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ERTMS Reference Design

Topic: N

Entering European Train Control System (ETCS)

Trains entering a European Train Control System (ETCS) Level 2 (L2), or Level 3 (L3) area need to register with the ETCS Trackside sub-system and transition to ETCS supervision. This includes when entering ETCS with and without signals areas from non ETCS areas and other areas (for example, depots, yards, sidings) where movements can take place other than in ETCS L2/L3, and trains need to operate under ETCS supervision.

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Industry review undertaken by System Authority Requirements, Issues and Configuration Management Working Group (RICWMG) during 2020

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Version History

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1.2	06/05/14	Updated to new Template
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1.4	29/07/14	N1, N2 & N3 combined and Technical Author Re-Format and Update
1.5	01/08/14	Comments resulting from combination addressed
1.6	24/09/15	Updated to Star Chamber review and combined comments for TLWG review prior to CCP
1.7	15/10/15	Updated to address comments from TA. Sections 3 and 4 amended to remove separation between entry signal and transition border.
1.8	20/10/15	Updated section 3 to include requirement for MA to be acknowledged by the ETCS onboard and for the RBC to receive this acknowledgement before the signal controlling entry to Level 2 only area can be cleared.
1.9	22/01/16	Updated for TLWG and TA review prior to CCP
1.10	01/02/16	Final version for CCP
1.11	09/03/16	Issued to ESB/OSG for Consideration
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2.1	31/05/16	Requirements references added and alignment to consolidation workshops
2.2	27/08/16	New template
3.0	29/09/16	Topic complete – with requirements
3.1	29/08/18	Includes proposed topic updates following review against Hybrid Level 3 (HL3) principles – see [HL3]. Changes to requirements as a result of the HL3 review or due to changes included in the DOORS database post September 2016 have not been included.
3.2	20/01/20	Topic transferred to new template and updated to address JA comments.
3.3	30/04/20	Topic comments for L0 incorporated and submitted for HAZID. Colour coding of changes implemented but requirement tagging still needs completion. The check against the quality guideline still needs to be done.
3.4	04/05/20	Made some minor updates in preparation for HAZID.
3.5	12/05/20	Minor amendments made and completion of requirement tagging. Submitted for L1 review quality review
3.6	22/05/20	Updated to reflect comments received from quality review.

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3.7	07/07/20	Updated to reflect L1 review comments.
3.8	23/09/20	Updated to reflect some of the RICMWG review comments. Version sent to requirements manager for requirements consolidation exercise.
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3.10	17/12/2020	Update to include in design guidance
3.11	13/05/21	Updated to requirement consolidation
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3.13	08/10/21	Updated to 2 nd pass requirements consolidation review
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3.16	08/11/21	Updated for further technical lead review
3.17	21/11/21	Updated to Technical Lead review comments
4.0	25/11/21	Final formatting for signatures and issue

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1 Introduction

1.1 Background and Context

There are a number of locations where a train will start outside an ETCS L2/L3 area and, on entering the ETCS area, will need to transition to ETCS L2/L3 operation with minimal driver intervention.

There may be a requirement for the transition to be carried out automatically without the train having to stop, and with minimum impact on performance.

The technical solution should not constrain the operation of the train on the approach to, or through, the transition.

Solutions must cater for locations where there is insufficient room to announce the transition prior to the border, and for the entry into with signals areas.

Alternatively, there may be locations where the manual selection of L2/L3 will be required; for example, at Start of Mission (SoM), if the train starts up in a level other than L2/L3 but within ETCS L2/L3 area. A solution must also be available for drivers in with signals areas to select L2/L3 when the train has previously been operating in Level NTC.

The solution must manage the train protection systems and provide sufficient protection at all times; this may require ETCS trackside transition related equipment and other trackside train protection equipment to be isolated.

At locations where it is acceptable for trains to operate in Level NTC instead of L2/L3 for shunting or other reasons, then this must be possible and the risks appropriately managed.

Note: In this topic, where the term Level NTC is used without a qualifying value of NID_NTC then it describes behaviour which is not dependent on the value of NID_NTC.

The displayed signal aspects on the approach to an ETCS L2/L3 area must be consistent with the information displayed on the Driver Machine Interface (DMI) from the border and, assuming normal driving behaviour, an intervention should not occur when entering ETCS L2/L3 area.

Analysis of the operational needs for depots, yards and sidings has indicated that the use of Level NTC and Shunting (SH) mode within these areas avoids the need for train data entry by the driver and provides flexibility. Movements may be controlled by lineside signals or site personnel. The entry to the L2/L3 area must be controlled and protected using conventional lineside signalling.

Typical locations to which this Topic applies are:

- entry into an L2/L3 without signals or with signals areas on a running line.
- entry into an L2/L3 without signals or with signals areas at the exit of a depot, yard or siding (typically, the depot, yard or siding would be without signalling).
- entry into an L2/L3 without signals or with signals areas at the exit of an Level NTC area, where it may be necessary for some trains to remain in Level NTC for shunting purposes; and
- stations in L2/L3 with signals areas where the driver will, as part of performing SoM, request a change from Level NTC to L2/L3.

Topic T describes the arrangements available for managing drivers not authorised to operate in ETCS but driving ETCS-fitted trains; this involves the provision of two NTC

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levels which both utilise the class B Train Protection & Warning System (TPWS)/Automatic Warning System (AWS) as follows:

- The first is described as NTC Level, 'TPWS>', on the DMI; it indicates that the train will transition to L2/L3 if instructed to do so by the ETCS Trackside. The NID_NTC value of 20 applies to this level.
- The second is described as NTC Level, 'TPWS Fixed', on the DMI; in this level the train will not normally be instructed to transition to L2 or L3 by the ETCS Trackside. The NID_NTC value of 21 applies to this level. This second level is intended for drivers not authorised to operate in ETCS.
- This reference design assumes that trains operating on the GB mainline network will implement the Rail Industry Standards requirements related to the AWS/TPWS being active when the train is Levels NTC, NID_NTC=20 and 21 (RIS-0797-CCS, 4.2.4 [R5] and RIS-0798-CCS, 4.2.5 [R6]). RIS-0775-CCS [R18], contains further guidance in relation to AWS/TPWS functionality in ERTMS/ETCS Level NTC, mode SH.

When considering each Option and Variant, all the likely levels and modes a train could approach the transition are considered. These are divided into those associated with normal operations, degraded operations (where there is a technical fault in the Trackside or Onboard) and abnormal events (where the driver has failed to select an appropriate level/mode, an operational irregularity has occurred, or the train is not fitted with ETCS).

1.2 Abbreviations

Abbreviations are explained on first use and are also in the ERTMS Glossary. For ease of reference, they are also explained below:

Abbreviation	Explanation
ATP	Automatic Train Protection
AWS	Automatic Warning System
BG	Balise Group
CCS TSI	Control, Command and Signalling Technical Specification for Interoperability
CLTO	Conditional Level Transition Order
DMI	Driver Machine Interface
EIRENE	European Integrated Railway Enhanced Network
EOA	End of Authority
ESR	Emergency Speed Restriction
ETCS	European Train Control System
EVC	European Vital Computer
FS	Full Supervision
GSM-R	Global System for Mobile Communications - Railway
HAZID	Hazard Identification
IXL	Interlocking
L0, L1, L2, L3	Level 0, Level 1, Level 2, Level 3
LTA	Level Transition Announcement

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Abbreviation	Explanation
LTO	Level Transition Order
MA	Movement Authority
MRSP	Most Restrictive Speed Profile
NL	Non Leading
NP	No Power
NTC	National Train Control
OPE TSI	Operation & Traffic Management Technical Specification for Interoperability
OS	On Sight
PoSA	Proceed on Sight Aspect
PRI	Preliminary Route Indicator
PS	Passive Shunting
PT	Post Trip
RBC	Radio Block Centre
SH	Shunting
SL	Sleeping
SN	National System (System National)
SoM	Start of Mission
SR	Staff Responsible
TPWS	Train Protection & Warning System
TRTS	Train Ready to Start
TSR	Temporary Speed Restriction
TSS	Train Stop Sensor
TR	Trip
TTD	Trackside Train Detection (using conventional methods)
UN	Unfitted
VSS	Virtual Sub-Section
WO	Written Order

2 Option Selection

2.1 Selection of Options / Variants

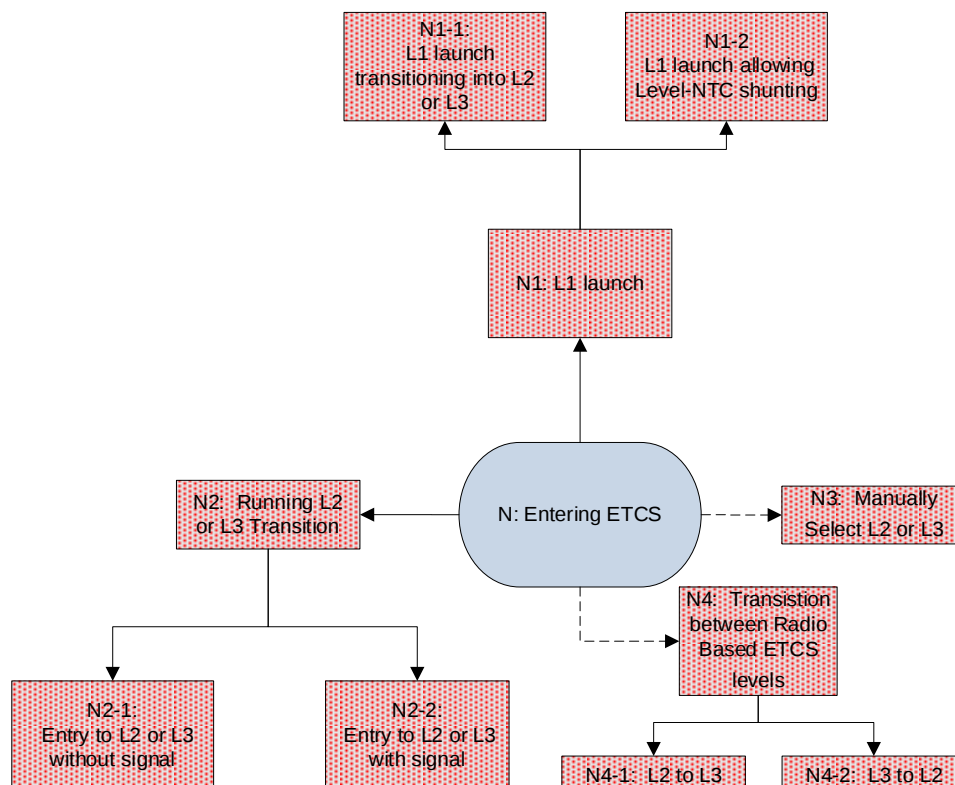


Figure 1 – Topic N Options and Variants

Figure 2 below shows a decision making tree on when to implement option N1 'L1 launch' instead of N2 'Running transition'. It can be seen that the preference is to implement N2 'running transition' and L1 launch should not be treated as the default option. L1 launch can be used but only if it meets the criteria set out below. The dotted lines show the other types of transitions but they are not actual options to be implemented.

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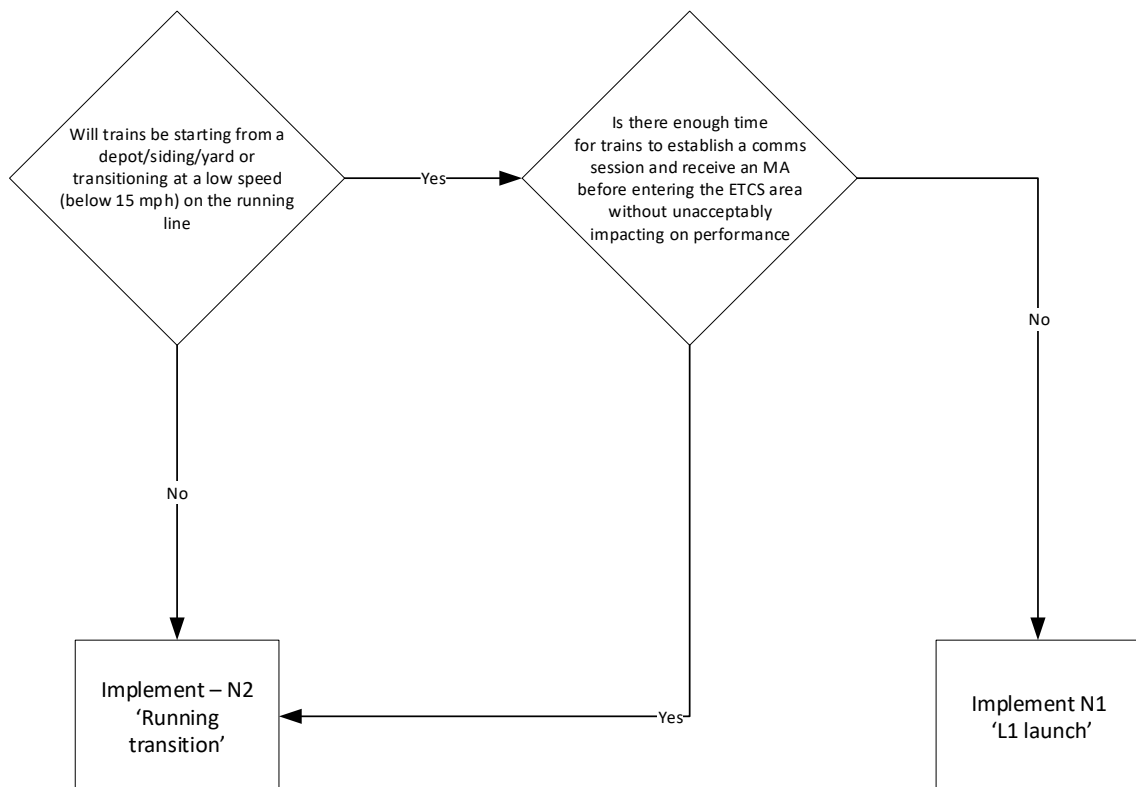


Figure 2 - Decision making tree for implementing option N1 or N2

Option N1 (L1 Launch) applies at the exit of depots, yards, sidings or slow speed connections where there is insufficient space to perform a running transition to L2/3 in accordance with Option N2. Level 1 launch is a two-stage process, a transition into Level 1 (where not undertaking shunting) and a subsequent transition to Level 2/3. The area between these two transitions, where shunting may occur if configured, is known as the Transition Zone (TZ). Option N1 has two variants as follows:

- Variant N1-1 applies where trains will be entering an ETCS L2/L3 area and there is no requirement to support shunting movements in Level NTC on the running line. The speed and layout must allow time for the train to connect with the Radio Block Centre (RBC) and receive an updated Movement Authority (MA) before being restricted by the length of the Level 1 MA issued at the L1 transition to facilitate to transition to L2/L3 at the exit of TZ.
- Variant N1-2 applies where provision needs to be made for some trains to make shunting movements across the boundary onto the running line whilst remaining in Level NTC. This variant is similar to N1-1 but additionally supports shunting movements across the boundary.

Option N2 is applicable where a running transition to L2/L3 is required without the need for the train to stop or significantly slow down, and with minimal impact on operational performance.

- Variant N2-1 is intended to be applied at the entry to a ETCS L2/L3 without signals area and controls the movement of trains over the transition border, depending on whether they are capable of, or required to, transition. The Variant is designed to prevent trains that cannot transition to L2/L3 (i.e. unfitted trains, trains that cannot establish a communications session with the RBC), or whose drivers are not authorised to operate in ETCS (i.e. trains for which the

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driver can only operate with class B protection), from being signalled across the transition border at all. The variant can also be applied at the border between an ETCS with signals area and an ETCS without signals area.

- Variant N2-2 is intended to facilitate running transitions to ETCS L2/L3 with signals area or, subsequently, within the ETCS L2/L3 with signals area, the retrying of a running transition to L2/L3 if a previous transition was not successful. The variant is designed to facilitate successful transitions to L2/L3 for drivers who are authorised to operate in L2/L3. At the same time, it is designed so as not to enforce a transition to L2/L3, but to allow trains to proceed into the ETCS with signals area without transitioning or impacting on performance.

Option N3 is used in situations where the driver is required to change levels to L2 or L3 manually. This could be required during the SoM procedure when the driver is not offered L2/L3 automatically on the DMI, but is required to operate in L2/L3.

Option N4 describes the situation where radio based ETCS is deployed as both L2 and L3 with the need for trains to transition between the levels, for example, at the boundary between areas commissioned by different projects where only one of the areas supports Level 3 operation.

2.2 Options not developed

None identified.

2.3 Applicability

Table 1 - Options Matrix

Option	Variant (s)	Entry to Level 2 without signals area	Entry to Level 2 with signals area	Entry to Hybrid Level 3 without signals area	Entry to Hybrid Level 3 with signals area	Entry to Automatic Train Operation (ATO) area	Moving Block
N1	N1-1	Y	Y	Y	Y	Y#	TBD
	N1-2	Y	Y	Y	Y	N	TBD
N2	N2-1	Y	Not applicable	Y	Not applicable	Y#	TBD
	N2-2	Not applicable	Y	Not applicable	Y	Y#	TBD
N3	Not Applicable	Y	Y	Y	Y	Y#	TBD
N4	N4-1	Not Applicable	Not Applicable	Y	Y	Y#	TBD
	N4-2	Y	Y	Not Applicable	Not Applicable	Y#	Not Applicable

- Applies up to Grade of Automation (GoA) 2.

PART 1 – L1 Launch

Entry into an ETCS area where there is insufficient distance for a running transition (Option N2), is via a transition to Level 1, which is initiated by a Balise Group (BG-1) at the border signal. BG-1 defines the start of the 'L1 Launch' TZ. The TZ is defined at each L1 Launch location, and will have a site-specific length [ETrckSS-1437], that enables the ETCS Onboard:

- to Transition to L1 and;
- to establish a radio communication session with the RBC.

Once the communication is established then the ETCS Onboard can be instructed to transition to L2/L3.

The TZ is the section of line between BG-1 and the location of the BG-2, where BG-2 is used to command an ETCS Onboard to transition to L2/L3 if it has not already done so.

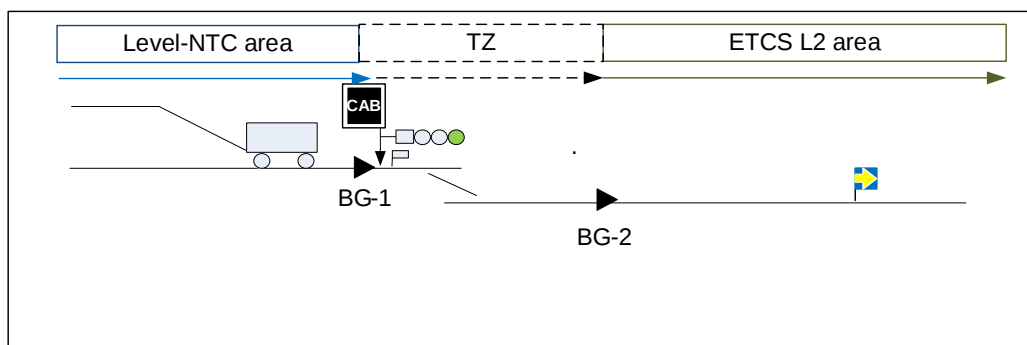


Figure 3 - L1 Launch Transition Zone

The System States and User Information sections within Part 1 - L1 Launch is split into two stages. These two stages describe:

1. the different ETCS Levels and ETCS modes in which trains may approach and enter the TZ
2. the different ETCS Levels and ETCS modes in which trains approach the L2/L3 area to exit the TZ

3 Variant N1-1 – L1 Launch transitioning into L2 or L3 with no provision for shunting

3.1 Specific User Requirements

The entry to an ETCS area will be controlled by a lineside signal. In most cases, an existing signal will be retained. [ESR-3]

Trains required to transition to ETCS will start the transition process on passing the entry signal. [ESR-658]

The arrangement will not require the transition to start before the train passes the signal. It will be restricted to low-speed moves or situations where trains are leaving depots, yards and other locations where the speed is low.

For this variant it will not be possible for shunting activities to take place past the signal without a transition to ETCS (See Variant N1-2 for that scenario).

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Transitions will be initiated if the driver has indicated to the ETCS system by selecting the appropriate Level NTC (each of which corresponds to a NID_NTC value) that they are authorised to operate in ETCS. [ESR-46]

For an ETCS with signals area, where a driver has indicated that they are not authorised to operate in ETCS the train will continue its journey with the appropriate class B protection system. [ESR-101] [ESR-66]

Trains entering the ETCS area in Level 0, UN, will be protected through operational rules and technical measures where possible. [ESR-36]

The ETCS must manage the applicable train protection systems at the transition. [ESR-36]

The design must consider degraded and abnormal situations supporting the recovery from a failure occurring during the transition process. [ESR-62]

3.2 Level 2, without signals

Level 1 Launch involves two stages of transition, the first being from a non ETCS Level/mode on approach to the TZ and the second being to leave the TZ into the ETCS L2/L3 area.

Each stage can be approached and occur in a normal/expected level/mode and sequence. The analysis and requirements need to also address degraded situations (where the normal transitions cannot take place) and abnormal situations (where the driver/train are in an unexpected level/mode).

Drivers need to be trained in what to expect during a level transition, how to react to unexpected sequences and how to operate in degraded scenarios. [EOPSS-857]

Table 2 below summarises the first stage of the transition down the left-hand side (entry to TZ), and the relevant section of this topic, and the second stage (approaching L2/L3 area), with the relevant section of this topic, across the top. For each there are normal (highlighted green), degraded (highlighted yellow) and abnormal (highlighted orange) options listed. The table then shows which stage 2 transition(s) may follow each of the stage 1 transitions.

Additional tables in Appendix A summarise the potential levels and modes on approach to the border, the priority tables within the BG, and the interaction between the Trackside and Onboard.

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Table 2 - L1 launch to L2 without signals transition matrix

	Entry To ETCS without Signals								
	Topic Section		3.2.2.1.1	3.2.2.1.2	3.2.2.2.1	3.2.2.2.2	3.2.2.2.3	3.2.2.3.1	3.2.2.3.2
Entry to Transition Zone (ETCS without signals)		Level, mode, scenario	L1 with comms	L0, (SH)	L1 no comms	L2, (SB)	L2, (SR)	NID_NTC=20, (SH), NID_NTC=21 (SH)	Train not fitted with ETCS
	3.2.1.1.1	NID_NTC=20 (SN) (signal off)	→ ↑		→ ↑				
	3.2.1.1.2	L0, (UN) (signal off)	→ ↑		→ ↑				
	3.2.1.1.3	L0, (SH)		→ ↑					
	3.2.1.2.1	NID_NTC=20 (SN) and Level 0 (UN) (Pathway cannot be set – verbal authorisation)					→ ↑		
	3.2.1.2.2	NID_NTC=20 (SN) and Level 0 (UN) (Degraded Pathway set, PoSA authorisation)	→ ↑		→ ↑				
	3.2.1.2.3	NID_NTC=20 (SN) and Level 0 (UN) (Degraded Pathway set, verbal authorisation)					→ ↑		
	3.2.1.2.4	NID_NTC=20 (SN) and Level 0 (UN) (LEU failed)				→ ↑			
	3.2.1.3.1	NID_NTC=20 (SN), NID_NTC=21 (SN), L0 (UN) (SPAD)				→ ↑			
	3.2.1.3.2	NID_NTC=20 (SH), NID_NTC=21 (SH) (SPAD)				→ ↑ NID_NTC=20 only on exit of SH			
	3.2.1.3.3	Train not fitted with ETCS (SPAD)							→ ↑
	3.2.1.3.4	NID_NTC=20 (SH), NID_NTC=21 (SH) (signal off)	→ ↑ NID_NTC=20 only on exit of SH					→ ↑ continuing in SH	
	3.2.1.3.5	NID_NTC=21 (SN) (signal off)	→ ↑ Driver responsibility to stop		→ ↑ Driver responsibility to stop				
	3.2.1.3.6	Train not fitted with ETCS (signal off)							→ ↑

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3.2.1 System States and User Information (Entry to TZ)

3.2.1.1 Normal Scenarios (intended approaches and transitions)

On approach to the TZ it is expected that in most instances that train will be operating in Level NTC (NID_NTC=20), SN with the ETCS authorised driver having entered valid data into the ETCS. At some locations, potentially the exit from private yards, depots and lines, the train may be approaching in Level 0, UN however this is not expected to be a common arrangement. In both these cases the normal scenario is for the train to transition to Level 1 with an appropriate MA.

For possession working through a TZ, the train will be operating in Level 0, SH with the intention that the entry into and exit from the TZ does not cause a change of level or mode and do not act immediately for the transition order from Balise and instead it will store in the ETCS Onboard.

3.2.1.1.1 Train approaches in Level NTC (NID_NTC=20), SN

The initial state is that the train is standing at, or approaching, the signal controlling exit from the non ETCS area, having entered the relevant train data and the driver having selected Level 'TPWS>' to indicate ETCS that they are authorised to operate the train in ETCS. [EOPSS-950] The train is in Level NTC (NID_NTC=20), SN and the Automatic Warning System (AWS)/TPWS is unsuppressed (RIS-0797-CCS, 4.2.4 [R5] and RIS-0798-CCS, 4.2.5 [R6]).

A TZ will be provided to support the step-up transition from Level NTC (NID_NTC=20) to L1 and then, once communication is established between ETCS Onboard and RBC, transition to L2/3. [ETrckSS-1437]

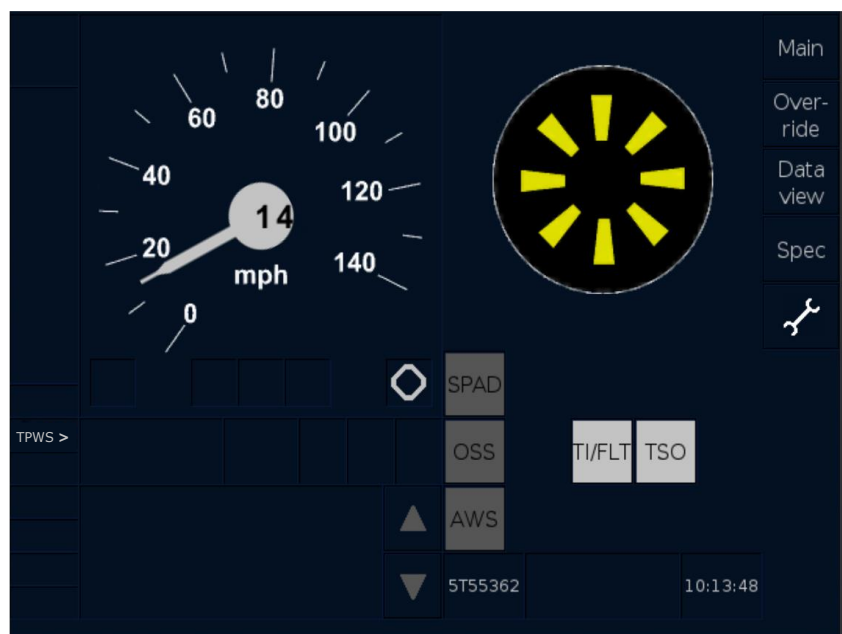


Figure 4 - Train operating in TPWS>

The signaller or automated system will set a Pathway from the signal controlling exit from the non ETCS area. No reason has been identified for the signaller to have extra information about the train other than: section occupation, train description, and route set information.

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Note: There may be a 'Train Ready to Start' (TRTS) device for the shunter or driver to operate to indicate that the train is ready to depart (see Topics D and P).

Once the Pathway is set, the lineside signal to proceed (typically, a main aspect signal) will be displayed. The train remains in Level NTC (NID_NTC=20), SN.

The aspect displayed will reflect the extent of the Pathway that has been set, and the L1 MA provided should be consistent with this (see L1 Launch example layout in Figure 5). [ETrckSS-270].

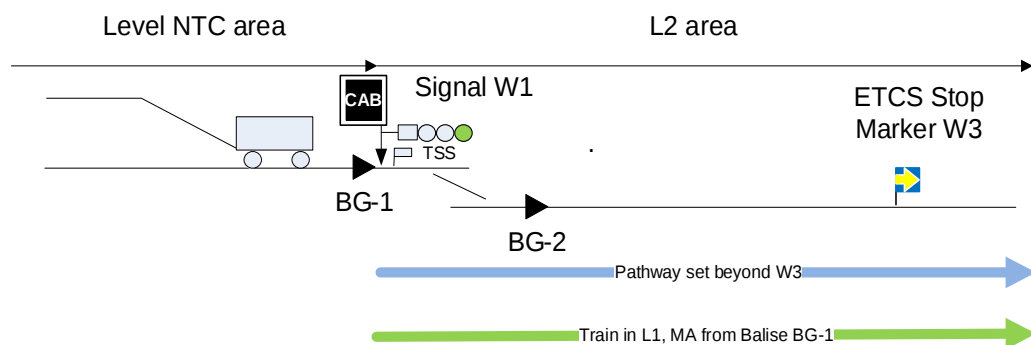


Figure 5 - Pathway set onto running line and proceed aspect displayed

With the signal showing a proceed, the telegram in BG-1 will be configured to include a Level Transition Order (LTO) with priority table of trackside supported levels for the TZ, a Level 1 MA and a session establishment command. [ETrckSS-727] [ETrckSS-1439] [ETrckSS-1438]

As the train reads BG-1 the ETCS Onboard will establish a radio connection with the RBC and transition to L1 with an MA onto the main line. Once in L1, the AWS/TPWS is suppressed (RIS-0797-CCS 4.2.3 [R5] and RIS-0798-CCS, 4.2.4 [R6]). A planning area will appear on the DMI, showing the extent of the MA. The driver will be required to acknowledge the transition to L1 within five seconds¹. Failure to acknowledge the transition will lead to the service brake being applied. [EOPSS-857]

Note: It is unlikely that the MA will include the necessary train/track data for the full length of the train, therefore an "Entering FS" message will be displayed on the DMI (see Figure 66). The Driver will need to manage the speed of the train to that of the non-ETCS area until the MA is updated to include the necessary train/track data that covers the entirety of the train. [EOPSS-1554] The message "Entering FS" will disappear when the MA is updated.

¹ Note that the acknowledgment has been agreed for removal in a future ETCS release (CR1166)

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Figure 6 - Train transitions to L1 and MA from Balise BG-1 shown on DMI

Once the train establishes a session with the RBC it will send a position report that informs the RBC the train is operating in L1.

Once the train is in communication with the RBC, the transition to L2/L3 for entry into an ETCS without signals area is described in 3.2.2.1.1

3.2.1.1.2 Train approaches in Level 0, UN

The system states and user information for trains approaching in Level 0, UN, are the same for trains approaching in Level NTC (NID_NTC=20), SN. (see 3.2.1.1.1)

Note: For trains in Level 0, the AWS/TPWS is already suppressed (RIS-0797-CCS 4.2.3 [R5] and RIS-0798-CCS, 4.2.4 [R6]).

Once the train is in communication with the RBC, the transition to L2/L3 for entry into an ETCS without signals area is described in 3.2.2.1.1

3.2.1.1.3 Train approaches in Level 0, SH – operation in possession

A train in L0, SH passing signal W1 displaying a proceed aspect will read the telegram in BG-1. As the train is operating in Level 0, SH, the ETCS Onboard will not try to establish communication or transition to Level 1. The priority table contained within the LTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 [R1]) and the driver will continue movements in SH.

Note: For trains in Level 0 the AWS/TPWS is already suppressed (RIS-0797-CCS 4.2.3 [R5] and RIS-0798-CCS, 4.2.4 [R6]).

On exiting SH, and if no other transition order has been read, the ETCS Onboard will automatically transition to Level 1, as this is the highest level in the LTO in BG-1 [ETckSS-1438]. The ETCS Onboard will enter SB and the driver will need to carry out SoM (see Topic G) as per Chapter 5 and 4 of Subset-026 [R1].

Note: whilst operating within a possession, drivers may pass border and other signals at danger under instruction. In this case the transition order stored will be for Level 2 instead of Level 1.

For trains continuing in L0 SH, the transition to L2/L3 for entry into an ETCS without signals area is described in 0

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3.2.1.2 Degraded scenarios (Trackside or ETCS Onboard failures)

Each of the following considers train approaching in Level NTC (NID_NTC=20), SN and Level 0, UN.

3.2.1.2.1 Pathway cannot be set – verbal authorisation

This scenario describes the events where a Pathway cannot be set (normal or degraded), preventing the signal from clearing. The signaller will need to secure the wheeled path in accordance with the rule book.

When signal W1 is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The driver will need to contact the signaller and request authority to proceed (see Topic S).

The driver selects 'Override' on the ETCS DMI before proceeding and operates the TPWS temporary isolation switch (GERT-8000-S5 [R17]).

When the train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This default telegram contains an LTO with higher priority of L2, resulting in a transition to L2 and also the default telegram will contain the session establishment packet (p42), since override is active the mode changes to SR. [ETrckSS-1443] [ETrckSS-1442] and Chapter 5 of Subset-026 [R1]

Once the train is in communication with the RBC, the transition to L2/L3 for entry into an ETCS without signals area is described in 3.2.2.2.3

3.2.1.2.2 Degraded Pathway can be set, Proceed on Sight Aspect (PoSA) available to authorise movement in On Sight (OS) mode

This scenario is only applicable if the border signal is capable of displaying a PoSA.

Due to degraded working in the TZ and/or the ETCS area the signaller will need to set an ETCS Degraded type Pathway (in accordance with topic X). Once the Pathway is set, the PoSA will clear (in accordance with the controls in Topic U).

With the signal showing a PoSA aspect, the telegram in BG-1 will be configured to include a LTO and priority table of trackside supported levels for the transition zone, a Level 1 MA with an OS mode profile starting immediately and a session establishment command. [ETrckSS-1444] [ETrckSS-1439]

The driver will be presented with a request to acknowledge the transition and entry to OS.

Note: The acknowledgment has been agreed for removal in a future ETCS release (CR1166)

The driver will have five seconds from the transition occurring to acknowledge both the transition and entry to OS, before the service brake is commanded. Once acknowledged, the train continues in OS.

If the driver does not acknowledge the transition within the five-second limit, the service brake will be commanded until the acknowledgement is made, at which time the command will be rescinded. [EOPSS-178]

See Topics U, H and S for details on the use of OS for permissive moves and degraded / PoSA Pathways, respectively.

Once the train is in communication with the RBC, the transition to L2/L3 for entry into an ETCS without signals area is described in 3.2.2.1.1

3.2.1.2.3 Degraded Pathway can be set, verbal authorisation

Due to degraded working within the TZ and/or the ETCS area the signaller may flag one or more sections as obstructed or set an ETCS Degraded Pathway (See Topic U).

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The signaller may need to inform the driver about the degraded section/s and provide any additional instructions for these sections/s in accordance with GERT8000-S5 [R17].

When signal W1 is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The driver will need to contact the signaller and request authority to proceed (see Topic S).

The signaller will need to set an ETCS Degraded type Pathway (in accordance with topic X).

The driver selects 'Override' on the ETCS DMI before proceeding and operates the TPWS temporary isolation switch (GERT-8000-S5 [R17]).

When the train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This default telegram contains an LTO with the higher priority of L2, resulting in a transition to L2 and the default telegram will contain the session establishment packet (p42), since override is active the mode changes to SR. [ETrckSS-1443] [ETrckSS-1442] and Chapter 5 of Subset-026 [R1]

Once the train is in communication with the RBC, the transition to L2/L3 for entry into an ETCS without signals area is described in 3.2.2.2.3

3.2.1.2.4 Lineside Electronic Unit (LEU) failed – default telegram

If the LEU fails, the balise group will be configured to send a default balise message. The message will have an LTO with L2 as the highest priority and an order to establish communication with the ETCS Trackside. [ETrckSS-1443] [ETrckSS-1442] [ETrckSS-817].

When the train passes the balise group and transitions to L2, the ETCS Onboard will enter Trip (TR) mode, as there is no MA to move in L2 (See Chapter 5 [R1]. The DMI will display the system state message "No MA received at level transition" [R9]. This will indicate to the driver that there is a fault with the Trackside.

Operational Rules and procedures will be applied to recover from the situation. [EOPSS-178] The driver will need to carry out SoM as part of Post Trip (PT), see Topic G and Chapter 5 [R1]. [EOPSS-178]

Following SoM, the transition to L2/L3 for entry into an ETCS without signals area is described in 3.2.2.2.2

3.2.1.3 Abnormal scenarios (Operationally related issues)

These scenarios describe situations where the train is being operated in a level other than those associated with normal operation or where an operating irregularity occurs.

3.2.1.3.1 SPAD with train approaching in Level NTC (NID_NTC=20), SN; Level NTC (NID_NTC=21), SN; or Level 0, UN

When signal W1 is displaying a stop aspect, the driver should not move the train beyond the signal.

