area, or needs to connect to an RBC following a break in communication or SoM within a Level 2/3 area, it is essential that it should establish communication with the correct RBC through the GSM-R mobile radio network in order to receive the MA and other control commands from

the RBC. P42 is used to command the on-board to establish connection with RBC within the area using the given telephone number and identity of the RBC. The same application will be required to disconnect from the RBC when the train exits the Level 2/3 area.

4.8.4 Implementation advice / Requirements

4.8.4.1 P42 will be programmed within the balise telegrams in the BGs located at the Entrance and Exit border of Level 2/3 to connect with, and disconnect from, the RBC. The on-board will communicate with, and use the commands from, the RBC to control the trains only while it is operating within (or near to) Level 2/3 areas.

4.8.5 Packet content

4.8.5.1 This packet contains mainly communication session order.

4.8.6 System Version applicability

4.8.6.1 P42 is available with System Version number X = 1 or 2.

4.9 P44 – Data used by applications outside the ERTMS/ETCS

4.9.1 Possible transmission Channel

4.9.1.1 Any

4.9.2 Goals and functions linked to the Packet

4.9.2.1 Messages between trackside and on-board devices, which contain information used by applications outside the ERTMS/ETCS.

4.9.3 Use Cases

4.9.3.1 P44 can be used outside the ETCS application by associating with NID_XUSER, which is the variable that uniquely defines the identity number of a specific user system for which the remainder of P44 is intended. The NID_XUSER and P44 can be used for more than one purpose, e.g. ASDO (Automatic Selective Door Operation), APCO (Automatic Power Change Over) and Speedo Meter Unit change, etc.

4.9.4 Implementation advice / Requirements

4.9.4.1 In order to use P44, the implementation project should request NID_XUSER from the authority (these IDs are assigned by the ERA at the request of a Member State).

4.9.4.2 For data to be forwarded to a National Train Control System, the NID_XUSER should equal 102.

4.9.4.2.1 Note: The previous clause is related to issue No. 116 of the Trackside Approval Issues Log [8] with reference to CR1338.

4.9.4.3 The P44 should not be implemented after packet 136 if NID_XUSER=102.

4.9.4.3.1 Note: The previous clause is related to ETCS-H0081 of SUBSET-113 [6].

4.9.5 Packet content

4.9.5.1 P44 contains the identity of the user system for which the remainder of the packet is intended.

4.9.6 System Version applicability

4.9.6.1 P44 is available with System Version number X = 1 or 2.

4.10 P45 – Radio Network registration

4.10.1 Possible transmission Channel

4.10.1.1 Balise, RBC, RIU

4.10.2 Goals and functions linked to the Packet

4.10.2.1 P45 is used to give the identity of the Radio Network to which a registration shall be enforced.

4.10.3 Use Cases

4.10.3.1 ETCS Level 2/3 works with the Radio Network to communicate with the RBC. When the train enters a Level 2/3 area, either at, or just prior to crossing, the border, the on-board will be commanded to register with the GSM-R Radio Network by sending P45 from the BG. Following registration, it is then possible to use P42 (Session Management) to establish the connection with the RBC via the GSM-R Network.

4.10.4 Implementation advice / Requirements

4.10.4.1 P45 will be used in telegrams from the BG located before to the BGs containing P42. The distance between P45 and P42 depends on the maximum allowed speed as there should be enough time between P45 and P42.

4.10.4.2 In areas where there is an overlap of several radio networks coverage, the P45 should never be sent together with a P42, P131 or P143.

4.10.4.2.1 Note: The previous clause is related to the ERTMS Trackside Approval Issues Log [8] with reference to CR1312 item 1.

4.10.5 Packet content

4.10.5.1 P45 contains the Radio Network identity.

4.10.6 System Version applicability

4.10.6.1 P45 is available with System Version number X = 1 or 2.

4.11 P46 – Conditional Level transition Order

4.11.1 Possible transmission Channel

4.11.1.1 Balise

4.11.2 Goals and functions linked to the Packet

4.11.2.1 The goal of P46 is to transmit the list of permitted ETCS Levels at the train's location and force a transition if the active Level of the train is not in the list.

4.11.2.2 The function linked to P46 is 'Conditional Level Transition Order', whose purpose is to ensure that each ETCS train runs in a permitted ETCS Level and/or to update the Level priority list.

4.11.3 Use Cases

4.11.3.1 Check if the train is operating in an authorised Level.

4.11.3.2 Correct driver error if there is any. E.g. exiting a depot and entering into the right level.

4.11.3.3 The Balise Group at a Level Transition Order will contain P41 or P46.

4.11.4 Implementation advices / Requirements

4.11.4.1 P46 should be installed near a transition zone and at locations where 'Start of Mission' is frequently performed.

4.11.4.2 In Baseline 3, P46 is 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'.

4.11.4.3 In Baseline 2, the rejection of P46 is not specified. Refer to [4].

4.11.5 Packet content

4.11.5.1 The packet contains a priority order of levels that the train will transition to unless the current level is in the list.

4.11.6 System Version applicability

4.11.6.1 P46 is available with System Version number X = 1 or 2.

4.12 P65 – Temporary Speed Restriction

4.12.1 Possible transmission Channel

4.12.1.1 Any

4.12.2 Goals and functions linked to the Packet

4.12.2.1 It sets a Temporary Speed Restriction on a given piece of track.

4.12.2.2 The function linked by P65 is TSR - see 5.2.

4.12.3 Use cases

4.12.3.1 See Temporary Speed Restriction (TSR), 5.2.

4.12.4 Implementation advice / Requirements

4.12.4.1 Distance to the start of a Temporary Speed Restriction shall be defined so that all the trains operating in the line will have sufficient distance to brake to the required speed taking into account possible overspeed.

