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ERTMS USERS GROUP - ENGINEERING GUIDELINE
79. Baseline 2 trackside for baseline 3 trains
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Modification history

Version	Date	Modification / Description	Editor
0A	20/05/18	First draft	A. Bossy
0.3	29/06/2020	Took into consideration AJM+ADIF comments Added chapter 2 (abbreviations and references) Added chapter 3 about BCA Added Chapter 4.3 : Balises in narrow curves.	A. Bossy
0.4	23/10/2020	Took into consideration comments from AJM Added the reference to the application guide.	A. Bossy
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1.0	14/12/2020	Release of first version during ESG87	All.
1A	12/04/2021	Addition of E507 CR	A. Bossy
2-	30/04/2021	Finalised second version Adoption of EUG document referencing format	EUG ESG

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1 Introduction

By construction, a baseline 3 train should be able to operate a baseline 2 trackside without any change. However, due to the fact the baseline 3 corrects a series of inconsistencies or errors in the specifications, including some minor changes in the air-gap interface, some modifications to baseline 2 lines could be necessary to ensure the proper operation of a full-TSI baseline 3 train. At the same time, backwards compatibility and preservation of investments principles should be considered.

1.1.1.1 The Baseline Compatibility Assessment (BCA) reports identify theoretical compatibility risks and propose mitigation measures to be considered by baseline 2 trackside when the risks are applicable and relevant in a specific network. The BCA reports are the reference documents provided to prevent potential compatibility impacts.

1.1.1.2 The BCAs should be used to anticipate the potential gaps or incompatibilities between baseline 3 onboards and system version 1 tracksides developed following baseline 2 specifications. The BCAs provide mitigation measures to be implemented to facilitate the acceptance of baseline 3 onboards on baseline 2 trackside.

1.1.1.3 This document aims at explaining how the BCAs are produced and how they can be used to ensure compatibility between a baseline 2 trackside and baseline 3 train. This document also highlights items which were not identified as compatibility issues in the BCAs but can still lead to operational or interoperability problems.

1.1.1.4 In addition to this document, reading chapter 6.5.1 of [SS-026-B3] and chapter 6 of Appendix "ENGINEERING RULES FOR OLDER SYSTEM VERSIONS" of [SS-040] can help to engineer a baseline 2 trackside for baseline 3 trains.

   Note: these chapters include the results of the BCA.

1.2 Scope and Field of Application

1.2.1.1 This guideline aims at providing a set of engineering rules to ensure compatibility between baseline 2 tracksides and baseline 3 trains:

- B3 MR1

- B3 R2

- B3 R2 + Art10SP[1]

1.2.1.2 The field of application is applicable to baseline 2 tracksides.

1.3 Applicable system versions

1.3.1.1 Table 1 describes which trackside and onboard system versions are managed by this guideline. It also describes in which guidelines other system version combinations are managed.

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[1] In the publication of Art10-related technical opinions, ERA recommends implementing the CR solutions proposed in the technical opinion, only on B3R2 onboards, as a service pack. B3R2 + Art10 should be understood as an onboard fully compliant with the B3R2 specifications and the CR solutions published in the last version of the Art10-related technical option.

Onboard System Version	Trackside System Version	
	1.Y	2.Y
1.Y	**This guideline**	Not applicable
2.Y	**This guideline**	

<div align="center">Table 1: System version management</div>

2 References and abbreviations

2.1 Abbreviations

2.1.1.1 The following abbreviations are used in this document.

Abbreviation	Description
BCA	Baseline Compatibility Assessment
CLTO	Conditional Level Transition Order
CR	Change Request

2.1 References

2.1.1.1 The following documents and versions apply:

Ref. N°	Document Reference	Title	Version
[SS-026-B3]	SUBSET-026	ERTMS/ETCS Class 1 System Requirements Specification	3.4.0 or 3.6.0
[SS-026-B2]	SUBSET-026	ERTMS/ETCS Class 1 System Requirements Specification	2.3.0d
[SS-036]	SUBSET-036	FFFIS for Eurobalise	3.1.0
[SS-040]	SUBSET-040	Dimensioning and Engineering rules	3.4.0
[OPINION ERA 2020-2]	Opinion ERA-OPI-2020-2	OPINION ERA/OPI/2020-2 OF THE EUROPEAN UNION AGENCY FOR RAILWAYS for European Commission regarding CCS TSI Error Corrections	-
[ETCS-VARIABLES]	ERA_ERTMS_040 001	ASSIGNMENT OF VALUES TO ETCS VARIABLES	1.28 or later
[BRAKING-CURVES-B2]	ERA/ERTMS/0400 22	BASELINE 2 REQUIREMENTS FOR IMPLEMENTATION OF BRAKING CURVES FUNCTIONALITY	5
[BCA-MR1]	EUG_UNISIG_BCA	Baseline Compatibility Assessment	1.0.0
[BCA-R2]	ERA_BCA_B3R2	Baseline Compatibility Assessment Baseline 3 Release 2	1.1.0