If the train passes signal W1 at 'Danger' in Level NTC, the TPWS Train Stop Sensor (TSS) at the signal being activated will result in the train brakes being applied. [ETrckSS-296], RIS-0797-CCS, 4.2.4 [R5] and RIS-0798-CCS, 4.2.5 [R6].

When the train passes BG-1, the default balise group message will be sent containing an LTO with L2 as the highest priority and an order to establish communication with the ETCS Trackside. [ETrckSS-1443] [ETrckSS-1442] [ETrckSS-817] [ETrckSS-727].

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When the train passes the balise group and transitions to L2, the ETCS Onboard will enter TR mode, as there is no MA to move in L2 (See Chapter 5 [R1]).

The DMI will display the system state message “No MA received at level transition” [R9].

Operational Rules and procedures will be applied to recover from the situation. [EOPSS-178] The driver will need to carry out SoM as part of PT, see Topic G and Chapter 5 of Subset-026 [R1].

Following SoM, the transition to L2/L3 for entry into an ETCS without signals area is described in 3.2.2.2.2

3.2.1.3.2 SPAD with train approaching in Level NTC (NID_NTC=20), SH; or Level NTC (NID_NTC=21), SH.

When signal W1 is displaying a stop aspect, the driver should not move the train beyond the signal.

If the train passes signal W1 at ‘Danger’ in Level NTC, the TPWS Train Stop Sensor (TSS) at the signal being activated will result in the train brakes being applied. [ETrckSS-296], RIS-0797-CCS, 4.2.4 [R5] and RIS-0798-CCS, 4.2.5 [R6].

When the train passes BG-1, the BG message will be sent containing an LTO with L2 as the highest priority and an order to establish communication with the ETCS Trackside. [ETrckSS-1443] [ETrckSS-1442] [ETrckSS-817] [ETrckSS-727].

As the train is operating in Level NTC, SH, the ETCS Onboard will not try to establish communication or transition to Level 2. The priority table contained within the LTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 [R1]).

The driver will need to follow operational procedures following TPWS activation.

For trains previously in Level NTC (NID_NTC=21), the driver should recognise that operation in ETCS is not within their competence and contact the signaller. [EOPSS-178] [EOPSS-956]

Trains in Level NTC (NID_NTC=20), SH, that were intended to be routed onto the ETCS Pathway, may be instructed to exit SH and carry out SoM (see Topic G) to continue in L2.

Following SoM, the transition to L2/L3 for entry into an ETCS without signals area is described in 3.2.2.2.2

3.2.1.3.3 SPAD with train approaching not fitted with ETCS

When signal W1 is displaying a stop aspect, the driver should not move the train beyond the signal.

If the train passes signal W1 at ‘Danger’ in a train not fitted with ETCS, the TPWS Train Stop Sensor (TSS) at the signal being activated will result in the train brakes being applied. [ETrckSS-296], RIS-0797-CCS, 4.2.4 [R5] and RIS-0798-CCS, 4.2.5 [R6].

As the train is not fitted with ETCS, the messages within BG-1 will not be read.

The driver will need to follow operational procedures following TPWS activation.

Following recovery from SPAD the signaller and/or driver will be aware that the train had been misrouted into the ETCS without signals area. This is described in 3.2.2.3.2.

3.2.1.3.4 Signal cleared with train approaching in Level NTC (NID_NTC=20), SH; or Level NTC (NID_NTC=21), SH.

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The initial state is that the driver of a train about to depart from the depot has previously been operating in Level NTC (NID_NTC=20), SH. The driver has not entered the relevant train data and the train remains in Level NTC (NID_NTC=20), SH. The train will be standing at, or approaching, the boundary, which is marked by a lineside signal W1. Since the train is in Level NTC (NID_NTC=20), the AWS/TPWS is unsuppressed (RIS-0797-CCS, 4.2.4 [R5] and RIS-0798-CCS, 4.2.5 [R6]).

Note: The train could be starting in Level NTC (NID_NTC=21) instead of (NID_NTC=20). If this were the case, this would be indicated on the DMI as TPWS Fixed. Other than this, the scenario described is the same.

The signaller or automated system will set a Pathway for the train onto the running line. No need has been identified for the signaller to have extra information about the train, in addition to that provided by current lineside signalling.

Once the Pathway is set, signal W1 will display a proceed aspect and appropriate route indication. [ETrckSS-282]. The train remains in Level NTC (NID_NTC=20), SH.

A train in SH passing signal W1 displaying a proceed aspect will read the telegram in BG-1. As the train is operating in Level NTC, SH, the ETCS Onboard will not try to establish communication or transition to Level 1. The priority table contained within the LTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 [R1]) and the driver will continue movements in SH.

On exiting SH, and if no other transition order has been read, the ETCS Onboard will automatically transition to Level 1. The ETCS Onboard will enter SB and the driver will need to carry out SoM (see Topic G) Chapter 5 and 4 of Subset-026 [R1].

Once the train is in communication with the RBC, the transition to L2/L3 for entry into an ETCS without signals area is described in 3.2.2.1.1

For trains previously in Level NTC (NID_NTC=21), the driver should recognise that operation in ETCS is not within their competence and contact the signaller. [EOPSS-178] [EOPSS-Nxx1]

Trains that have not exited SH in the TZ, the transition to L2/L3 for entry into an ETCS without signals area is described in 3.2.2.3.1

3.2.1.3.5 Signal cleared with train approaching in Level NTC (NID_NTC=21), SN.

With the signal showing a proceed, the telegram in BG-1 will be configured to include a LTO and priority table of trackside supported levels for the TZ, a Level 1 MA and a session establishment command. [ETrckSS-727] [ETrckSS-1439] [ETrckSS-1438] As the train reads BG-1 the ETCS Onboard will establish a radio connection with the ETCS trackside and transition to L1 with an MA onto the main line. The driver will be required to acknowledge the transition to L1 within five seconds². Failure to acknowledge this will lead to the service brake being applied. The driver should recognise that they are not authorised to proceed and will stop the train. [EOPSS-Nxx1], see 3.2.2.1.1 with the comms established, if the comms is not established after L1 transition into TZ then see 3.2.2.2.1.

3.2.1.3.6 Signal cleared with approaching train not fitted with ETCS

With signal W1 showing a proceed aspect, trains not fitted with ETCS will be unaffected by the transition. Unless the signalling error of routing an unfitted train towards an ETCS only line is identified by either the signaller or the driver, then the train will continue beyond the signal and through the TZ.

² Note that the acknowledgment has been agreed for removal in a future ETCS release (CR1166)

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See 3.2.2.3.2 for trains not fitted with ETCS approaching L2/L3 area.

3.2.2 System States and User Information (Entering ETCS without signals area from TZ)

The following scenarios apply at the end of the TZ and the entrance to the ETCS without signals areas. In most cases they are preceded by one of the transitions/scenarios described in 3.2.1.

3.2.2.1 Normal Scenarios (intended approaches and transitions)

The normal sequence is that on passing the signal at the entrance to the TZ the ETCS Onboard will have been instructed to change to Level 1 and start the process of establishing a communication session with the RBC.

3.2.2.1.1 Train approaches in L1 with communication

Once the ETCS Onboard has established communication and the RBC detects that train is operating in L1 it will send to the train an LTO for L2 transition and the corresponding MA for the Pathway set. [ETrckSS-1240]

Note: the MA issued from the balise group may be restricted in length to less than the length of the set Pathway in order to reduce the complexity of having multiple switchable messages.

It is possible that before the train has established communication with the RBC that it will receive a LTO for L2 transition from a balise group (BG-2). [ETrckSS-1436] [ETrckSS-1433] The balise group (BG-2) will also apply to any sleeping ETCS Onboard within the formation. The MA sent by BG-1 remains valid when the level changes from L1 to L2. Once the session is established, the RBC will issue the corresponding MA upon receipt of the position report.

The train transitions into L2 and the AWS/TPWS remains suppressed (RIS-0797-CCS 4.2.3 [R5] and RIS-0798-CCS, 4.2.4[R6]).

The train will transition to L2 without the need for the driver to acknowledge the message.

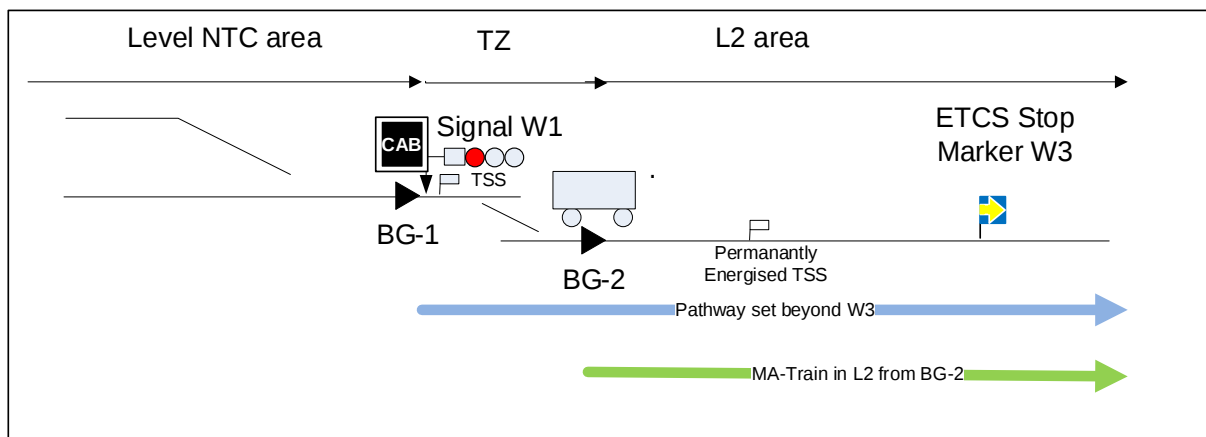


Figure 7 - Transition to L2

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Figure 8 - Communication session established

As soon as the RBC obtains a valid position from the train, it will update the MA, provided that subsequent Pathways are available (set, locked and detected). [ETrckSS-1240]

Note: the MA issued from the balise group may be restricted in length to less than the length of the set Pathway in order to reduce the complexity of having multiple switchable messages.

Note: Since the MA currently held onboard was not issued by the RBC there is the potential that the RBC issues an MA with an OS mode profile because the train is already in the Pathway and the line ahead cannot be guaranteed to be clear. Avoiding this requires the RBC to utilise the level and mode reported in the position report to issue an MA without a mode profile (assume Track Ahead Free).



Figure 9 - MA updated

3.2.2.1.2 Train approaches in Level 0, SH – operation in possession

The train continues into the L2 area, when passing BG-2 the ETCS Onboard will receive the LTO, ordering transition to L2. [ETrckSS-1436] [ETrckSS-1433] As the train

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is in SH, the priority table within the LTO is stored but not processed (See Chapter 4 [R1]).

On exiting SH, and if no other transition order has been read, the ETCS Onboard will automatically transition to Level 2. The ETCS Onboard will enter SB and the driver will need to carry out SoM (see Topic G) Chapter 5 and 4 of Subset-026 [R1].

3.2.2.2 Degraded scenarios (Trackside or ETCS Onboard failures)

3.2.2.2.1 Transition to Level 1 but no communication session can be established

Due to no communication session with the RBC being established, the train will continue with the L1 MA it has received from BG-but will not be able to obtain an updated MA from the RBC. The driver will stop the train at the End of Authority (EOA) and contact the signaller. [EOPSS-178]

If the train passes the BG-2 before reaching the EOA, the LTO within the telegram will order transition to L2. [ETrckSS-1436] [ETrckSS-1433]

If BG-2 has not been passed, to continue into the ETCS without signals area the driver will need to manually select Level 2 as described in Option N3 (see section 7).

Once in L2 the driver will need to override the EOA (See Topic S) to continue, if communication with the ETCS Trackside cannot be established.

3.2.2.2.2 SoM train in L2, SB

Once SoM is complete and a communication with the ETCS Trackside has been established (see Topic G) the driver presses start and the ETCS Onboard requests a Level 2 MA. The RBC issues the MA when the conditions for the Pathway are met (See Topic X and U), the driver can continue up to the to ETCS marker W3. If the signaller sets the forward Pathway from W3 (in accordance with Topic X and U) the MA can be extended (in accordance with Topic A).

3.2.2.2.3 Train approaches in L2 SR

The driver will continue in SR adhering to the limitations and instructions of the Written Order (WO) (see Topic S). Once the communication with the ETCS Trackside has been established, and the Pathway has been set and proved (in accordance with Topic X and U) the ETCS Onboard can receive a Level 2 MA and continue up to ETCS marker W3.

Note: The mode profile of the MA will be dependent on the Pathway type that has been secured and the state of each block section (in accordance with Topic U)

If the signaller sets the forward Pathway from ETCS marker W3 (in accordance with Topic X and U) the MA can be extended (in accordance with Topic A).

3.2.2.3 Abnormal scenarios (Operationally related issues)

3.2.2.3.1 Train approaching in Level NTC (NID_NTC=20), SH; or Level NTC (NID_NTC=21), SH

The train will continue towards ETCS marker W3, and the brakes will be applied when the train passes over the permanently energised TSS located at the end of TZ or between the TZ and W3. [ETrckSS-1440] Operational Rules will need to be followed for a train receiving a brake activation due to TPWS.

3.2.2.3.2 Approaching train not fitted with ETCS

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The train will continue towards ETCS marker W3, and the brakes will be applied when the train passes over the permanently energised TSS located at the end of TZ or between the TZ and W3. [ETrckSS-1440] [ETrckSS-954]

Operational Rules will need to be followed for a train receiving a brake activation due to TPWS.

3.2.3 Impact on other topics

Topic X – Pathway Controls

Topic U – Pathway Controls for the Issue of Movement Authorities

Topic A – Continuing Movement

Topic AA – Consistent Provision of Lineside Signage

3.2.4 Design Guidance

The use of L1 launch should be subject to site-specific risk assessment and should take into consideration all movements not under ETCS control such as propelling.

3.2.4.1 Entry to TZ

The lineside signal marks the boundary to the ETCS area. Normally, the existing signal will be retained unaltered.

The lineside signal should be provided with conventional protection arrangements (TPWS, trapping protection, etc.) to manage vehicles being propelled, or ones which are not fitted with ETCS Onboard. [ETrckSS-296]

Routing information is to be provided at the entry signal in accordance with conventional signalling rules.

The transition to L1 should be designed to occur immediately beyond the lineside signal.

The transmission of MA by a balise group leads to the need to use the variable M_MCOUNT to detect that the message is consistent where the balise reader might have passed the first balise when the message is updated. [ETrckSS-817]

The length of the MA accompanying the L1 LTO should be sufficient to allow connection to the RBC to occur. It is acceptable for the MA to extend more than one block section, although this may add more complexity to the switchable BG.

The BG at the border normally comprises one fixed balise and one switchable balise although extra balises may be required to accommodate the data to be transmitted.

The default telegram(s) sent by the BG corresponds to no proceed aspect being displayed [ETrckSS-1443] and includes Session Establishment [ETrckSS-727], National Values and a Level Transition Order with priority table of Level 3 (where required), Level 2 and Level 0. [ETrckSS-1439] [ETrckSS-1442]

When a main proceed aspect is displayed the telegrams sent by the BG contain Session Establishment [ETrckSS-727], National Values, a Level Transition Order with priority table of Level 1, Level 3 (where required), Level 2 and Level 0 [ETrckSS-1439] [ETrckSS-1438] and a Level 1 Movement Authority with associated track description.

Where there is suitable track on approach to the signal, an extra BG to command the train to connect to the RBC on approach to the TZ should be considered. [ETrckSS-727]

The designer should consider the layout and operations on approach to the TZ and whether there is any performance benefit to be gained from providing a BG. Establishing the connection early may not be desirable if there are points on the approach. Likewise, it would be undesirable to provide a BG where trains would stand at the boundary signal for extended periods, thereby holding RBC communications

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channels open unnecessarily. The BG should be positioned so that a train passes over it before stopping at the normal stopping position in preparation for leaving the depot. In the situation where trains do not stop and are 'flighted out' of depots, there may be no case for providing a BG since there is little or no performance benefit.

Whilst primarily envisaged at depot exits, this variant could also be used on running lines. However, it should be noted that, unless the switchable balise at the border has multiple MAs to cater for different sections of clear route, it may restrict the speed through the border. It could also be used on a short connecting line between an NTC line and an L2 without signals line to avoid having to provide connection and announcement balises (with associated cancellations) on the NTC line.

Lower speeds on the approach to BG-1 and within which the rear of a train could still be applicable once the transition has occurred, should be extended to end after the transition border. This is to avoid the driver accelerating to the higher speed applicable at the transition border while the rear of the train, which cannot be supervised by ETCS, is still within the lower speed area,

The distance beyond BG-1 to which the lower speed is extended could be as little as one metre and set such that the rear of the train is supervised.

The following table summarises the configuration of the border balise group.

Signal state	BBG contents
Signal at danger	Session Establishment (ETrckSS-727)
	LTO (ETrckSS-1439)
	L3, L2, L0 (ETrckSS-1442)
	National Values (ETrckSS-223)
	Default Telegram (ETrckSS-1443)
	TPWS provision (ETrckSS-296)
Signal showing proceed (not shunting)	Session Establishment (ETrckSS-727)
	LTO (ETrckSS-1439)
	L1, L3, L2, L0 (ETrckSS-1438)
	National Values (ETrckSS-223)

3.2.4.2 TZ to ETCS without signals area

The location of the L2 transition (BG-2) should be at least 5 seconds at line speed from the L1 transition to allow for driver acknowledgement of the transition.

Once the train establishes a communication session the ETCS Trackside responds by sending a Level Transition Order with priority table of Level 3 (where required), Level 2 and Level 0 [ETrckSS-1433] accompanied by a Level 2 Movement Authority message [ETrckSS-1240]. The Trackside design takes account of the fact the Onboard already holds an MA (issued by BG-1) when configuring the MA sent over radio.

The BG at the entry to the ETCS without signals area is configured to send National Values and a Level Transition Order with priority table of Level 3 (where required), Level 2 and Level 0 [ETrckSS-1436] [ETrckSS-1433].

To prevent trains that are not fitted with ETCS, and trains in Level NTC, SH, from continuing onto the L2 without signals line, a permanently energised TSS located at the end of TZ or between the TZ and W3. [ETrckSS-1440] [ETrckSS-954].

The following table summarises the behaviour of the Trackside (RBC) and configuration of the border balise group.

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RBC Behaviour	BBG contents
Train in L1, send LTO + MA (ETrckSS-1240)	CLTO (ETrckSS-730)
L3, L2, L0 (ETrckSS-1433)	L3, L2, L0 (ETrckSS-1433)
	National Values (ETrckSS-223)

3.3 Level 2, with signals

The system states and user information are largely the same for L2 with signals as they were for L2 without signals (see 3.2) where the Onboard is in Level 0 or Level NTC (NID_NTC=20).

The behaviour of an Onboard in Level NTC (NID_NTC=21) is different and detailed in the relevant sections.

Any other differences to the system states and user information are explained below.

Drivers need to be trained in what to expect during a level transition, how to react to unexpected sequences and how to operate in degraded scenarios. [EOPSS-857]

Table 3 summarises the first stage of the transition down the left-hand side (entry to TZ), and the relevant section of this topic, and the second stage (approaching L2/L3 with signals area), with the relevant section of this topic, across the top. For each there are normal (highlighted green), degraded (highlighted yellow) and abnormal (highlighted orange) options listed. The table then shows which stage 2 transition(s) may follow each of the stage 1 transitions.

Additional tables in Appendix A summarise the potential levels and modes on approach to the border, the priority tables within the BG, and the interaction between the Trackside and Onboard.

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Table 3 - L1 launch to L2 with signals transition matrix

		Entry To ETCS with Signals									
Topic Section		3.3.2.1.1	3.3.2.1.2	3.3.2.1.3	3.3.2.1.4	3.3.2.2.1	3.3.2.2.2	3.3.2.2.3	3.3.2.3.1	3.3.2.3.2	3.3.2.3.3
	Level, mode, scenario	L1 with comms	NID_NTC=21	L0, UN	L0, (SH)	L1 no comms	L2, (SB)	L2, (SR)	NID_NTC=20 (SH)	NID_NTC=21 (SH)	Train not fitted with ETCS
Entry to Transition Zone (ETCS with signals)	3.3.1.1.1	NID_NTC=20 (SN) (signal off)	→ ↑			→ ↑					
	3.3.1.1.2	NID_NTC=21 (SN) (signal off)		→ ↑							
	3.3.1.1.3	L0, (UN) (signal off)			→ ↑						
	3.3.1.1.4	L0, (SH)				→ ↑					
	3.3.1.2.1	NID_NTC=20 (SN) (Pathway cannot be set – verbal authorisation)						→ ↑			
	3.3.1.2.2	NID_NTC=21 (SN) (Pathway cannot be set – verbal authorisation)		→ ↑							
	3.3.1.2.3	L0, (UN) (Pathway cannot be set – verbal authorisation)			→ ↑						
	3.3.1.2.4	NID_NTC=20 (SN) Degraded Pathway can be set, PoSA available	→ ↑				→ ↑				
	3.3.1.2.5	NID_NTC=21 (SN) Degraded Pathway can be set, PoSA available		→ ↑							
	3.3.1.2.6	L0, (UN) Degraded Pathway can be set, PoSA available			→ ↑						
	3.3.1.2.7	NID_NTC=20 (SN) Degraded Pathway can be set, verbal authorisation						→ ↑			
	3.3.1.2.8	NID_NTC=21 (SN) Degraded Pathway available		→ ↑							
	3.3.1.2.9	L0, (UN) Degraded Pathway can be set, verbal authorisation			→ ↑						
	3.3.1.2.10	NID_NTC=20 (SN) LEU failed					→ ↑				
	3.3.1.2.11	NID_NTC=21 (SN) LEU failed		→ ↑							
	3.3.1.2.12	L0, (UN) LEU failed			→ ↑						
	3.3.1.3.1	NID_NTC=20 (SN) SPAD					→ ↑				
	3.3.1.3.2	NID_NTC=21 (SN) SPAD		→ ↑							
	3.3.1.3.3	L0, (UN) SPAD			→ ↑						
	3.3.1.3.4	NID_NTC=20 (SH) SPAD					→ ↑ on exit SH		→ ↑ continuing in SH		
	3.3.1.3.5	NID_NTC=21 (SH) SPAD		→ ↑ on exit SH						→ ↑ continuing in SH	
	3.3.1.3.6	L0, (SH) SPAD			→ ↑ on exit SH	→ ↑				→ ↑ continuing in SH	
	3.3.1.3.7	Train not fitted with ETCS SPAD									→ ↑
	3.3.1.3.8	NID_NTC=20 (SH) signal off	→ ↑ on exit SH						→ ↑ continuing in SH		
	3.3.1.3.9	NID_NTC=21 (SH) signal off		→ ↑ on exit SH						→ ↑ continuing in SH	
	3.3.1.3.10	Train not fitted with ETCS signal off									→ ↑

3.3.1 System States and User Information (Entry to TZ)

3.3.1.1 Normal Scenarios (intended approaches and transitions)

On approach to the TZ it is expected that in most instances that train will be operating in Level NTC (NID_NTC=20), SN with the driver having entered valid data into the ETCS. As it is an ETCS with signals configuration it is also likely that trains will be approaching in Level NTC (NID_NTC=21), SN and will continue into the ETCS with signals area using the conventional signalling, TPWS protection and operational rules. At some locations, potentially the exit from private yards, depots and lines, the train may be approaching in Level 0, UN however this is not expected to be a common arrangement. The normal scenario, for trains continuing under ETCS supervision, is for the train to transition to Level 1 with an appropriate MA.

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For possession working through a TZ, the train will be operating in Level 0, SH with the intention that the entry into and exit from the TZ does not cause a change of level or mode.

3.3.1.1.1 Train approaches in Level NTC (NID_NTC=20), SN – normal/intended operation at most locations

The driver experience is the same as ETCS without signals section 3.2.1.1.1, but there are some technical differences which are except with LTO configured as CLTO within BG-1, and priority table including Level NTC (NID_NTC=20) for TZ prior to ETCS with signals area. [ETrckSS-1445] & [ETrckSS-1444]

Once the train is in communication with the RBC, the transition to L2/L3 for entry into an ETCS with signals area is described in 3.3.2.1.1.

3.3.1.1.2 Train approaches in Level NTC (NID_NTC=21), SN – normal/intended operation at most locations

If the driver has previously selected TPWS Fixed, and the signal leads into a with signals area, the train will not transition to L1.

For a main Pathway from signal W1 into a with signals area, BG-1 will send a CLTO (to allow the continued use of Level NTC (NID_NTC=21) – see Topic T) [ETrckSS-1445] & [ETrckSS-1444]

Once the train has entered the TZ and is approaching the ETCS with signals area see 3.3.2.1.2.

3.3.1.1.3 Train approaches in Level 0, UN – normal/intended operation at some locations

A train in L0 UN passing signal W1 displaying a proceed aspect will read the telegram in BG-1. As the train is in L0, and the CLTO within BG-1 contains L0 in the priority table of trackside supported levels, the ETCS Onboard will remain in L0 [ETrckSS-1444] [ETrckSS-1445]. The ETCS Onboard will establish a session with the RBC.

Note: As the CLTO does not force the transition for trains operating in L0, Operational rules are required to manage movements within the TZ and ETCS with signals area.

Note: For trains in Level 0 the AWS/TPWS is suppressed (RIS-0797-CCS 4.2.3 [R5] and RIS-0798-CCS, 4.2.4 [R6]).

Once the train has entered the TZ the approach to the ETCS with signals area is described in 3.3.2.1.3.

3.3.1.1.4 Train approaches in Level 0, SH – operation in possession

A train in L0, SH passing signal W1 displaying a proceed aspect will read the telegram in BG-1. As the train is operating in Level 0, SH, the ETCS Onboard will not try to establish communication or transition. The priority table contained within the CLTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 of Subset-026 [R1] and the driver will continue movements in SH.

Note: For trains in Level 0 the AWS/TPWS is already suppressed (RIS-0797-CCS 4.2.3 [R5] and RIS-0798-CCS, 4.2.4 [R6]).

If the train remains in SH mode, the approach to the ETCS with signals area is described in section 3.3.2.1.4.

On exiting SH, and if no other transition order has been read, the ETCS Onboard will remain in L0 as this is included in the priority table of trackside supported levels [ETrckSS-1444].

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The ETCS Onboard will enter SB and the driver will need to carry out SoM (see Topic G) Chapter 5 and 4 of Subset-026 [R1].

3.3.1.2 Degraded scenarios (Trackside or ETCS Onboard failures)

3.3.1.2.1 Train approaching in Level NTC (NID_NTC=20), SN, Pathway cannot be set – verbal authorisation

Same as ETCS without signals section 3.2.1.2.1 except with LTO configured as CLTO within BG-1, and priority table for TZ prior to ETCS with signals area. The operation of override leads to the train transitioning to Level 2 and SR upon entry to the TZ. [ETrckSS-1445] & [ETrckSS-1446]

Once the train is in communication with the RBC, the entry into an ETCS with signals area is described in 3.3.2.2.3.

3.3.1.2.2 Train approaching in Level NTC (NID_NTC=21), SN, Pathway cannot be set – verbal authorisation

This scenario describes the events where a Pathway cannot be set (normal or degraded), preventing the signal from clearing. The signaller will need to secure the wheeled path in accordance with the rule book.

When signal W1 is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The Driver will need to contact the signaller and request authority to proceed.

The driver operates the TPWS temporary isolation switch GERT8000-S5 [R17].

When the train passes over BG-1 the ETCS Onboard reads the CLTO which includes Level NTC (NID_NTC=21) and the ETCS Onboard will remain in Level NTC (NID_NTC=21). [ETrckSS-1445] & [ETrckSS-1446]

Once the train has entered the TZ the approach to the ETCS with signals area is described in 3.3.2.1.2.

3.3.1.2.3 Train approaching in L0, UN, Pathway cannot be set – verbal authorisation

When signal W1 is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The Driver will need to contact the signaller and request authority to proceed.

Note: For trains in Level 0 the AWS/TPWS is already suppressed (RIS-0797-CCS 4.2.3 [R5] and RIS-0798-CCS, 4.2.4 [R6]).

When the Train passes over BG-1 the ETCS Onboard reads the CLTO, which includes L0, and the ETCS Onboard will remain in L0, UN. [ETrckSS-1445] & [ETrckSS-1446]

Note: As the CLTO does not force the transition for trains operating in L0, Operational rules are required to manage movements within the TZ and ETCS with signals area.

Once the train has entered the TZ the approach to the ETCS with signals area is described in 3.3.2.1.3.

3.3.1.2.4 Train approaching in Level NTC (NID_NTC=20), SN, Degraded Pathway can be set, PoSA available to authorise movement, OS mode

Same as ETCS without signals section 3.2.1.2.2 except with LTO configured as CLTO within BG-1, and priority table for TZ prior to ETCS with signals area. [ETrckSS-1445] & [ETrckSS-1444]

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Once the train is in communication with the RBC, the transition to L2/L3 for entry into an ETCS without signals area is described in 3.3.2.1.1.

3.3.1.2.5 Train approaching in Level NTC (NID_NTC=21), SN, Degraded Pathway can be set, PoSA available to authorise movement

This scenario is only applicable if the border signal is capable of displaying a PoSA.

Due to Degraded working in the TZ and/or the ETCS area the signaller will need to set an ETCS Degraded or PoSA type Pathway (in accordance with Topic X). Once the Pathway is set the PoSA will clear (in accordance with the controls in Topic U).

When the train passes BG-1, the ETCS Onboard will read the telegram containing the CLTO and remain in Level NTC (NID_NTC=21). [ETrckSS-1444] & [ETrckSS-1445]

Once the train has entered the TZ the approach to the ETCS with signals area is described in 3.3.2.1.2.

3.3.1.2.6 Train approaching in L0, UN, Degraded Pathway can be set, PoSA available to authorise movement

This scenario is same as above section 3.3.1.2.5, but the train will remain in L0, UN after passing BG-1.

Note: As the CLTO does not force the transition for trains operating in L0, Operational rules are required to manage movements within the TZ and ETCS with signals area.

Once the train has entered the TZ the approach to the ETCS with signals area is described in 3.3.2.1.3.

3.3.1.2.7 Train approaching in Level NTC (NID_NTC=20), SN, Degraded Pathway can be set, verbal authorisation

Due to degraded working within the TZ and/or the ETCS area the signaller may flag one or more sections as obstructed or set an ETCS Degraded Pathway (See Topic U). The signaller may need to inform the driver about the degraded section/s and provide any additional instructions for these sections/s.

When signal W1 is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The Driver will need to contact the signaller and request authority to proceed (see Topic S)

The signaller will need to set an ETCS Degraded type Pathway (in accordance with topic X).

The driver selects 'Override' on the ETCS DMI before proceeding and operates the TPWS temporary isolation switch (GERT8000-S5 [R17]).

When the Train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This contains a CLTO resulting in a transition to L2 and since override is active the mode changes to SR. [ETrckSS-1445] [ETrckSS-1446] and Chapter 5 [R1]

Once the train is in communication with the RBC, the transition to L2/L3 for entry into an ETCS without signals area is described in 3.3.2.2.3.

3.3.1.2.8 Train approaching in Level NTC (NID_NTC=21), SN, Degraded Pathway can be set, verbal authorisation

Same as above section 3.3.1.2.7 except that no 'Override' is required and the train will remain in Level NTC (NID_NTC=21).

Once the train has entered the TZ the approach to the ETCS with signals area is described in 3.3.2.1.2.

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3.3.1.2.9 Train approaching in L0, UN Degraded Pathway can be set, verbal authorisation

Same as section 3.3.1.2.8, except that when the Train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This contains a CLTO, and the train will remain in L0. [ETrckSS-1445] [ETrckSS-1446] and Chapter 5 of Subset-026 [R1]

Note: For trains in Level 0 the AWS/TPWS is already suppressed (RIS-0797-CCS 4.2.3 [R5] and RIS-0798-CCS, 4.2.4 [R6]).

Once the train has entered the TZ the approach to the ETCS with signals area is described in 3.3.2.1.3.

3.3.1.2.10 Train approaching in Level NTC (NID_NTC=20), SN, LEU failed – default telegram

Same as ETCS without signals section 3.2.1.2.4 except with the LTO configured as a CLTO within BG-1, and the priority table is that for a TZ prior to ETCS with signals area. [ETrckSS-1445] & [ETrckSS-1446]

Following SoM, the transition to L2/L3 for entry into an ETCS with signals area is described in 3.3.2.2.2.

3.3.1.2.11 Train approaching in Level NTC (NID_NTC=21), SN, LEU failed – default telegram

When the Train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This contains a CLTO, and the train will remain in Level NTC (NID_NTC=21). [ETrckSS-1443] [ETrckSS-1445] [ETrckSS-1446] and Chapter 5 of Subset-026 [R1]

Once the train has entered the TZ, the approach to the ETCS with signals area is described in 3.3.2.1.2.

3.3.1.2.12 Train approaching in L0, UN, LEU failed – default telegram

When the Train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This contains a CLTO, and the train will remain in L0. [ETrckSS-1443] [ETrckSS-1445] [ETrckSS-1446] and Chapter 5 [R1]

Note: As the CLTO does not force the transition for trains operating in L0, Operational rules are required to manage movements within the TZ and the ETCS with signals area.

Once the train has entered the TZ, the approach to the ETCS with signals area is described in 3.3.2.1.3.

3.3.1.3 Abnormal scenarios (Operationally related issues)

3.3.1.3.1 SPAD with train approaching in Level NTC (NID_NTC=20), SN

Same as ETCS without signals section 3.2.1.3.1 except with the LTO configured as a CLTO within BG-1, and the priority table is that for a TZ prior to ETCS with signals area. [ETrckSS-1445] & [ETrckSS-1446]

Following SoM, the transition to L2/L3 for entry into an ETCS with signals area is described in 3.3.2.2.2.

3.3.1.3.2 SPAD with train approaching in Level NTC (NID_NTC=21), SN

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Same as ETCS without signals section 3.2.1.3.1 except with LTO configured as CLTO within BG-1.

When the train passes BG-1, the BG message will have an CLTO which includes Level NTC (NID_NTC=21) in the priority table. [ETrckSS-1445] [ETrckSS-1446] & [ETrckSS-1443].

The ETCS Onboard will remain in Level NTC (NID_NTC=21). Operational Rules and procedures will be applied to recover from the situation including the TPWS reaction.

Once the train has entered the TZ, the approach to the ETCS with signals area is described in 3.3.2.1.2.

3.3.1.3.3 SPAD with train approaching in L0, UN

Same as ETCS without signals section 3.2.1.3.1 except with LTO configured as CLTO within BG-1.

The ETCS Onboard will remain in L0, UN as the CLTO contains L0 in the priority table [ETrckSS-1446], [ETrckSS-1445].

Note: As the CLTO does not force the transition for trains operating in L0, Operational rules are required to manage movements within the TZ and ETCS with signals area.

Once the train has entered the TZ, the approach to the ETCS with signals area is described in 3.3.2.1.3.

3.3.1.3.4 SPAD with train approaching in Level NTC (NID_NTC =20), SH

Same as ETCS without signals section 3.2.1.3.2 except with the LTO configured as a CLTO within BG-1.

When the train passes BG-1, the BG message will have an CLTO with L2 as the highest priority and an order to establish communication with the ETCS Trackside. [ETrckSS-817] [ETrckSS-1446] & [ETrckSS-1445].

Trains in Level NTC (NID_NTC=20), SH, that were intended to be routed onto the ETCS line, may be instructed to exit SH and carry out SoM (see Topic G) to continue in L2.

Following SoM, the transition to L2/L3 for entry into an ETCS with signals area is described in 3.3.2.2.2.

Where trains are to continue in SH, the approach to the ETCS with signals area is described in 3.3.2.3.1.

3.3.1.3.5 SPAD with train approaching in Level NTC (NID_NTC =21), SH

Same as ETCS without signals section 3.2.1.3.2 except with LTO configured as CLTO within BG-1

Trains in Level NTC (NID_NTC=21), SH, that were intended to be routed onto the ETCS line, may be instructed to exit SH and carry out SoM (see Topic G) to continue in Level NTC (NID_NTC=21).

On exiting SH, the approach to the ETCS with signals area is described in 3.3.2.1.2.

Where trains are to continue in SH, the approach to the ETCS with signals area is described in 3.3.2.3.2.

3.3.1.3.6 SPAD with train approaching in Level 0, SH

Same as ETCS without signals section 3.2.1.3.11 except with the LTO configured as a CLTO within BG-1.

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When the train passes BG-1, the BG message will have an CLTO with L2 as the highest priority and an order to establish communication with the ETCS Trackside. [ETrckSS-1443] [ETrckSS-817] [ETrckSS-1446] & [ETrckSS-1445]

As the train is operating in Level 0, SH, the ETCS Onboard will not try to establish communication or transition to Level 2. The priority table contained within the CLTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 of Subset-026 [R1]). The possibilities of TZ exit conditions can be L0, UN on exit of SH mode (see 3.3.2.1.3), L0, SH as it is (see 3.3.2.1.4) or NID_NTC=21, SH as continuing in SH (see 3.3.2.3.2)

3.3.1.3.7 SPAD with train approaching not fitted with ETCS

Same as L2 without signals, section 3.2.1.3.3.