4.12.4.2 If possible, transmission by RBC is recommended.

4.12.4.3 To avoid any contradiction between enforcing/replacing and revoking a TSR, the same TSR identity (NID_TSR) should not be used in a P65 and a P66 sent in the same message (CR1306).

4.12.5 Packet content

4.12.5.1 This packet contains a defined TSR speed in a specified distance.

4.12.6 System Version applicability

4.12.6.1 P65 is available in System Version number X = 1 or 2.

4.13 P66 – Temporary Speed Restriction Revocation

4.13.1 Possible transmission Channel

4.13.1.1 Any

4.13.2 Goals and functions linked to the Packet

4.13.2.1 It revokes a Temporary Speed Restriction by using the same identity as the given TSR, unless the TSR is irrevocable.

4.13.2.2 The function linked by P66 is TSR – see 5.2.

4.13.3 Use cases

4.13.3.1 See Temporary Speed Restriction (TSR), 5.2

4.13.4 Implementation advice / Requirements

4.13.4.1 A TSR imposed by a Balise Group can only be revoked by P66 sent from a Balise Group. Similarly, a TSR imposed via an RBC message cannot be revoked by P66 from a Balise Group.

4.13.4.2 P64 (sent by the RBC) can be used to inhibit a revocable TSR sent by a Balise Group. This function is not recommended since it cannot be cancelled by the Trackside, except where the line is a mixture of L1 and L2/3.

4.13.4.3 A Temporary Speed Restriction stored in the on-board is cancelled immediately if a P66 containing the same TSR ID is accepted.

4.13.4.4 To avoid any contradiction between enforcing/replacing and revoking a TSR, the same TSR identity (NID_TSR) should not be used in a P65 and a P66 sent in the same message (CR1306).

4.13.5 Packet content

4.13.5.1 P66 contains the identity of the TSR to be revoked.

4.13.6 System Version applicability

4.13.6.1 P66 is available in System Version number X = 1 or 2.

4.14 P67 – Track condition – Big metal masses

4.14.1 Possible transmission Channel

4.14.1.1 Balise

4.14.2 Goals and functions linked to the Packet

4.14.2.1 The goal of this Packet is transmission of the position of a Big Metal Mass, e.g. (temporary auxiliary) metal bridge, wagon hauling “shuttles” in shunting yards, mechanical and electro-dynamic retarders in shunting yards, concrete platforms and metal catenary.

4.14.2.2 The function linked by P67 is ‘Track condition – Big Metal Masses’.

4.14.2.3 This function is used to transmit to the train the position of zones in which BMMs are present and could disrupt trackside communication. In these zones, the on-board will not react to alarms received from the balise-reading hardware.

4.14.3 Use Cases

4.14.3.1 The Metal Mask that the on-board is required to tolerate is specified in SUBSET-036 [2]. Metal masses that fall outside this mask should be announced using P67 to allow the ETCS kernel to ignore alarms raised by the on-board balise transmission equipment.

4.14.3.2 Electromagnetic fields in the railway environment in the near spectrum used by the balise transmission could be falsely detected as a balise by the BTM resulting in a brake application. The application of BMM track condition where electromagnetic interference is likely to occur, can be used to suppress the alarms raised by the on-board balise transmission equipment.

4.14.4 Implementation advice / Requirements

4.14.4.1 Distance to the leading edge of metal masses shall be defined so that all the trains operating in the line will have sufficient distance/time within which to act accordingly, allowing for on-board processing time (see SUBSET-036 [2] and SUBSET-041 [7]). However, as the BMM information does not trigger any display on the DMI, and it only affects the internal behaviour of the EVC. Therefore, there are no requirements that it should be transmitted together with the MA.

4.14.4.2 In tracks where trains are starting up regularly the BG with the BMM information shall be placed as close as possible to the beginning of the BMM area to avoid that a train does not read the BG before passing the BMM area while still respecting SUBSET-041 [7]. Each BMM area should be announced by separate BGs with information of the BMM area.

4.14.4.2.1 Note: if the missing of the BMM information by the on-board could lead to a safety risk (loss of safety-relevant BGs inside the BMM area due to on-board balise transmission equipment failure) additional mitigation can be put in place, e.g., duplication of BMM information in more balise groups.

4.14.4.3 If possible, the balise group transmitting the BMM information shall be located at a position where the route taken by the train is unambiguous, or from where the different routes have similar properties regarding BMM conditions and balise positions (i.e. no BMM information masks any possible balise), also considering possible odometry inaccuracy.

4.14.4.3.1 Note: Similarly to other track conditions, new Track condition BMM information replaces stored information from the start location of the first element of the new information. However, it is not possible to transmit “initial state” with Packet 67. There is at this day no validated solution for making an already transmitted BMM information ineffective.

4.14.4.4 If there are several multiple consecutive big metal mass areas with no balise groups between each other there should be built one big BMM area.

4.14.4.5 The information from the TC BMM is stored on-board until the minSRE of the train is more than 300m in rear of the zone, even for a reverse movement. The stored information for 300m in rear of the minSRE allows to reduce the number of BG needed e.g. in shunting areas.