Ref. N°	Document Reference	Title	Version
[ERA APPLICATION GUIDE]	GUI/CCS TSI/2020	Guide for the application of the CCSTSI	7.0

3 Use of BCAs

3.1.1.1 BCAs were introduced since the release of B3MR1 specification to identify the compatibility issues introduced by a change in the specifications.

3.1.1.2 During the BCA process, for each baseline, the following question is analysed CR by CR:

- Q4 Can a Baseline X (BX) Onboard not implementing that Change Request (CR) run a normal service on a BX Trackside not compliant to that CR?

3.1.1.3 For each combination of baseline designed to be compatible the following questions are analysed CR by CR:

- Q1 Can a BX onboard implementing that CR run a normal service on a Baseline Z (BZ) Trackside not compliant to that CR?

- Q2 Can a BX Onboard not implementing that CR run a normal service on a BZ trackside that implements that CR?

3.1.1.4 For new baselines, the following question is answered to guarantee the backward compatibility:

- Q3 Can a BX onboard run a normal service on a BZ trackside not implementing this CR (the major version of BX being greater than BZ)?

Note: this Q3 only applies to [BCA-MR1].

3.1.1.5 Some CR might not be applicable for a trackside / onboard combination for several reasons, among which:

- the CR does not apply for one of the sub-systems (for example a CR affecting level crossing functionality will not be analysed for B2 tracksides as the functionality is not defined for these tracksides);

- the CR only applies for a specific system version;

- the wording in one of the versions of the specifications was clear enough to not generate an issue (for example, the solution to a previous CR was not clear enough, but the wording prior to this CR was clear enough)

3.1.1.6 If for a Baseline combination, one of the questions (Q1, Q2 or Q4) generates a "no" for a given CR, the CR is declared incompatible. If technically feasible, a trackside engineering mitigation measure is proposed for implementation. The mitigation measure can be as wide as:

- Do not use a function

- Do not transmit 2 packets together

- Do not use a specific value of an ETCS variable

3.1.1.7 It is the responsibility of the Infrastructure Manager (IM) to decide whether the implementation of a mitigation measure is needed or not. The IM should make the decision considering the behaviour of the onboards already operating on its infrastructure.

3.1.1.8 Some CRs analysed in a BCA can result in not having a suitable trackside mitigation measure (see CR 958 in [BCA-MR1]). Ensuring compatibility might then only be possible by modifying the EVC, or both trackside and EVC.

3.1.1.9 Some CR analysed in a BCA may not have a solution, but only a problem description. This happens only for the BCAs delivered within Article 10 containing error corrections. The compatibility analysis for such CRs might not be the final step of the process compatibility will be re-evaluated once the CR is resolved).

3.1.1.10 The design of the Baseline 2 trackside shall be analysed against the reports [BCA-MR1], [BCA-R2] and [OPINION ERA 2020-2] to ensure the trackside can host a baseline 3 train.

3.1.1.11 For [BCA-MR1], all the CR listed in the table 2.2.1.7 and for which an 'X' is in the column "B2" shall be analysed.

3.1.1.12 For [BCA-R2] the following CRs shall be analysed:

- the CR listed in table "B2 (230d) maintenance" for which the content of column "Q1", "Q2" or "Q4" is "no"

- the table "CR1249 compatibility matrix"

3.1.1.13 For [OPINION ERA 2020-2], the following CRs shall be analysed:

- the CR listed in table "B2 (230d) maintenance" for which the content of column "Q4" is "no".

- the CR listed in table "Art10SP" for which the content of column "Q1c" and "Q2c" is "no".