Once the train has entered the TZ, the approach to the ETCS with signals area is described in 3.3.2.3.3.

3.3.1.3.8 Signal cleared with train approaching in Level NTC (NID_NTC=20), SH

Same as ETCS without signals section 3.2.1.3.4 except with the LTO configured as a CLTO within BG-1, and the priority table is that for a TZ prior to ETCS with signals area. [ETrckSS-1445] & [ETrckSS-1446]

On exiting SH, and once the train is in communication with the RBC, the transition to L2/L3 for entry into an ETCS without signals area is described in 3.3.2.1.1.

Where trains are to continue in SH, the approach to the ETCS with signals area is described in 3.3.2.3.1.

3.3.1.3.9 Signal cleared with train approaching in Level NTC (NID_NTC=21), SH

Same as ETCS without signals section 3.2.1.3.4 except with the LTO configured as a CLTO within BG-1, and the priority table is that for a TZ prior to ETCS with signals area. [ETrckSS-1445] & [ETrckSS-1446]

When the driver exits SH the train will remain in Level NTC (NID_NTC=21). On exiting SH, the approach to the ETCS with signals area is described in 3.3.2.1.2.

Where trains are to continue in SH, the approach to the ETCS with signals area is described in 3.3.2.3.2.

3.3.1.3.10 Signal cleared with approaching train not fitted with ETCS

With signal W1 showing a proceed aspect, trains not fitted with ETCS will be unaffected by the transition.

Once the train has entered the TZ, the approach to the ETCS with signals area is described in 3.3.2.3.3.

3.3.2 System States and User Information (Entry to ETCS with signals area from TZ)

The following scenarios apply at the end of the TZ and the entrance to the ETCS with signals areas. In most cases they are preceded by one of the transitions/scenarios described in 3.3.1.

3.3.2.1 Normal Scenarios (intended approaches and transitions)

3.3.2.1.1 Train approaches in L1 with communication

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Same as ETCS without signals section 3.2.2.1.1 except with the LTO configured as a CLTO within BG-2, and the priority table is that for an ETCS with signals area. [ETrckSS-730] & [ETrckSS-1435]

3.3.2.1.2 Train approaches in Level NTC (NID_NTC=21)

When the ETCS Onboard reads the CLTO within BG-2 which contains NID_NTC=21 within the table of priorities, the train will remain in Level NTC (NID_NTC=21) and continue into the ETCS with signals area if the forward Pathway has been set and proved (in accordance with Topic X and U). [ETrckSS-730] [ETrckSS-1435]

3.3.2.1.3 Train approaches in L0, UN

When the ETCS Onboard reads the CLTO within BG-2 which contains L0 within the table of priorities, the train will remain in L0 and continue into the ETCS with signals area if the forward Pathway has been set and proved (in accordance with Topic X and U). [ETrckSS-730] [ETrckSS-1435]

Note: As the CLTO does not force the transition for trains operating in L0, Operational rules are required to manage movements within the TZ and ETCS with signals area.

Note: For trains in Level 0 the AWS/TPWS is already suppressed (RIS-0797-CCS 4.2.3 [R5] and RIS-0798-CCS, 4.2.4 [R6]).

3.3.2.1.4 Train approaches in Level 0, SH – operation in possession

The train continues into the L2 area, when passing BG-2 the ETCS Onboard will receive the CLTO. [ETrckSS-730] [ETrckSS-1435] As the train is in SH, the priority table within the CLTO is stored but not processed (See Chapter 4 [R1]).

On exiting SH, and if no other transition order has been read, the ETCS Onboard will remain in L0.

3.3.2.2 Degraded scenarios (Trackside or ETCS Onboard failures)

3.3.2.2.1 Transition to Level 1 but no communication session can be established

Same as ETCS without signals section 3.2.2.2.1 except with the LTO configured as a CLTO within BG-2, and the priority table is that for an ETCS with signals area. [ETrckSS-730] & [ETrckSS-1435]

3.3.2.2.2 SoM train in L2, SB

Same as ETCS without signals section 3.2.2.2.2 except with the LTO configured as a CLTO within BG-2, and the priority table is that for an ETCS with signals area. [ETrckSS-730] & [ETrckSS-1435]

3.3.2.2.3 Train approaches in Level 2, SR

Same as ETCS without signals section 3.2.2.2.3 except with the LTO configured as a CLTO within BG-2, and the priority table is that for an ETCS with signals area. [ETrckSS-730] & [ETrckSS-1435]

3.3.2.3 Abnormal scenarios (Operationally related issues)

3.3.2.3.1 Train approaching in Level NTC (NID_NTC=20), SH

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If the driver exits SH prior to passing BG-2 trains in Level NTC (NID_NTC=20) will begin transition to L1 see 3.3.1.1.1 & 3.3.2.1.13.3.1.1.1. and will transition to L2 if pass the BG-2.

If the train passes over BG-2 without exiting SH, the ETCS Onboard will read the CLTO which contains NID_NTC=20 within the priority table. [ETrckSS-730] [ETrckSS-1435] On exiting SH the train will remain in Level NTC (NID_NTC=20).

3.3.2.3.2 Train approaching in Level NTC (NID_NTC=21), SH

If the driver exits SH prior to passing BG-2 trains in Level NTC (NID_NTC=21) will remain in Level NTC (NID_NTC=21) see 3.3.2.1.2.

When the train passes over BG-2, the ETCS Onboard will read the CLTO which contains NID_NTC=21 within the priority table. [ETrckSS-730] [ETrckSS-1435] & On exiting SH the train will remain in Level NTC (NID_NTC=21) see 3.3.2.1.2.

3.3.2.3.3 Approaching train not fitted with ETCS

An unfitted train will continue its journey onto the running line and be driven in accordance with the aspects displayed by the lineside signalling system.

3.3.3 Impact on other topics

None

3.3.4 Design Guidance

3.3.4.1 Entry to TZ

The arrangements for entry to the TZ described in 3.2.4.1 are largely unaffected.

To allow Level NTC (NID_NTC=21) operation, the BG at the boundaries into and out of the TZ should contain CLTO on approach to a with signals area, and the priority table needs to include L2 in case the train is tripped before reaching the L2 transition order point.

Routing information is to be provided at the entry signal in accordance with conventional signalling rules.

The default telegram(s) sent by the BG corresponds to no proceed aspect being displayed [ETrckSS-1443] and includes Session Establishment [ETrckSS-727], National Values and a Conditional Level Transition Order with priority table of Level 3 (where required), Level 2, Level NTC (NID_NTC=21) and Level 0 [ETrckSS-730] [ETrckSS-1445] [ETrckSS-1446].

When a main proceed aspect is displayed the telegrams sent by BG-1 contain Session Establishment [ETrckSS-727], National Values a Conditional Level Transition Order with priority table of Level 1, Level 3 (where required), Level 2, Level NTC (NID_NTC=21) and Level 0 [ETrckSS-730] [ETrckSS-1444] [ETrckSS-1445] and a Level 1 MA with associated track description.

The following table summarises the configuration of the border balise group.

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Signal state	BBG contents
Signal at danger	Session Establishment (ETrckSS-727)
	CLTO (ETrckSS-1445) (ETrckSS-730)
	L3, L2, NID_NTC=21, L0 (ETrckSS-1446)
	National Values (ETrckSS-223)
	Default Telegram (ETrckSS-1443)
Signal showing proceed (not shunting)	Session Establishment (ETrckSS-727)
	CLTO (ETrckSS-1445) (ETrckSS-730)
	L1, L3, L2, NID_NTC=21, L0 (ETrckSS-1444)
	National Values (ETrckSS-223)

3.3.4.2 TZ to ETCS with signals area

The location of the L2 transition (BG-2) should be at least 5 seconds at line speed from the L1 transition to allow for driver acknowledgement of the transition.

If the train establishes a communication session the ETCS Trackside and reports it is in Level NTC (NID_NTC=21) the Trackside requests that the session is terminated [ETrckSS-958].

Once an Onboard not in Level NTC (NID_NTC=21) connects, the Trackside responds by sending a Level Transition Order with priority table of Level 3 (where required), Level 2, Level NTC (NID_NTC=21), Level NTC (NID_NTC=20) and Level 0 [ETrckSS-1435] accompanied by a Level 2 MA message [ETrckSS-1240]. The Trackside design takes account of the fact the Onboard already holds an MA (issued by BG-1) when configuring the MA sent over radio.

The BG at the entry to the ETCS with signals area is configured to send National Values and a Conditional Level Transition Order with priority table of Level 3 (where required), Level 2, Level NTC (NID_NTC=21), Level NTC (NID_NTC=20) and Level 0 [ETrckSS-730] [ETrckSS-1435].

The following table summarises the behaviour of the Trackside (RBC) and configuration of the border balise group.

RBC Behaviour	BBG contents
Train in L1, send LTO + MA (ETrckSS-1240)	CLTO (ETrckSS-730)
L3, L2, NID_NTC=21, NID_NTC=20, L0 (ETrckSS-1435)	L3, L2, NID_NTC=21, NID_NTC=20, L0 (ETrckSS-1435)
Train in NID_NTC=21, terminate session (ETrckSS-958)	National Values (ETrckSS-223)

3.4 Hybrid L3, without signals

3.4.1 System States and User Information

Same as Level 2, without signals (see section 3.2), reading references to Level 2 as Hybrid Level 3.

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3.4.2 Impact on other topics

None

3.4.3 Design Guidance

For entry to an HL3 with without signals line, Trackside Train Detection (TTD) should be provided, covering at least the area of the L3 line within which a train might operate with no communications with the RBC. The TTD provided needs to cater for situations where:

- the transition to L3 is unsuccessful and the train remains in Level 1 under the supervision of the Level 1 MA;
- the train departs the depot in Level NTC, SH; or
- unfitted trains exit the depot.

The application of TTD in the area around the entry point must not unacceptably impact normal L3 operational performance through the area.

Routing information is to be provided at the entry signal in accordance with conventional signalling rules as trains only transition to Level 1 on passing the entry signal, i.e. the move up to and past the entry signal is made in Level NTC on the basis of conventional signalling information.

3.5 Hybrid Level 3 with signals

3.5.1 System States and User Information

Same as Level 2, without signals (see section 3.3), reading references to Level 2 as Hybrid Level 3.

3.5.2 Impact on other topics

None

3.5.3 Design Guidance

Routing information is to be provided at the entry signal in accordance with conventional signalling rules as trains only transition to Level 1 on passing the entry signal, i.e. the move up to and past the entry signal is made in Level NTC on the basis of conventional signalling information.

3.6 ATO

The arrangements for entering ATO from an NTC area are described in ATO Reference Design Topic QQ.

3.7 Moving Block

To be developed.

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4 Variant N1-2 – L1 Launch allowing Level NTC shunting

4.1 Specific User Requirements

The entry to the ETCS area will be controlled by a lineside signal.

Trains required to transition to ETCS will start the transition process on passing the entry signal. [ESR-658] In most cases, an existing signal will be retained. [ESR-3]

The arrangement will not require the transition to start before the train passes the signal.

The arrangement will be restricted to low-speed moves or trains leaving depots, yards and other locations where the speed is low.

It will be possible for shunting activities to take place past the signal without requiring a transition to ETCS. [ESR-50]

It will be configured to deliver the operational needs for shunting movements. The solution will need to demonstrate that it is in accordance to Common Safety Method for Risk Evaluation and Assessment (CSM-RA). Limits of the shunting area must be indicated to the driver or person in charge. [ESR-53]

Transitions will be initiated if the driver has indicated that they are authorised to operate in ETCS. [ESR-46]

For an ETCS with signals area, where a driver has indicated that they are not authorised to operate in ETCS the train will continue its journey with the class B protection system. [ESR-101] [ESR-66]

Trains entering the ETCS area in Level 0 will be protected technically or through operational procedures.

The ETCS must manage the applicable train protection systems at the transition. [ESR-36]

The design must consider degraded and abnormal situations supporting the recovery from a failure occurring during the transition process. [ESR-62]

4.2 Level 2, without signals

The system states and user information in Variant N1-1 (see 3.2) mostly apply in an area where L1 Launch without shunting activities is used. The differences are explained below and detailed in 4.2.1.

As Level 1 launch involves two stages of transition, the first being from a non ETCS Level/mode on approach to the transition zone and the second being to leave the transition zone into the ETCS L2/L3 area. Each stage can be approached and occur in a normal/expected level/mode and sequence. The analysis and requirements need to also address degraded situations (where the normal transitions cannot take place) and abnormal situations (where the driver/train are in an unexpected level/mode).

Drivers need to be trained in what to expect during a level transition, how to react to unexpected sequences and how to operate in degraded scenarios. [EOPSS-857]

Table 4 summarises the first stage of the transition down the left hand side (entry to TZ), and the relevant section of this topic, and the second stage (approaching L2/L3 with signals area), with the relevant section of this topic, across the top. For each there are normal (highlighted green), degraded (highlighted yellow) and abnormal (highlighted orange) options listed. The table then shows which stage 2 transition(s)

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may follow each of the stage 1 transitions. The provisions for stage 2 are the same as those described for Topic N1-1 and hence are not repeated in this section.

In some L1 launch areas, operational shunting moves within the TZ may be required. These shunting moves can be to a head shunt, and back, to the TZ area and back, or used to carry out movements on diverging non ETCS lines from the TZ. Shunting movements in Level NTC are unaffected by the first stage of the transition and should not experience the second stage as these movements are not intended to enter the ETCS area. [EOPSS-950]

Additional tables in Appendix A summarise the potential levels and modes on approach to the border, the priority tables within the BG, and the interaction between the Trackside and Onboard.

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Table 4 - L1 Launch to ETCS without signals (with shunting) – options matrix

Entry To ETCS without Signals								
Topic Section		3.2.2.1.1	3.2.2.1.2	3.2.2.2.1	3.2.2.2.2	3.2.2.2.3	3.2.2.3.1	3.2.2.3.2
	Level, mode, scenario	L1 with comms	L0, (SH)	L1 no comms	L2, (SB)	L2, (SR)	NID_NTC=20, (SH), NID_NTC=21 (SH)	Train not fitted with ETCS
Entry to Transition Zone (ETCS no signals with shunting)	4.2.1.1.1 NID_NTC=20 (SN) (signal off)	→ ↑		→ ↑				
	4.2.1.1.2 L0, (UN) (signal off)	→ ↑		→ ↑				
	4.2.1.1.3 L0, (SH) (signal off)		→ ↑					
	4.2.1.1.4 L-NTC SH or SN (routed to Headshunt)	NO ENTRY TO ETCS- Train remains in L-NTC						
	4.2.1.1.5 L-NTC SH or SN (shunting within TZ)	NO ENTRY TO ETCS- Train remains in L-NTC						
	4.2.1.1.6 L-NTC SH or SN (shunting to another line via TZ)	NO ENTRY TO ETCS- Train remains in L-NTC						
	4.2.1.2.1 NID_NTC=20 (SN) and Level 0 (UN) (Pathway cannot be set – verbal authorisation)					→ ↑		
	4.2.1.2.2 NID_NTC=20 (SN) and Level 0 (UN) (Degraded Pathway set, PoSA authorisation)	→ ↑		→ ↑				
	4.2.1.2.3 NID_NTC=20 (SN) and Level 0 (UN) (Degraded Pathway set, verbal authorisation)					→ ↑		
	4.2.1.2.4 NID_NTC=20 (SN) and Level 0 (UN) (LEU failed)				→ ↑			
	4.2.1.2.5 NID_NTC=21 or NID_NTC=20, SN Pathway cannot be set (intended shunt) Verbal authorisation					→ ↑		
	4.2.1.2.6 NID_NTC=21 or NID_NTC=20, SH Pathway cannot be set (intended shunt) Verbal authorisation				→ ↑		→ ↑ continuing in SH	
	4.2.1.2.7 NID_NTC=21 or NID_NTC=20, SN Shunt Pathway cannot be set (intended shunt) PoSA authorisation	→ ↑		→ ↑				
	4.2.1.2.8 NID_NTC=21 or NID_NTC=20, SH Shunt Pathway cannot be set (intended shunt) PoSA authorisation	→ ↑		→ ↑			→ ↑ continuing in SH	
	4.2.1.2.9 NID_NTC=21 or NID_NTC=20, SN Degraded Pathway set (intended shunt) Verbal authorisation					→ ↑		
	4.2.1.2.10 NID_NTC=21 or NID_NTC=20, SH Degraded Pathway set (intended shunt) Verbal authorisation				→ ↑		→ ↑ continuing in SH	
	4.2.1.2.11 NID_NTC=21 or NID_NTC=20, SN LEU failed (intended shunting move in TZ)				→ ↑			
	4.2.1.2.12 NID_NTC=21 or NID_NTC=20, SH LEU failed (intended shunting move in TZ)				→ ↑		→ ↑ continuing in SH	

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	Topic Section		3.2.2.1.1	3.2.2.1.2	3.2.2.2.1	3.2.2.2.2	3.2.2.2.3	3.2.2.3.1	3.2.2.3.2
		Level, mode, scenario	L1 with comms	L0, (SH)	L1 no comms	L2, (SB)	L2, (SR)	NID_NTC=20, (SH), NID_NTC=21 (SH)	Train not fitted with ETCS
Entry to Transition Zone (ETCS no signals with shunting)	4.2.1.3.1	NID_NTC=20 (SN), NID_NTC=21 (SN), L0 (UN) (SPAD)				→ ↑			
	4.2.1.3.2	NID_NTC=20 (SH), NID_NTC=21 (SH) (SPAD)				→ ↑ NID_NTC=20 only on exit of SH			
	4.2.1.3.3	Train not fitted with ETCS (SPAD)							→ ↑
	4.2.1.3.4	NID_NTC=20 (SH), NID_NTC=21 (SH) (signal off)	→ ↑ NID_NTC=20 only on exit of SH					→ ↑ continuing in SH	
	4.2.1.3.5	NID_NTC=21 (SN) (signal off)	→ ↑ Driver responsibility to stop		→ ↑ Driver responsibility to stop				
	4.2.1.3.6	Train not fitted with ETCS (signal off)							→ ↑

4.2.1 System States and User Information - (Entry to Transition Zone- with shunting)

4.2.1.1 Normal Scenarios (intended approaches and transitions)

4.2.1.1.1 Train approaches in Level NTC (NID_NTC=20), SN (intended transition to ETCS)

No different to Variant N1-1 See 3.2.1.1.1

4.2.1.1.2 Train approaches in Level 0, UN (intended transition to ETCS)

No different to Variant N1-1 See 3.2.1.1.2

4.2.1.1.3 Train approaches in Level 0, SH

No different to Variant N1-1 See 3.2.1.1.3

4.2.1.1.4 Train is in Level NTC (NID_NTC=20) or (NID_NTC=21), SH or SN and is routed to a Headshunt

The initial state is that the train is required to shunt out into the Headshunt and back. The train will be standing at, or approaching, the boundary, which is marked by a lineside authority (usually a signal). Since the train is in Level NTC (NID_NTC=20) the AWS/TPWS is unsuppressed (RIS-0797-CCS, 4.2.4 [R5] and RIS-0798-CCS, 4.2.5 [R6]).

Note: The train could be starting in Level NTC (NID_NTC=21) instead of (NID_NTC=20). If this were the case, the DMI would indicate that the train was in TPWS Fixed. Other than this, the scenario is the same.

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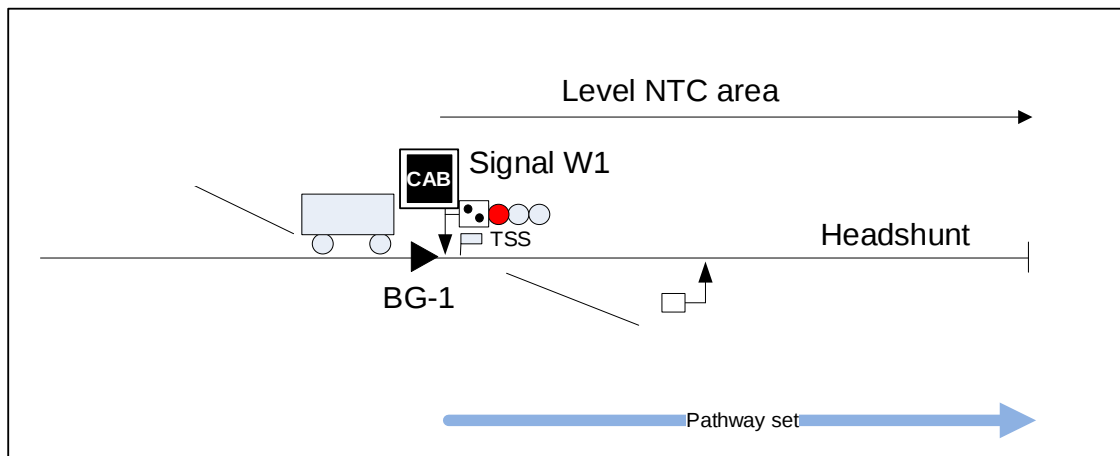


Figure 10 - Train routed to Headshunt



Figure 11 - Train in SH at boundary

The signaller will set a Pathway for the train to the headshunt (at some locations, the wheeled path may be set by the person in charge, using a ground frame or other item of trackside equipment). No need has been identified for the signaller to have extra information about the train in addition to that provided by current lineside signalling.

Once the Pathway is set, signal W1 will display a proceed aspect and the appropriate route indication. [ETrckSS-282]

The train remains in Level NTC SH or SN.

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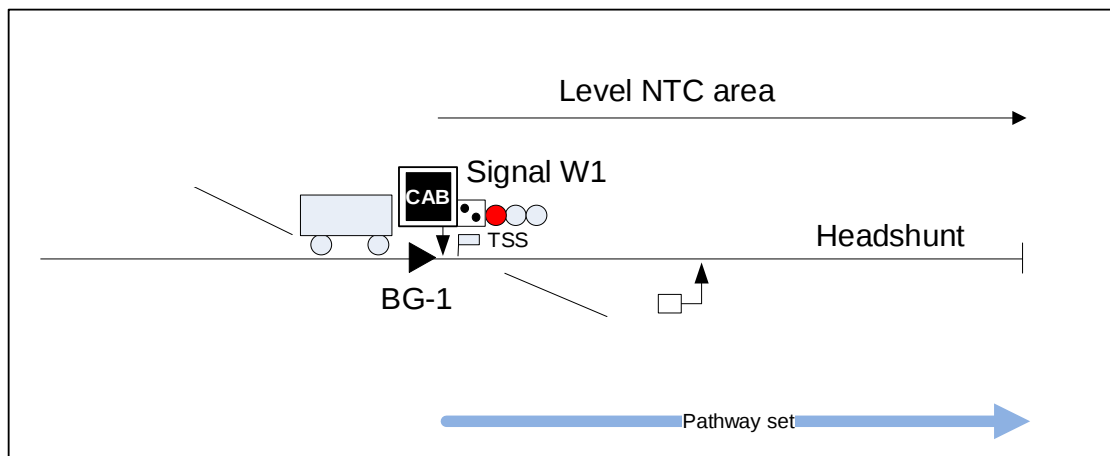


Figure 12 - Pathway set and subsidiary aspect displayed

As the train passes the boundary, the switchable balise (BG-1) provided for transition to L1 for other moves will send a CLTO that enables the train to remain in Level NTC. [ETrckSS-1441] [ETrckSS-Nxx1]

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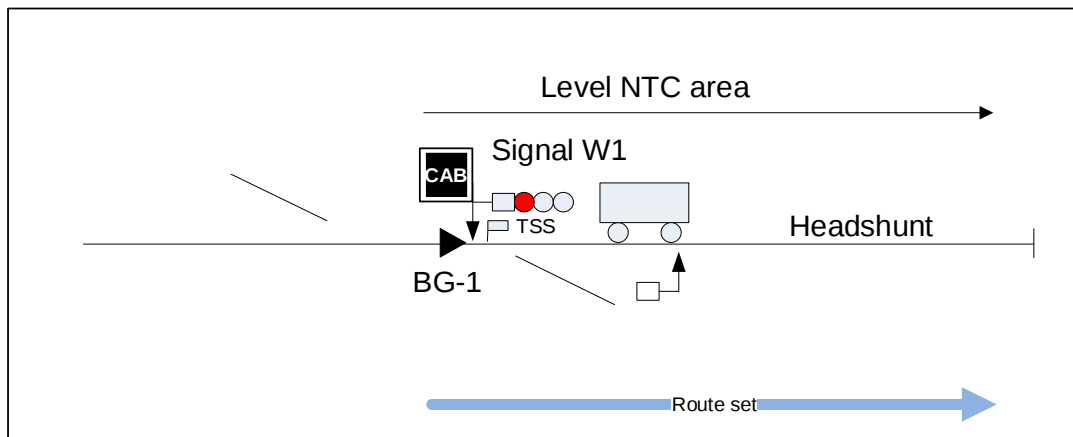


Figure 13 - Train enters headshunt remaining in Level NTC (NID_NTC=20) SH

Once the shunt move is complete, the train may be propelled back, or the driver may change ends and open the cab in Level NTC SH or SN. [EOPSS-1557]

Note: If Passive Shunting (PS) is permitted, the ETCS Onboard may retain SH during the cab change.

Authorisation of the move will be via lineside signal and / or instructions from the person in charge.

4.2.1.1.5 Train is in Level NTC either (NID_NTC=20) or (NID_NTC=21), SH or SN shunting within TZ

The initial state is that the train which is required to shunt out onto the running line and back is in Level NTC (NID_NTC=20), SH or SN. The train will be standing at, or approaching, the boundary, which is marked by a lineside signal. Since the train is in Level NTC (NID_NTC=20) the AWS/TPWS is unsuppressed (RIS-0797-CCS, 4.2.4 [R5] and RIS-0798-CCS, 4.2.5 [R6]).

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Note: The train could be starting in Level NTC (NID_NTC=21) instead of (NID_NTC=20). If this were the case, the DMI would indicate that the train was in TPWS Fixed. Other than this, the scenario described is the same.



Figure 14 - Train in Level NTC (NID_NTC=20) SH at boundary

The signaller will set a pathway for the train onto the running line as far as the shunt limit. No need has been identified for the signaller to have extra information about the train in addition to that provided by current lineside signalling.

Once the pathway is set, signal W1 will display a proceed aspect (typically, a subsidiary signal) along with the appropriate route indication. [ETrckSS-282] The train remains in Level NTC SH or SN.

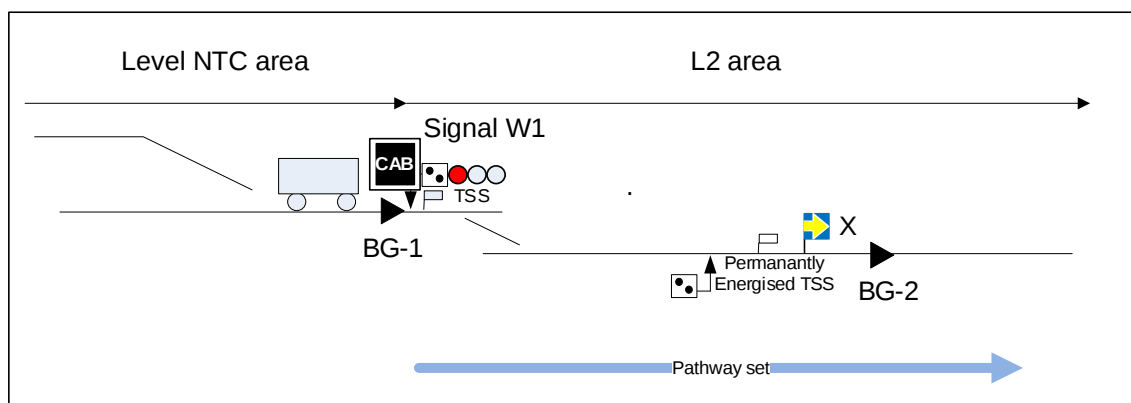


Figure 15 - Pathway set and subsidiary aspect displayed

As the train passes the boundary, the switchable balise group (BG-1) provided for transition to L1 for other moves will send a CLTO that enables the train to remain in Level NTC. The CLTO also includes L2 (as appropriate) in the priority table. [ETrckSS-1441] [ETrckSS-Nxx1]

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To protect against trains passing the signal at danger and entering the running line, it may be appropriate to provide TPWS TSS loop at the boundary (i.e. at signal W1).



Figure 16 - Train proceeds, remaining in Level NTC (NID_NTC=20) SH

The limit of the shunting move will be marked by location or other markers, as described in Topic AA and Topic P.

A TPWS TSS loop will be provided between the TZ and the ETCS without signals area, to restrict the movements of trains in Level NTC. [ETrckSS-1440]

BG-2 situated at the end of the TZ contains a LTO which will cause a train entering the ETCS without signals area to transition to L2. This will happen immediately for trains in Level NTC, SN or when the driver exits SH.

Once the shunt move is complete, then the train may be propelled back, or the driver may change ends and open the cab in Level NTC, SH or SN. Authorisation of the move will be via a lineside signal. [EOPSS-1557]

For each site the operational requirements for propelling movements will be described, this is so that the ETCS trackside can be configured appropriately. [EOPSS-1463].

4.2.1.1.6 Train is in Level NTC, SH or SN shunting to another line via TZ

This scenario applies at any location that has a shunt Pathway that enables a train to move to another site via the L1 Launch TZ.

The initial state is that the train which is required to exit is in Level NTC (NID_NTC=20), SH or SN. Since the train is in Level NTC (NID_NTC=20), the AWS/TPWS is unsuppressed (RIS-0797-CCS, 4.2.4 [R5] and RIS-0798-CCS, 4.2.5 [R6]). The train will be standing at, or approaching, the boundary, which is marked by a lineside signal.

Note: The train could be starting in Level NTC (NID_NTC=21) instead of (NID_NTC=20). If this were the case, the DMI would indicate that the train was in TPWS Fixed. Other than this, the scenario is the same.

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Figure 17 - Train in Level NTC (NID_NTC=20) SH at boundary

The signaller will set a Shunt Pathway for the train onto the running line as far as the other site. Where the running line is not provided with lineside signals, it may be necessary for a single Pathway to be set for the entire move. No need has been identified for the signaller to have extra information about the train in addition to that provided by current lineside signalling.

Once the Pathway is set, the lineside authority to proceed will be displayed (typically, a subsidiary signal) along with the appropriate route indication. [ETrckSS-282]
The train remains in Level NTC SH or SN.

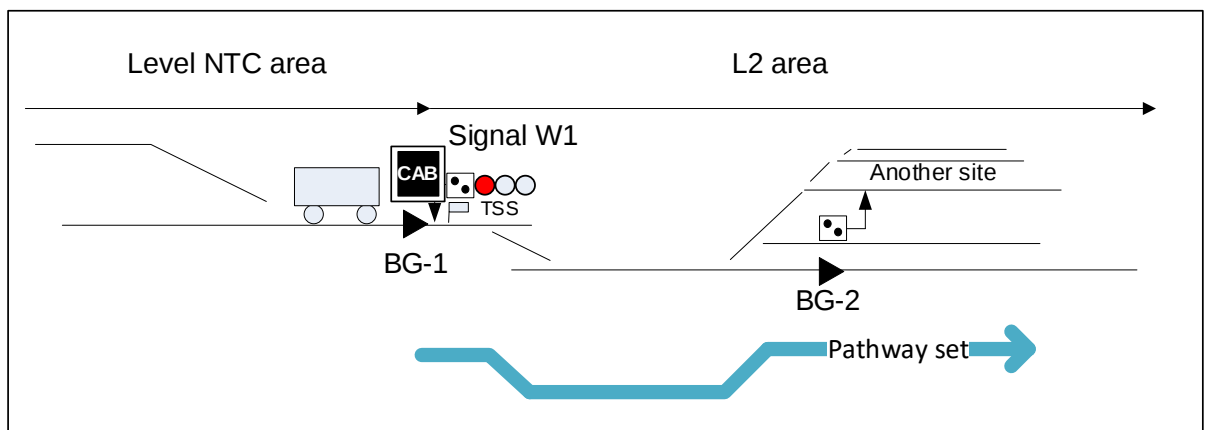


Figure 18 - Route set and subsidiary aspect displayed

As the train passes the boundary, the switchable balise (BG-1) provided for transition to L1 for other moves will send a CLTO order that enables the train to remain in Level NTC, and which includes L2 (as appropriate) in the priority table. [ETrckSS-1441]
[ETrckSS-Nxx1]

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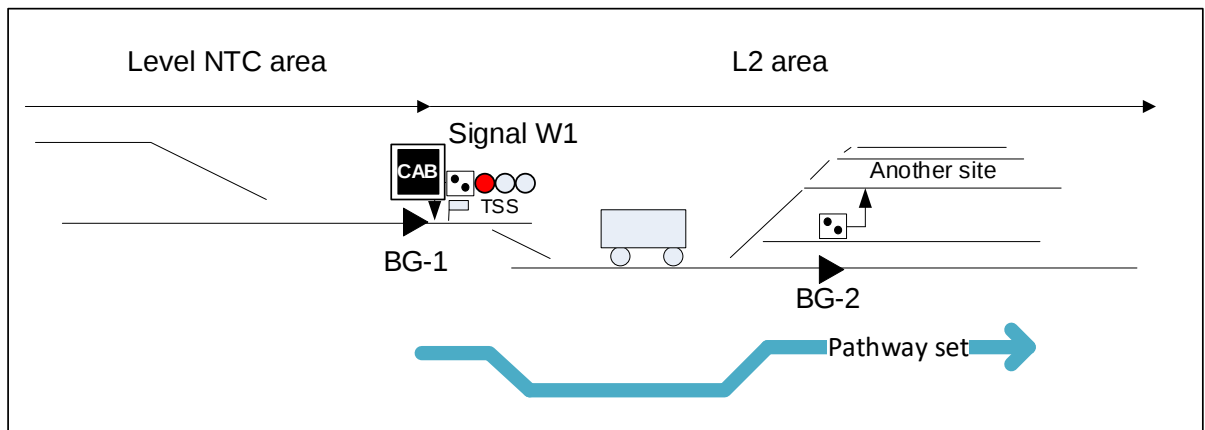


Figure 19 - Train proceeds, remaining in Level NTC (NID_NTC=20) SH

At the boundary of the other site, it may be necessary to provide a lineside signal or sign to control entry to the site or exit from it back onto the running line.

4.2.1.2 Degraded scenarios (Trackside or ETCS Onboard failures)

4.2.1.2.1 Train Approaching in Level NTC (NID_NTC=20), SN or L0, UN Pathway cannot be set (intended transition to ETCS) – verbal authorisation

No different to Variant N1-1 See 3.2.1.2.1

4.2.1.2.2 Train Approaching in Level NTC (NID_NTC=20), SN or L0, UN Degraded Pathway can be set (intended transition to ETCS), PoSA available, OS mode

No different to Variant N1-1 See 3.2.1.2.2

4.2.1.2.3 Train Approaching in Level NTC (NID_NTC=20), SN or L0, UN Degraded pathway can be set (intended transition to ETCS), verbal authorisation.

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No different to Variant N1-1 See 3.2.1.2.3

4.2.1.2.4 Train Approaching in Level NTC (NID_NTC=20), SN or L0, UN LEU failed (intended transition to ETCS) – default telegram

No different to Variant N1-1 See 3.2.1.2.4

4.2.1.2.5 Train Approaching in Level NTC (NID_NTC=21 or NID_NTC=20), SN Pathway cannot be set (intended shunting move in TZ) – verbal authorisation

This scenario describes the events where a Pathway cannot be set (normal or degraded), preventing the signal from clearing. The signaller will need to secure the wheeled path in accordance with the rule book.

Note: where a train which would have entered the TZ for the purposes of shunting needs to pass the border signal at danger due to a failure, then the train will transition to L2 and the ability of the driver to complete the shunting activity in L2 needs to be considered particularly if they are not authorised to operate in L2 normally.

When signal is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The driver will need to contact the signaller and request authority to proceed (see Topic S). A driver who is not authorised to operate the train in ETCS cannot proceed.

A driver authorised to operate in ETCS selects 'Override' on the ETCS DMI before proceeding and operates the TPWS temporary isolation switch (GERT8000-S5 [R17])

When the train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This contains an LTO resulting in a transition to L2 and since override is active the mode changes to SR. [ETrckSS-1443] [ETrckSS-1442] and Chapter 5 [R1]

The driver can continue with shunting movements within the TZ, in L2, SR (see 3.2.2.2.3).