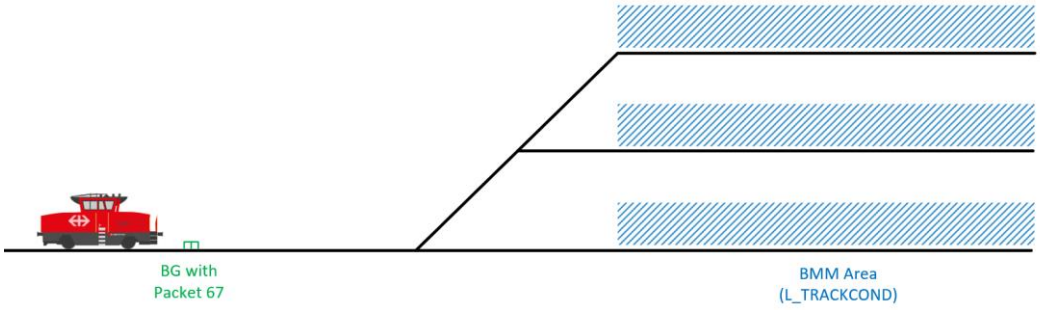

Figure 2: Example for clause 4.14.4.5 where one dedicated balise group can be used in shunting yards for multiple tracks and BMM areas

4.14.4.5.1 Note: It is not guaranteed that the on-board unit deletes the stored information exactly after having moved away for the distance mentioned in 4.14.4.5. Thus, it might be possible that the train keeps the information and the information might be used again even when the train is on a neighbouring track if the conditions are fulfilled.

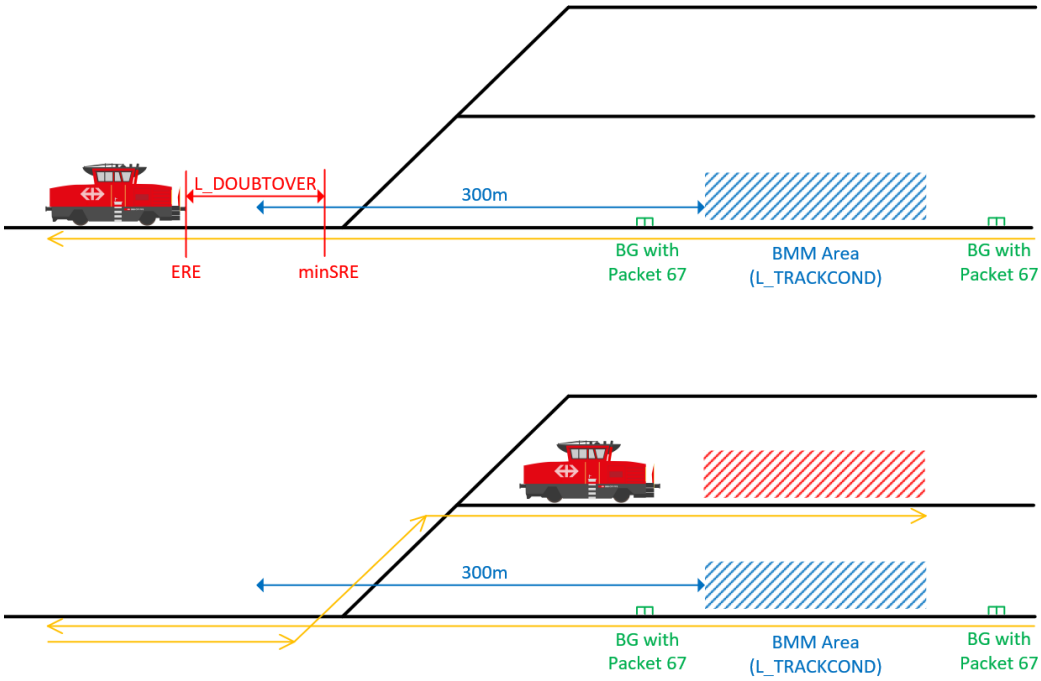

Figure 3: Situation described from 4.14.4.2.1 where the train keeps the information even when having moved to neighbouring track

4.14.5 Packet content

4.14.5.1 The packet contains the distance for which integrity check alarms of balise transmission will be ignore at a specified location.

4.14.6 System Version applicability

4.14.6.1 P67 is available with System Version number X = 1 or 2.

4.15 P72 – Packet for sending plain text messages

4.15.1 Possible transmission Channel

4.15.1.1 Balise, RBC

4.15.2 Goals and functions linked to the Packet

4.15.2.1 To send text messages to the driver, which are displayed on the Driver Machine Interface (DMI).

4.15.3 Use Cases

4.15.3.1 P72 can be used to send any information from the Trackside to the driver; this information is displayed on the DMI in a brief text. e.g. the text message warns the driver ‘TSR ahead’ or ‘Stop if in SR’, etc.

4.15.4 Implementation advice / Requirements

4.15.4.1 In addition to the text messages themselves, the P72 will always specify the start and end condition to display the text messages and whether any acknowledgement is required from the driver.

4.15.4.2 To avoid any misinterpretation by the on-board, the start/end sub-condition should not be:

- a change of mode that is the result of a mode profile for current location;
- a level transition that is the result of an immediate/Conditional Level Transition order; or
- a change of mode that is the result of an immediate/Conditional Level Transition order,
- given in the same trackside message as the P72 (CR1312, 1334).