- the table "Art10SP-CR1335 for RBC-RBC HO"

4 Engineering recommendations

4.1.1.1 By construction, a baseline 3 train should be able to operate on a baseline 2 trackside without any change. However, a baseline 2 trackside could require some upgrades to ensure baseline 3 trains operate as expected[2]. This part of the document aims at providing advice allowing the trackside to host baseline 3 trains. This does not explain any new functions provided by ETCS which are backwards compatible, but only some warning on the implementation.

4.2 Balise installation in narrow curves

4.2.1.1 Some restrictions for installation balises in narrow curves (with short horizontal and/or vertical radius) were added in the chapter 5.6.5 of [SS-036]. By not following these restrictions on a baseline 2 trackside, there is a risk that trains (not only baseline 3 trains) are not able to read the content of these balises.

4.2.1.2 Note: This is also the case with baseline 2 trains. Therefore, additional tests may be needed in the B2 on-boards to assure the behaviour expected by the trackside.

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[2] Note the baseline 2 trackside could also require upgrades to ensure full interoperability with baseline 2 trains. These upgrades are out of scope of this guideline.

4.3 Use of "System Version order" (P2)

4.3.1.1 It is not necessary to use packet 2 to have baseline 3 trains operating on a system version 1 trackside.

4.3.2 Rationale

4.3.2.1 The behaviour of a train operating system version 2 only differs from a train operating system version 1 train by two set of clauses listed in chapter 6.6.2 of [SS-026-B3]:

- One concerning the end conditions to display a text message (plain text or fixed text)

- The other concerning the behaviour on passing a Balise Group (BG) in Staff Responsible (SR), containing a packet "Stop if in SR" and previously announced in the list of allowed BG in SR.

4.3.2.2 The clause concerning the change in the end conditions to display a text message seems to be inserted in [SS-026-B3] for general understanding/editorial reasons. It replaces clause 3.12.3.4.7.2 which states that "the on-board equipment shall consider the driver acknowledgement as requested by trackside". As the text message (P72) has to be translated according to clause [6] of 6.6.3.2.3, "as requested by trackside" could be misinterpreted: the trackside has no impact on the end condition of display. Packet 2 is then not necessary to fulfil clause 6.6.2.1.1 of [SS-026-B3].

4.3.2.3 Concerning the behaviour on reception of a packet "Stop if in SR" when in SR (see clauses 6.6.2.2), the list of authorised balises in SR (P63) can only be transmitted by RBC (see clause 7.4.2.16 of [SS-026-B3]). Before receiving the list of balises, the train will have established a communication session with the RBC and received the message 32 with M_VERSION=1.Y.

4.3.2.4 The train will automatically operate SV=1 according to clause 3.17.2.8 of [SS-026-B3]. It is then not necessary to transmit the packet 2 for to get the behaviour in clauses 6.6.2.2.

4.4 Change of traction current

4.4.1.1 The variable M_TRACTION is declared as being not interoperable in clause 1.3.4.1 of [ETCS-VARIABLES]. This document also recommends to always use packet 239 if the function of change of traction system is to be used with system version X=1. No justification is given for the incompatibility, in addition, CR 1038, originating from the change in the specifications, is not identified as being incompatible in the [BCA-MR1].

4.4.1.2 Packet 39 shall only be used if the value of M_TRACTION is not one of the "non-interoperable values" as defined in clause 6.5.1.5.33 of [SS-026-B3].

4.4.1.3 In case a non-interoperable value of M_TRACTION is used, packet 239 should be used with the appropriate M_VOLTAGE and NID_CTRACTION (packet 239 does not have to be transmitted together with packet 39, to simplify the design, it is recommended to transmit the packet 239 and 39 in the same BG or radio message).

4.4.1.4 Note: It could be necessary to request a new NID_CTRACTION value to the European Rail Agency.

4.4.2 Rationale

4.4.2.1 The "non-interoperable" values for M_TRACTION listed in clause 6.5.1.5.33 of [SS-026-B3] do not have an official translation to the M_VOLTAGE/NID_CTRACTION in the table of clause [13] in 6.6.3.2 of [SS-026-B3].

4.4.2.2 According to clause [13] in 6.6.3.2 of [SS-026-B3], in case the train cannot translate from the M_TRACTION system to M_VOLTAGE/NID_CTRACTION, the train will ignore the packet, even if the M_TRACTION value is defined onboard.