The table of priorities will be updated to include Level NTC, and the transition initiated, when the driver carries out the return movement and passes the border of TZ (See Topic O)

4.2.1.2.6 Train Approaching in Level NTC (NID_NTC=20 or NID_NTC=21), SH Pathway cannot be set (intended shunting move in TZ) – verbal authorisation

This scenario describes the events where a Pathway cannot be set (normal or degraded), preventing the signal from clearing. The signaller will need to secure the wheeled path in accordance with the rule book.

When signal is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The Driver will need to contact the signaller and request authority to proceed.

The driver selects operates the TPWS temporary isolation switch (GERT8000-S5 [R17])

When the train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This contains an LTO to L2. [ETrckSS-1443] [ETrckSS-1442] and Chapter 5 [R1]

As the train is operating in Level NTC, SH, the ETCS Onboard will not try to establish communication or transition to L2. The priority table contained within the LTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 [R1]).

The driver can continue with shunting movements within the TZ, in Level NTC, SH (see 3.2.2.3.1).

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On exiting SH, and if no other transition order has been read, the ETCS Onboard will automatically transition to Level 2. The ETCS Onboard will enter SB and the driver will need to carry out Start of Mission (see Topic G) Chapter 5 and 4 of Subset-026 [R1 (see 3.2.2.2.2).

Since Level NTC (NID_NTC=21) is not contained in the priority table, a driver not authorised to operate in ETCS but who shunts into the TZ will not be able to select 'TPWS Fixed' to return.

The limit of the shunting move will be marked by location or other markers, as described in Topic AA and Topic P.

The table of priorities will be updated to include Level NTC, and the transition initiated, when the driver carries out the return movement and passes the transition border of TZ (See Topic O)

4.2.1.2.7 Train Approaching in Level NTC (NID_NTC=20 or NID_NTC=21), SN Degraded Pathway set (intended shunting move in TZ) – PoSA

As the telegram in BG-1 will be configured to include a Level Transition Order (LTO) for a degraded/PoSA pathway, it will cause the transition of the train to Level 1 (see 3.2.2.1.1 and 3.2.2.2.1 for transition with comms and without comms). This may be inappropriate for a shunting activity and local instructions may be required to advise the signaller regarding when to use the PoSA/degraded route.

4.2.1.2.8 Train Approaching in Level NTC (NID_NTC=20 or NID_NTC=21), SH Degraded Pathway set (intended shunting move in TZ) – PoSA

This scenario is only applicable if the border signal is capable of displaying a PoSA Due to Degraded working in the TZ and/or the ETCS area the Signaller will need to set an ETCS Degraded type pathway (in accordance with topic X). Once the Pathway is set the PoSA will clear (in accordance with the controls in Topic U).

With the signal showing a PoSA aspect, the telegram in BG-1 will be configured to include a Level Transition Order (LTO) and priority table of trackside supported levels for the transition zone, a Level 1 MA with an OS mode profile starting immediately and a session establishment command. [ETrckSS-1438] [ETrckSS-1439] As the train is operating in Level NTC, SH, the ETCS Onboard will not try to establish communication or transition. The priority table contained within the LTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 [R1]).

The driver can continue with shunting movements within the TZ, in Level NTC, SH (see 3.2.2.3.1).

On exiting SH, and if no other transition order has been read, the ETCS Onboard will automatically transition to Level 1 and establish a session.

The limit of the shunting move will be marked by location or other markers (W3), as described in Topic AA and Topic P.

4.2.1.2.9 Train Approaching in Level NTC (NID_NTC=20 or NID_NTC=21), SN Degraded Pathway set (intended shunting move in TZ) – Verbal Authorisation

Due to degraded working within the TZ and/or the ETCS area the signaller may flag one or more sections as obstructed, or set an ETCS Degraded Pathway (See Topic U). The signaller may need to inform the driver about the degraded section/s and provide any additional instructions for these section/s.

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When signal W1 is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The Driver will need to contact the signaller and request authority to proceed (see Topic S)

The Signaller will need to set an ETCS Degraded type pathway (in accordance with topic X).

The driver selects 'Override' on the ETCS DMI before proceeding and operates the TPWS temporary isolation switch (GERT8000-S5 [R17])

When the Train passes over BG-1, the ETCS Onboard receives the default telegram from the balise group. This contains an LTO resulting in a transition to L2 and since override is active the mode changes to SR. [ETrckSS-1443] [ETrckSS-1442] and Chapter 5 of Subset-026 [R1]

Note: where a train which would have entered the TZ for the purposes of shunting needs to pass the border signal at danger due to a failure, then the train will transition to L2 and the ability of the driver to complete the shunting activity in L2 needs to be considered particularly if they are not authorised to operate in L2 normally.

The driver can continue with shunting movements within the TZ, in L2, SR (see 3.2.2.2.3).

The table of priorities will be updated to include L-NTC, and the transition initiated, when the driver carries out the return movement and passes the transition border (See Topic O)

4.2.1.2.10 Train Approaching in Level NTC (NID_NTC=21 or NID_NTC=20), SH

Degraded Pathway set (intended shunting move in TZ) –Verbal Authorisation

Due to degraded working within the TZ and/or the ETCS area the signaller may flag one or more sections as obstructed, or set an ETCS Degraded Pathway (See Topic U). The signaller may need to inform the driver about the degraded section/s and provide any additional instructions for these section/s.

When signal W1 is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The Driver will need to contact the signaller and request authority to proceed (see Topic S)

The Signaller will need to set an ETCS Degraded type pathway (in accordance with topic X).

The driver selects 'Override' on the ETCS DMI before proceeding and operates the TPWS temporary isolation switch (GERT8000-S5 [R17])

When the Train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This contains an LTO to L2. [ETrckSS-1443] [ETrckSS-1442] and Chapter 5 [R1]

As the train is operating in Level NTC, SH, the ETCS Onboard will not try to establish communication or transition to L2. The priority table contained within the LTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 [R1]).

The driver can continue with shunting movements within the TZ, in Level NTC, SH (see 3.2.2.3.1).

On exiting SH, and if no other transition order has been read, the ETCS Onboard will automatically transition to Level 2. The ETCS Onboard will enter SB and the driver will need to carry out Start of Mission (see Topic G) Chapter 5 and 4 of Subset-026 [R1].

The limit of the shunting move will be marked by location or other markers (W3), as described in Topic AA and Topic P (see 3.2.2.2.2).

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The table of priorities will be updated to include Level NTC, and the transition initiated, when the driver carries out the return movement and passes the transition border (See Topic O)

4.2.1.2.11 Train approaching in Level NTC (NID_NTC=20 or NID_NTC=21), SN LEU failed (intended shunting move in TZ) – default telegram

If the Lineside encoder unit fails the balise group will be configured to send a default balise message. The message will have an LTO with L2 as the highest priority and an order to establish communication with the ETCS Trackside. [ETrckSS-1443] [ETrckSS-1442][ETrckSS-817] [ETrckSS-727]

When the train passes the balise group and transitions to L2, the ETCS Onboard will enter TR mode, as there is no Authority to move in L2 (See Chapter 5 [R1]. The DMI will display the system state message “No MA received at level transition” [R9]. This will indicate to the the driver that there is a fault with the balise group.

Operational Rules and procedures will be applied to recover from the situation. [EOPSS-178] The Driver will need to carry out SoM as part of post trip, see Topic G and Chapter 5 of Subset-026 [R1].

The driver can continue with shunting movements within the TZ, in L0, SH or, where the driver is competent and the trackside is configured for a Shunting Area (see Topic P) in L2, SH.

Note: The ability of the driver to complete the shunting activity in L2 needs to be considered particularly if they are not authorised to operate in L2 normally.

The table of priorities will be updated to include Level NTC, and the transition initiated, when the driver carries out the return movement and passes the transition border (See Topic O)

4.2.1.2.12 Train approaching in Level NTC (NID_NTC=20 or NID_NTC=21), SH LEU failed (intended shunting move in TZ) – default telegram

If the Lineside encoder unit fails the balise group will be configured to send a default balise message. The message will have an LTO with L2 as the highest priority and an order to establish communication with the ETCS Trackside. [ETrckSS-1443] [ETrckSS-1442][ETrckSS-817] [ETrckSS-727]

When the Train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This contains an LTO to L2. [ETrckSS-1443] [ETrckSS-1442] and Chapter 5 [R1]

As the train is operating in Level NTC, SH, the ETCS Onboard will not try to establish communication or transition to L2. The priority table contained within the LTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 [R1]).

The driver can continue with shunting movements within the TZ, in Level NTC, SH see 3.2.2.3.1).

On exiting SH, and if no other transition order has been read, the ETCS Onboard will automatically transition to Level 2. The ETCS Onboard will enter SB and the driver will need to carry out Start of Mission (see Topic G) Chapter 5 and 4 of Subset-026 [R1] (see 3.2.2.2.2).

The limit of the shunting move will be marked by location or other markers (W3), as described in Topic AA and Topic P.

The table of priorities will be updated to include Level NTC, and the transition initiated, when the driver carries out the return movement and passes the transition border (See Topic O)

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4.2.1.3 Abnormal scenarios (Operationally related issues)

4.2.1.3.1 SPAD with train approaching in Level NTC (NID_NTC=20 or NID_NTC=21), SN, or Level 0, UN

No different to Variant N1-1 See 3.2.1.3.1

4.2.1.3.2 SPAD with train approaching in Level NTC (NID_NTC =20 or NID_NTC=21), SH

No different to Variant N1-1 See 3.2.1.3.2

4.2.1.3.3 SPAD with train approaching not fitted with ETCS

No different to Variant N1-1 See 3.2.1.3.3

4.2.1.3.4 Signal cleared with train approaching in Level NTC (NID_NTC=20 or NID_NTC=21), SH

No different to Variant N1-1 See 3.2.1.3.4

4.2.1.3.5 Signal cleared with train approaching in Level NTC (NID_NTC=21), SN

No different to Variant N1-1 See 3.2.1.3.5

4.2.1.3.6 Signal cleared with train approaching not fitted with ETCS

No different to Variant N1-1 See 3.2.1.3.6

4.2.2 Impact on other topics

Topic O - Exiting ETCS (Transition from Level 2 or Level 3 to Level NTC or Level 0)

Topic P - Shunting

Topic AA - Consistent Provision of Lineside Signage

4.2.3 Design Guidance

The use of L1 launch should be subject to site specific risk assessment and should take into consideration all movements not under ETCS control such as propelling.

4.2.3.1 Entry to TZ

The lineside signal marks the boundary to the ETCS area. Normally, the existing signal will be retained unaltered.

The lineside signal should be provided with conventional protection arrangements (TPWS, trapping protection, etc.) to manage vehicles being propelled, or ones which are not fitted with ETCS Onboard. [ETrckSS-296]

Routing information is to be provided at the entry signal in accordance with conventional signalling rules.

The transmission of an MA by a balise group leads to the need to use the variable M_MCOUNT to detect that the message is consistent where the balise reader might have passed the first balise when the message is updated. [ETrckSS-817]

The length of an MA accompanying the L1 LTO should be sufficient to allow connection to the RBC to occur. It is acceptable for the MA to extend more than one block section, although this may add more complexity to the switchable BG.

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The BG at the border normally comprises one fixed balise and one switchable balise although extra balises may be required to accommodate the data to be transmitted.

The default telegram(s) sent by the BG corresponds to no proceed aspect being displayed [ETrckSS-1443] and includes Session Establishment [ETrckSS-727], National Values [ETrckSS-223] and a Level Transition Order with priority table of Level 3 (where required), Level 2 and Level 0 [ETrckSS-1439] [ETrckSS-1442].

When a main proceed aspect is displayed the telegrams sent by the BG contain Session Establishment [ETrckSS-727], National Values [ETrckSS-223], a Level Transition Order with priority table of Level 1, Level 3 (where required), Level 2 and Level 0 [ETrckSS-1439] [ETrckSS-1438] and a Level 1 Movement Authority with associated track description.

When shunting is authorised by means of a shunt aspect, the BG is configured not to send Session Establishment [ETrckSS-1434] and to contain National Values [ETrckSS-223] and a Conditional Level Transition Order with priority table Level NTC (NID_NTC=20), Level NTC (NID_NTC=21), Level 3 (where required), Level 2 and Level 0 [ETrckSS-1441] [ETrckSS-1445].

Where there is suitable track on approach to the signal, an extra BG to command the train to connect to the RBC on approach to the TZ should be considered. [ETrckSS-727]

Where shunting within the TZ or shunting to another site via the TZ is used, the TZ will need to be long enough to accommodate all shunting moves. BG-2 will then be positioned such that trains carrying out shunting moves do not read the telegrams containing the LTO, which will force transition to L2.

Routing information is to be provided at the entry signal, in accordance with conventional signalling rules, to support drivers of trains departing the depot in Level NTC, SH. [ETrckSS-282]

The following table summarises the configuration of the border balise group.

Signal state	BBG contents
Signal at danger	Session Establishment (ETrckSS-727)
	LTO (ETrckSS-1439)
	L3, L2, L0 (ETrckSS-1442)
	National Values (ETrckSS-223)
	Default Telegram (ETrckSS-1443)
	TPWS provision (ETrckSS-296)
Signal showing proceed (not shunting)	Session Establishment (ETrckSS-727)
	LTO (ETrckSS-1439)
	L1, L3, L2, L0 (ETrckSS-1438)
	National Values (ETrckSS-223)
Signal showing shunting aspect	CLTO (ETrckSS-1445)
	NTC20, NTC21, L3, L2, L0 (ETrckSS-1441)
	National Values (ETrckSS-223)
	(Note – the BBG does not contain a session establishment message [ETrckSS-1434])

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4.2.3.2 TZ to ETCS without signals area

The decision to shift balises provided for the L2 transition to a location after the limit of shunt / entrance to the other site, or to use switchable balises, will be dependent on:

- the distance to the limit of shunt or entrance to the other site compared with the distance for which operations in L1, and subsequently L2 without connection to the RBC, can be tolerated for non-shunting moves; and
- the complexity of the switching arrangements (both for the L1 transition and the L2 transition) required to achieve the desired result.

Once the train establishes a communication session the ETCS Trackside responds by sending a Level Transition Order with priority table of Level 3 (where required), Level 2 and Level 0 [ETrckSS-1433] accompanied by a Level 2 Movement Authority message [ETrckSS-1240]. The Trackside design takes account of the fact the Onboard already holds an MA (issued by BG-1) when configuring the MA sent over radio.

The BG at the entry to the ETCS without signals area is configured to send National Values [ETrckSS-223] and a Level Transition Order with priority table of Level 3 (where required), Level 2 and Level 0. [ETrckSS-1436] [ETrckSS-1433]

To prevent trains that are not fitted with ETCS, and trains in Level NTC, SH, from continuing onto the L2 without signals line, a permanently energised TPWS TSS is placed at the end of the TZ. [ETrckSS-1440] [ETrckSS-954]

The location of announcements to, and acknowledgements by, the driver will need to be determined for each site.

All routes and moves should be under the authority of lineside signals and/or site personnel.

The extent of the moves not under ETCS control should be clearly established and marked at the lineside.

The following table summarises the response of the ETCS Trackside (RBC) and the configuration of the border balise group.

RBC Behaviour	BBG contents
Train in L1, send LTO + MA (ETrckSS-1240)	LTO (ETrckSS-1436)
L3, L2, L0 (ETrckSS-1433)	L3, L2, L0 (ETrckSS-1433)
	National Values (ETrckSS-223)
	(Note – if Level NTC shunting is permitted in the TZ the BBG is accompanied by a permanently energised TPWS TSS [ETrckSS-1440])

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4.3 Level 2, with signals

As Level 1 launch involves two stages of transition, the first being from a non ETCS Level/mode on approach to the transition zone and the second being to leave the transition zone into the ETCS L2/L3 area. Each stage can be approached and occur in a normal/expected level/mode and sequence. The analysis and requirements need to also address degraded situations (where the normal transitions cannot take place) and abnormal situations (where the driver/train are in an unexpected level/mode).

Drivers need to be trained in what to expect during a level transition, how to react to unexpected sequences and how to operate in degraded scenarios. [EOPSS-857]

Table 5 - L1 Launch to ETCS with signals (with shunting) options matrix Part 1 and Table 6 summarise the first stage of the transition down the left hand side (entry to TZ), and the relevant section of this topic, and the second stage (approaching L2/L3 with signals area), with the relevant section of this topic, across the top. For each there are normal (highlighted green), degraded (highlighted yellow) and abnormal (highlighted orange) options listed. The table then shows which stage 2 transition(s) may follow each of the stage 1 transitions. Since the stage 2 transitions are the same as those described in Variant N1-1 (see sec 3.2.2 and 3.3.2) they are not repeated here.

In some L1 launch areas, operational shunting moves within the TZ may be required. These shunting moves can be to a head shunt, and back, to the TZ area and back, or used to carry out movements on diverging non ETCS lines from the TZ. There is no two stage transition for shunting moves as these movements are not intended to enter the ETCS area.

Additional tables in Appendix A summarise the potential levels and modes on approach to the border, the priority tables within the BG, and the interaction between the Trackside and Onboard.

Table 5 - L1 Launch to ETCS with signals (with shunting) options matrix Part 1

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Entry To ETCS with Signals											
Topic Section	3.3.2.1.1	3.3.2.1.2	3.3.2.1.3	3.3.2.1.4	3.3.2.2.1	3.3.2.2.2	3.3.2.2.3	3.3.2.3.1	3.3.2.3.2	3.3.2.3.3	
Level, mode, scenario	L1 with comms	NID_NTC=21	L0, UN	L0, (SH)	L1 no comms	L2, (SB)	L2, (SR)	NID_NTC=20 (SH)	NID_NTC=21 (SH)	Train not fitted with ETCS	
4.3.1.1.1	NID_NTC=20 (SN) (signal off)	→ ↑			→ ↑						
4.3.1.1.2	NID_NTC=21 (SN) (signal off)		→ ↑								
4.3.1.1.3	L0, (UN) (signal off)			→ ↑							
4.3.1.1.4	L0, (SH) (signal off)				→ ↑						
4.3.1.1.5	L-NTC SH or SN (routed to Headshunt)	NO ENTRY TO ETCS WITH SIGNALS AREA- Train remains in L-NTC									
4.3.1.1.6	L-NTC SH or SN (shunting within TZ)	NO ENTRY TO ETCS WITH SIGNALS AREA- Train remains in L-NTC									
4.3.1.1.7	L-NTC SH or SN (shunting to another line via TZ)	NO ENTRY TO ETCS WITH SIGNALS AREA- Train remains in L-NTC									
4.3.1.2.1	NID_NTC=20 (SN) (Pathway cannot be set – verbal authorisation)						→ ↑				
4.3.1.2.2	NID_NTC=21 (SN) (Pathway cannot be set – verbal authorisation)		→ ↑								
4.3.1.2.3	L0, (UN) (Pathway cannot be set – verbal authorisation)			→ ↑							
4.3.1.2.4	NID_NTC=20 (SN) Degraded Pathway can be set, PoSA available	→ ↑			→ ↑						
4.3.1.2.5	NID_NTC=21 (SN) Degraded Pathway can be set, PoSA available		→ ↑								
4.3.1.2.6	L0, (UN) Degraded Pathway can be set, PoSA available			→ ↑							
4.3.1.2.7	NID_NTC=20 (SN) Degraded Pathway can be set, verbal authorisation						→ ↑				
4.3.1.2.8	NID_NTC=21 (SN) Degraded Pathway available		→ ↑								
4.3.1.2.9	L0, (UN) Degraded Pathway can be set, verbal authorisation			→ ↑							
4.3.1.2.10	NID_NTC=20 (SN) LEU failed					→ ↑					
4.3.1.2.11	NID_NTC=21 (SN) LEU failed		→ ↑								
4.3.1.2.12	L0, (UN) LEU failed			→ ↑							
4.3.1.2.13	NID_NTC=20, SN Pathway cannot be set (shunting intended)						→ ↑				
4.3.1.2.14	NID_NTC=21, SN Pathway cannot be set (shunting intended)	NO ENTRY TO ETCS WITH SIGNALS AREA- Train remains in L-NTC, SN									
4.3.1.2.15	NID_NTC=20, SH Pathway cannot be set (shunting intended)					→ ↑ on exit SH		→ ↑ continuing in SH			
4.3.1.2.16	NID_NTC=21, SH Pathway cannot be set (shunting intended)	NO ENTRY TO ETCS WITH SIGNALS AREA- Train remains in L-NTC, SH Train stays in NID_NTC=21 on exiting SH									
4.3.1.2.17	NID_NTC=20, SN Degraded Pathway set (shunting intended) PoSA	→ ↑			→ ↑						
4.3.1.2.18	NID_NTC=21, SN Pathway cannot be set (shunting intended) PoSA	NO ENTRY TO ETCS WITH SIGNALS AREA- Train remains in L-NTC, SN									

Table 6 - L1 Launch to ETCS with signals (with shunting) options matrix Part 2

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Entry to Transition Zone (ETCS with signals + shunting)	Topic Section	3.3.2.1.1	3.3.2.1.2	3.3.2.1.3	3.3.2.1.4	3.3.2.2.1	3.3.2.2.2	3.3.2.2.3	3.3.2.3.1	3.3.2.3.2	3.3.2.3.3	
	Level, mode, scenario	L1 with comms	NID_NTC=21	L0, UN	L0, (SH)	L1 no comms	L2, (SB)	L2, (SR)	NID_NTC=20 (SH)	NID_NTC=21 (SH)	Train not fitted with ETCS	
	4.3.1.2.19	NID_NTC=20, SH Degraded Pathway set (shunting intended) PoSA	→ ↑ on exit SH				→ ↑ on exit SH			→ ↑ continuing in SH		
	4.3.1.2.20	NID_NTC=21, SH Degraded Pathway set (shunting intended) PoSA	NO ENTRY TO ETCS WITH SIGNALS AREA- Train remains in L-NTC, SH Train stays in NID_NTC=21 on exiting SH									
	4.3.1.2.21	NID_NTC=20, SN Degraded Pathway set (shunting intended) Verbal Authorisation							→ ↑			
	4.3.1.2.22	NID_NTC=21, SN Pathway cannot be set (shunting intended) Verbal Authorisation	NO ENTRY TO ETCS WITH SIGNALS AREA- Train remains in L-NTC, SN									
	4.3.1.2.23	NID_NTC=20, SH Degraded Pathway set (shunting intended) Verbal Authorisation						→ ↑ on exit SH		→ ↑ continuing in SH		
	4.3.1.2.24	NID_NTC=21, SH Pathway cannot be set (shunting intended) Verbal Authorisation	NO ENTRY TO ETCS WITH SIGNALS AREA- Train remains in L-NTC, SH Train stays in NID_NTC=21 on exiting SH in TZ									
	4.3.1.2.25	NID_NTC=20 (SN) (intended shunt) LEU failed						→ ↑				
	4.3.1.2.26	NID_NTC=21 (SN) (intended shunt) LEU failed	NO ENTRY TO ETCS WITH SIGNALS AREA- Train remains in L-NTC, SN									
	4.3.1.2.27	NID_NTC=20 (SH) (intended shunt) LEU failed						→ ↑ on exit SH		→ ↑ continuing in SH		
	4.3.1.2.28	NID_NTC=20 (SH) (intended shunt) LEU failed	NO ENTRY TO ETCS WITH SIGNALS AREA- Train remains in L-NTC, SH Train stays in NID_NTC=21 on exiting SH in TZ									
	4.3.1.3.1	NID_NTC=20 (SN) SPAD						→ ↑				
	4.3.1.3.2	NID_NTC=21 (SN) SPAD	→ ↑									
	4.3.1.3.3	L0, (UN) SPAD		→ ↑								
	4.3.1.3.4	NID_NTC=20 (SH) SPAD						→ ↑ on exit SH		→ ↑ continuing in SH		
	4.3.1.3.5	NID_NTC=21 (SH) SPAD	→ ↑ on exit SH								→ ↑ continuing in SH	
	4.3.1.3.6	Train not fitted with ETCS SPAD										→ ↑
	4.3.1.3.7	Train not fitted with ETCS signal off										→ ↑

4.3.1 System States and User Information (Entry to TZ with shunting)

Some of the system states and user information for L1 launch allowing shunting in L2 without signals will apply in a L2 with signals area. Where there is no change, there will be references to the suitable section any differences have been identified below.

Note: There is no requirement for a permanently energised TPWS TSS loop at the shunting boundary limit associated with an ETCS with signals area.

For other scenarios for L1 launch see 3.2.1

4.3.1.1 Normal Scenarios (intended approaches and transitions)

4.3.1.1.1 Train approaches in Level NTC (NID_NTC=20), SN (intended entry to ETCS with signals)

No different from Variant N1-1 See 3.3.1.1.1

4.3.1.1.2 Train approaches in Level NTC (NID_NTC=21), SN (intended entry to ETCS with signals)

No different from Variant N1-1 See 3.3.1.1.2

4.3.1.1.3 Train approaches in Level 0, UN (intended entry to ETCS with signals)

No different from Variant N1-1 See 3.3.1.1.3

4.3.1.1.4 Train approaches in Level 0, SH (intended entry to ETCS with signals)

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No different from Variant N1-1 See 3.3.1.1.4

4.3.1.1.5 Train is in Level NTC (either NID_NTC=20 or NID_NTC=21), SH or SN and is routed to a Headshunt

No different from Level 2 without signals See 4.2.1.1.4

4.3.1.1.6 Train is in Level NTC (either NID_NTC=20 or NID_NTC=21), SH or SN shunting within TZ

No different from Level 2 without signals See 4.2.1.1.5

4.3.1.1.7 Train is in Level NTC SH or SN shunting to another line via TZ

No different from Level 2 without signals See 4.2.1.1.6

4.3.1.2 Degraded scenarios (Trackside or ETCS Onboard failures)

4.3.1.2.1 Train approaching in Level NTC (NID_NTC=20), SN, Pathway Cannot be set (intended entry to ETCS with signals) – verbal authorisation

No different from Variant N1-1 See 3.3.1.2.1

4.3.1.2.2 Train approaching in Level NTC (NID_NTC=21), SN, Pathway cannot be set (intended entry to ETCS with signals) – verbal authorisation

No different from Variant N1-1 See 3.3.1.2.2

4.3.1.2.3 Train approaching in L0, UN, Pathway cannot be set (intended entry to ETCS with signals) – verbal authorisation

No different from Variant N1-1 See 3.3.1.2.3

4.3.1.2.4 Train approaching in Level NTC (NID_NTC=20), SN Degraded Pathway set (intended entry to ETCS with signals), PoSA available, OS mode

No different from Variant N1-1 See 3.3.1.2.4

4.3.1.2.5 Train approaching in Level NTC (NID_NTC=21), SN Degraded Pathway set (intended entry to ETCS with signals), PoSA available, OS mode

No different from Variant N1-1 See 3.3.1.2.5

4.3.1.2.6 Train approaching in L0, UN , Degraded Pathway set (intended entry to ETCS with signals), PoSA available, OS mode

No different from Variant N1-1 See 3.3.1.2.6

4.3.1.2.7 Train approaching in Level NTC (NID_NTC=20), Degraded pathway (intended entry to ETCS with signals), verbal authorisation

No different from Variant N1-1 See 3.3.1.2.7

4.3.1.2.8 Train approaching in Level NTC (NID_NTC=21), Degraded pathway (intended entry to ETCS with signals), verbal authorisation

No different from Variant N1-1 See 3.3.1.2.8

4.3.1.2.9 Train approaching in L0, UN, Degraded pathway (intended entry to ETCS with signals), verbal authorisation

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No different from Variant N1-1 See 3.3.1.2.9

4.3.1.2.10 Train approaching in Level NTC (NID_NTC=20), LEU failed (intended entry to ETCS with signals) – default telegram

No different from Variant N1-1 See 3.3.1.2.10

4.3.1.2.11 Train approaching in Level NTC (NID_NTC=21), LEU failed (intended entry to ETCS with signals) – default telegram

No different from Variant N1-1 See 3.3.1.2.11

4.3.1.2.12 Train approaching in L0, UN, LEU failed (intended entry to ETCS with signals) – default telegram

No different from Variant N1-1 See 3.3.1.2.12

4.3.1.2.13 Train Approaching in Level NTC (NID_NTC=20), SN Pathway cannot be set (intended shunting move in TZ) – verbal authorisation

This scenario describes the events where a Pathway cannot be set (normal or degraded), preventing the signal from clearing. The signaller will need to secure the wheeled path in accordance with the rule book.

When signal is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The Driver will need to contact the signaller and request authority to proceed (see Topic S).

The driver selects 'Override' on the ETCS DMI before proceeding and operates the TPWS temporary isolation switch. (GERT8000-S5 [R17])

When the Train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This contains an CLTO that does not include NID_NTC=20 within the priority table, resulting in a transition to L2 and since override is active the mode changes to SR. [ETrckSS-1445] [ETrckSS-1446] and Chapter 5 of Subset-026 [R1]

Note: where a train which would have entered the TZ for the purposes of shunting needs to pass the border signal at danger due to a failure, then the train will transition to L2 and the ability of the driver to complete the shunting activity in L2 needs to be considered particularly if they are not authorised to operate in L2 normally.

The driver can continue with shunting movements within the TZ, in L2 (see 3.3.2.2.3).

The table of priorities will be updated to include Level NTC, and the transition initiated, when the driver carries out the return movement and passes the transition border of TZ (See Topic O)

4.3.1.2.14 Train Approaching in Level NTC (NID_NTC=21), SN Pathway cannot be set (intended shunting move in TZ) – verbal authorisation

This scenario describes the events where a Pathway cannot be set (normal or degraded), preventing the signal from clearing. The signaller will need to secure the wheeled path in accordance with the rule book.

When signal W1 is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The Driver will need to contact the signaller and request authority to proceed.

The driver operates the TPWS temporary isolation switch (GERT8000-S5 [R17]).

When the Train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This contains a CLTO including NID_NTC=21 within the priority

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table. The ETCS Onboard will remain in Level NTC (NID_NTC=21). [ETrckSS-1445] [ETrckSS-1446] and Chapter 5 [R1]

The driver can continue with shunting movements in Level NTC (NID_NTC=21), SN.

4.3.1.2.15 Train Approaching in Level NTC (NID_NTC=20), SH Pathway cannot be set (intended shunting move in TZ) – verbal authorisation

This scenario describes the events where a Pathway cannot be set (normal or degraded), preventing the signal from clearing. The signaller will need to secure the wheeled path in accordance with the rule book.

When signal W1 is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The Driver will need to contact the signaller and request authority to proceed.

The driver operates the TPWS temporary isolation switch (GERT8000-S5 [R17]).

When the Train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This contains a CLTO without NID_NTC=20 and L2 as the highest priority. [ETrckSS-1445] [ETrckSS-1446] and Chapter 5 of Subset-026 [R1]

As the train is operating in Level NTC, SH, the ETCS Onboard will not try to establish communication or transition to L2. The priority table contained within the LTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 [R1]).

The driver can continue with shunting movements within the TZ, in Level NTC, SH (see 3.3.2.3.1).

On exiting SH, and if no other transition order has been read, the ETCS Onboard will automatically transition to Level 2. The ETCS Onboard will enter SB and the driver will need to carry out Start of Mission (see Topic G) Chapter 5 and 4 of Subset-026 [R1] (see 3.3.2.2.2).

The limit of the shunting move will be marked by location markers (W3), as described in Topic AA.

The table of priorities will be updated to include Level NTC, and the transition initiated, when the driver carries out the return movement and passes the transition border (See Topic O)

4.3.1.2.16 Train Approaching in Level NTC (NID_NTC=21), SH Pathway cannot be set (intended shunting move in TZ) – verbal authorisation

This scenario is the same as 4.3.1.2.15, with the exception of reading Level NTC (NID_NTC=20) as Level NTC (NID_NTC=21) (see 3.3.2.3.2).

4.3.1.2.17 Train Approaching in Level NTC (NID_NTC=20), SN Degraded Pathway set (intended shunting move in TZ) – PoSA

No different to L2 without signals See 4.2.1.2.7

4.3.1.2.18 Train Approaching in Level NTC (NID_NTC=21), SN Degraded Pathway set (intended shunting move in TZ) – PoSA

This scenario is only applicable if the border signal is capable of displaying a PoSA.

Due to Degraded working in the TZ and/or the ETCS area the signaller will need to set an ETCS Degraded type Pathway (in accordance with topic X). Once the Pathway is set the PoSA will clear (in accordance with the controls in Topic U).

With the signal showing a PoSA aspect, the telegram in BG-1 will be configured to include a CLTO and priority table of trackside supported levels for the transition zone.

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The priority table will include NID_NTC=21, so the ETCS Onboard will remain in Level NTC (NID_NTC=21), SN. [ETrckSS-1444] [ETrckSS-1445]

The driver can continue shunting activities in Level NTC (NID_NTC=21), SN.

4.3.1.2.19 Train Approaching in Level NTC (NID_NTC=20), SH Degraded Pathway set (intended shunting move in TZ) – PoSA

This scenario is only applicable if the border signal is capable of displaying a PoSA.

Due to Degraded working in the TZ and/or the ETCS area the Signaller will need to set an ETCS Degraded type pathway (in accordance with topic X). Once the Pathway is set the PoSA will clear (in accordance with the controls in Topic U).

With the signal showing a PoSA aspect, the telegram in BG-1 will be configured to include a CLTO and priority table of trackside supported levels for the transition zone. The priority table will not include NID_NTC=20. [ETrckSS-1444] [ETrckSS-1445]

As the train is operating in Level NTC, SH, the ETCS Onboard will not try to establish communication or transition. The priority table contained within the CLTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 [R1]).

The driver can continue with shunting movements within the TZ, in Level NTC, SH.

On exiting SH, and if no other transition order has been read, the ETCS Onboard will transition to L1 (see 3.3.2.1.1).

The limit of the shunting move will be marked by location markers (W3), as described in Topic AA.

The table of priorities will be updated to include Level NTC, and the transition initiated, when the driver carries out the return movement and passes the transition border (See Topic O)

4.3.1.2.20 Train Approaching in Level NTC (NID_NTC=21), SH Degraded Pathway set (intended shunting move in TZ) – PoSA

This scenario is only applicable if the border signal is capable of displaying a PoSA.

Due to Degraded working in the TZ and/or the ETCS area the Signaller will need to set an ETCS Degraded type pathway (in accordance with topic X). Once the Pathway is set the PoSA will clear (in accordance with the controls in Topic U).

With the signal showing a PoSA aspect, the telegram in BG-1 will be configured to include a CLTO and priority table of trackside supported levels for the transition zone. The priority table will include NID_NTC=21 [ETrckSS-1444] [ETrckSS-1445]

As the train is operating in Level NTC, SH, the ETCS Onboard will not try to establish communication or transition. The priority table contained within the CLTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 of Subset-026 [R1]).

The driver can continue with shunting movements within the TZ, in Level NTC, SH.

On exiting SH, and if no other transition order has been read, the ETCS Onboard will remain in Level NTC (NID_NTC=21).

The limit of the shunting move will be marked by location markers (W3), as described in Topic AA.

4.3.1.2.21 Train Approaching in Level NTC (NID_NTC=20), SN Pathway cannot be set, (intended shunting move in TZ) – verbal authorisation

Due to degraded working within the TZ and/or the ETCS area the signaller may flag one or more sections as obstructed, or set an ETCS Degraded Pathway (See Topic

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U). The signaller may need to inform the driver about the degraded section/s and provide any additional instructions for these section/s.

When signal W1 is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The Driver will need to contact the signaller and request authority to proceed (see Topic S)

The Signaller will need to set an ETCS Degraded type pathway (in accordance with topic X).

The driver selects 'Override' on the ETCS DMI before proceeding and operates the TPWS temporary isolation switch (GERT8000-S5 [R17]).

When the Train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This contains an CLTO that does not include NID_NTC-20 within the priority table, resulting in a transition to L2 and since override is active the mode changes to SR. [ETrckSS-1445] [ETrckSS-1446] and Chapter 5 [R1]

Note: where a train which would have entered the TZ for the purposes of shunting needs to pass the border signal at danger due to a failure, then the train will transition to L2 and the ability of the driver to complete the shunting activity in L2 needs to be considered particularly if they are not authorised to operate in L2 normally.

The driver can continue with shunting movements within the TZ, in L2 (see 3.3.2.2.3).

The table of priorities will be updated to include Level NTC, and the transition initiated, when the driver carries out the return movement and passes the transition border of TZ (See Topic O).

4.3.1.2.22 Train Approaching in Level NTC (NID_NTC=21), SN Pathway cannot be set, (intended shunting move in TZ) – verbal authorisation

Due to degraded working within the TZ and/or the ETCS area the signaller may flag one or more sections as obstructed, or set an ETCS Degraded Pathway (See Topic U). The signaller may need to inform the driver about the degraded section/s and provide any additional instructions for these section/s.

When signal W1 is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The Driver will need to contact the signaller and request authority to proceed.

The Signaller will need to set an ETCS Degraded type pathway (in accordance with topic X).

The driver operates the TPWS temporary isolation switch (GERT8000-S5 [R17]).