4.15.5 Packet content

4.15.5.1 The packet contains the text messages showing on the DMI at a specific location for a defined period of time.

4.15.6 System Version applicability

4.15.6.1 P72 is available with System Version number X = 1 or 2.

4.16 P76 – Packet for sending fixed text messages

4.16.1 Possible transmission Channel

4.16.1.1 Balise, RBC

4.16.2 Goals and functions linked to the Packet

4.16.2.1 To send text messages to the driver, which are displayed on the DMI.

4.16.3 Use Cases

4.16.3.1 P76 can be used to send fixed text messages from the available table by selecting a number. E.g. Q_TEXT = 0 is ‘Level crossing not protected’.

4.16.4 Implementation advice / Requirements

4.16.4.1 In addition to the text messages themselves, the P76 will always specify the start and end condition to display the text messages and whether any acknowledgement is required from the driver.

4.16.4.2 To avoid any misinterpretation by the on-board, the start/end sub-condition should not be:

- a change of mode that is the result of a mode profile for current location;
- a level transition that is the result of an immediate/Conditional Level Transition order; or
- a change of mode that is the result of an immediate/Conditional Level Transition order,

given in the same trackside message as the P76 (CR1312, 1334).

4.16.5 Packet content

4.16.5.1 The packet contains a fixed text message showing on the DMI at a specified location for a defined period of time.

4.16.6 System Version applicability

4.16.6.1 P76 is available with System Version 1.0.

4.16.6.1.1 Note: Q_TEXT values are not defined in baseline 2, the behaviour of the on-board is unpredictable.

4.16.6.2 P76 is available with System Version 2.Y.

4.16.6.3 P76 is ignored in System Version 1.1.

4.17 P79 – Geographical Position Information

4.17.1 Possible transmission Channel

4.17.1.1 Balise, RBC

4.17.2 Goals and functions linked to the Packet

4.17.2.1 P79 gives geographical location information for one or multiple references to the train.

4.17.3 Use Cases

4.17.3.1 There are various applications available with P79, including indication of whether the next BG is in the same country or another country when the train approaches the border crossing. The on-board will display the geographical position only on driver request.

4.17.4 Implementation advice / Requirements

4.17.4.1 Please refer to section 3.6.6 of SUBSET-026 [1] for more details.

4.17.5 Packet content

4.17.5.1 The packet contains mainly the location and direction from the geographical position reference BG.

4.17.6 System Version applicability

4.17.6.1 P79 is available with System Version number X = 1 or 2.

4.18 P88 – Level Crossing Information

4.18.1 Possible transmission Channel

4.18.1.1 Any

4.18.2 Goals and functions linked to the Packet

4.18.2.1 To provide level crossing information.

4.18.3 Use Cases

4.18.3.1 It will be possible for the Trackside to inform the ERTMS/ETCS on-board of the conditions under which a LX must be passed. P88 will inform the on-board whether the LX is protected or not and, if not protected, it will command the on-board, specifying the speed at which to pass the LX, if stopping required on the approach to the LX, etc.

4.18.4 Implementation advice / Requirements

4.18.4.1 Please refer to section 3.12.5 of SUBSET-026 [1] for more details.

4.18.5 Packet content

4.18.5.1 This packet contains basic information of a LX including distance to the start point, length of the LX and its protection status.

4.18.6 System Version applicability

4.18.6.1 P88 is available with System Version number X = 2.

4.19 P90 – Track ahead free up to level 2/3 transition location

4.19.1 Possible transmission Channel

4.19.1.1 Balise

4.19.2 Goals and functions linked to the Packet

4.19.2.1 P90 is a notification to the on-board that the track ahead is free from the Balise Group transmitting this information up to the Level 2/3 transition location.

4.19.3 Use Cases

4.19.3.1 P90 is sent for transition to L2 or L3 from Level 0, 1, or NTC: if a Level 2/3 transition is announced and a communication session is already established, an MA request will be sent to the RBC when the information ‘Track ahead free up to Level 2/3 transition location’ is received from the Balise Group.

4.19.4 Implementation advice / Requirements

4.19.4.1 P90 should only be used when the Trackside can establish that the train is the first one approaching the transition location. This is often done by a switchable BG.

4.19.4.2 The P90 should never be sent together with an immediate LTO to L2.

4.19.4.2.1 Note: The previous clause is related to the ERTMS Trackside Approval Issues Log [8] with reference to CR1312 item 5.

4.19.5 Packet content

4.19.5.1 The main information contained in P90 is the identity of the BG at the transition location.

4.19.6 System Version applicability

4.19.6.1 P90 is available with System Version number X = 1 or 2.

4.20 P131 – RBC transition order

4.20.1 Possible transmission Channel

4.20.1.1 Balise, RBC

4.20.2 Goals and functions linked to the Packet

4.20.2.1 P131 is used to order an RBC transition.

4.20.3 Use Cases

4.20.3.1 P131 is used to facilitate the RBC to RBC Hand-Over when the train crosses the border of between two RBC areas. This is essential for seamless operation of the train in an ETCS Level 2/3 area. A radio communication session with the Accepting RBC is opened by the on-board based on the RBC transition order received from the 'Handing Over' RBC or from the Balise Group.