4.4.3 Impact if not implemented

4.4.3.1 The train will ignore the packet 39 if it cannot translate the M_TRACTION to the M_VOLTAGE/NID_CTRACTION system.

4.4.3.2 Note: B2 tracksides implementing non-interoperable values for M_TRACTION shall assign additional requirements or tests for B2 trains to assure that the non-interoperable value works as expected by the trackside. Similar compatibility problems with B3 trains are expected for B2 train without these additional requirements.

4.5 Use of "Predefined text messages" (P76)

4.5.1 Clause

4.5.1.1 Packet 76 shall not be transmitted by radio or balise group.

4.5.2 Rationale

4.5.2.1 The clause 6.6.3.2.3 states that a packet 76 received from a system version 1 trackside shall be rejected by the onboard.

4.5.3 Impact if not implemented

4.5.3.1 The train will reject a packet 76 as it is not defined in the table 6.6.3.2.3. In this case no text message shall be displayed.

4.5.3.2 Note: CR 1143 introduced the change but was not analysed as being incompatible. The use of packet 76 in a B2 trackside is not harmonised, as no Q_TEXT value is defined in [SS-026-B2]. Additional requirements or tests may also be required for B2 trains to show the corresponding text message. Similar compatibility problems with B3 trains are expected for B2 train without these additional requirements.

4.6 Use of M_LOADINGGAUGE by RBC

4.6.1.1 An RBC shall not use the M_LOADINGGAUGE received in the packet 11 (validated train data).

4.6.1.2 An RBC shall consider as valid all the values of M_LOADINGGAUGE and acknowledge the train data.

4.6.2 Rationale

4.6.2.1 A baseline 3 train will always report M_LOADINGGAUGE=0 (meaning the train has a non-interoperable gauge), when operating on a system version 1 trackside according to clause [3c] at §6.6.3.4.5 of [SS-026-B3].

4.6.3 Impact if not implemented

4.6.3.1 Implementation specific.

4.6.3.2 If the train data is not acknowledged by the RBC (transmission of the message 8 as an answer to message 129), the train will not accept any other message from the trackside, preventing the train from being moved.

4.6.3.3 Note: The only defined value for M_LOADINGGAUGE is "0". In addition, it is specified that the variable shall not be used by the trackside, therefore similar compatibility problems are expected for B2 trains in case M_LOADINGGAUGE is used.

4.7 Use of "Route suitability" function (P70)

4.7.1.1 Packet 70 shall not be transmitted without packet 207 except when transmitting Q_TRACKINIT = 1 or if Q_SUITABILITY = "10" and this is the only route suitability information used.

4.7.2 Rationale

4.7.2.1 According to [11] of clause 6.6.3.2.3 of [SS-026-B3], the train shall reject packet 70 in such a case.

4.7.2.2 According to clause 6.5.1.7.6 of [SS-026-B3], this value is forbidden as no interoperable load gauge is defined (see paragraph 1.3.4 and A.6.4 of [ETCS-VARIABLES]) in system version 1.

4.7.3 Impact if not implemented

4.7.3.1 The train will reject the P70 and won't apply the checks against the route suitability.

4.7.3.2 The train will reject the message containing the packet 70 as the Q_SUITABILITY value is invalid.

4.8 Transmission of information after acknowledgement of train data

4.8.1 Clause

4.8.1.1 An RBC should only transmit the following messages or packets to a train in SB after having acknowledged the train data of the train (transmission of message 8 to the train):

- Linking (P5)

- MA (M3, M33 and P15) + Mode profile (P80) + List of balises in SH (P49)

- Gradient profile (P21)

- International Static Speed Profile (P27)

- Axle load speed profile (P51)

- SR authorisation (M2) + list of balises in SR mode (P63)

- Temporary Speed Restriction (P65)

- Temporary Speed Restriction Revocation (P66)

- Route Suitability Data (P70)

- RBC Transition Order (P131)

- Track conditions (P67, P68, P39, P239, P207)

- Reversing Area Information (P138)

- Reversing Supervision Information (P139)

4.8.2 Rationale

4.8.2.1 A baseline 3 train will ignore this information if the validated train data has not been acknowledged.

4.8.3 Impact if not implemented

4.8.3.1 The train will not apply the transmitted information.

4.9 Transmission of train data before start of mission position report

4.9.1 Clause

4.9.1.1 An RBC should acknowledge the train data during start of mission even if the start of mission report was not yet received.