When the Train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This contains a CLTO including NID_NTC=21 within the priority table. The ETCS Onboard will remain in Level NTC (NID_NTC=21). [ETrckSS-1445] [ETrckSS-1446] and Chapter 5 of Subset-026 [R1]

The driver can continue with shunting movements in Level NTC (NID_NTC=21), SN

4.3.1.2.23 Train Approaching in Level NTC (NID_NTC=20), SH Pathway cannot be set (intended shunting move in TZ) – verbal authorisation

Due to degraded working within the TZ and/or the ETCS area the signaller may flag one or more sections as obstructed, or set an ETCS Degraded Pathway (See Topic U). The signaller may need to inform the driver about the degraded section/s and provide any additional instructions for these section/s.

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When signal W1 is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The Driver will need to contact the signaller and request authority to proceed (see Topic S)

The Signaller will need to set an ETCS Degraded type pathway (in accordance with topic X).

The driver operates the TPWS temporary isolation switch (GERT8000-S5 [R17]).

When the Train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This contains a CLTO without NID_NTC=20 and with L2 as the highest priority. [ETrckSS-1445] [ETrckSS-1446] and Chapter 5 of Subset-026 [R1]

As the train is operating in Level NTC, SH, the ETCS Onboard will not try to establish communication or transition to L2. The priority table contained within the LTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 [R1]).

The driver can continue with shunting movements within the TZ, in Level NTC, SH (see 3.3.2.3.1).

On exiting SH, and if no other transition order has been read, the ETCS Onboard will automatically transition to Level 2. The ETCS Onboard will enter SB and the driver will need to carry out Start of Mission (see Topic G) Chapter 5 and 4 of Subset-026 [R1] (see 3.3.2.2.2).

The limit of the shunting move will be marked by location markers (W3), as described in Topic AA.

The table of priorities will be updated to include Level NTC, and the transition initiated, when the driver carries out the return movement and passes the transition border of TZ (See Topic O).

4.3.1.2.24 Train Approaching in Level NTC (NID_NTC=21), SH Pathway cannot be set (intended shunting move in TZ) – verbal authorisation

Due to degraded working within the TZ and/or the ETCS area the signaller may flag one or more sections as obstructed, or set an ETCS Degraded Pathway (See Topic U). The signaller may need to inform the driver about the degraded section/s and provide any additional instructions for these section/s.

When signal W1 is displaying a stop aspect, or no aspect, the driver should not move the train beyond the signal. The Driver will need to contact the signaller and request authority to proceed (see Topic S).

The Signaller will need to set an ETCS Degraded type pathway (in accordance with topic X).

The driver operates the TPWS temporary isolation switch (GERT8000-S5 [R17]).

When the Train passes over BG-1 the ETCS Onboard receives the default telegram from the balise group. This contains a CLTO with NID_NTC=21. [ETrckSS-1445] [ETrckSS-1446] and Chapter 5 of Subset-026 [R1].

As the train is operating in Level NTC, SH, the ETCS Onboard will not try to establish communication or transition. The priority table contained within the CLTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 [R1]).

The driver can continue with shunting movements within the TZ, in Level NTC, SH.

On exiting SH, and if no other transition order has been read, the ETCS Onboard will remain in Level NTC (NID_NTC=21).

The limit of the shunting move will be marked by location markers (W3), as described in Topic AA.

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4.3.1.2.25 Train Approaching in Level NTC (NID_NTC=20), SN LEU failed (intended shunting move in TZ) – default telegram

If the Lineside encoder unit fails the balise group will be configured to send a default balise message. The message will have an CLTO with L2 as the highest priority and an order to establish communication with the ETCS Trackside. [ETrckSS-1445] [ETrckSS-1446][ETrckSS-817] [ETrckSS-727]

When the train passes the balise group and transitions to L2, the ETCS Onboard will enter TR mode, as there is no Authority to move in L2 (See Chapter 5 [R1]. The DMI will display the system state message “No MA received at level transition” [R9]. This will indicate to the driver that there is a fault with the balise group.

Operational Rules and procedures will be applied to recover from the situation. [EOPSS-178] The Driver will need to carry out SoM as part of post trip, see Topic G and Chapter 5 of Subset-026 [R1].

The driver can continue with shunting movements within the TZ, in L2.

Note: The ability of the driver to complete the shunting activity in L2 needs to be considered particularly if they are not authorised to operate in L2 normally.

The table of priorities will be updated to include Level NTC, and the transition initiated, when the driver carries out the return movement and passes the transition border of TZ (See Topic O).

4.3.1.2.26 Train Approaching in Level NTC (NID_NTC=21), SN LEU failed (intended shunting move in TZ) – default telegram

If the Lineside encoder unit fails the balise group will be configured to send a default balise message which the train will receive when it passes over BG-1. The message will have an CLTO including NID_NTC=21 and with L2 as the highest priority and an order to establish communication with the ETCS Trackside and the ETCS Onboard will remain in Level NTC (NID_NTC=21) [ETrckSS-1445] [ETrckSS-1446][ETrckSS-817] [ETrckSS-727] and Chapter 5 of Subset-026 [R1]

The driver can continue with shunting movements in Level NTC (NID_NTC=21), SN.

4.3.1.2.27 Train Approaching in Level NTC (NID_NTC=20), SH LEU failed (intended shunting move in TZ) – default telegram

If the Lineside encoder unit fails the balise group will be configured to send a default balise message which the train will receive when it passes over BG-1. The message will have an CLTO without NID_NTC=20 and with L2 as the highest priority and an order to establish communication with the ETCS Trackside. [ETrckSS-1445] [ETrckSS-1446][ETrckSS-817] [ETrckSS-727] and Chapter 5 of Subset-026 [R1]

As the train is operating in Level NTC, SH, the ETCS Onboard will not try to establish communication or transition to L2. The priority table contained within the CLTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 of Subset-026 [R1]).

The driver can continue with shunting movements within the TZ, in Level NTC, SH (see 3.3.2.3.1).

On exiting SH, and if no other transition order has been read, the ETCS Onboard will automatically transition to Level 2. The ETCS Onboard will enter SB and the driver will need to carry out Start of Mission (see Topic G) Chapter 5 and 4 of Subset-026 [R1] (see 3.3.2.2.2).

The limit of the shunting move will be marked by location markers (W3), as described in Topic AA.

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The table of priorities will be updated to include Level NTC, and the transition initiated, when the driver carries out the return movement and passes the transition border (See Topic O).

4.3.1.2.28 Train Approaching in Level NTC (NID_NTC=21), SH LEU failed (intended shunting move in TZ) – default telegram

If the Lineside encoder unit fails the balise group will be configured to send a default balise message which the train will receive when it passes over BG-1. The message will have an CLTO with NID_NTC=21 and L2 as the highest priority and an order to establish communication with the ETCS Trackside. [ETrckSS-1445] [ETrckSS-1446][ETrckSS-817] [ETrckSS-727] and Chapter 5 of Subset-026 [R1]

As the train is operating in Level NTC, SH, the ETCS Onboard will not try to establish communication or transition. The priority table contained within the CLTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 of Subset-026 [R1]).

The driver can continue with shunting movements within the TZ, in Level NTC, SH.

On exiting SH, and if no other transition order has been read, the ETCS Onboard will remain in Level NTC (NID_NTC=21).

The limit of the shunting move will be marked by location markers (W3), as described in Topic AA.

4.3.1.3 Abnormal scenarios (Operationally related issues)

4.3.1.3.1 SPAD with train approaching in Level NTC (NID_NTC=20), SN (intended entry to ETCS with signals),

No different from Variant N1-1 See 3.3.1.3.1

4.3.1.3.2 SPAD with train approaching in Level NTC (NID_NTC=21), SN (intended entry to ETCS with signals),

No different from Variant N1-1 See 3.3.1.3.2

4.3.1.3.3 SPAD with train approaching in Level 0, UN

No different from Variant N1-1 See 3.3.1.3.3

4.3.1.3.4 SPAD with train approaching in Level NTC (NID_NTC =20), SH (intended entry to ETCS with signals)

No different from Variant N1-1 See 3.3.1.3.4

4.3.1.3.5 SPAD with train approaching in Level NTC (NID_NTC=21), SH (intended entry to ETCS with signals)

No different from Variant N1-1 See 3.3.1.3.5

4.3.1.3.6 SPAD with train approaching not fitted with ETCS

No different from Variant N1-1 See 3.3.1.3.7

4.3.1.3.7 Signal cleared with train approaching not fitted with ETCS

No different from Variant N1-1 See 3.3.1.3.10

4.3.2 Impact on other topics

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None

4.3.3 Design Guidance

The configuration the TZ is similar to 4.2.3 with the following exceptions.

4.3.3.1 Entry to TZ

The default telegram(s) sent by the BG corresponds to no proceed aspect being displayed [ETrckSS-1443] and includes Session Establishment [ETrckSS-727], National Values [ETrckSS-223] and a Conditional Level Transition Order with priority table of Level 3 (where required), Level 2, Level NTC (NID_NTC=21) and Level 0 [ETrckSS-730] [ETrckSS-1445] [ETrckSS-1446].

When a main proceed aspect is displayed the telegrams sent by the BG contain Session Establishment [ETrckSS-727], National Values [ETrckSS-223], a Conditional Level Transition Order with priority table of Level 1, Level 3 (where required), Level 2, Level NTC (NID_NTC=21) and Level 0 [ETrckSS-730] [ETrckSS-1444] [ETrckSS-1445] and a Level 1 Movement Authority with associated track description.

When shunting is authorised by means of a shunt aspect, the BG is configured not to send Session Establishment [ETrckSS-1434] and to contain National Values [ETrckSS-223] and a Conditional Level Transition Order with priority table Level NTC (NID_NTC=20), Level NTC (NID_NTC=21), Level 3 (where required), Level 2 and Level 0 [ETrckSS-1441] [ETrckSS-1445].

The following table summarises the configuration of the border balise group.

Signal state	BBG contents
Signal at danger	Session Establishment (ETrckSS-727)
	CLTO (ETrckSS-1445) (ETrckSS-730)
	L3, L2, NTC21, L0 (ETrckSS-1446)
	National Values (ETrckSS-223)
	Default Telegram (ETrckSS-1443)
Signal showing proceed (not shunting)	Session Establishment (ETrckSS-727)
	CLTO (ETrckSS-1445) (ETrckSS-730)
	L1, L3, L2, NTC21, L0 (ETrckSS-1444)
	National Values (ETrckSS-223)
Signal showing shunting aspect	CLTO (ETrckSS-1445)
	NTC20, NTC21, L3, L2, L0 (ETrckSS-1441)
	National Values (ETrckSS-223)
	(Note – the BBG does not contain a session establishment message [ETrckSS-1434])

4.3.3.2 TZ to ETCS without signals area

Same as 4.2.3.2

4.4 Hybrid L3, without signals

4.4.1 System States and User Information

Same as Level 2, without signals (see section 4.2.1), reading references to Level 2 as Hybrid Level 3.

4.4.2 Impact on other topics

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None

4.4.3 Design Guidance

See section 3.4.3

4.5 Hybrid Level 3 with signals

4.5.1 System States and User Information

Same as Level 2, without signals (see section 4.3.1), reading references to Level 2 as Hybrid Level 3.

4.5.2 Impact on other topics

None

4.5.3 Design Guidance

See section 3.5.3

4.6 ATO

Not applicable.

4.7 Moving Block

To be developed.

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PART 2 – Running Transition to L2/L3

5 Variant N2-1 – Running Transition at the Entry to an L2 or Hybrid Level 3 (HL3) only area

5.1 Specific User Requirements

The transition to L2/L3 within an ETCS-controlled area must be pre-determined and should not require driver action, other than acknowledgements. [ESR-99]

A lineside signal will authorise running moves into the ETCS without signals area and this will form the boundary. In most cases, an existing signal will be retained. This provides a clear operational rules boundary and supports degraded operations. [ESR-3]

The transition design will not cause trains to reduce speed for the transition, unless required operationally. [ESR-643]

Only the trains equipped with an operational ETCS will be authorised to enter an ETCS only area. [ESR-287]

Only drivers who have indicated to the system during SoM that they are authorised to drive in ETCS will be given permission to enter an L2 or HL3 without signals area. [ESR-55]

To avoid a train tripping at the border, a train must have an MA onboard before transitioning into L2/L3. [ESR-61]

Trains unable to transition must be stopped by conventional signalling. [ESR-55]

The transition design must support movements where communication with the ETCS has not been established. [ESR-62] [ESR-810]

The ETCS must manage the applicable train protection systems at the transition. [ESR-36]

5.2 Entry into Level 2, without signals

The location of the transition is selected to provide a driveable experience for the driver in the normal scenario where the ETCS Onboard receives notification of the level transition, an MA and a proceed aspect is displayed by the signal to enter the ETCS area. The location is also selected to support the normal degraded events where there is a failure in the ETCS Trackside or ETCS Onboard preventing that normal scenario. Consideration is also given to the situations where the transition is approached in a different level or mode from those in which the train would normally be operating. The result of the above analysis is for that the preferable location is for the transition to occur at/immediately beyond a lineside signal.

For running transitions between Levels 2 and 3, see Option N4.

Section 5.2.1 describes the transition from an area where ETCS operation is not available to a Level 2 area. Section 5.2.2 details the extra scenarios where the transition is from an ETCS with signals area to a Level 2 area.

Drivers need to be trained in what to expect during a level transition, how to react to unexpected sequences and how to operate in degraded scenarios. [EOPSS-857]

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5.2.1 System States and User Information (Entering L2 without signals area from a non-ETCS area)

As drivers can encounter many different scenarios for a running transition at the entry to an L2 without signals area [EOPSS-857], the system states and user information section has been split into sub sections. The first sections describe each normal/expected level/mode and sequence. The analysis and requirements need to also address degraded situations (where the normal transitions cannot take place) and abnormal situations (where the driver/train are in an unexpected level/mode).

Table 7 summarises the starting conditions and the end conditions of each scenario with the relevant section of this topic listed. For each there are normal (highlighted green), degraded (highlighted yellow) and abnormal (highlighted orange) options listed.

The tables in Appendix A 13.6 summarise the potential levels and modes on approach to the border and the interaction between the ETCS Trackside and ETCS Onboard.

Table 7 - Running transition from L-NTC area to L2 without signals area

	Topic Section	Starting condition	End Condition
		Level, Mode, scenario	Level, mode
Entry to L2 without signals from L-NTC area	5.2.1.1.1	Train approaches in Level NTC (NID_NTC=20), SN	L2, FS
	5.2.1.1.2	Train approaches in Level 0, SH – operation in possession	L0, SH
	5.2.1.1.3	Start of Mission in Transition Announcement Area, NID_NTC=20, SN	L2, FS
	5.2.1.1.4	Approaching train is in Level 0 (L0) UN	L2, FS
	5.2.1.2.1	Pathway cannot be set, verbal authorisation Level NTC (NID_NTC=20)	L2, SR
	5.2.1.2.2	Degraded Pathway, PoSA Level NTC (NID_NTC=20)	L2, OS
	5.2.1.2.3	Degraded Pathway, verbal authorisation, (NID_NTC=20)	L2, SR
	5.2.1.2.4	Communication cannot be established (NID_NTC=20)	L2, SR
	5.2.1.3.1	Approaching train is in Level NTC (NID_NTC=21), SN	NID_NTC=21, SN (held at signal)
	5.2.1.3.2	Approaching train is in Level NTC (NID_NTC=20), SH	NID_NTC=20, SH (held at signal)
	5.2.1.3.3	Approaching train is in Level NTC (NID_NTC=21), SH	NID_NTC=21, SH (held at signal)
	5.2.1.3.4	Approaching train not fitted with ETCS	same as starting condition (held at signal)
	5.2.1.3.5	SPAD with train approaching in NID_NTC=20 (SN)	L2, TR
	5.2.1.3.6	SPAD with train approaching in NID_NTC=21 (SN)	L2, TR
	5.2.1.3.7	SPAD with train approaching in NID_NTC=20 (SH)	NID_NTC=20, SH
	5.2.1.3.8	SPAD with train approaching in NID_NTC=21 (SH)	NID_NTC=21, SH
	5.2.1.3.9	SPAD with Approaching train not fitted with ETCS	same as starting condition
	5.2.1.3.10	SPAD with train approaching in Level 0 (L0) UN	L2 TR

5.2.1.1 Normal Transition to L2 without signals, (intended approaches and transitions)

On approach to the L2 without signals area it is expected that in most instances that train will be operated by an authorised driver in Level NTC (NID_NTC=20), SN with the driver having entered valid data into the ETCS.

For possession working, the train will be operating in Level 0, SH with the intention that the entry into the L2 without signals area does not cause a change of level or mode.

5.2.1.1.1 Train approaches in Level NTC (NID_NTC=20), SN

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The solution below is designed to meet the user requirements. In particular, the design makes sure that the train has been issued with an MA before the boundary signal is allowed to display a proceed aspect. In the event that a driver passes the signal at danger without MA, an ETCS trip will occur and will be managed in accordance with ETCS operating rules. An alternative location of the transition could lead to confusion regarding which rules should be applied in the event of a SPAD. Any alternative solution proposed will be considered if it meets the user requirements and is supported by a risk assessment that proves that the risk is tolerable.

In the following system state description, it is assumed that there are no other trains in the transition area, all track sections are clear, and the ETCS Onboard and ETCS Trackside system versions are compatible. The presence of any other trains in the transition area will impact on the signal aspects for following trains on the approach to the transition border. Furthermore, this will impact where, in relation to the transition border, following trains receive the transition announcement and MA. [EOPSS-857]

a) Start Conditions

A ETCS fitted train operating in Level NTC (NID_NTC=20), SN is approaching the Running Transition Approach Area (RTAA) (the RTAA is not to be confused with TZ described in N1-1 and N1-2, the RTAA is designed to allow the trains to do the running transition without going through L1 Launch). The Pathway into the L2 area from the signal controlling entry to the L2 area (Signal Z, immediately before the transition border) is set, but the signal is maintained at 'Danger'. [ETrckSS-292]

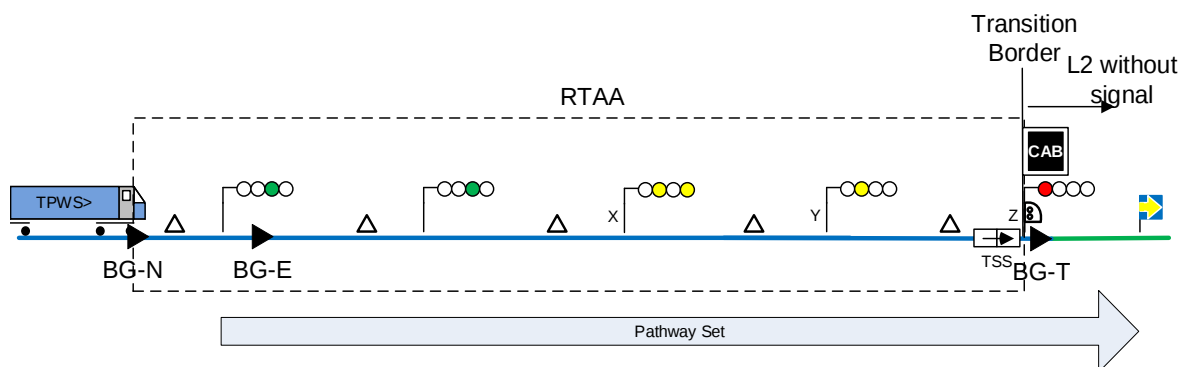


Figure 20 - Train approaching RTAA – L2 without signals area

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Figure 21 - Level NTC (NID_NTC=20)_Train approaching RTAA – L2 without signals area

The driver is controlling the train in accordance with lineside signal aspects and within the speed profile (including any relevant Temporary Speed Restriction (TSR) / Emergency Speed Restriction (ESR)) applicable to the train. See Design Guidance - section 5.2.4.2 for TSR/ESR design at transitions and Topic F for how TSRs are imposed for communicating ETCS trains.

The on-board Automatic Warning System (AWS) is providing appropriate indications and tones, and the driver is reacting to these, as required.

b) Registration

The fitted train passes over series of linked BGs, so that the Last Relevant Balise Group (LRBG) will be established. When the train passes BG-N (in **Figure 20**) and receives an order to register with the radio network (packet 45) for those mobile terminals that are not already registered with the radio network.³ [ETrckSS-287] There is no change on the ETCS DMI, and Signal Z is maintained at 'Danger'. The driver is controlling the train in accordance with lineside signal aspects and within the speed profile (including any relevant TSR/ESR) applicable to the train. The on-board AWS is providing appropriate indications and tones, and the driver is reacting to these, as required.

c) Establish Communication Session

The fitted train passes over a BG (BG-E in **Figure 22**), which commands the establishment of a communication session with the RBC controlling the L2 area beyond the transition border (packet 42). [ETrckSS-287]

The ETCS Onboard initiates the establishment of a communication session in accordance with the protocol defined in Subset-026, section 3.5.3 [R1]. When the communication session is established, the 'Connection Up' symbol is displayed (see **Figure 23**). Signal Z is maintained at 'Danger'.

³ It is expected that mobile terminals will already be registered since they retain network settings when in No Power (NP) mode.

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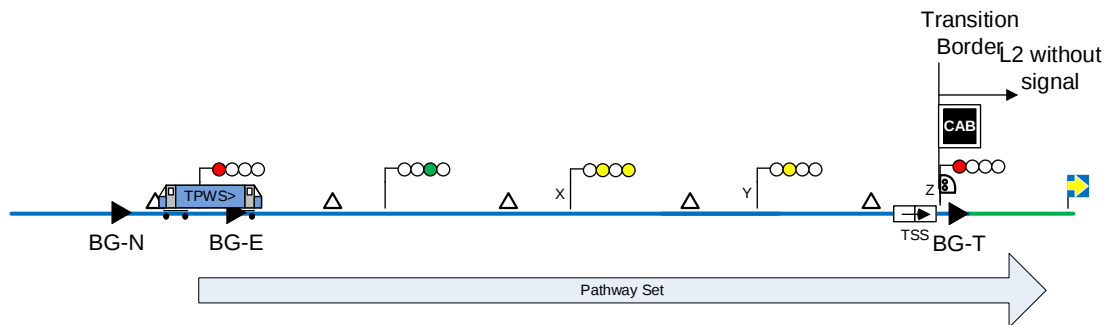


Figure 22 - Establish Session

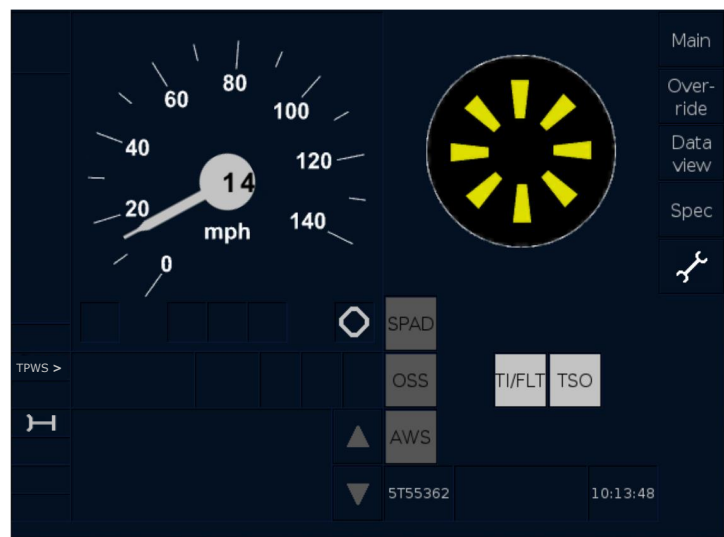


Figure 23 - Establish communication session

The driver is controlling the train in accordance with lineside signal aspects and within the speed profile (including any relevant TSR/ESR) applicable to the train. The on-board AWS is providing appropriate indications and tones, and the driver is reacting to these, as required.

d) Announce Transition, Authorise Movement

A transition announcement⁴ (packet 41) and MA are sent to the train from the RBC for the extent of the Pathway that has been set from the border. [ETrckSS-379]

The MA will be referenced from the LRBG reported by the train and will include the relevant track description and track condition information on approach to the transition. [ETrckSS-275]

The MA message (message 3) is configured to require the ETCS Onboard to acknowledge its receipt.

The ETCS Onboard receives the announcement and the MA, and transmits the receipt acknowledgment. Once the receipt acknowledgement is received by the RBC, Signal

⁴ To avoid distracting the driver on approach to a potential red signal the LTA does not contain an acknowledgement window.

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Z is cleared to the proceed aspect appropriate for the extent of the Pathway that has been set. [ETrckSS-292]

Topic U describes the Pathway controls required for the issue of a MA.

The ETCS Onboard uses the priority table within the transition announcement and the available levels onboard to determine that a transition to L2 is required and displays the LTA to the driver. [ETrckSS-1433]

In accordance with the Operation & Traffic Management Technical Specification for Interoperability (OPE TSI) [R8], the driver prepares to apply the rules for L2 when the announcement symbol is displayed.

Note: The announcement will be displayed when the communication is established and the Pathway to enter the L2 without signals area has been set and proved. The indication will appear below the circular speed gauge (DMI area C1) and is not audibly announced by Sinfo.

The location at which the announcement appears on the DMI is not fixed and if the Pathway in the ETCS area is not set, the train may come to a stand at signal Z prior to the LTA being transmitted by the Trackside.

There is no specific indication to the driver of the receipt of the MA on the ETCS DMI.

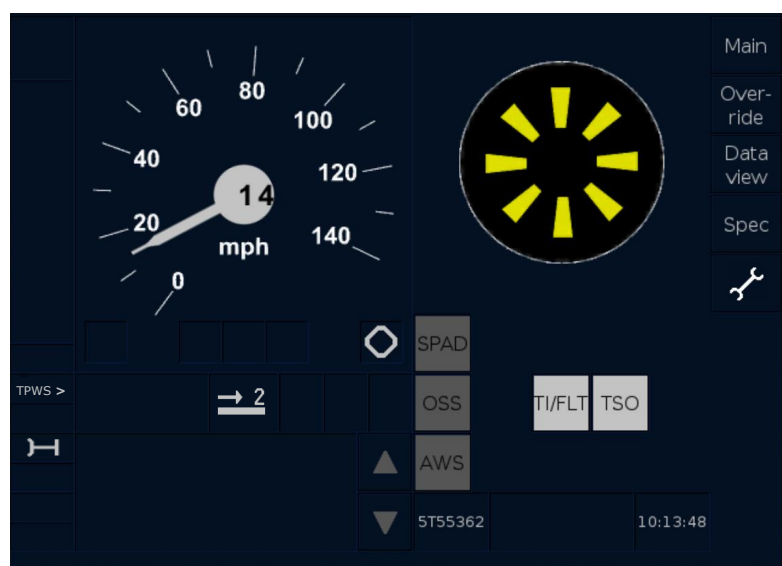
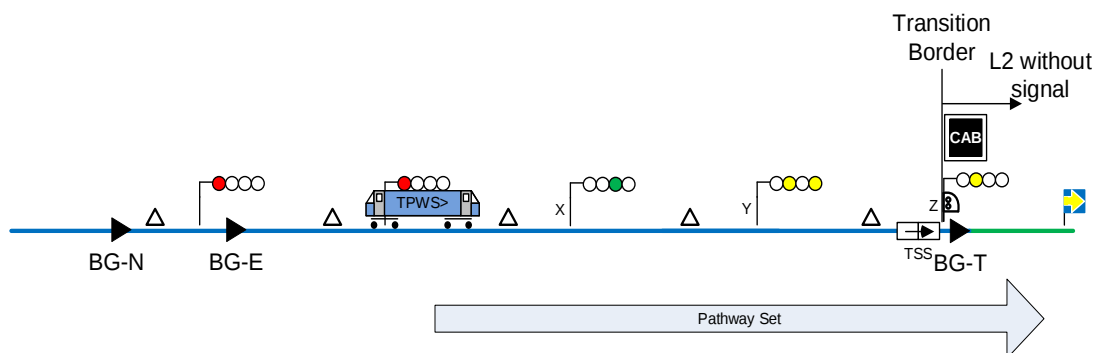


Figure 24 - Level 2 transition announced

Since linking information is not available in Level NTC, there is the potential that the estimated position used by the ETCS Onboard will lead to the transition occurring prior to the border signal. Each time that the ETCS Onboard reads a compliant balise group on the approach to the transition it reports its position, and the Trackside responds with an updated LTA and MA based on the new LRBG. [ETrckSS-Nxx2]

e) Transition and Acknowledgement

The location where the transition is designed to occur is marked by a suitable lineside board. [ETrckSS-38]

The ETCS Onboard requests the driver to acknowledge the transition when the transition occurs. This is to minimise driver distraction when approaching the signal (as they will be identifying and interpreting the aspect and reacting to AWS indications) and provide a consistency to level transition acknowledgment locations presented to the driver. [ETrckSS-301]

The diagram illustrates a railway track layout. A blue track line runs horizontally. On the left, there are two signal boxes labeled BG-N and BG-E. Between them and to the right of BG-E are several signal groups represented by circles. Further right, there are two signal boxes labeled X and Y, each with a signal group. A train labeled L2 is shown approaching from the left. The track ends at a vertical line labeled 'Transition Border'. To the right of the border, the track continues as a green line labeled 'L2 without signal'. A signal box labeled 'CAB' is located at the transition border. A large arrow labeled 'Pathway Set' points to the right.

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Figure 25 - Level 2 transition and acknowledgement requested

The driver acknowledges the transition as soon as possible after the presentation of the acknowledgement request.



Figure 26 - Level transition acknowledged

If the driver has not acknowledged within 5s of the transition occurring, the ETCS Onboard will command a service brake application. The command will be rescinded, and the service brake released, when the driver does eventually acknowledge the transition (see Subset-026, section 5.10.4 [R1]).

5.2.1.1.2 Train approaches in Level 0, SH – operation in possession

If the train is in SH the communication with the ETCS Trackside will not be established after passing the relevant BG. Signal Z will remain at danger as no MA or LTA has been issued. [ETrckSS-292].

The operational instructions applicable to possession working and the driver can be authorised past the signal at danger by the appointed person. When the train is

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authorised to pass Signal Z in SH, the priority table will be updated when the train passes over BG-T and reads the LTO. The transition to L2 will not occur until the driver has exited SH.

5.2.1.1.3 Start of Mission in RTAA

Where trains which are to be routed over the transition border are regularly required to perform SoM in the transition approach area, the transition sequence will commence once the driver has completed SoM and the ETCS Onboard is instructed to connect to the RBC by a balise group message. The driver is expected to select Level NTC (NID_NTC=20).

Ideally, the RTAA should be located such that trains which are to be routed over the transition border are not normally required to perform SoM in the RTAA; however, this may not always be possible.

To support running transitions, following SoM in the RTAA, additional communication session establishment balises (BG-E) must be provided (or communication session establishment packets included in balises located for other purposes) closer to the transition border. Once the session is established the process described in 5.2.1.1.1 will be followed.

Where there is a divergence within the transition approach area extra balise groups will be provided to terminate sessions not required as described in 5.2.4.

5.2.1.1.4 Approaching train is in Level 0 (L0), Unfitted (UN)

Whilst no operational need for a train to be operating in L0 UN has been identified (the use of L0 SH is proposed for use within possessions – see Topic B), If an approaching train is operating in L0 UN, it will transition in the same manner as a train operating in Level NTC (NID_NTC=20), SN (see 5.2.1.1.1). Any train approaching in L0 UN will register with the network, establish a communication session, receive the announcement and MA, and transition to L2.

5.2.1.2 Degraded scenarios (Trackside or ETCS Onboard failures)

Each of the following considers train approaching in Level NTC (NID_NTC=20), SN or Level 0, UN

5.2.1.2.1 Pathway cannot be set, verbal authorisation

The approaching train can establish a session with the RBC, but Signal Z cannot clear and no MA into the L2 area can be sent, possibly due to an ETCS Trackside failure. The train may still be required to cross the border and enter the L2 area in degraded mode operation.

The driver will bring the train to a stand at Signal Z.

Once at a stand at Signal Z, the driver contacts the signaller and receives authority to pass the signal at 'Danger'. [EOPSS-178]

The driver operates the TPWS temporary isolation switch (GERT-8000-S5 [R17] and selects 'Override' on the ETCS DMI before proceeding. On crossing the transition border (and reading the border balise group which contains the LTO with supported levels in a priority table), the ETCS Onboard transitions to L2 and enters Staff Responsible (SR) mode. The on-board Class B systems (AWS and TPWS) remain suppressed (RIS-0797-CCS 4.2.3 [R5] and RIS-0798-CCS, 4.2.4 [R6]). The driver proceeds in accordance with the signaller's instructions.

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5.2.1.2.2 Degraded Pathway can be set, PoSA available, OS mode

This scenario requires the border signal to have the capability of displaying a Proceed on sight aspect (PoSA).

Due to degraded working in the ETCS area the signaller will need to set an ETCS Degraded type Pathway (in accordance with topic X). Once the Pathway is set the PoSA will clear (in accordance with the controls in Topic U).

The steps leading up to the transition are the same as the steps identified in 5.2.1.1.1, except the MA will include an OS mode profile. The signaller may also need to communicate with the driver before setting the Pathway to inform the driver why the Pathway is degraded/obstructed including any additional instructions the driver may need follow. The PoSA Pathway, can then be set and proved.

The subsidiary signal to Signal Z will clear once the MA is sent and acknowledged and any approach control timers, utilised to control the speed of the train for the Degraded Pathway or obstructed Pathway, have expired. [ETrckSS-292]

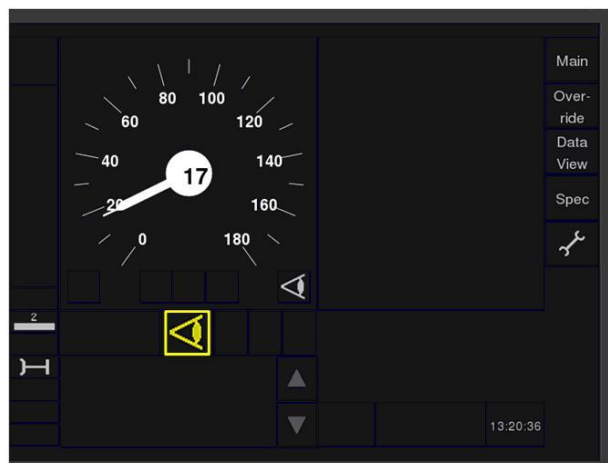


Figure 27 - OS acknowledgement requested

When the ETCS Onboard transitions to L2 and enters OS, the driver will first be presented with the acknowledgement request for the level transition. Once this is acknowledged, the driver will be presented with the acknowledgement request for the entry to OS.

The driver will have five seconds from the point where the ETCS Onboard enters OS to acknowledge entry to OS before the service brake is commanded. Once acknowledged, the train continues in OS.

Note: A European Change Request is proposing that the level transition will not require acknowledgment.

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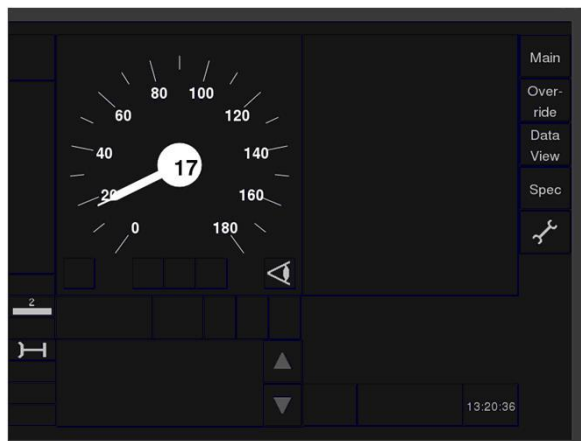


Figure 28 - OS acknowledged

If the driver does not acknowledge within the five-second limit, the service brake will be commanded until the acknowledgement is made, at which time the command will be rescinded.

See Topics U for details on the use of OS for degraded / Proceed on Sight Authority (PoSA) Pathways, respectively.

5.2.1.2.3 Degraded pathway can be set, no PoSA, verbal authorisation,

Due to Degraded working in the ETCS area the signaller will need to set an ETCS Degraded type Pathway (in accordance with topic X).

The steps in 5.2.1.2.2 will apply for this scenario with the following difference.

Due to the Pathway being degraded, signal Z will not be able to clear. The driver will stop at the red signal, in accordance with the rule book, and contact the signaller.

The signaller will give the driver authority to pass signal Z in accordance with the rule book.

The driver operates the TPWS temporary isolation switch (GERT-8000-S5 [R17] and selects 'Override' on the ETCS DMI before proceeding. On crossing the transition border (and reading the border balise group which contains the LTO with supported levels in a priority table), the ETCS Onboard transitions to L2 and enters Staff Responsible (SR) mode. The suppression of the on-board Class B systems (AWS and TPWS)) is now enforced because the train is in L2 (RIS-0797-CCS 4.2.3 [R5] and RIS-0798-CCS, 4.2.4 [R6]). The driver proceeds in accordance with the signaller's instructions.