4.20.4 Implementation advice / Requirements

4.20.4.1 See SUBSET-026 [1], chapter 5.15 and chapter 3.15.1.

4.20.5 Packet content

4.20.5.1 This packet contains "Accepting" RBC identity and RBC radio subscriber number at a specified location.

4.20.6 System Version applicability

4.20.6.1 P131 is available with System Version number X = 1 or 2.

4.21 P132 – Danger for Shunting information

4.21.1 Possible transmission Channel

4.21.1.1 Balise

4.21.2 Goals and functions linked to the Packet

4.21.2.1 P132 is used to transmit the aspect of a Shunting signal.

4.21.2.2 It gives the order 'Stop if in SH' mode or 'Go if in SH' mode.

4.21.3 Use Cases

4.21.3.1 P132 is used to prevent trains running in SH mode to enter areas where SH mode is not allowed.

4.21.4 Implementation advice / Requirements

4.21.4.1 Implementation advices / Requirements are not provided in this guideline.

4.21.5 Packet content

4.21.5.1 The packet contains the aspect of a 'Danger for Shunting' signal.

4.21.6 System Version applicability

4.21.6.1 P132 is available with System Version number X = 1 or 2.

4.22 P134 – EOLM Packet

4.22.1 Possible transmission Channel

4.22.1.1 Balise

4.22.2 Goals and functions linked to the Packet

4.22.2.1 P134 announces a loop.

4.22.3 Use Cases

4.22.3.1 P134 is used in BGs to act as an End-of-Loop Marker (EOLM) device at the beginning or end of a loop in a track. The BGs will send the EOLM information to passing trains so that the on-board knows when the train is entering or leaving a track equipped with a loop.

4.22.4 Implementation advice / Requirements

4.22.4.1 The orientation of EOLMs is identical to Balise Group orientation. The general rules for BG orientation therefore also apply to EOLMs. EOLM information might be contained in a Balise Group that contains other information.

4.22.5 Packet content

4.22.5.1 This packet contains basic information of a look including the distance between the EOLM and the start point, length and direction of the loop.

4.22.6 System Version applicability

4.22.6.1 P134 is available with System Version number X = 1 or 2.

4.23 P135 – Stop Shunting on desk opening

4.23.1 Possible transmission Channel

4.23.1.1 Balise

4.23.2 Goals and functions linked to the Packet

4.23.2.1 If a PS engine desk is opened and previously received ‘Stop Shunting on desk opening’ information from a BG is stored on-board, the on-board will switch to SB (Standby mode).

4.23.3 Use Cases

4.23.3.1 To enable the IM to force authorisation of SH each time the cab is opened, irrespective of whether the PS was selected.

4.23.4 Implementation advice / Requirements

4.23.4.1 The train shall pass the BG before entering the Shunting area.

4.23.5 Packet content

4.23.5.1 The packet does not contain any information.

4.23.6 System Version applicability

4.23.6.1 P135 is available with System Version number 1.1, 2.Y.

4.23.6.2 A Baseline 2 on-board will ignore P135.

4.24 P137 – Stop if in Staff Responsible

4.24.1 Possible transmission Channel

4.24.1.1 Balise

4.24.2 Goals and functions linked to the Packet

4.24.2.1 P137 is used to transmit to the train the order to stop if the active mode is SR and the override function is not active.

4.24.2.2 In System Version X=2, if P137 is sent from a BG on an active list of BG in SR, P137 is ignored. In System Version X=1, P137 is not ignored.

4.24.2.2.1 Note: If a BG is encountered and not on an active list of BG in SR, the train will trip.

4.24.3 Use Cases

4.24.3.1 Used wherever the risk of overrun by a train in SR needs to be managed. For instance:

- At the exit of a siding giving access to the main track
- At each stop marker board
- At each optical signal from which a route can be set
- Where flank protection is not provided
- At a Level Transition Order location

4.24.4 Implementation advice / Requirements

4.24.4.1 The Balise Group should be placed in accordance with SUBSET-040 [3] 4.1.1.4, in order for the train to be able to read and process the message before the EOA is passed by the min. safe antenna position.

4.24.5 Packet content

4.24.5.1 This packet contains information indicating whether an on-board operating in SR must stop or not.

4.24.6 System Version applicability

4.24.6.1 P137 is available with System Version number X = 1 or 2.

4.25 P141 – Default Gradient for temporary speed restriction

4.25.1 Possible transmission Channel

4.25.1.1 Balise

4.25.2 Goals and functions linked to the Packet

4.25.2.1 The goal of P141 is to define the gradient that the train must consider for TSR supervision where the gradient profile is not defined.

4.25.2.2 For X=2, in the absence of a gradient profile (e.g. in SR), the on-board assumes the gradient to be 0.

4.25.2.3 For X=1, P141 is required for a TSR while in SR.

4.25.3 Use Cases

4.25.3.1 In the context of this document, this packet applies only in SR (see 5.2.4.2).

4.25.4 Implementation advice / Requirements

4.25.4.1 P141 should be included wherever a TSR is sent by a Balise Group, because the Default Gradient for a TSR stored in the on-board will be valid until a new TSR Default Gradient is received.

4.25.4.2 P141 may be omitted if the application can be sure that P141 has not been sent to the on-board, or a P141 with an acceptable default gradient is stored in the on-board.

4.25.5 Packet content

4.25.5.1 Value of the Default Gradient for a TSR.

4.25.6 System Version applicability

4.25.6.1 P141 is available with System Version number X = 1 or 2.

4.26 P145 – Inhibition of Balise Group message consistency reaction

4.26.1 Possible transmission Channel

4.26.1.1 Balise

4.26.2 Goals and functions linked to the Packet

4.26.2.1 P145 ensures that the ETCS/ERTMS on-board will not command application of the service brake after a missed telegram or after an error during the decoding.

4.26.3 Use Cases

4.26.3.1 This can be used to avoid performance consequences associated with a message inconsistency error; however, it should not be applied in balises which contain a critical message such as LTO or Stop if in SR (see SUBSET-040 [3] 4.2.4.1).