4.9.2 Rationale

4.9.2.1 From baseline 3 MR1, during the start of mission, the order of data is input into the EVC is not fixed: the driver could enter the train data before modifying the level. The following scenario can lead to a deadlock.

4.9.2.2 On a dual signalling line (level NTC/1 and level 2/3), the train has carried out an end of mission in NTC (or level 1). When carrying out a new start of mission a train with a valid position will:

- Start with an unchanged level (NTC or level 1);

- Require the driver to input and validate train data;

- After 1 and 2, allow the driver to manually change to level 2/3, input RBC contact information and perform a mission in level 2/3.

4.9.2.3 Similarly, a train may perform an end of mission after the leading train cab has transitioned to L2/3, while the non-leading cab has only read the CLTO message and consequently, still remains in LNTC/L1. When changing ends, the conditions at a new start of mission are as in 4.9.2.2.

4.9.2.4 In such situations, the train could transmit the message 129 (Validated Train Data) to the RBC just after the session is established applying clause 3.18.3.4 of [SS-026-B3], before transmitting the start of mission position report (message 157). The RBC could only be expecting the message 157, as described in the start of mission flow chart in chapter 5.4 of the [SS-026-B2] and take a defensive measure like closing the communication session or not acknowledging the train data.

4.9.3 Impact if not implemented

4.9.3.1 This is dependent on RBC implementation and could lead to a deadlock situation, an unexpected closure of communication or any other defensive measure taken by the RBC.

5 Operational problems created by baseline 3 changes

Baseline 3 specifications have added new functionality or functional changes which could have operational impacts on a baseline 2 trackside. According to [ERA APPLICATION GUIDE] clause 2.6.102, it is possible to implement functions on a Baseline 2 trackside, without the need to recertify the existing trackside against baseline 3, the certificate would be amended to include the new functionalities and their references (TSI and set of specifications).

5.1 Use of "Stop Shunting on desk opening" (P135)

5.1.1 Clause

5.1.1.1 If the operation in SH mode is not allowed on the trackside, and operational mitigations are not considered safe enough compared to a technical mitigation packet 135 (Stop Shunting on desk opening), should be implemented at the appropriate locations.

5.1.1.2 The appropriate locations are project specific but should be determined by understanding the origin of trains which could haul locomotive in PS mode, for example: at shunting yard exits, level transitions from level 0 or NTC, or from ETCS-fitted lines with other operational rules.

5.1.1.3 Note packet 135 is applicable to baseline 3 only, and the implementation of a balise group containing this packet will require this particular balise group, to be certified against baseline 3 specifications (see clause 2.6.102 of [ERA APPLICATION GUIDE]).

5.1.2 Rationale

5.1.2.1 If an EVC in PS is attached to a train, and packet 135 is not transmitted on activating the PS cab. The EVC will transition to SH mode without any action from the driver (see clause 4.4.20.1.8 and transition [23] of chapter 4.6 of SS-026). The acknowledgement of the transition will also not be made visible to the driver.

5.1.3 Impact if not implemented

5.1.3.1 The onboard could be in SH mode without the driver having requested it or the trackside having ordered it.

5.1.3.2 On a level 2 trackside where the RBC always answers "SH refused" to a "Request for shunting" message, the packet "Danger for shunting" could have been omitted in balise groups. This would mean the train would be in SH mode on a line without a way to stop it.

5.2 Non-stopping areas

5.2.1.1 Baseline 2 defines three types of non-stopping areas:

- Tunnel

- Bridges

- Other reasons

5.2.1.2 The CENELEC norm which was used by many suppliers to develop their DMI provided different icons for the different types of non-stopping areas. They could then be associated

to different operational rules depending on local context (e.g. Tunnel icon has been used to manage safety exit area inside tunnel).

5.2.1.3   In baseline 3, all the non-stopping areas track conditions are merged in a single non-stopping area (see exception [8] of clause 6.6.3.2.3 of [SS-026-B3]). They will be displayed the same way to the driver, thus leading to a single operational rule independent from the cause.

5.2.1.4   Note: The DMI for B2 is not harmonised, therefore, additional requirements or tests may be needed in B2 on-boards to assure the behaviour expected by the trackside. Similar compatibility problems with B3 trains are expected for B2 train without these additional requirements.

5.2.1.5   Note: the use of text messages in place of tunnel/bridge/other reasons non-stopping area track conditions, should be considered in order to ensure the same information is shown to a baseline 2 or 3 train driver.