Once a Pathway has been set and provided and the conditions for an MA are met, the ETCS Trackside will issue an MA to the train operating in SR after passed the signal resulting in OS.

5.2.1.2.4 Communication session cannot be established

The approaching train is not in communication with the RBC. This could occur due to an ETCS Onboard failure, a problem with the communication network or if SoM has occurred after the last BG containing session establishment information. Signal Z cannot, therefore, be cleared, but the train may still be required to cross the border and enter the L2 area in degraded mode operation.

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Note: The driver will be able to determine the status of the communication session from the following indications on the DMI:

- If the train has attempted to establish a session with the RBC and failed, then the 'Connection Lost / Setup Failed' indication is displayed on the DMI 45 seconds after the first attempt to contact the RBC was made (see **Figure 29**).

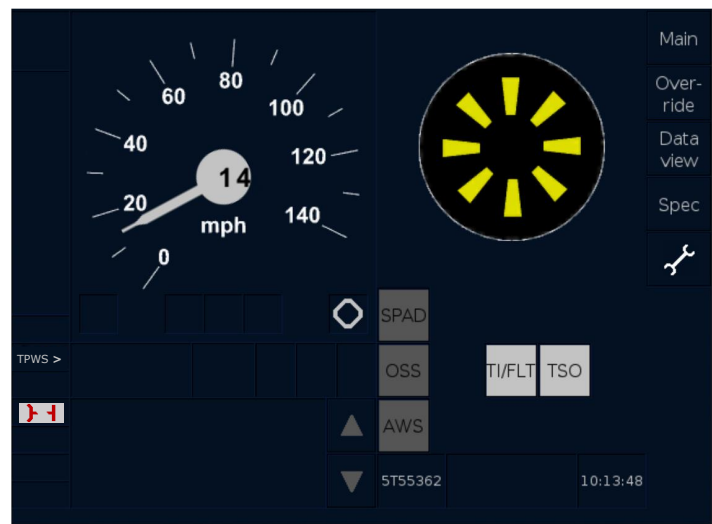


Figure 29 - Connection lost / setup failed indication

- If the train has not attempted to establish a session with the RBC, neither the 'Connection Up' (see Figure 30) nor the 'Connection Lost / Setup Failed' indication will be displayed.

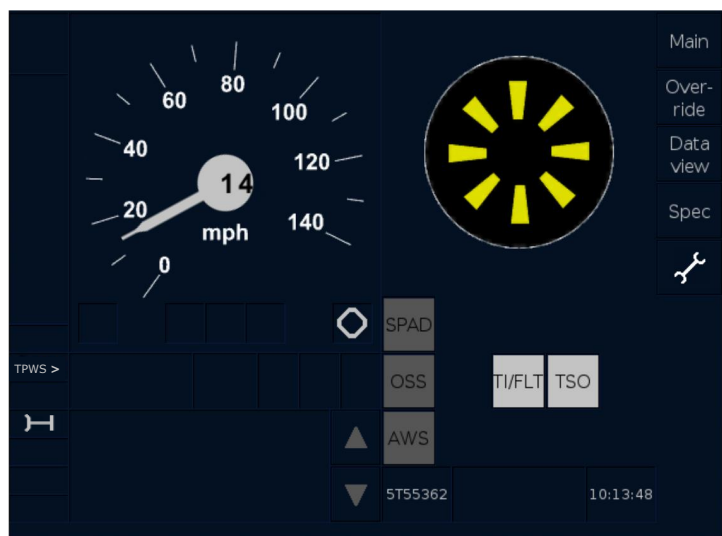


Figure 30 - Train has not attempted to establish a session with the RBC

The driver will bring the train to a stand at signal Z. Once at a stand at signal Z, the driver contacts the signaller and receives authority to pass the signal at 'Danger'. [EOPSS-178]

The driver operates the TPWS temporary isolation switch (GERT-8000-S5 [R17]) and selects 'Override' on the ETCS DMI before proceeding. On crossing the transition

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border (and reading the border balise group which contains the LTO with supported levels in a priority table), the ETCS Onboard transitions to L2 and enters SR. The suppression of the on-board Class B systems (AWS and TPWS)) is now enforced because the train is in L2 (RIS-0797-CCS 4.2.3 [R5] and RIS-0798-CCS, 4.2.4 [R6]). The driver proceeds in accordance with the signaller's instructions.

5.2.1.3 Abnormal scenarios (Operationally related issues)

5.2.1.3.1 Approaching train is in Level NTC (NID_NTC=21), SN

The operations in Level NTC (NID_NTC=21), SN on the approach to an L2 without signals area transition border are unlikely and should be considered as abnormal and unintended operations, possibly due to driver error (e.g. the driver has manually selected the wrong level), or due to a planning/misrouting error.

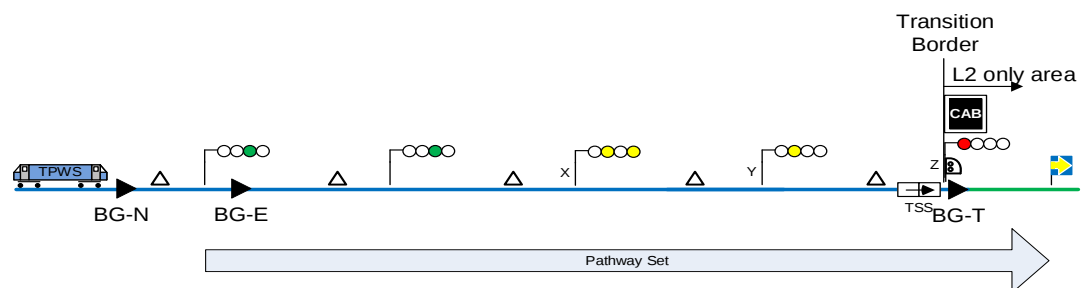


Figure 31 - TPWS Train approaching RTAA – L2 without signals area

If the approaching train is in 'Level NTC (NID_NTC=21)', it will still receive, and respond to, the registration and communication session establishment orders (BG-N and BG-E in **Figure 31**).

The ETCS Onboard registers with the Global System for Mobile Communications – Railway (GSM-R) network and establishes a communication session with the RBC controlling the L2 area. In accordance with Subset 026 [R1], once the session is established, the train will send a position report which contains its level and mode. The RBC detects the reported Level NTC (NID_NTC=21) and instructs the ETCS Onboard to terminate the session. [ETrckSS-958]

Note: The driver may see the safe communication icon appearing and then disappearing when the communication is terminated.

Since the train is not communicating the Trackside will maintain signal Z at danger. [ETrckSS-379] [ETrckSS-292] The driver controls the train to a stand at signal Z. [EOPSS-178]

If operating in Level NTC (NID_NTC=21) due to an error then the driver can manually select TPWS> on the DMI (See Topic G7-Change of Level). Once the train is in Level NTC (NID_NTC=20) the normal transition can resume (see 5.2.1.1.1)

Where the driver is not competent for ETCS driving they may be required to enter the ETCS L2 area in SR to aid in recovery of service. The signaller will need to authorise override (see Topic S). When authorisation is given entry into the L2 area will follow the same process as that for entry of non-communicating trains, i.e. The driver operates the TPWS temporary isolation switch (GERT-8000-S5 [R17] and selects 'Override' on the ETCS DMI, and then proceeds over the transition balise.

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Without performing the necessary overrides, if the train passes Signal Z at 'Danger', it will be tripped by a TPWS TSS loop located at the signal [ETrckSS-296] and On reading balise group BG-T containing the LTO priority table the train will transition to L2 and enter TR as there is no MA held on board.

Operational procedures will be defined for drivers entering an area which is not on their complementary certificate to operate.

Note: there may be multiple Session Establish messages on approach to signal Z so the train may connect and be instructed to disconnect several times.

5.2.1.3.2 Approaching train is in Level NTC (NID_NTC=20), SH

Whilst operation in SH other than in a possession or a designated shunting area is prohibited operationally, the reaction of the system is no different to L0, SH See 5.2.1.1.2. Signal Z will remain at danger as no MA or LTA has been issued.

5.2.1.3.3 Approaching train is in Level NTC (NID_NTC=21), SH

If the train is in SH the communication with the ETCS Trackside will not be established after passing the relevant BG. Signal Z will remain at danger as there is no MA or LTA has been issued. [ETrckSS-292]. [ETrckSS-379]

The driver will stop the train at the signal, and contact the signaller.

The signaller or driver will identify that the driver does not have the necessary competence to enter the L2 without signals area.

Operational rules are required to recover from the situation.

5.2.1.3.4 Approaching train is not fitted with an ETCS Onboard

As the train is not fitted with ETCS Onboard equipment the communication with the ETCS Trackside will not be established after passing the relevant BG. Signal Z will remain at danger as no MA or LTA has been issued. [ETrckSS-292]. [ETrckSS-379]

If the train is required to pass the signal at danger, then this will be done in accordance with GERT-8000-S5 [R17].

5.2.1.3.5 SPAD with train approaching in Level NTC (NID_NTC=20), SN

When signal Z is displaying a stop aspect, the driver should not move the train beyond the signal.

If the train passes signal at 'Danger' in Level NTC, the TPWS Train Stop Sensor (TSS) at the signal being activated will result in the train brakes being applied. [ETrckSS-296], RIS-0797-CCS, 4.2.4 [R5] and RIS-0798-CCS, 4.2.5 [R6].

When the train passes the border BG, the BG message will have an LTO with L2 as the highest. [ETrckSS-1436] [ETrckSS-1433].

When the train passes the balise group and transitions to L2, the ETCS Onboard will enter TR mode, as there is no Authority to move in L2 (See Chapter 5 [R1]).

The DMI will display the system state message "No MA received at level transition" [R9].

Operational Rules and procedures will be applied to recover from the situation. [EOPSS-178]

The Driver will need to carry out SoM as part of post trip, see Topic G and Chapter 5[R1].

5.2.1.3.6 SPAD with train approaching in Level NTC (NID_NTC=21), SN

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This scenario is the same as a SPAD in Level NTC (NID_NTC=20) See 5.2.1.3.55

The signaller or driver will identify that the driver does not have the necessary competence to enter the L2 without signals area.

Operational rules are required to recover from the situation.

5.2.1.3.7 SPAD with train approaching in Level NTC (NID_NTC=20), SH

If the train is in SH the communication with the ETCS Trackside will not be established after passing the relevant BG. Signal Z will remain at danger as there is no MA or LTA has been issued. [ETrckSS-292]. [ETrckSS-379]

If the train passes the signal at 'Danger', it will be tripped by the TPWS TSS loop located at the signal. [ETrckSS-296]

The priority table contained within the LTO message and the RBC details will be stored by the ETCS Onboard (See Chapter 4 [R1])

The driver will need to follow operational procedures following TPWS activation and manually change to Level 2 to proceed.

5.2.1.3.8 SPAD with train approaching in Level NTC (NID_NTC=21), SH

This scenario is the same as a SPAD in Level NTC (NID_NTC=20) See 5.2.1.3.7

The signaller or driver will identify that the driver does not have the necessary competence to enter the L2 without signals area.

Operational rules are required to recover from the situation.

5.2.1.3.9 SPAD with train approaching not fitted with ETCS

As the train is not fitted with ETCS Onboard equipment the communication with the ETCS Trackside will not be established after passing the relevant BG. Signal Z will remain at danger as no MA or LTA has been issued. [ETrckSS-292]. [ETrckSS-379]

If the train passes the signal at 'Danger', it will be tripped by the TPWS TSS loop located at the signal. [ETrckSS-296]

5.2.1.3.10 SPAD with train approaching train in L0, UN

When signal Z is displaying a stop aspect, the driver should not move the train beyond the signal.

When the train passes the border BG, the BG message will have an LTO with L2 as the highest. [ETrckSS-1436] [ETrckSS-1433] [ETrckSS-817] [ETrckSS-727].

When the train passes the balise group and transitions to L2, the ETCS Onboard will enter TR mode, as there is no MA to move in L2 (See Chapter 5 [R1].

The DMI will display the system state message "No MA received at level transition" [R9].

Operational Rules and procedures will be applied to recover from the situation. [EOPSS-178]

The Driver will need to carry out SoM as part of post trip, see Topic G and Chapter 5[R1].

5.2.2 System States and User Information (Entering L2 without signals from L2 with signals area)

The System states and user information for entering a L2 without signals from a L2 with signals area are mostly the same as entering a L2 without signals from a Level NTC area (See 5.2.1). The additions are listed in **Table 8** below.

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Table 8 - Running Transition from L2 with signals to L2 without signals area

Entry to L2 without signals from L2 with signals area		Starting condition	End Condition
	Topic Section	Level, Mode, scenario	Level, mode
	5.2.2.1.1	Approaching train is in L2 with an MA and can be granted an MA to cross the transition border	same as starting condition
	5.2.2.2.1	Approaching train is in L2 SR with a communication session established	L2,FS
	5.2.2.2.2	Approaching train is in L2 SR with no communication session established	L2,SR

5.2.2.1 Normal Transition to L2 without signals, (intended approaches and transitions)

5.2.2.1.1 Approaching train is in L2 with an MA and can be granted an MA to cross the transition border

If the approaching train is in L2 with an MA, it is unaffected by the transition arrangements and can continue across the border in L2 with the appropriate MA. Signal Z clears when the MA into the L2 without signals area is transmitted by the RBC and the receipt acknowledgement from the ETCS Onboard is subsequently received. [ETrckSS-292] In the background the table of priorities will be updated but this does not affect the driver.

5.2.2.2 Degraded scenarios (Trackside or ETCS Onboard failures)

5.2.2.2.1 Approaching train is in L2 SR with a communication session established

Trains may approach the transition border in L2 if the area before the border is in a with signals area. If the approaching train is already operating in L2 and has been authorised up to signal Z in SR, the signal clears once the MA has been transmitted to the train and the receipt acknowledgement from the ETCS Onboard is subsequently received by the RBC. [ETrckSS-292]

This transmission of the MA could be part of the functionality to step up from SR to FS (or OS depending on the Pathway set ahead), as described in Option A2 of Topic A – Continuing Movement,

Note: The MA sent with the LTA will be referenced from the LRBG based on the last reported position of the train, therefore the train will step up on approach signal Z. [ETrckSS-379]

5.2.2.2.2 Approaching train is in L2 SR with no communication session established

Trains may approach the transition border in L2 if the area before the border is in a with signals area. If the approaching train is already operating in L2 and has been authorised up to signal Z in SR, and the train is not in communication with the RBC, the signal must be maintained at 'Danger'.

As the train is already in L2, it will be authorised by the signaller to pass Signal Z in SR when the conditions for this are met, which will require the driver to select 'Override' as a 'Stop if in SR' balise is located at the entry signal. [EOPSS-178]

There is no need for the driver to override the TPWS as this, along with the AWS, is already suppressed (RIS-0797-CCS 4.2.3 [R5] and RIS-0798-CCS, 4.2.4 [R6]).

5.2.2.3 Abnormal scenarios (Operationally related issues)

No additional scenarios identified, see 5.2.1

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5.2.3 Impact on other Topics

Topic A – Continuing Movement

Topic U – Movement Authorities

Topic S – Degraded Working

5.2.4 Design Guidance

5.2.4.1 Transition Scheme Design

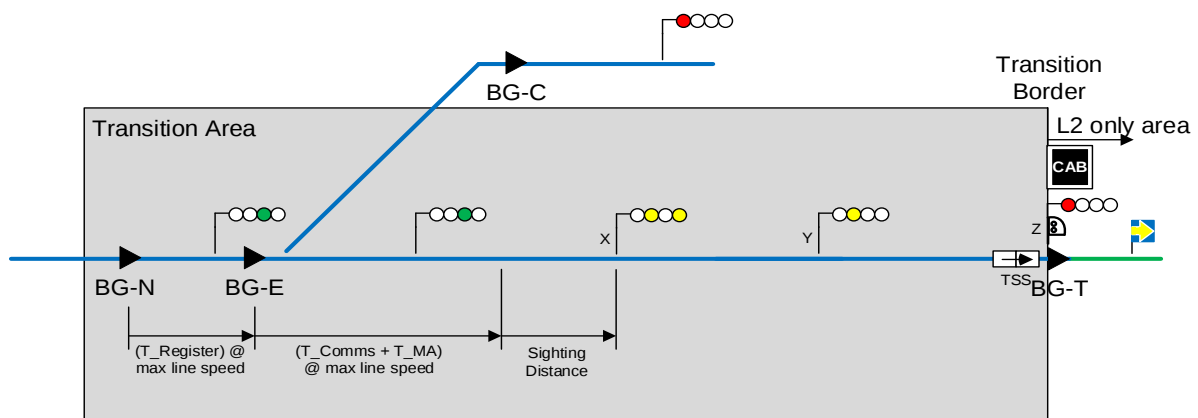


Figure 32 - Approach area overview – L2 without signals

5.2.4.1.1 Location of Transition

The location of the transition border considers driver workload and the hazards associated with drivers being distracted from other priority tasks by the transition arrangements and the change in driving rules. Consideration is also given to these other tasks occurring in the approach area or immediately beyond the transition border. These other priority tasks may include:

- monitoring locally-monitored crossings;
- responding to approaching neutral sections or traction changeover locations; and
- stopping at a station, or any other location where the train may be operationally required to stop.

The ideal location for a transition is on a section of plain line but this may not be achievable. The location of the transition border considers the number of possible routes from different tracks that can lead up to it as this can greatly complicate the amount of track description data that the RBC needs to hold. The number of possible routes from different tracks that can lead up to the location of the transition border can also complicate the management of that data and affect the mitigation of any risks associated with the full length of a train not being supervised after the transition border is crossed (see guidance below on avoiding Entry to FS/OS messages).

The location should enable an unrestricted aspect sequence up to the border which may require that the first block sections within the ETCS area are of sufficient length to support the required braking distances for the lineside aspects.

The transition design aligns the displayed aspects with the extent of the MA within the ETCS area to avoid sudden interventions at the point of transition. This supports drivers of trains being at a speed after the transition that does not result in a train

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already having exceeded the indication supervision limit for any approaching EOAs or speed restrictions. It may, therefore, be necessary, where ETCS section lengths are shorter than is conventional, or where the first MA includes an OS profile for signal Z to be approach-controlled. [ETrckSS-270] The location of the transition border should also take account of the relative location of decreases in the speed profile appropriate to any train that can cross the border.

5.2.4.1.2 Network Registration

Although the ETCS Onboard will attempt to register with the GSM-R network at power-up, BG-N ordering registration with the network is included, this is a separate BG from the session establishment BG⁵ and this is to provide a second opportunity to register should registration fail at power-up. Communication session establishment orders sent to an ETCS Onboard that is not registered with the network will be rejected; this could delay or prevent the clearing of signal Z and impact on performance. Where the risk of registration at power-up failing is acceptably low, BG-N need not be provided. Non-provision of BG-N has the added benefit that it reduces the extent of the 'RTAA', i.e. the area before the transition border that is required to facilitate the transition arrangements.

5.2.4.1.3 Session Establishment

BG-E containing the relevant session establishment packet is placed sufficient distance after BG-N to allow registration to be completed.

All subsequent BG marked as linked within the approach area to the transition also contain a session establishment packet to allow for trains which undertake Start of Mission within the area. [ETrckSS-Nxx3]

Where there is a divergence away from the transition, BG-C is provided to terminate the current session.

The Trackside is configured to request termination of a session from a train reported to be in Level NTC (NID_NTC=21). [ETrckSS-958]

A separate BG-E from BG-N to establish communication⁵ is placed sufficiently far from the transition to enable the session to be established, an MA to be issued and the border signal to clear to proceed before the driver encounters a cautionary aspect. [ETrckSS-287]

5.2.4.1.4 Transmission of Level Transition Announcement and Movement Authority

The ETCS Trackside transmits an LTA with a priority table of Level 3 (where required), Level 2 and Level 0. [ETrckSS-379] [ETrckSS-1433] when the following conditions are met:

- The train is communicating
- The train is not operating in Level NTC (NID_NTC)=21
- Signals between the current position of the train and the transition border are showing proceed and the line is clear
- A Pathway is set from the transition border into the ETCS area
- All the conditions for issue of an MA in the ETCS area are satisfied [ETrckSS-732]

⁵ This is to provide mitigation for the error condition associated with issue 1 of CR1312

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The LTA and MA are referenced to the LRBG (the last linked BG reported by the Onboard).

The MA includes track description information for the approach to the transition sufficient to cover the length of the longest expected train. This is to minimise the frequency of 'Entering FS' or 'Entering OS' messages being displayed to the driver (see Subset-026, sections 4.4.9.1.4 and 4.4.12.1.7 [R1]) following the transition to L2. This requires the RBC to 'know' the track condition data applicable before the transition border, and maximises the supervision provided by the system after the transition has occurred. [ETrckSS-275] It also avoids the need for the driver to check that the rear of the train has passed the transition border before following the speed information displayed on the ETCS DMI⁶.

Each time that the Onboard reports a new LRBG the Trackside sends an updated LTA and MA based on that new location. This is done to reduce the confidence interval which affects when the LTA will be actioned and also the supervision of the MA after the transition. [ETrckSS-Nxx2]

5.2.4.1.5 Control of Signal Z

The entry to an L2 without signals area is controlled by the aspect displayed by the entry signal Z. [ETrckSS-286]

Only those trains that can operate in the L2 without signals area are signalled past signal Z.

Signal Z should provide the full range of aspects for the area in which it is applied: four aspects if in a four-aspect area, three aspects if in a three-aspect area. There must be no inconsistency in aspect sequence at signal Z.

Note: There is no intention to provide new signals at, or on the approach to, the entry into the ETCS area.

Signal Z and any associated subsidiary signal only clears for an approaching train when:

- the appropriate route into the L2 area is set and conventional Interlocking (IXL) conditions for the relevant signal to clear are met.
- the approaching train is in communication with the RBC.
- the approaching train is not operating in Level NTC (NID_NTC=21) (see section 5.2).
- the RBC has transmitted an MA and the LTA to the train and a receipt acknowledgement has been received⁷; and
- any approach control timers have expired.

⁶ The system status message: 'Entering FS' or 'Entering OS' is shown to the driver when the front of the train is entering an FS or OS area, but track description data (speed, gradient) is not available for the whole length of the train. When one of these text messages appears, the driver is responsible for respecting the speed restrictions that apply for the part of the train that is not covered by speed and gradient data. Designing the ETCS Trackside implementation to avoid the presentation of these messages is in line with the wishes of the European Operational Rules Group, who do not want this to be a driver responsibility.

⁷ This means that the driver of a train operating in L-NTC can determine from the appropriate method of signalling (in this instance, the lineside signal aspect) whether the train can cross the border or not; there is no need to try and determine from other ETCS-related indications (communications status, announcement of transition, etc.), while operating in L-NTC, whether the train will transition to L2/L3 without being tripped. Until the train transitions to L2/L3, there is no direct indication to the driver on the ETCS DMI that an MA has been received and stored by the ETCS Onboard, and using the signal aspect in this manner means that additional indications, or interpretation of the available indications, are not required.

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Signal Z and its associated subsidiary signal must not, therefore, clear for trains (ETCS fitted or unfitted) that are not in communication with the RBC or operating in Level NTC (NID_NTC=21) [ETrckSS-292] [ETrckSS-379] .

Signal Z is provided with TPWS equipment. [ETrckSS-296]

Trains routed away from the transition border must also not receive the transition announcement as the ETCS Onboard will transition to the announced level when the announced location is reached. If the transition announcement has been received by trains subsequently routed away, e.g. because it was wrongly routed, the driver will need to close the cab in order for the stored LTA to be cancelled.

Conventional routing information is to be provided at the entry signal, as required by, and in accordance with, conventional signalling rules. The need for a Preliminary Route Indicator (PRI) (for routing after the entry signal) prior to the transition border will be determined in accordance with the rules in RIS-0703-CCS [R10] for the provision of PRIs on the assumption that the transition does not occur and based on the area after the RTAA being conventionally signalled. Conventional routing information provided before or at the entry signal, must be replicated via text message displayed on the ETCS DMI once the transition to Level 2 is complete, in accordance with Topic V.

5.2.4.1.6 Consistency of Aspects and MA

When cleared for a 'main' Pathway, signal Z must display an aspect in keeping with the available route beyond the transition border. There must be no change in meaning of the conventional aspect to the driver.

Therefore:

- First caution (single yellow, 3-aspect; double yellow, 4-aspect) displayed by signal Z means that the MA extends for signalling braking distance beyond the signal, in accordance with GKRT0075 [R3] rules.
- Second caution (single yellow, 4-aspect) displayed by signal Z means that the MA extends for at least 50% of signalling braking distance beyond the signal, in accordance with GKRT0075 [R3] rules.

Note: A single yellow aspect is the most restrictive main aspect that can be displayed by signal Z when the train acknowledged an MA.

Any changes to the aspect displayed by signal Z, or its associated subsidiary signal, must be reflected in an updated MA sent to the train. If the signal is replaced, the MA must be shortened to the transition border. [ETrckSS-270]

The RBC must only transmit a transition announcement and MA to cross the border to an approaching train if:

- signal Z and its associated subsidiary signal are 'capable of clearing'; and
- it has been determined that the approaching train is the first train before the border, i.e. there is no other train between the approaching train and the transition border.

The MA sent to the train must:

- reflect the type and extent of the Pathway set beyond the transition border and be consistent with the signal aspect displayed by signal Z or the subsidiary signal; it must include all relevant TSR information that has been configured into the ETCS Trackside.
- data applicable before the transition border, and maximises the supervision provided by the system after the transition has occurred. [ETrckSS-275] It also

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avoids the need for the driver to check that the rear of the train has passed the transition border before following the speed information displayed on the ETCS DMI⁸.

Note: Where there are multiple approaches to a transition border, for example, where the transition border is located immediately after a converging junction from one or multiple routes, the RBC must be capable of determining which route led the train to the transition border and provide the relevant speed information, including applicable TSR information, as part of the MA.

5.2.4.1.7 Transition Border and BBG

Subset-026, section 5.10.1 [R1] requires a BG to be placed at the transition border with an immediate LTO or CLTO. BG-T in **Figure 33** fulfils this requirement and contains the National Values [ETrckSS-223] and a Level Transition Order with a priority table of Level 3 (where required), Level 2 and Level 0. [ETrckSS-1433] [ETrckSS-1436]

Note: This balise also supports the update of the table of priority of trackside-supported ETCS levels held by the ETCS Onboard on trains operating in Sleeping (SL) and Non-Leading (NL) modes.

The driver must not be requested to acknowledge the transition prior to the transition taking place. This is to prevent:

- the driver being distracted on the approach to the signal;
- clashes with any required acknowledgement of the AWS; and
- because the acknowledgement is associated with a change in the rules.

The transition design must not normally impact on performance, capacity timings or headway. [ETrckSS-287]

Trains entering the L2 area must receive the information necessary to switch the units for speed display to those appropriate for the new area before, or at, the transition border (see Topic Z, Option Z2). Any changes to the units for speed display must only come into force at the transition border.

To meet availability and performance requirements, the project should consider whether balises within BGs provided for transition purposes may be duplicated, and whether transition-related messages in one BG should be repeated in subsequent or additional BGs (for example, BG-E could also include the network registration packet and further session messages provide as described above).

5.2.4.2 Temporary and Emergency Speed Restrictions and Transitions to L2 without signal areas Design

- a) The way in which TSRs and ESRs are managed on an ETCS L2 without signals railway differs from the methods used in conventionally-signalled systems, as described in Topic F. Transition borders between conventionally-signalled (ETCS unfitted or L2 with signals areas) and L2 without signals areas are also, therefore, locations at which the methods of applying TSRs and ESRs change. Operational rules and instructions will be provided for areas where TSRs/ESRs extend beyond non-ETCS and ETCS boundaries. The following sections provide a description of the proposed methods of managing the change for TSRs and ESRs in the vicinity

⁸ The system status message: 'Entering FS' or 'Entering OS' is shown to the driver when the front of the train is entering an FS or OS area, but track description data (speed, gradient) is not available for the whole length of the train. When one of these text messages appears, the driver is responsible for respecting the speed restrictions that apply for the part of the train that is not covered by speed and gradient data. Designing the ETCS Trackside implementation to avoid the presentation of these messages is in line with the wishes of the European Operational Rules Group, who do not want this to be a driver responsibility.

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of transition borders, at entry to a L2 without signals area from a non-ETCS-fitted area. **TSRs that start and end before the transition border**

TSRs that start and end before the transition border are fully signed (TSR commencement board and TSR termination board and, where required, an AWS magnet TSR warning board), in accordance with RIS-0735-CCS [R4].

If a TSR ends sufficiently close to the transition border that the rear of trains that operate on the line, and which cross the transition border, are still required to be supervised after the transition has occurred, then the end of the TSR (at least) must be configured in the ETCS. [ETrckSS-959]

If the TSR ends far enough away from the transition border that the rear of trains that operate on the line are not still required to be supervised after the transition has occurred, then there is no need to configure the TSR in the ETCS.

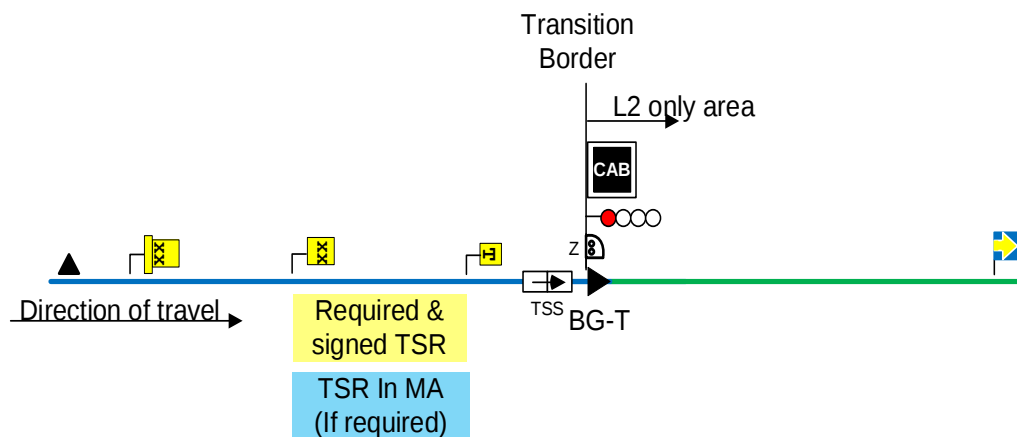


Figure 33 - TSR starts and ends before the transition border

b) TSRs that straddle the transition border

TSRs that start before the transition border and end within the L2 without signals area, are only partially signed (AWS magnet, TSR warning board, and TSR commencement board; no TSR termination board), in accordance with GKRT0075 [RD3]. The TSR information is entered into the ETCS Trackside, starting at the transition border. Fitted trains that transition to L2 with an MA will immediately be supervised to the TSR from the transition point onwards.

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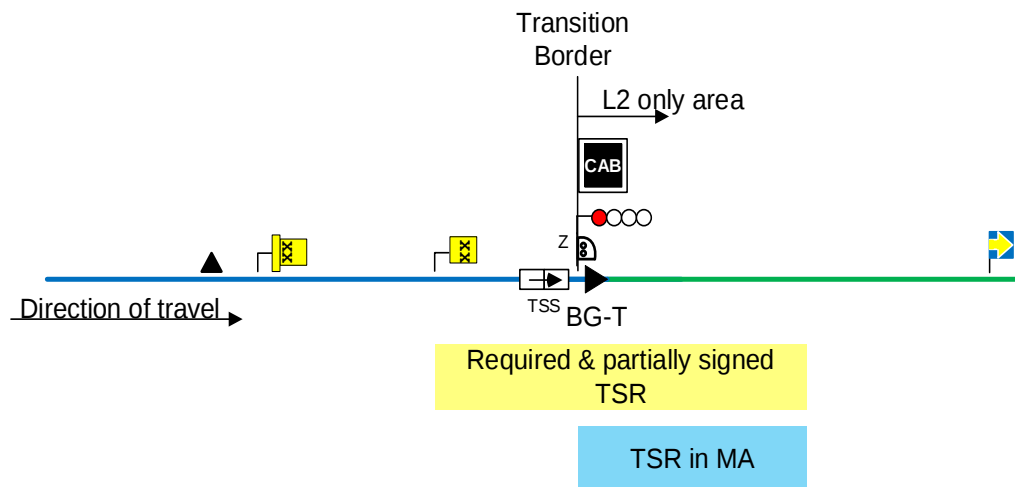


Figure 34 - TSR straddles the transition border

c) TSRs starting within the L2 without signals area - $\leq$ Deceleration Distance

Where a TSR is required to start in the L2 without signals area at less than the deceleration distance from the transition border, i.e. where the warning board would be located before or at the transition border, the TSR must be extended back to start at, or on the approach to, the transition border. This is to minimise the risk of an ETCS intervention if the driver fails to respond to the warning board (possibly, due to being distracted by the transition arrangements) and is then travelling too fast when the train transitions. [ETrckSS-735]

The TSR information is entered into the ETCS trackside, starting at the transition border. Fitted trains that transition to L2 should already be at the required speed when the TSR becomes supervised as part of the ETCS Onboard-determined Most Restrictive Speed Profile (MRSP) applicable from the transition point onwards.

Where the required TSR is very low in comparison to the normal line-speed, extending this TSR back to start at the transition border could have major performance implications. Consideration should be given to defining an intermediate TSR starting before or at the transition border and extending to the nominal start location of the required TSR. The speed of the intermediate TSR would be higher than the TSR required initially. It would be chosen such that the original TSR now started in the L2 without signals area at greater than deceleration distance from the transition border if the deceleration distance calculations for the initially required TSR were performed using the intermediate TSR and the initially required TSR as the start and end speeds. The intermediate TSR would straddle the transition border and be fully signed, as shown in section b). The initially required TSR would then start at greater than deceleration distance from the transition border and would not be signed at all, as shown in section d).

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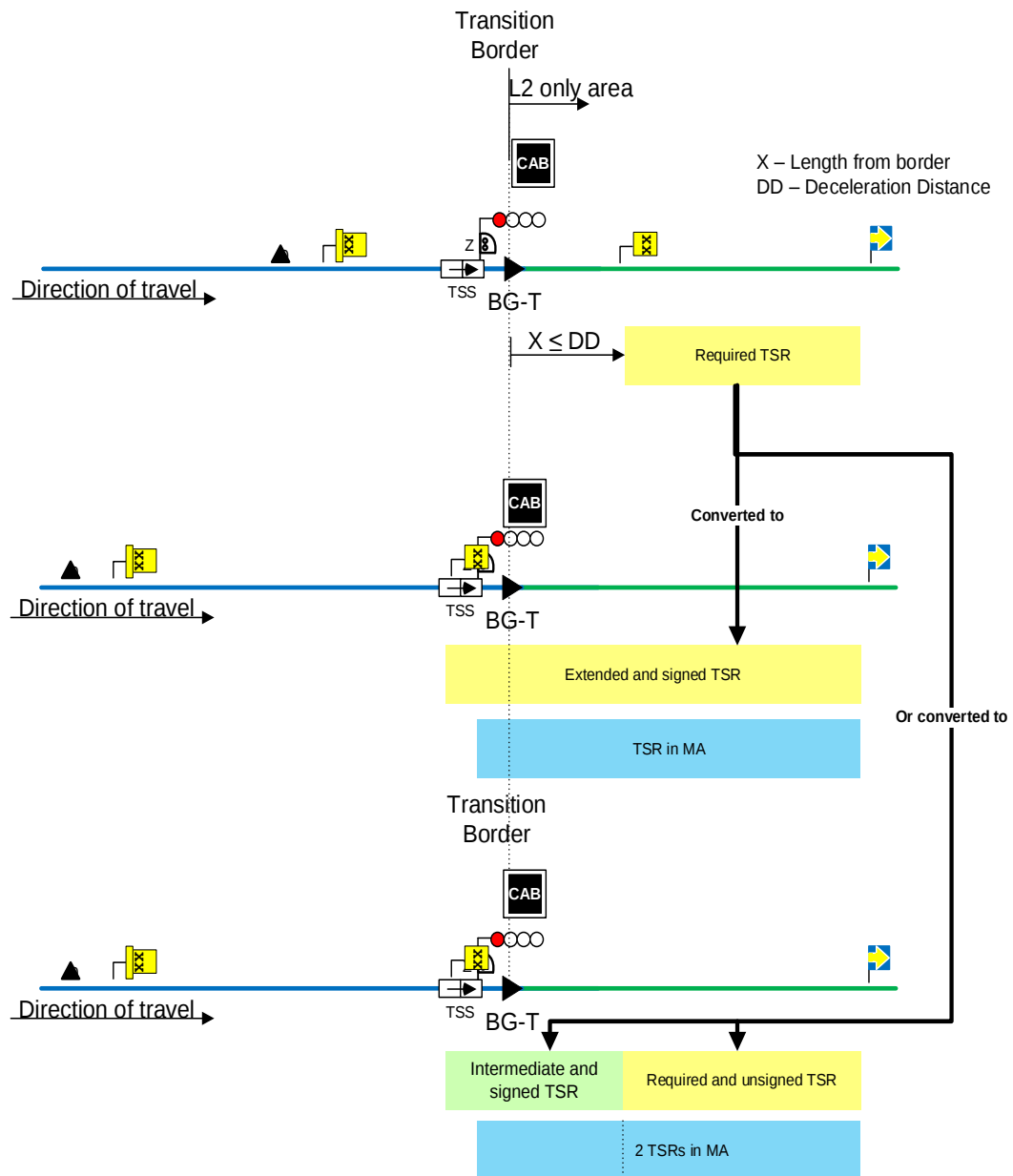


Figure 35 - TSR starts $\leq$ deceleration distance from transition border

d) TSRs starting within the L2 without signals area - > Deceleration Distance

No TSR related trackside equipment (signage or AWS magnets) is provided for TSRs that are required to start in the L2 without signals area at greater than deceleration distance from the transition border, i.e. where the warning board would be located after the transition border. The TSR information is entered into the ETCS trackside, starting at the required start location. Fitted trains that transition to L2 will be supervised to the ETCS Onboard-determined MRSP, including the TSR, from the transition point onwards.