4.26.4 Implementation advice / Requirements

4.26.4.1 Used at a start/depart location if it is possible that a BTM is located at a BG, however one should only use P145 if the BG does not contain safety-related information as per clause 4.2.4.1 of SUBSET-040 [3].

4.26.4.2 If it is necessary to use P145 in a critical Balise Group, it is recommended to add a second Balise Group. E.g. a BG providing a TSR.

4.26.4.3 When the train can determine the orientation of the BG even though the BG message is inconsistent (e.g., the number of balises (n) inside the BG is 3 or more, and n-2 balise(s) are failed), the train shall ignore P145 if Q_DIR does not match the orientation of the train compared to the orientation of the BG. Therefore, BGs with P145 should have Q_DIR = 2.

4.26.4.4 When the train cannot determine the orientation of the balise group and the BG message is inconsistent (e.g., the train detected only one balise of the group), the train will only accept P145 if Q_DIR = 2.

4.26.5 Packet content

4.26.5.1 The packet does not contain any information.

4.26.6 System Version applicability

4.26.6.1 P145 is available with System Version number 1.1, 2.Y.

4.26.6.2 A Baseline 2 on-board will ignore P145.

4.27 P181 – Generic LS function marker

4.27.1 Possible transmission Channel

4.27.1.1 Balise

4.27.2 Goals and functions linked to the Packet

4.27.2.1 P181 enables the generic toggling on/off of the display of the Lowest Supervised Speed within the MA.

4.27.2.2 P181 has to be stored in the on-board to enable P180 LSSMA display toggle order. Otherwise, the LSSMA is 'always' displayed (see SUBSET-026 [1], clause 4.4.19.1.4.7).

4.27.3 Use Cases

4.27.3.1 P180 is used on the border lines between Switzerland and Italy to make sure that the correct speed profile is adopted. P180 is used to control when the LSSMA is displayed in the different areas.

4.27.4 Implementation advice / Requirements

4.27.4.1 See clause 4.4.19.1.4.7 of SUBSET-026 [1] for more details.

4.27.5 Packet content

4.27.5.1 The packet does not contain any information.

4.27.6 System Version applicability

4.27.6.1 P181 is available with System Version 2.Y.

4.28 P254 – Default balise, loop or RIU information

4.28.1 Possible transmission Channel

4.28.1.1 Balise, loop, RIU

4.28.2 Goals and functions linked to the Packet

4.28.2.1 It indicates to the on-board that a balise telegram, loop message or RIU information contains default information due to a fault in the trackside equipment.

4.28.3 Use Cases

4.28.3.1 P254 can be used to indicate to the on-board that the Trackside system has a failure, such as a Lineside Electronic Unit (LEU) failure, by sending a telegram, including the default balise information.

4.28.4 Implementation advice / Requirements

4.28.4.1 If one (and only one) of a pair of duplicated balise telegrams received by the on-board includes the information ‘default balise information’, the on-board will ignore any other information included in this telegram and will consider information from the telegram not containing ‘default balise information’.

4.28.5 Packet content

4.28.5.1 The packet does not contain any information.

4.28.6 System Version applicability

4.28.6.1 P254 is available with System Version number X = 1 or 2.

4.29 P255 – End of Information

4.29.1 Possible transmission Channel

4.29.1.1 Balise, Loop

4.29.2 Goals and functions linked to the Packet

4.29.2.1 P255 acts as a finish flag; the receiver will stop reading the remaining part of the message/telegram when receiving NID_PACKET = 255 (1111 1111).

4.29.3 Use Cases

4.29.3.1 It is always included as the last packet of a telegram.

4.29.3.2 It is used for the train positioning function.

4.29.4 Implementation advice / Requirements

4.29.4.1 There are no specific rules or requirements.

4.29.5 Packet content

4.29.5.1 This packet only consists of NID_PACKET containing 8 bit 1s.

4.29.6 System Version applicability

4.29.6.1 P255 is available in all versions.

5. Analyse by functions

5.1 Virtual Balise Cover function

5.1.1 Goal of the function

5.1.1.1 The purpose of using a VBC is to achieve that OBU behaviour is not affected by the balise telegram.

5.1.1.1.1 Note: VBC engineering rules for ETCS trackside exclusion needs to be in accordance with the national operational rules for operation with excluded ETCS (operated level/mode) and with the ETCS trackside design.

5.1.1.1.2 Note: The VBC function could be used either for all trains or only for certain trains. The choice depends on the need of the trackside.

5.1.2 ETCS Packets Involved

5.1.2.1 The Packets involved for this function are:

- P0 (or P200 for SV = 1.1)
- P6

5.1.3 Function realisation

5.1.3.1 A Virtual Balise Cover is defined, via P6 (see 4.6), by all of the following:

- a marker: identification number of the VBC
- an identifier of the country/region
- a validity period: time period during which a VBC can be active
- a qualifier: definition of whether the VBC is set or removed

5.1.3.2 Alternatively, the driver will be able to set a new VBC or remove an existing one during SoM.

5.1.3.3 A VBC is declared as ‘Active’ when the qualifier of the VBC is set to ‘Set a VBC’, as long as the validity period has not yet elapsed.

5.1.4 Use Cases

5.1.4.1 Exclusion of ETCS level 1 functions

5.1.4.1.1 If the operated level/mode in the area where ETCS level 1 functions are excluded is LNTC/SN or L0/UN, the VBC marker (P0 or P200) should be engineered at least for all balises transmitting P41 (Level Transition Order to L1). Then the ETCS level 1 exclusion can be realized either manually or automatically.

5.1.4.1.2 The manual exclusion of ETCS level 1 functions is realized by setting the respective VBC code by the driver, in rear of the entry border of the ETCS level 1 excluded area and:

- if in L1 before entering the ETCS level 1 excluded area, the driver manually changes the level to LNTC/L0 or
- if already in LNTC/L0, no further actions are needed (unless required by the class B system)

5.1.4.1.3 After the train has passed the ETCS level 1 excluded area, the driver manually removes the VBC code and, if needed depending on national operational rules and trackside design, manually changes the level to L1 (SR).

5.1.4.1.4 The automatic exclusion of ETCS level 1 functions is realized by placing at the border of the ETCS level 1 excluded area:

- for the direction towards the ETCS level 1 excluded area, BGs transmitting P6 (VBC order to set the VBC with the respective ID) and P41 (Level Transition Order to LNTC/L0) unless the train is already in a LNTC/L0 area;
- for the direction exiting the ETCS level 1 excluded area, P6 (VBC order to remove the VBC with respective ID).

5.1.4.1.5 After the train has passed the ETCS level 1 excluded area, if needed, transition to L1 should be ensured.

5.1.4.1.6 If the exclusion of ETCS level 1 functions is intended only for certain vehicles and this exclusion is performed automatically, the VBC chaining principle described in Figure 4 should be used.

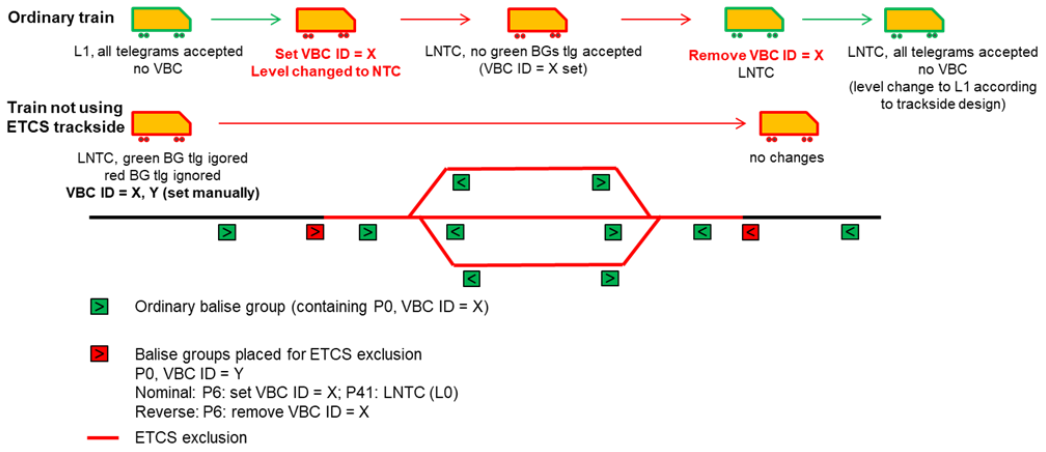

Figure 4: Usage of VBC chaining principle

5.1.4.1.7 All balises of L1 trackside should contain VBC with ID = “X” (P0 or P200) and at the border of the ETCS level 1 excluded area:

- for the direction towards the ETCS level 1 excluded area, the BGs should contain VBC with ID = “Y” and transmit P6 (VBC order to set the VBC with the ID = “X”) and P41 (Level Transition Order to LNTC/L0)
- for the direction exiting the ETCS level 1 excluded area, the BGs should transmit P6 (VBC order to remove the VBC with ID = “X”).

5.1.4.1.8 For vehicles intended not to operate with ETCS only on the ETCS level 1 excluded area, VBC with ID = “X” will be set and removed automatically.

5.1.4.1.9 For vehicles intended not to operate with ETCS over the entire line, VBC with ID = “X” and ID = “Y” should be set manually by the driver.

5.1.4.2 Testing ETCS trains

5.1.4.2.1 During testing of a new installation of ETCS on a line or after modification of an existing ETCS line, the VBC chaining principle described in Figure 4 could be used. For testing trains, VBC with ID = “Y” should be set manually by the driver, so that the train will still read the balises with VBC ID = “X” in the excluded area.

5.1.4.3 Level transition

5.1.4.3.1 At a border from an SV 1.Y line to an SV 2.Y line (with NTC fall back), the VBC function can be used to send LTO with different tables of priority to B2 trains and B3 trains respectively. This process is not described in this guideline.

5.2 TSR

5.2.1 Goal of the function

5.2.1.1 The goal of the function is to set a Temporary Speed Restriction and revoke a set TSR.

5.2.2 ETCS Packets Involved

5.2.2.1 The Packets involved in this function are:

- P65
- P66

5.2.3 Function realisation

5.2.3.1 The following information is transmitted via P65 from the Trackside to the train:

- Identity number of Temporary Speed Restriction
- Distance to beginning of Temporary Speed Restriction
- Length of the Temporary Speed Restriction
- Speed restriction value
- Indication of whether the train length delay applies or not
- Revocable or irrevocable Temporary Speed Restriction