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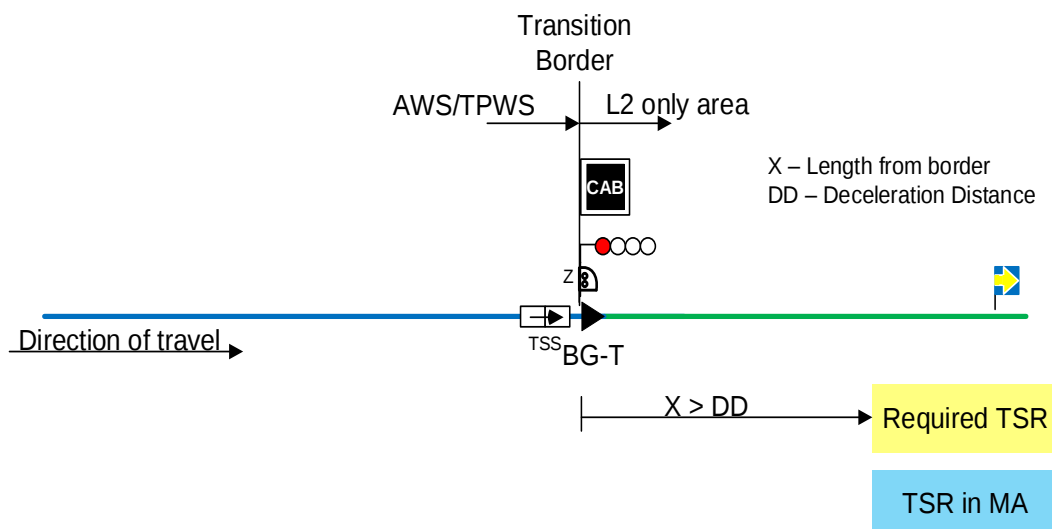


Figure 36 - TSR starts > deceleration distance from transition border

e) Emergency Speed Restrictions

ESRs around a transition border to an L2 without signals area are managed in the same way as TSRs, except for the differences in conventional signage requirements, as defined in GKRT0075 [RD3], i.e. additional emergency indicator and associated AWS magnet. The emergency indicator and associated AWS magnet are only provided if a warning board is to be installed, i.e. if the warning board for an ESR starting in the L2 without signals area is to be located before, or at, the transition border, the emergency indicator and AWS magnet are then provided. If the warning board fell just within the L2 without signals area, and would not, therefore, be provided, the emergency indicator and AWS magnet would not be provided either.

Train drivers are advised of the speed restriction until all necessary trackside equipment is installed and the data is entered into the ETCS trackside.

5.3 Entering a Hybrid Level 3, without signals area

5.3.1 System States and User Information

For transitions where the train is not initially in ETCS and enters a HL3 without signals area, this is the same as Level 2, without signals (see section 5.2), reading references to Level 2 as Hybrid Level 3; symbol LE12 as LE14; and symbol LE13 as LE15 .

For running transitions from L2 to L3 see Option N4-1.

5.3.2 Impact on other topics

See section 5.2.3.

5.3.3 Design Guidance

At the entry to an HL3 area, there is no additional reliance on the receipt of train integrity information prior to the transition for the issue of the first MA.

Note: This may not be the case for entry to a non-HL3 area.

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In situations where it is not possible to issue an MA, or the train is not in communication with the RBC, Operational Rules covering the authorisation of non-communicating trains into the area will need to consider TTD and Virtual Sub-Section (VSS) occupancy states.

When a train enters an HL3 area, applying the principles in [R7], the first VSS will become ambiguous because the possibility that another train is following the entering train cannot immediately be excluded by the ETCS HL3 Trackside. To allow a smooth entry into the HL3 area, specific measures should be taken to trigger the transition from 'ambiguous' state to 'occupied' state when the train is completely inside the HL3 area, i.e. it has passed a TTD border at the entry to the HL3 area.

5.4 ATO

- 5.4.1 The arrangements for entering from an NTC area are described in ATO Reference Design Topic QQ.

5.5 Moving Block

- 5.5.1 To be developed.

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6 Variant N2-2 - Running Transition at the Entry to an L2 or HL3 with Signals Area

6.1 Specific User Requirements

A transition into an ETCS L2/L3 with signals area must be pre-determined and should not require any driver action, other than acknowledgements. [ESR-99]

The transition design will not cause trains to reduce speed for the transition unless required operationally. [ESR-643]

Only drivers that have indicated to the ETCS system during SoM that they are authorised to drive in ETCS will transition to ETCS at the transition boundary.

Drivers that have indicated to the system during SoM that they are not authorised to drive in ETCS will not transition into ETCS at the transition boundary but will continue to operate under the supervision of Class B system. [ESR-66] [ESR-101]

ETCS with signals areas will support operations in Level NTC and L2 or L3. Because conventional train detection is required to support operation in Level NTC in track circuit block areas, an L3 with signals area will be a Hybrid Level 3 implementation.

The transition design must support movements of trains where communication with the RBC has not been established. [ESR-62] [ESR-810]

The ETCS must manage the applicable train protection systems at the transition. [ESR-36]

6.2 Entry into Level 2, without signals area

This is not applicable to N2-2 and is covered in variant N2-1, section 5.2.

6.3 Entry into L2 with signals area

The location of the transition is selected in a similar manner to that described in N2-1 (see section 5) in order to provide a driveable experience for the driver in the normal scenario where the ETCS Onboard receives notification of the level transition, an MA and a proceed aspect is displayed to enter the ETCS area. The preferred location is selected to support the degraded events where there is a failure in the trackside or ETCS Onboard preventing that normal scenario. Consideration has been given to the situations where the transition is approached in a different level or mode from those in which the train would normally be operating. The result of the above analysis was that the preferable location is for the transition to occur at/immediately beyond a lineside signal.

If a project wishes to place the transition at another location then a driveability analysis needs to be undertaken considering all the potential normal, degraded and abnormal situations listed in the following sections.

Drivers need to be trained in what to expect during a level transition, how to react to unexpected sequences and how to operate in degraded scenarios. [EOPSS-857] [EOPSS-861]

6.3.1 System States and User Information (Entering L2 with signals area from a non ETCS area)

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As drivers can encounter many different scenarios for a running transition at the Entry to an L2 with signals area [EOPSS-857], the system states and user information section has been split into sub sections. The first sections describe each normal//expected level/mode and sequence. The analysis and requirements need to also address degraded situations (where the normal transitions cannot take place) and abnormal situations (where the driver/train are in an unexpected level/mode).

Table 9 summarises the starting conditions and the end conditions of each scenario with the relevant section of this topic listed. For each there are normal (highlighted green), degraded (highlighted yellow) and abnormal (highlighted orange) options listed.

The tables in Appendix A 13.5 summarise the potential levels and modes on approach to the border and the interaction between the Trackside and ETCS Onboard.

Table 9 - Running transition from Level NTC area to L2 with signals area

	Topic Section	Starting condition	End Condition
		Level, Mode, scenario	Level, mode
Entry to L2 with Signals from L-NTC area	6.3.1.1.1	Train approaches in Level NTC (NID_NTC=20), SN	L2, FS
	6.3.1.1.2	Train approaches in Level NTC (NID_NTC=21), SN	same as starting condition
	6.3.1.1.3	Train approaches in Level 0, SH – operation in possession	L0, SH
	6.3.1.1.4	Start of Mission in Transition Announcement Area, NID_NTC=20, SN	L2, FS
	6.3.1.1.5	Approaching train is in Level 0 (L0) UN	L2, FS
	6.3.1.2.1	Pathway cannot be set, verbal authorisation Level NTC (NID_NTC=20)	L2, SR
	6.3.1.2.2	Pathway cannot be set, verbal authorisation Level NTC (NID_NTC=21)	same as starting condition
	6.3.1.2.3	Degraded Pathway, PoSA Level NTC (NID_NTC=20)	same as starting condition
	6.3.1.2.4	Degraded Pathway, PoSA Level NTC (NID_NTC=21)	same as starting condition
	6.3.1.2.5	Degraded Pathway, verbal authorisation, (NID_NTC=20)	same as starting condition
	6.3.1.2.6	Degraded Pathway, verbal authorisation, (NID_NTC=21)	same as starting condition
	6.3.1.2.7	Communication cannot be established (NID_NTC=20)	same as starting condition
	6.3.1.3.1	Approaching train is in Level NTC (NID_NTC=20), SH	NID_NTC=20, SH
	6.3.1.3.2	Approaching train is in Level NTC (NID_NTC=21), SH	NID_NTC=21, SH
	6.3.1.3.3	Approaching train not fitted with ETCS	same as starting condition
	6.3.1.3.4	SPAD with train approaching in NID_NTC=20 (SN)	TPWS intervention
	6.3.1.3.5	SPAD with train approaching in NID_NTC=21 (SN)	TPWS intervention
	6.3.1.3.6	SPAD with train approaching in NID_NTC=20 (SH)	NID_NTC=20, SH
	6.3.1.3.7	SPAD with train approaching in NID_NTC=21 (SH)	NID_NTC=21, SH
	6.3.1.3.8	SPAD with approaching train not fitted with ETCS	same as starting condition
	6.3.1.3.9	SPAD with train approaching in Level 0 (L0) UN	same as starting condition

6.3.1.1 “Normal” Transition to L2 with signals

On approach to the L2 with signals area it is expected that in most instances that train will be operating by ETCS authorised driver in Level NTC (NID_NTC=20), SN with the driver having entered valid data into the ETCS for the L2 transition, while ETCS unauthorised driver continue the operation in Level NTC (NID_NTC=21).

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For possession working, the train will be operating in Level 0, SH with the intention that the entry into the L2 with signals area does not cause a change of level or mode.

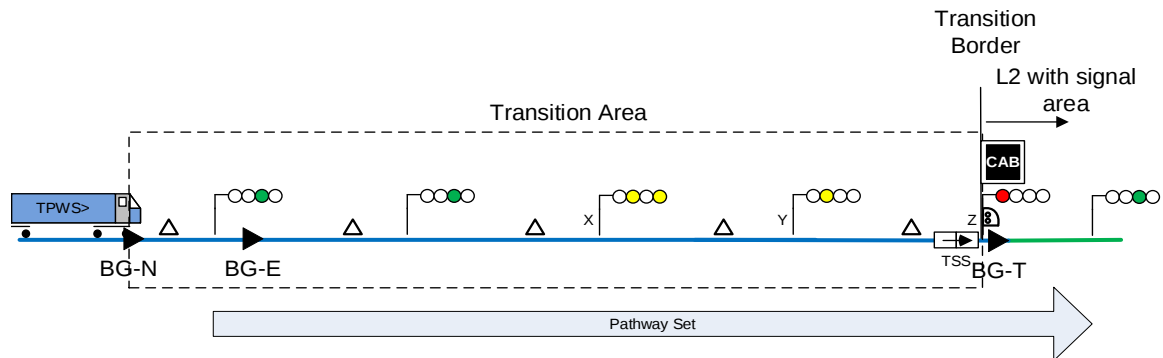


Figure 37 - Train approaching RTAA – L2 with signals area

6.3.1.1.1 Approaching Train is in Level NTC (NID_NTC=20), SN

No different from Variant N2-1 See 5.2.1.1.1 with the following exceptions:

- signal Z will not be held at danger until the ETCS Onboard acknowledges the MA, this is to reduce the impact on performance when non ETCS train is operating in the RTAA.
- the train passes the transition border at the entry signal [ETrckSS-286]. Since the ETCS Onboard has an LTA, information from CLTO will not be accepted [SS26 4.8.3 note 11]. The train will transition to L2 when the announcement distance contained in the LTA reached. In the absence of a mode profile, FS will be selected by the ETCS Onboard.

6.3.1.1.2 Train approaches in Level NTC (NID_NTC=21), SN

When the approaching train is in 'Level NTC (NID_NTC=21)', it will still receive, and respond to, the registration and communication session establishment orders (BG-N and BG-E in Figure 37).

The ETCS Onboard registers with the Global System for Mobile Communications – Railway (GSM-R) network and establishes a communication session with the RBC controlling the L2 with signal area. In accordance with Subset 026 [R1], once the session is established, the train will send a position report which contains its level and mode. The RBC detects the reported Level NTC (NID_NTC=21) and instructs the ETCS Onboard to terminate the session. [ETrckSS-958]

Note: The driver may see the safe communication icon appearing and then disappearing when the communication is terminated.

Signal Z is not maintained at danger.

If the train is operating in Level NTC (NID_NTC=21) and the driver is authorised to operate in L2, at any time on the journey when the driver notices the erroneous mode, the relevant rules and instructions can be followed for the driver to manually select TPWS> on the DMI (See Topic G7-Change of Level) with the train at a stand.

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If the train is in Level NTC (NID_NTC=20) the normal transition can resume (see 5.2.1.1.1)

On passing BG_T, the train reads the CLTO which contains NID_NTC=21 and the train continues in this level.

6.3.1.1.3 Train approaches in Level 0, SH – operation in possession

No different from Variant N2-1 See 5.2.1.1.2 with the exception that signal Z will not be held at danger except that since the BG-T is a CLTO including L0 when the driver exits SH they will remain in L0, not go to L2.

6.3.1.1.4 Start of Mission in RTAA, Level NTC (NID_NTC=20), SN

This is similar to Variant N2-1 See 5.2.1.1.3 with the exception that signal Z will not be held at danger until the ETCS Onboard acknowledges the MA. This may mean that if the SoM takes place after the last BG containing session establishment the train will transition to L2 on passing signal Z and reading the border BG. Without a session, and hence no MA, the result will be entry into TR.

6.3.1.1.5 Approaching train is in Level 0, UN

No different from Variant N2-1 See 5.2.1.1.4 with the exception that signal Z will not be held at danger until the ETCS Onboard acknowledges the MA. If the train receives and executes the LTA from RBC then it will transition in the same manner as a train operating in Level NTC (NID_NTC=20), SN when the distance specified in the LTA has been travelled (see 5.2.1.1.1), if no communications, then when the train passes BG-T train will remain in L0, UN as the CLTO from BG-T contains L0 in the priority list.

6.3.1.2 Degraded scenarios (Trackside or ETCS Onboard failure)

The Degraded scenarios consider trains approaching in Level NTC (NID_NTC=20 and 21), SN or Level 0, UN

6.3.1.2.1 Pathway cannot be set, verbal authorisation Level NTC (NID_NTC=20)

As the pathway cannot be set, signal Z will be at danger and the driver will have a normal aspect sequence to stop at the signal. Once at a stand at Signal Z, the driver contacts the signaller and receives authority to pass the signal at 'Danger'. [EOPSS-178]

The driver operates the TPWS temporary isolation switch (GERT-8000-S5 [R17]) and selects 'Override' on the ETCS DMI before proceeding. If the train receives and executes the LTA from RBC then it will transition in the same manner as a train operating in Level NTC (NID_NTC=20), SN when the distance specified in the LTA has been travelled (see 5.2.1.1.1), if no communications, then when passes BG-T train will remain in Level NTC (NID_NTC=20) as the CLTO from BG-T contains Level NTC (NID_NTC=20) in the priority list.

6.3.1.2.2 Pathway cannot be set, verbal authorisation Level NTC (NID_NTC=21)

As the pathway cannot be set, Signal Z will be at danger and the driver will have a normal aspect sequence to stop at the signal. The driver applies the rules and operates the TPWS temporary isolation to pass signal Z at danger (GE RT-8000-S5). When the train passes the border, it will remain in Level NTC (NID_NTC=21), SN.

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6.3.1.2.3 Degraded Pathway, PoSA Level NTC (NID_NTC=20)

No different from Variant N2-1, see 5.2.1.2.2. If the train receives and executes the LTA from RBC, otherwise it will remain the same as starting condition as BG-T contains CLTO with priority list including Level NTC (NID_NTC=20).

6.3.1.2.4 Degraded Pathway, PoSA Level NTC (NID_NTC=21)

The approaching train will not have a communication session with the RBC as the RBC will instruct the train to disconnect as train in NID_NTC=21. Signal Z will display PoSA and the driver can proceed. When the train passes the border, it will remain in Level NTC (NID_NTC=21), SN.

6.3.1.2.5 Degraded Pathway, verbal authorisation, (NID_NTC=20)

The driver applies the rules and operates the TPWS temporary isolation to pass signal Z at danger (GE RT-8000-S5) and overrides the ETCS. When the train passes the border it will remain in Level NTC (NID_NTC=20), SN. If the train receives and executes the LTA from RBC, it will transition to L2, SR otherwise will remain the same as starting condition as BG-T contains CLTO with priority list including Level NTC (NID_NTC=20).

6.3.1.2.6 Degraded Pathway, verbal authorisation, (NID_NTC=21)

The driver applies the rules and operates the TPWS temporary isolation to pass signal Z at danger (GE RT-8000-S5). When the train passes the border it will remain in Level NTC (NID_NTC=21), SN.

6.3.1.2.7 Communication cannot be established (NID_NTC=20)

Without a communication session the Onboard will not receive a Level Transition Announcement and hence will remain in Level NTC (NID_NTC=20), SN as BG-T contains CLTO with priority list including Level NTC (NID_NTC=20).

6.3.1.3 Abnormal scenarios (Operationally related issues)

6.3.1.3.1 Approaching train is in Level NTC (NID_NTC=20), SH

Without a communication session the Onboard will not receive a Level Transition Announcement and hence will remain in Level NTC (NID_NTC=20), SH (even after the exit from SH).

6.3.1.3.2 Approaching train is in Level NTC (NID_NTC=21), SH

Without a communication session the Onboard will not receive a Level Transition Announcement and hence will remain in Level NTC (NID_NTC=21), SH (even after the exit from SH).

6.3.1.3.3 Approaching train not fitted with ETCS

No different from Variant N2-1, see 5.2.1.3.4 with the exception that signal Z will not be held at danger and the driver can legitimately pass and will continue without a reaction (TPWS or ETCS)

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6.3.1.3.4 SPAD with train approaching in NID_NTC=20 (SN)

When signal is displaying a stop aspect, the driver should not move the train beyond the signal.

If the train passes signal at 'Danger' in Level NTC, the TPWS Train Stop Sensor (TSS) at the signal being activated will result in the train brakes being applied. [ETrckSS-296], RIS-0797-CCS, 4.2.4 [R5] and RIS-0798-CCS, 4.2.5 [R6].

When the train passes the border BG, the BG message will have an CLTO with Level NTC (NID_NTC=20), hence will remain in Level NTC (NID_NTC=20).

6.3.1.3.5 SPAD with train approaching in NID_NTC=21 (SN)

When signal is displaying a stop aspect, the driver should not move the train beyond the signal.

If the train passes signal at 'Danger' in Level NTC, the TPWS Train Stop Sensor (TSS) at the signal being activated will result in the train brakes being applied. [ETrckSS-296], RIS-0797-CCS, 4.2.4 [R5] and RIS-0798-CCS, 4.2.5 [R6].

When the train passes the border BG, the BG message will have an CLTO with Level NTC (NID_NTC=21), hence will remain in Level NTC (NID_NTC=21).

6.3.1.3.6 SPAD with train approaching in NID_NTC=20 (SH)

Without a communication session the Onboard will not receive a Level Transition Announcement and hence will remain in Level NTC (NID_NTC=20), SH. Where TPWS is provided then it will be activated.

6.3.1.3.7 SPAD with train approaching in NID_NTC=21 (SH)

Without a communication session the Onboard will not receive a Level Transition Announcement and hence will remain in Level NTC (NID_NTC=21), SH. Where TPWS is provided then it will be activated.

6.3.1.3.8 SPAD with train approaching train not fitted with ETCS

No different from Variant N2-1, see 5.2.1.3.9.

6.3.1.3.9 SPAD with train approaching train in L0, UN

The train remains in L0, UN and the driver supervises the train in accordance with the lineside signals. The priority table is updated at the border but the ETCS will not apply a reaction. As the train is operating in Level 0, none of the train protection systems will apply a reaction as a consequence of the SPAD.

6.3.2 Impact on other topics

Topic A – Continuing Movement

Topic U – Movement Authorities

Topic S – Degraded Working

6.3.3 Design Guidance

6.3.3.1 Transition Scheme Design

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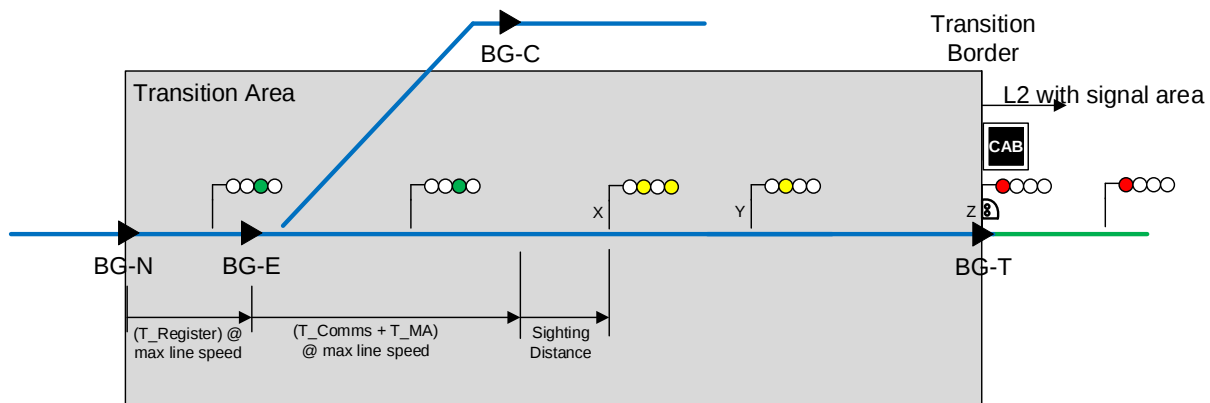


Figure 38 - RTAA overview – L2 with signals

The design guidance for the transition to L2 with signal area is same as the design guidance of transition to L2 no signal area (see 5.2.4) with following exceptions.

Control of Signal Z

The transition design must enable the speed of trains approaching the signal controlling entry to the ETCS L2 with signals area to be controlled appropriately for the type and extent of the Pathway set into the L2 with signal area.

It must normally be possible for all trains, regardless of operating level or communications status, to be signalled into the L2 with signals area with no impact on performance.

If a communication session cannot be established, or it is not possible for an MA to be granted, but it is possible to clear signal Z to a proceed aspect, then trains already in Level NTC (NID_NTC=20) remain in that level and proceed into the L2 with signals area without announcement to the driver of, or transition to, L2 or Level NTC (NID_NTC=21). [ETrckSS-730] [ETrckSS-1441]

Trains in Level NTC (NID_NTC=21) must be able to proceed into the L2 with signals area without transitioning to L2 or Level NTC (NID_NTC=20) and without an announcement of the transition being made to the driver.

Speed profiles in vicinity of Transition

The implementation must take into account the risk of overspeed in an L2 with signals area if the linespeed for operations in L2 is higher than that for operations in Level NTC.

The risk is that drivers of trains that normally transition to L2 and operate at the higher linespeed may, on occasion, not transition to L2 and may incorrectly drive at the L2 speed when actually operating in Level NTC. Potential mitigation measures include not permitting higher speed operations in L2, and the use of different units for speed display in L2 and Level NTC, which may make the different operating level more obvious.

6.3.3.2 TSR and ESR and Transitions from unfitted to L2 with signals areas

In with signals areas, the requirement for lineside equipment for TSRs and ESRs is unchanged due to the need to support operation of unfitted trains, trains operating in Level NTC (NID_NTC=20), or trains continuing to operate in Level NTC

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(NID_NTC=21). To reduce the impact of the transition border on all trains, the following is proposed for the implementation of TSRs and ESRs in the area around a transition border to a with signals area. Operational rules and instructions will be provided for areas where TSRs/ESRs extend beyond non-ETCS and ETCS boundaries.

a) TSRs that Start and End before the Transition Border

No different from Variant N2-1, see 5.2.1.1.4 a)

b) TSRs that Straddle the Transition Border

No different from Variant N2-1, see 5.2.1.1.4 b) except fully signed including in L2 with signal area

TSRs that start before the transition border and end within the with signals area are fully signed (AWS magnet and TSR warning board, if required, TSR commencement board, and TSR termination board), in accordance with GKRT0075 [RD3]. The TSR information entered into the ETCS starts at the transition border. Fitted trains that transition to L2 with an MA will immediately be supervised to the TSR from the transition point onwards.

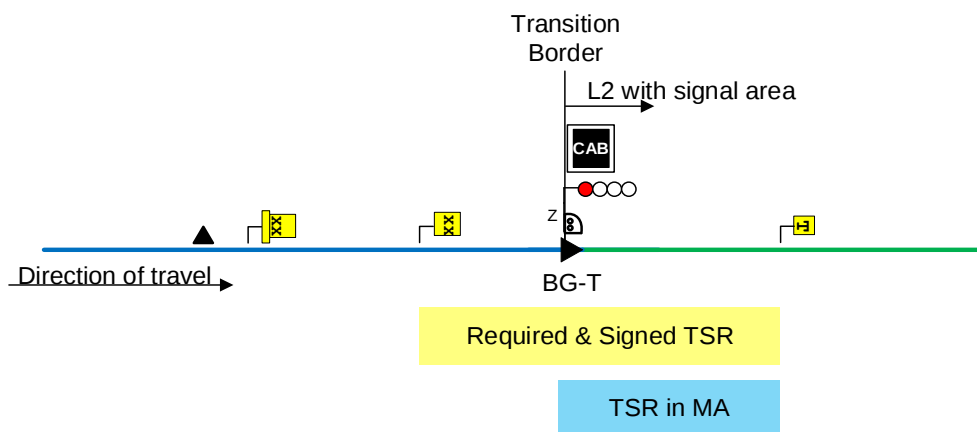


Figure 39 - TSR straddles transition border

c) TSRs starting within the L2 with signals area - $\leq$ Deceleration Distance from transition border

No different from Variant N2-1, see 5.2.1.1.4 c), except the extended TSR is fully signed (AWS magnet and TSR warning board, if required, TSR commencement board, and TSR termination board), in accordance with GKRT0075 [RD3].

The intermediate and required TSRs are fully signed (AWS magnet and TSR warning board, if required, TSR commencement board, and TSR termination board), in accordance with GKRT0075 [RD3].

d) TSRs starting within the L2 with signals area - $>$ deceleration distance from transition border

No different from Variant N2-1, see 5.2.1.1.4 d), except that TSRs that are required to start in the with signals area at $>$ deceleration distance from the transition border are fully signed (AWS magnet and TSR warning board, if required, TSR commencement board, and TSR termination board), in accordance with GKRT0075 [RD3].

e) Emergency Speed Restrictions

ESRs around a transition border to a L2 with signals area are managed in the same way as TSRs, except for the differences in the conventional signage requirements, as

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defined in GKRT0075 [RD3], i.e. additional emergency indicator and associated AWS magnet.

All train drivers are advised of the speed restriction until all necessary trackside equipment is installed and the data is entered into the ETCS.

6.4 Entry to a Hybrid Level 3, without signals area

This is not applicable to N2-2 and is covered in variant N2-1, section 5.1.

6.5 Entry to a Hybrid Level 3 with signals area

6.5.1 System States and User Information

For Transitions where the train is not initially in ETCS and enters a HL3 with signals area, this is the Same as Level 2, with signals (see section 6.3), reading references to Level 2 as Hybrid Level 3.

For running transitions from L2 to L3 see Option N4-1.

6.5.2 Impact on other topics

None

6.5.3 Design Guidance

At the entry to a Hybrid Level 3 area, there is no additional reliance on the receipt of train integrity information for the issue of the first MA prior to the transition. It should be noted, however, that this may not be the case for entry to a non-HL3 area. In situations where it is not possible to issue an MA, or the train is not in communication with the RBC, Operational Rules covering the authorisation of non-communicating trains into the area will need to consider TTD and VSS occupancy states.

When a train enters an HL3 area applying the principles in [R7], the first VSS will become 'ambiguous' because it cannot immediately be excluded by the ETCS HL3 Trackside that another train is following the entering train. To allow a smooth entry into the HL3 area, specific measures should be taken to trigger the transition from 'ambiguous' state to 'occupied' state when the train is completely inside the HL3 area, i.e., it has passed a TTD border at the entry to the HL3 area.

Conventional routing information is to be provided at the entry signal, as required by, and in accordance with, conventional signalling rules. The need for a PRI (for routing after the entry signal) prior to the transition border will be determined in accordance with the rules in RIS-0703-CCS [R10] for the provision of PRIs on the assumption that the transition does not occur and based on the area after the RTAA being conventionally signalled. Conventional routing information provided before or at the entry signal, must be replicated via text message displayed on the ETCS DMI once the transition to Level 2/3 is complete, in accordance with Topic V.

6.6 ATO

The arrangements for entering ATO from a Level NTC area are described in ATO Reference Design Topic QQ.

6.7 Moving Block

To be developed.

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PART 3 – Manually Select L2 or L3

7 Option N3 – Manually Select L2 or L3

7.1 Specific User Requirements

Option N3 is used in situations where the ETCS authorised driver is required to change levels manually to L2 or L3 on the DMI. [ESR-359]

The driver needs to be advised which levels may be selected in each area, particularly when they are required to undertake Start of Mission. [ESR-360]

7.2 Level 2, without signals

7.2.1 System States and User Information

The driver identifies that they are in an area of Level 2 operation and that the level is not currently Level 2. This may occur because a previous driver was operating the train in Level NTC, particularly NID_NTC=21; the driver has just selected “Exit Shunting” or the driver has been advised that, following a failure, ETCS availability has been restored.

In the first case the driver checks the level as part of Start of Mission and changes it if required.

In the second case, exiting shunting is the equivalent of undertaking Start of Mission and the driver checks the level as above.

In the last case a change of level using the DMI menus will result in the Onboard immediately tripping with the mode changing to TR as the train was in L2 before failure and once ETCS restored or driver selects L2 after has been advised that ETCS is restored, there is no MA and the train will change to TR (not the SoM process). To avoid this the driver needs to close the cab and undertake a Start of Mission. [EOPSS-857]

During SoM, the driver must check that the level proposed on the DMI is appropriate for the start of the journey. [EOPSS-781]

During Start of Mission the driver may be asked to confirm the level or they can select ‘Level’ on the main menu in the DMI. They then select L2 from the available levels. [EOPSS-120]

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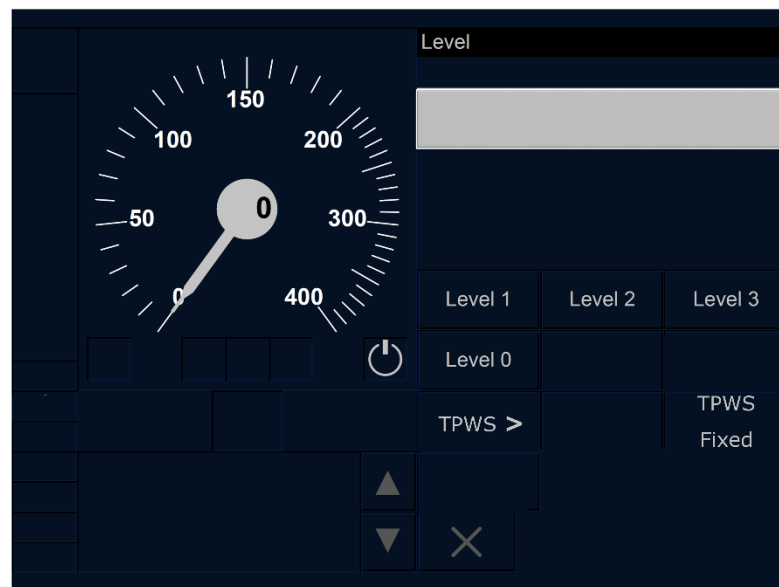


Figure 40 - DMI Level window

Following this, the ETCS Onboard will connect to an RBC so that a session can be established. The next steps are covered in Topic G – SoM.

- 7.2.2 Impact on other topics
None identified.

7.2.3 Design Guidance

This Option requires L2 to be available for selection on the ETCS DMI at any train starting location where L2 operation is supported by the ETCS Trackside. This is achieved through the transmission, and storing, of the relevant priority tables (see other options in Topic N).

7.3 Level 2 with signals

Same as Level 2, without signals (see section 7.2).

7.4 Hybrid Level 3, without signals

Same as Level 2, without signals (see section 7.2), reading references to Level 2 as Level 3.

7.5 Hybrid Level 3 with signals

Same as Level 2, without signals (see section 7.2), reading references to Level 2 as Level 3.

7.6 ATO

The arrangements for entering ATO from an NTC area are described in ATO Reference Design Topic QQ.

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7.7 Moving Block

To be developed.

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PART 4 – Transitions between Radio-based ETCS Levels

8 Option N4-1 – Level 2 to Hybrid Level 3

8.1 Specific User Requirements

The transition from L2 into L3 area will not require driver action.

The valid existing MA issued in the L2 area will enable the train to do the transition into L3 while running.

8.2 Level 2 without signals to Hybrid Level 3 without signals

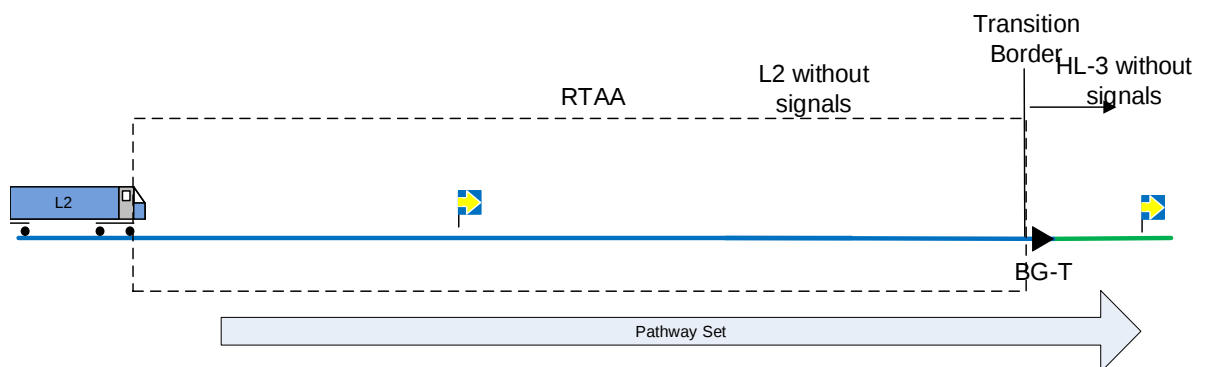


Figure 41 - Train approaching RTAA - HL-3 without signals area

Trains not operating in Level 2 (any shunt intentional movement) will be unaffected by this border. If the train is in SH, it will store and transition accordingly when exiting SH.

Trains operating in Level 2 will transition to Level 3, the driver will observe a change in level icon but the Movement Authority and mode will remain unchanged.

Trains operating in SR will continue with only the level changing.

Note: it is assumed that the solution for CR1353 as described in the Technical Opinion 2020 is implemented in the Onboard to avoid a transition to Level 0 if Level 3 is not configured onboard.

8.3 Level 2 without signals to Hybrid Level 3 with signals

Trains not operating in Level 2 (e.g. - any shunt intentional movement) will be unaffected by this border. If the train is in SH, it will store and transition accordingly when it exits SH.

Trains operating in Level 2 will transition to Level 3, the driver will observe a change in level icon but the Movement Authority and mode will remain unchanged.

Trains operating in SR will continue with only the level changing.

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8.4 Level 2 with signals to Hybrid Level 3 without signals

Trains not operating in Level 2 will be managed at the border in a similar manner to the description in N2-1.