5.2.3.2 P66 contains the identity of the TSR to be revoked.

5.2.4 Use Cases

5.2.4.1 In order to slow train down at Level Crossings only if P88 cannot be used.

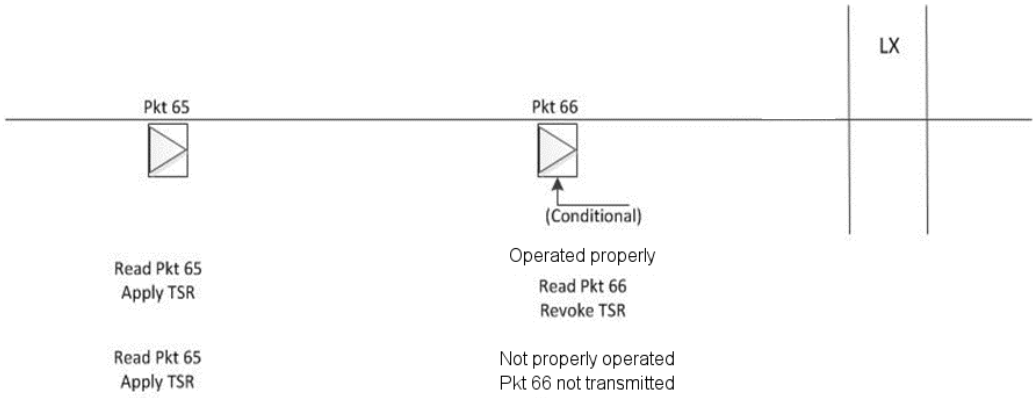

Figure 5: Apply or revoke TSR at LX

5.2.4.1.1 When a train passes the BG and reads P65, the TSR will be applied. The train will reduce speed approaching the level crossing.

5.2.4.1.2 When the level crossing has operated properly (e.g. Flashing lights on) P66 will be read and the TSR cancelled immediately. The train approaches the level crossing at normal speed.

5.2.4.1.3 When the level crossing has not been properly operated (e.g. Flashing Lights OFF) indicates that the level crossing is not working, so P66 will not be sent. The TSR still applies.

5.2.4.2 Slow train down in SR

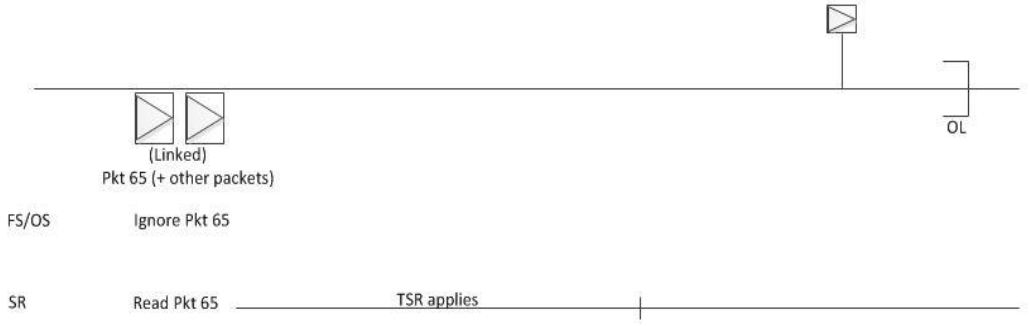

Figure 6: Use of linking information to apply TSR in SR mode

5.2.4.2.1 Full Supervision (FS)/On Sight (OS) mode: Linking information is used in the on-board and P65 is not included in the linking information, therefore, the BG is not taken into account. The BG message is rejected and the TSR is not applied.

5.2.4.2.2 SR: Linking information is unavailable, therefore, the BG is taken into account. The BG message is accepted and the TSR is applied. This affords the driver early warning and slows the train down on its approach to the Stop Marker Board in case, for some reason, it is not visible (e.g. weather conditions or vegetation, etc.). Another scenario is where the freight train requires a longer overlap distance (450m); in this situation, the TSR ensures that the train stops before the end of the overlap.

5.2.4.2.3 P141 is sent together with P65 if the train is on a downhill slope to make sure that the potential overrun distance is within the safe range.

5.2.4.3 Point protection in case of override

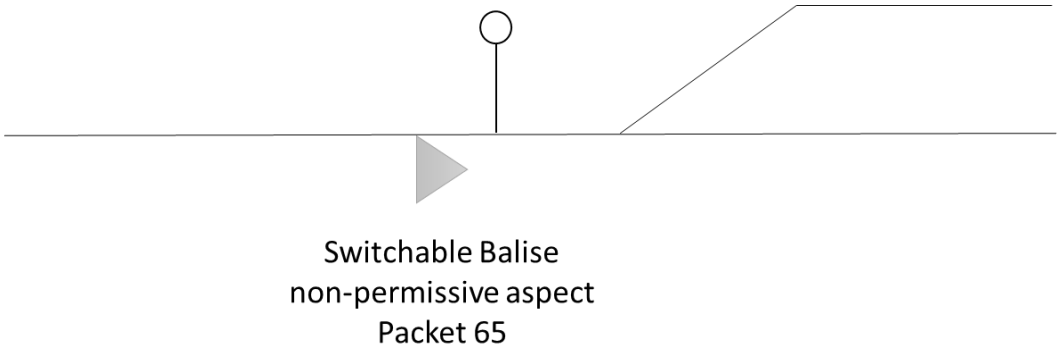

Figure 7: Use of irrevocable TSR for points protection

5.2.4.3.1 When the signal shows a non-permissive aspect, P65 is sent with an irrevocable TSR with the most restrictive speed associated with the points concerned.

5.2.4.3.2 This TSR protects the points when the RBC cannot send an MA to the on-board and the driver has to select ‘override’ at the signal.