Trains operating in Level 2 will transition to Level 3, the driver will observe a change in level icon but the Movement Authority and mode will remain unchanged.

Trains operating in SR will continue with only the level changing.

Note: it is assumed that the solution for CR1353 as described in the Technical Opinion 2020 is implemented in the Onboard to avoid a transition to Level 0 if Level 3 is not configured onboard.

8.5 Level 2 with signals to Hybrid Level 3 with signals

Trains not operating in Level 2 will be unaffected by this border.

Trains operating in Level 2 will transition to Level 3, the driver will observe a change in level icon but the Movement Authority and mode will remain unchanged.

Trains operating in SR will continue with only the level changing.

8.6 Design Guidance

The relevant application rules for Hybrid Level 3 elsewhere in this document relating to transitions are to be applied.

8.7 ATO

Transitions between L2 and L3 will have no affect on ATO operation, as long as ATO operational and engagement conditions are maintained.

8.8 Moving Block

Not developed

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9 Option N4-2 – Level 3 to Level 2

9.1 Specific User Requirements

The transition from L3 into L2 area will not require driver action, other than acknowledgements.

If the L3 area is without signal, the valid existing MA issued in the L3 area will enable the train to do the transition into L2 while running.

9.2 Hybrid Level 3 without signals to Level 2 without signals

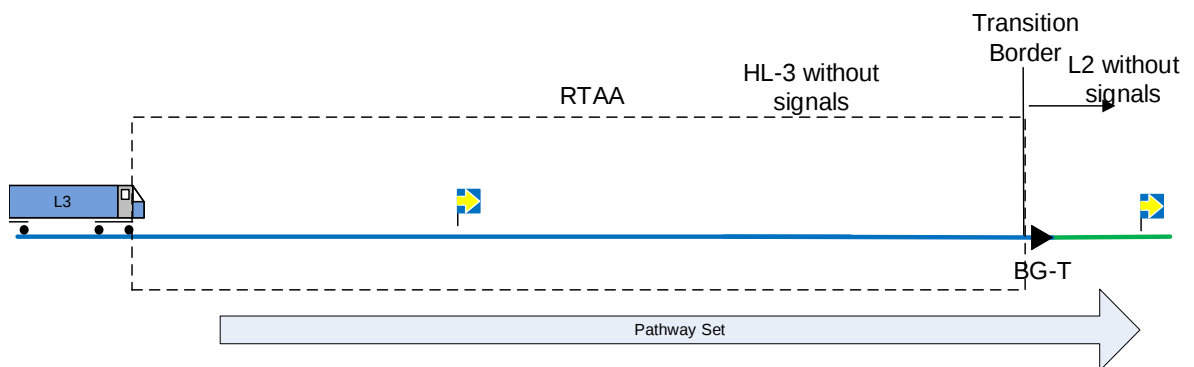


Figure 42 - Train approaching RTAA - L2 without signals area

Trains not operating in Level 3 (e.g. - any shunt intentional movement) will be unaffected by this border. If the train is in SH, it will store and transition accordingly when it exits SH.

Trains operating in Level 3 will transition to Level 2, the driver will observe a change in level icon but the Movement Authority is unchanged (including any Mode Profile, where relevant)

Trains operating in SR will continue with only the level changing.

9.3 Hybrid Level 3 without signals to Level 2 with signals

Trains not operating in Level 3 (e.g. - any shunt intentional movement) will be unaffected by this border. If the train is in SH, it will store and transition accordingly when it exits SH.

Trains operating in Level 3 will transition to Level 2, the driver will observe a change in level icon but the Movement Authority and is unchanged (including any Mode Profile, where relevant).

Trains operating in SR will continue with only the level changing.

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9.4 Hybrid Level 3 with signals to Level 2 without signals

Trains not operating in Level 3 will be managed at the border in a similar manner to the description in N2-1.

Trains operating in Level 3 will transition to Level 2, the driver will observe a change in level icon but the Movement Authority and is unchanged (including any Mode Profile, where relevant).

Trains operating in SR will continue with only the level changing.

9.5 Hybrid Level 3 with signals to Level 2 with signals

Trains not operating in Level 3 will be unaffected by this border.

Trains operating in Level 3 will transition to Level 2, the driver will observe a change in level icon but the Movement Authority and is unchanged (including any Mode Profile, where relevant).

Trains operating in SR will continue with only the level changing.

9.6 Design Guidance

The application rules for Hybrid Level 3 relating to transitions are to be applied

9.7 ATO

Transitions between L2 and L3 will have no affect on ATO operation, as long as ATO operational and engagement conditions are maintained.

9.8 Moving Block

To be developed.

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10 Requirements

The requirements listed below were extracted from the Dynamic Object-Oriented Requirements System (DOORS) database.

During the review process a number of additional requirements have been identified and improvements in the text of the currently agreed requirements are also proposed. Details are listed in section .

10.1 ETCS System Requirements

The ETCS shall not command a transition to ETCS at the entry to an ETCS with signals area where the train is operating in Level NTC, NID_NTC=21.

ESR-101

Status: Normative

Rationale: To avoid the train transitioning into ETCS Levels 1-3 with a driver who does not hold the competency to operate in those Levels.

Guidance: This assumes that the driver holds the competency to drive in Level NTC on a railway on which both the ETCS signalling system and the system over which it is overlaid are commissioned and operational.
This is a GB specific facility to prevent normal transition from Level NTC to ETCS Levels as described in the Control, Command and Signalling (CCS) National Technical Specification Notice (NTSN). Where the driver has selected Level NTC NID_NTC=20, then a normal transition takes place.

Topics: N1-1, N1-2, N2-2, T1

Where an ETCS Level 1 Launch capability is provided, a train operating in Level NTC with NID_NTC=21 shall not be commanded to transition when entering an area of ETCS with signals.

ESR-46

Status: Application-Specific

Rationale: To prevent a train transitioning into an ETCS Level unless the driver has selected a Level NTC which confirms that they have the competency to drive in ETCS Levels.

Guidance: The driver selects Level NTC, NID_NTC=21, when they do not hold the competency to drive in ETCS operation.

Topics: N1-1, N1-2, T1

The ETCS shall facilitate recovery from a failure related to the transition from one ETCS level to another.

ESR-62

Status: Normative

Rationale: To enable safe recovery when the entire ETCS level transition process cannot be completed normally.

Guidance: The ETCS Onboard executes level transitions as commanded by the ETCS Trackside. Failures may prevent issue of an authority to move (lineside or ETCS) and, in this situation, operational procedures are applied.

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Topics: N1-1, N1-2, N2-1, N2-2, O2-1, O2-2

The capability shall be provided for ETCS Level 1 to be used as an intermediate step in the process of transitioning to Level 2 or 3.

ESR-658

Status: Application-Specific

Rationale: To facilitate trains entering ETCS operation at locations where infrastructure constraints mean that the actions necessary for a running transition into Level 2 or 3 may not be completed reliably without impacting on performance.

Guidance: This use of Level 1 as an intermediate stage is referred to as 'Level 1 Launch'. An example of where 'Level 1 Launch' might be utilised is at the exits from depots or sidings onto a Level 2 or 3 fitted line (Level 2/3 without signals or with signals area) where there is insufficient distance on the approach to the signal authorising entry to the Level 2 or 3 fitted line for a train reliably to establish a communications session with the Radio Block Centre (RBC).

Topics: N1-1, N1-2

The location of announcements to, and acknowledgements by, the driver shall be determined for each site.

ESR-99

Status: Application-Specific

Rationale: To take account of the site-specific factors which influence driver workload and, hence, the driver's ability to assimilate and react to announcements and acknowledgements. The variability in site-specific factors between locations means that a robust generic rule for the location of announcements and acknowledgements is not practicable.

Guidance: The location of an announcement to, and acknowledgment by, the driver is important because, if it is incorrectly positioned, it may cause driver error due to high workload.

Topics: G1-2, G2, H1, H2, N2-1, N2-2, O2-1, O2-2, O3, V1, V2

Lineside signals shall be provided or retained only where essential.

ESR-3

Status: Normative

Rationale: There may be occasions when lineside signals are required to support operations.

Guidance: Where it is not possible to provide a Movement Authority on the ETCS Driver Machine Interface (DMI) for regular moves (e.g. shunting), then a lineside signal can be considered.

Topics: N1-1, N1-2, N2-1, O1

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Where operationally required at locations where Level 1 Launch is implemented, the ETCS shall support shunting activities in Level NTC (Level NTC) Shunting (SH) mode into an ETCS with or without signals area.

ESR-50

Status: Application-Specific

Rationale: To eliminate level transitions for an out and back shunting movement from a location operated in Level NTC.

Guidance: If Shunt routes are available at the same outlet as routes that join the mainline, then Shunt moves are made in Level NTC SH so that the train does not automatically transition to a higher ETCS level and mode.
The ETCS with or without signals area is that area where non-shunting movements are carried out in ETCS Level 1, 2 or 3.

Topics: N1-2

The limits of shunting movements into an ETCS-fitted area from an unfitted area shall be marked and supervised.

ESR-53

Status: Normative

Rationale: A train in Shunting (SH) mode has a supervised speed but is not issued a Movement Authority. An alternative method is therefore required to constrain the area in which movements may be undertaken.

Guidance: For designed shunt routes (such as into sidings or stabling locations, or for reversing a train onto a line returning in the direction from which it has come), the ETCS provides a 'Danger for Shunting Information' packet that can be permanently included in a balise message.

Topics: N1-2

Trains that are unable to transition to ETCS supervision shall be presented with a 'stop' aspect at the entrance to an ETCS without signals area.

ESR-55

Status: Normative

Rationale: To prevent a 'proceed' aspect from being displayed at the entrance to an ETCS without signals area if the train cannot be controlled by the ETCS.

Guidance: Trains unable to make the transition include unfitted trains, fitted trains which cannot establish communications with the Radio Block Centre, and trains where the driver has selected Level NTC, NID_NTC=21.

Topics: N2-1

All fitted trains intending to enter an ETCS without signals area via a running transition shall possess a valid Movement Authority for the area before reaching the point of entry.

ESR-61

Status: Normative

Rationale: To avoid the inability of the train to transition between signalling systems at its full line speed.

Topics: N2-1

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The ETCS shall be capable of managing running transitions at speeds up to the maximum permissible speed for the track in the vicinity of the transition border.

ESR-643

Status: Normative

Rationale: To minimise the impact of the transition on capacity, journey time and user experience.

Guidance: It is not necessary for trains routinely to travel at speeds below the maximum permissible speed in order to achieve a successful transition.
The design allows for the complete transition process (including radio connections and the need to repeat commands) taking place at the permissible speed in sufficient time to avoid the driver having to reduce speed.

Topics: N2-1, N2-2, O2-1, O2-2

The ETCS shall not command a transition to ETCS at the entry to an ETCS with signals area where the train is not configured for or capable of ETCS operation.

ESR-66

Status: Normative

Rationale: To avoid performance impact by enabling such trains to continue using the lineside signals and associated train protection systems.

Guidance: Trains not configured for or capable of making a transition include unfitted trains, trains where the driver has selected Level NTC, NID_NTC=21, and fitted trains which cannot establish communications with the Radio Block Centre.

Topics: N1-1, N1-2, N2-2

The driver shall be able to select all applicable ETCS operating levels when required during a journey.

ESR-359

Status: Normative

Rationale: To allow the driver to select an alternative level where the current level is inappropriate for the intended operation.

Guidance: Manual selection of operating level may be required in certain degraded situations on ETCS with signals implementations, in situations where running transition arrangements are not provided, or to support possession working.

Topics: G3-4, N3, O1

The ETCS design shall provide effective integration with neighbouring signalling and train protection systems.

ESR-36

Status: Normative

Rationale: To facilitate a smooth transition between Level 2 or 3 and Level NTC (and vice versa) as trains cross the boundary between areas.

Guidance: Trains operating on Class B-fitted routes will be equipped with Class B train protection systems in addition to the ETCS. When the ETCS is active, the Class B system will be suppressed and, when not operating in ETCS Levels 0-

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3, the Class B system will be available. NB GB's proposal for ETCS operation is to use Level 2 or 3 for normal operation and Level 0 in possessions. The ETCS manages the suppression, or otherwise, of the Class B system as the train undertakes transitions to and from Level NTC.

Topics: N1-1, N1-2, N2-1, N2-2, O1, O2-1, O2-2, O3

Safety

ETCS-unfitted rail vehicle access to ETCS-signalled infrastructure shall be controlled.

ESR-287

Status: Normative

Rationale: To reduce the risks associated with a train operating in an ETCS area without an effective train protection system. Safety requirement implementing safety measure SM-1323

Guidance: Movements of unfitted railway vehicles in ETCS areas are managed in accordance with operational rules and under the instruction of the authorised person, normally the signaller.
It is also possible for engineering plant vehicles to join and leave the railway at Road Rail Access Points.

Topics: N2-1, P1

Safety

A degraded pathway shall be available at all entries into ETCS-fitted areas.

ESR-810

Status: Normative

Rationale: To reduce the occurrence of Class B system and ETCS overrides and the frequency of the requirement to obtain signaller authorisation for a move over the transition border. Safety requirement implementing safety measure SM-669

Guidance: The provision of Proceed on Sight Authority (PoSA) enables the driver to obtain an authority to enter the ETCS-fitted area from a lineside signal and avoids the need to suppress the Train Protection and Warning System (TPWS); this solution is the default solution for permanent transition locations. The setting of a degraded pathway normally results in a Movement Authority being available, at transition, that includes an On Sight (OS) mode profile.

Topics: N2-1, N2-2

The driver shall be informed of the level to be selected or confirmed at Start of Mission (SoM) for each planned journey.

ESR-360

Status: Normative

Rationale: To enable drivers to confirm that the train is starting in the correct level at SoM.

Guidance: Selection of the appropriate level during SoM determines whether automatic transitions will occur during the journey.

Topics: N3, O1

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10.2 ATO System Requirements

None identified.

10.3 ETCS Trackside Sub-System Requirements

Safety

The Movement Authority (MA) applicable after a transition and the conventional lineside aspect which authorises the train to enter the ETCS area shall be consistent.

ETrckSS-270

Status: Normative

Rationale: To prevent an ETCS-generated brake intervention if the driver is driving in accordance with the lineside aspects. Safety requirement implementing safety measure SM-102

Guidance: The expectation of this requirement is that a driver approaching a transition on a cautionary lineside aspect sequence, and obeying their Professional Driving Policy, is unlikely to experience an ETCS-generated brake application when passing the transition point.
The MA may extend over more block sections than the lineside aspect would indicate but not fewer.
In the case of Level 1 Launch, this may add more complexity to the switchable Balise Group. The design of Level 1 Launch allows time for the train to connect to the Radio Block Centre (RBC) (if not already connected), transition to Level 2 or 3, and receive an updated MA from the RBC before the driver needs to brake for the End of Authority (EOA).

Topics: N1-1, N2-1, N2-2

A Movement Authority (MA) sent by the ETCS Trackside shall be supported by relevant track description and track condition information for the entirety of the train and the extent of the MA.

ETrckSS-275

Status: Normative

Rationale: To provide the driver, via the ETCS Onboard, with information to support the safe and efficient management of the train; this includes enabling the safe supervision of the entire length of a train following a level transition or when receiving an MA to exit Standby (SB) or Staff Responsible (SR) mode.

Guidance: The track description and track condition information is normally sent in the same message as the MA.
Where the track description does not extend for the entirety of the train, the 'Entering FS' (Entering Full Supervision mode) or 'Entering OS' (Entering On Sight mode) message is displayed on the ETCS Driver Machine Interface, which requires the driver to manage the speed of the train. Compliance with this requirement reduces the likelihood of these messages being presented to the driver.
Where the track description cannot be readily determined due to a number of approach routes to the transition (for example, at the exit to an unsignalled yard) a single 'worst case' description is defined on a site-by-site basis.
When issuing a first MA, and where the approach route cannot be determined,

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a conservative profile is included (for example, with a speed profile set to the applicable SR ceiling speed).

In some circumstances, for example, as part of Level 1 Launch, it may not be possible to place a Balise Group which can be used as the Last Relevant Balise Group far enough before the transition and the message cannot be avoided. Where Level 1 Launch is deployed, the message is always displayed. If the MA ends at an End of Authority (EOA) in the Level NTC area, then the track description covers the full extent of the MA. If the MA ends at a Limit of Authority (LoA) at the transition border, it may be acceptable to end the track description information at the transition border.

Topics: G1-1, G1-2, G1-3, G1-4, N2-1, N2-2

Safety

The signal authorising movements over the transition border into an ETCS without signals area with a transition to Level 2 or 3 shall only display a proceed aspect when the Movement Authority (MA) has been acknowledged by the approaching train.

ETrckSS-292

Status: Normative

Rationale: To minimise the risk of a train being signalled into an ETCS without signals area without an MA. Safety requirement implementing safety measures SM-387 & SM-511

Guidance: Conditions for displaying a proceed aspect include:

- a. the appropriate route into the ETCS without signals area being set;
- b. conventional Interlocking (IXL) conditions requiring the relevant signal to display a proceed aspect being met;
- c. the approaching train being in communication with the Radio Block Centre (RBC); and
- d. the train being driven by a driver authorised to operate in Level 2 or 3.

This requirement applies to running transitions from Level NTC directly to Level 2 or 3. Where Level 1 is used as an intermediate step, then the aspect of the signal cannot be restricted since the train is not in communication until it passes the signal.

Topics: N2-1

A train in Level NTC Shunting (SH) mode shall be authorised to enter an ETCS area by an appropriate signal aspect, and route indication where applicable.

ETrckSS-282

Status: Normative

Rationale: The driver requires the information on the movement to be provided since it is not available on the ETCS Driver Machine Interface (DMI).

Guidance: The appropriate signal aspect is a position light except in an ETCS with signals area, where a main aspect may be used.
A route indication may be provided to inform the driver/Person in Charge, as determined by a signal sighting process.
This facility is normally only provided where the ETCS Onboard is initially instructed to transition to Level 1 to enter the ETCS area.

Topics: N1-1, N1-2, N2-2

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Trains reporting that they are operating in Level 1 shall be ordered by the Radio Block Centre (RBC) to transition to Level 2 or Level 3 and receive an updated Movement Authority (MA) for the pathway.

ETrckSS-1240

Status: Generic Product

Rationale: To instruct a train in Level 1 to transition to the target operating level with an updated MA.

Guidance: On establishment of a communication session, the ETCS Onboard reports its position. The report triggers the RBC to send the Level Transition Order and an updated MA.

Topics: N1-1

The ETCS Trackside shall include measures to manage an ETCS-unfitted train entering an ETCS without signals area via Level 1 Launch.

ETrckSS-954

Status: Normative

Rationale: To prevent trains operating on running lines without a compatible train protection system.

Guidance: The signal associated with Level 1 Launch displays a 'proceed' aspect irrespective of whether the train is capable of supporting ETCS operation. (For transitions to ETCS without signals areas where the train goes directly to Level 2 or 3, the border signal is maintained at 'danger' until the train has connected). Potential measures include the provision of a Class B train stop feature positioned to allow ETCS-fitted trains to transition and suppress the Class B on-board system before encountering the train stop.

Topics: N1-1, N2-1

A lineside signal (entry signal) and a transition into an area where ETCS operation is supported shall be co-located.

ETrckSS-286

Status: Normative

Rationale: To control transitions into ETCS areas.

Guidance: The signal controls entry into the ETCS area and provides a clearly defined boundary.
The signal at the entry to a Level 2/3 only area is controlled to show only a 'proceed' aspect when a Movement Authority has been issued to the train. Where entry to the ETCS area is via a Level 1 Launch, the signal marks the entry to the Transition Zone at the start of the ETCS area. This requirement is consistent with Subset-091, version 3.6.0 clause 10.4.1.7, Rule A.

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Topics: N2-1, N2-2

Where it is possible that a train may pass over Balise Groups (BGs) to establish a communication session but is not routed into an ETCS with or without signals area, further balises shall be positioned to order termination of a session for that train.

ETrckSS-288

Status: Application-Specific

Rationale: To avoid unnecessary use of communication channels and Radio Block Centre capacity.

Guidance: This can apply where a line diverges after the BG, which prompts the train to establish a communication session, but that line does not enter the ETCS area.

Topics: N2-1, N2-2

Safety

Signs in accordance with Rail Industry Standard RIS-0733-CCS shall be provided to mark the entry to or exit from cab-signalling areas.

ETrckSS-38

Status: Normative

Rationale: Providing lineside signs at the boundaries of ETCS-fitted areas supports the driver and trackside staff in identifying where Operational Rules may change and where specific Operational Rules apply. Safety requirement implementing safety measures SM-59, SM-65, SM-352 & SM-1396

Guidance: Where the exit from an ETCS-fitted area is via a diverging junction and the exit point is located before the junction, a direction arrow is included.

Topics: N2-1, N2-2, O2

The priority table of ETCS Trackside supported levels shall be transmitted as part of a Conditional Level Transition Order (CLTO) from the Border Balise Group at the entrance to an ETCS with signals area.

ETrckSS-730

Status: Normative

Rationale: To enable trains operating in Level NTC (NID_NTC=21) to enter an ETCS with signals area without changing level.

Guidance: The priority table in the CLTO is configured to include Level NTC (NID_NTC=21).
A CLTO is used in accordance with Subset-026 to update the priority table held by the ETCS Onboard. Where the train is not operating in one of the levels listed, a transition is initiated.
Locations are determined on an application basis. The inclusion of Level NTC (NID_NTC=20) supports the degraded scenario where a train fails to establish communication.

Topics: N2-2, W

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Safety

The signal controlling entry into an ETCS without signals area shall be equipped with the Train Protection and Warning System (TPWS).

ETrckSS-296

Status: Normative

Rationale: To stop unfitted trains or trains driven by drivers who are not authorised to drive in ETCS if they pass the signal at 'Danger'. Safety requirement implementing safety measures SM-857, SM-898, SM-903 & SM-1267

Guidance: The signal protecting entry to an ETCS without signals area is maintained at 'Danger' unless the approaching train is communicating with the ETCS Trackside.

Topics: N1-1, N2-1

Safety Exported

The design rules for Temporary Speed Restrictions (TSRs) and Emergency Speed Restrictions (ESRs) shall include the need to extend a TSR/ESR to start at, or on the approach to, a transition into an ETCS area if the TSR/ESR would otherwise start at less than deceleration distance after the transition into the ETCS area.

ETrckSS-735

Status: Normative

Rationale: To provide sufficient warning of the TSR/ESR for the driver to decelerate to the required speed. Safety requirement implementing safety measures SM-703, SM-958, SM-960, SM-964 & SM-981

Guidance: TSR Warning Boards are provided in the Level NTC area. Extending the TSR/ESR to commence in the Level NTC area or at the transition border avoids a driver suddenly encountering the urgent need to brake on entering ETCS. Where the extension of a low speed TSR/ESR introduces a significant performance impact, an intermediate TSR/ESR may be provided in the Level NTC area such that, at the transition border, the train speed is compatible with the deceleration distance within the ETCS area. This requirement is additional to the TSR/ESR design rules for lineside-signalled areas set out in Rail Industry Standard RIS-0735-CCS.

Topics: F1, N2-1, N2-2

Safety

The ETCS Trackside shall only send a Movement Authority (MA) to a train which will transition into ETCS Level 2 or 3 if all the conditions for the border signal to clear, with the exception of receipt of the acknowledgement of the MA message, have been satisfied

ETrckSS-732

CCMS:	64375796
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Status: Generic Product

Rationale: To avoid the train receiving an MA which could become effective in the event the train passes the border signal at 'danger'. Safety requirement implementing safety measures SM-551 & SM-553

Guidance: Conventional Interlocking (IXL) conditions for the relevant signal to clear are met for the pathway set.
At the entrance to an ETCS without signals area, the border signal is maintained at 'danger' until the approaching train has connected and acknowledged receipt of the MA.

Topics: N2-1, N2-2

When validated train data is received from a train reporting that it is operating in Level NTC, NID_NTC=21, the Radio Block Centre (RBC) shall instruct the ETCS Onboard to terminate the communication session.

ETrckSS-958

Status: Generic Product

Rationale: To terminate the session and to prevent a Level Transition Order being received from the RBC.

Guidance: This can be achieved by sending a general message containing a session management packet to the ETCS Onboard.
Drivers not authorised or not intending to operate in ETCS are trained to select Level NTC, NID_NTC = 21 at Start of Mission.

Topics: N2-1, N2-2

Exported

Where a Speed Restriction Management System (SRMS) ends at less than maximum train length from entry into an ETCS area, the SRMS shall provide appropriate TSR data to the ETCS Trackside.

ETrckSS-959

Status: Normative

Rationale: To mitigate the risk of the ETCS indicating that a train can travel at line speed on passing the transition, rather than waiting for the rear of the train to clear the speed restriction.

Guidance: The SRMS can place TSRs in the approach area to the transition for the ETCS Trackside to be able to accept them.

Topics: N2-1, N2-2

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Safety

The combination of default telegrams, allocation of packets, and the setting of M_MCOUNT shall cause a safe reaction by the ETCS Onboard in the event of failure of the Lineside Electronic Unit (LEU) or connections to switchable balises.

ETrckSS-817

Status: Normative

Rationale: To provide a safe response if a switchable balise cannot be controlled by the ETCS Trackside. Using a pre-defined default value not equal to 255 allows a train to react to an incorrect message. Safety requirement implementing safety measures SM-51 & SM-353

Guidance: Switchable balises are used as part of Level 1 Launch and to protect locally-monitored level crossings.
A safe reaction (service brake intervention or trip) may be generated by setting the default telegram to the most restrictive information, using M_MCOUNT set to 254 in the switchable balise, or the strategic allocation of packets and use of M_MCOUNT where more than one switchable balise exists within a group.

Topics: N1-1, N1-2

The priority table of ETCS Trackside supported levels in non-ETCS areas with TPWS supervision shall be, in descending order of priority, Level NTC (NID_NTC=20), Level NTC (NID_NTC=21), and Level 0.

ETrckSS-1432

Status: Normative

Rationale: To provide the driver with a consistent list of supported levels that are supported by the available trackside Class B systems, or otherwise operationally necessary.

Guidance: Drivers normally select Level NTC (NID_NTC=20) for operation in non-ETCS areas. Where a driver is not authorised to operate in ETCS or the ETCS Trackside is not available, then they select Level NTC (NID_NTC=21). Movements within possessions are undertaken in Level 0.
A consistent list supports the development of consistent operational instructions and driver training for GB's railway.
Following consultation with the Network Rail Technical Authority, the priority table may be modified to cater for other Class B systems.

Topics: N1-2, O1-1, O2

Safety

The priority table of ETCS Trackside supported levels in ETCS without signals areas shall be, in descending order of priority, Level 3 (where required), Level 2, and Level 0.

ETrckSS-1433

Status: Normative

CCMS:	64375796
Version:	4.00
Date:	25/11/21

Rationale: To provide the driver with a consistent list of supported levels that are supported by the ETCS Trackside, or otherwise operationally necessary. Safety requirement implementing safety measure SM-1277

Guidance: Drivers normally select ETCS Level 2 or 3 for operations in an ETCS without signals area.
Movements within possessions are undertaken in Level 0.
A consistent list supports the development of consistent operational instructions and driver training for GB's railway.

Topics: N2-1, O1-1

The priority table of ETCS Trackside supported levels in ETCS with signals areas shall be, in descending order of priority, Level 3 (where required), Level 2, Level NTC (NID_NTC=21), Level NTC (NID_NTC=20), and Level 0.

ETrckSS-1435

Status: Normative

Rationale: To provide the driver with a consistent list of supported levels that are supported by the ETCS Trackside, or otherwise operationally necessary.

Guidance: Drivers normally select ETCS Level 2 or 3 for operations in an ETCS with signals area if authorised to do so. Drivers not authorised to select ETCS Level 2 or 3 normally select Level NTC (NID_NTC=21) for operation in an ETCS with signals area.
Movements within possessions are undertaken in Level 0.
A consistent list supports the development of consistent operational instructions and driver training for GB's railway.
This requirement assumes that the Train Protection and Warning System is the Class B system provided. The inclusion of Level NTC (NID_NTC=20) supports the degraded scenario where a train fails to establish communication.

Topics: N2-2, O1-1

The priority table of ETCS Trackside supported levels shall be transmitted as part of a Level Transition Order (LTO) from the Border Balise Group at the entrance to an ETCS without signals area.

ETrckSS-1436

Status: Normative

Rationale: To cause trains to transition to a level supported beyond the transition.

Guidance: An LTO is used in accordance with Subset-026 to update the priority table held by the ETCS Onboard, which results in the level transition.
This facility is also provided at the end of a Transition Zone, following Level 1 Launch.

Topics: N2-1

Where ETCS Level 1 is used as an intermediate step as part of a transition to ETCS Level 2 or 3, the Deployment Project Team shall define a Transition Zone (TZ) at each location of a sufficient length to accommodate the staged transition and any site-specific shunting activities.

ETrckSS-1437

Status: Normative

CCMS:	64375796
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Date:	25/11/21

Rationale: To allow the transition to Level 1 to be completed successfully before commencing the second transition, and to support site-specific operational requirements.

Guidance: Level 1 Launch is a method for achieving operation in Level 2 or 3 where there is insufficient distance to establish a communication session prior to entering the ETCS area. The TZ is the section of line between the lineside signal at the border and the location of the balise group where a train, having transitioned to Level 1, is commanded to transition to Level 2 or 3 if it has not already done so.
The TZ is sized to allow the driver to acknowledge the transition to Level 1 and enable the radio session to be established.
At some locations, shunting activities can be undertaken in Level NTC within the TZ, and the TZ is sized to accommodate this activity.

Topics: N1-1

The priority table of ETCS Trackside supported levels in the Transition Zone (TZ) prior to an ETCS without signals area where shunting is not active and a 'proceed' aspect is displayed on the border signal shall be, in descending order of priority, Level 1, Level 3 (where required), Level 2, and Level 0.

ETrckSS-1438

Status: Normative

Rationale: To initiate the transition to ETCS operation when the driver has been authorised to enter an ETCS without signals area.

Guidance: Trains transition automatically to Level 1. Levels 2 and 3 allow for driver selection if the transition does not occur automatically. Level 3 may be included if the ETCS Trackside supports it; however, since not all trains may be configured for Level 3, Level 2 is also included. Level 0 is included for possessions.
Where a train is authorised to enter the TZ for shunting purposes, a different requirement applies.

Topics: N1-1

The priority table of ETCS Trackside supported levels in the Transition Zone (TZ) prior to an ETCS area where shunting is active and a 'proceed' aspect is displayed on the border signal shall be, in descending order of priority, Level NTC (NID_NTC=20), Level NTC (NID_NTC=21), Level 3 (where required), Level 2, and Level 0.

ETrckSS-1441

Status: Normative

Rationale: To enable shunting to be undertaken without a transition to ETCS.

Guidance: Trains authorised to shunt into the ETCS area remain in their current level (0 or NTC).
Within the TZ, the driver may, having completed shunting, manually select Level 2 or 3 and enter train data to obtain a Movement Authority.
Authorisation to enter the TZ is given by a position light aspect unless the end of the TZ is marked by a main lineside signal (ETCS with signals areas), in which case, a main aspect may be displayed.

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This requirement assumes that the Train Protection and Warning System is the Class B system provided.

Topics: N1-2, N2-2

The priority table of ETCS Trackside supported levels in the Transition Zone (TZ) prior to an ETCS without signals area where a 'proceed' aspect on the border signal is not displayed shall be, in descending order of priority, Level 3 (where required), Level 2, and Level 0.

ETrckSS-1442

Status: Normative

Rationale: To define the acceptable levels within the TZ when a train has not been authorised to enter the zone.

Guidance: Trains passing the border signal at 'danger' without authority transition to Level 2 or 3 and are tripped.
Having acknowledged the trip, the driver undertakes Start of Mission in Level 2 or 3.

Topics: N1-1

10.3.1 The following requirements are subject to a proposal for change

Balise Groups necessary for network registration and establishing a communication session with the Radio Block Centre (RBC) shall be positioned on the approach to the level transition such that a train can normally transition without braking.

ETrckSS-287

Status: Normative

Rationale: To minimise the impact on performance.

Guidance: The position takes into account the time required for network registration and establishment of a communication session, as well as the time required for the entry signal to be cleared and to display the appropriate proceed aspect. It may be sensible to allow 40 seconds for the train to connect. This is configured to happen before the driver of the approaching train sights, and begins reacting to, the first restrictive aspect associated with the signal authorising movements over the transition border at danger, assuming there are no other trains in the transition area.

Topics: N2-1, N2-2

Safety

Transition orders leading to a transition from Level NTC to Level 1, 2 or 3 shall be configured such that the transition acknowledgement request is presented to the driver when the transition occurs.

ETrckSS-301

Status: Normative

Rationale: To provide a consistent presentation of the level transition acknowledgement to the driver. Safety requirement implementing safety measures SM-25, SM-137, SM-185, SM-507 & SM-868

CCMS:	64375796
Version:	4.00
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Guidance: Where the transition requires acknowledgement, the driver has 5 seconds to complete the acknowledgement before the service brake is initiated.

Topics: N2-1, N2-2, O2, O3

The priority table of ETCS Trackside supported levels shall be transmitted as part of a Level Transition Order from the switchable Balise Group (BG) at the entrance to the Transition Zone (TZ) prior to an ETCS-without signals area.

ETrckSS-1439

Status: Normative

Rationale: To cause trains not in Shunting (SH) mode to transition to Level 1 at the entrance to the TZ.

Guidance: Trains are instructed to transition to Level 2 or 3 by the Radio Block Centre (RBC) when a communication session is established. A BG at the end of the TZ updates the table of supported levels for trains not in communication with the RBC.
Where trains can operate in Level NTC within the TZ, a different requirement applies.

Topics: N1-1

A permanently energised Train Protection and Warning System Train Stop Sensor shall be provided at the boundary between a Transition Zone (TZ) in which shunting in Level NTC is permitted and an ETCS without signals area.

ETrckSS-1440

Status: Normative

Rationale: To restrict the movement of trains operating in Level NTC to the TZ.

Guidance: The end of the TZ is marked at the lineside to support the driver in understanding the permitted limit of the shunting movement. The form of the lineside indication is determined on a site-specific basis, following assessment. Rail Industry Standard RIS-0733-CCS catalogues the approved lineside operational signs and sets out the process for proposing new designs of lineside operational signs.

Topics: N1-2

The default telegram in the Balise Group (BG) at the entrance to a Transition Zone (TZ) shall include the Level Transition Order (LTO) associated with no 'proceed' aspect being displayed.

ETrckSS-1443

Status: Normative

Rationale: To manage an unauthorised movement into the TZ by tripping the train.

Guidance: The default telegram is transmitted when the signal is not displaying a 'proceed' aspect.
Trains in Level 0 Unfitted (UN) or Level NTC National System (SN) mode are tripped because no Movement Authority is available from the Border BG.

CCMS:	64375796
Version:	4.00
Date:	25/11/21

Topics: N1-1

The priority table of ETCS Trackside supported levels in the Transition Zone (TZ) prior to an ETCS with signals area where shunting is not active and a 'proceed' aspect is displayed on the border signal shall be, in descending order of priority, Level 1, Level 3 (where required), Level 2, Level NTC (NID_NTC=21), Level NTC (NID_NTC=20), and Level 0.

ETrckSS-1444

Status: Normative

Rationale: To initiate the transition to ETCS operation when the driver has been authorised to enter an ETCS with signals area unless the driver is not authorised to operate in ETCS.

Guidance: Trains operating in Level NTC (NID_NTC=21) do not transition on entry to the TZ.
Other trains transition automatically to Level 1. Levels 2 and 3 allow for driver selection if the transition does not occur automatically. Level 3 may be included if the ETCS Trackside supports it; however, since not all trains may be configured for Level 3, Level 2 is also included. Level 0 is included for possessions. The inclusion of Level NTC (NID_NTC=20) supports the degraded scenario in which a train fails to establish communication. Where a train is authorised to enter the TZ for shunting purposes, a different requirement applies.
This requirement assumes that the Train Protection and Warning System is the Class B system provided.

Topics: N1-1

The priority table of ETCS Trackside supported levels shall be transmitted by a Conditional Level Transition Order (CLTO) in a switchable Balise Group (BG) at the entrance to the Transition Zone (TZ) prior to an ETCS with signals area.

ETrckSS-1445

Status: Normative

Rationale: To manage the transition to Level 1 at the entrance to the TZ based on whether the train is, or is not, in Level NTC (NID_NTC=21).

Guidance: Trains operating in Level NTC (NID_NTC=21) are not instructed to transition. Other trains are instructed to transition to Level 2 or 3 by the Radio Block Centre (RBC) when a communication session is established. A BG at the end of the TZ updates the table of supported levels for trains not in communication with the RBC.

Topics: None

The priority table of ETCS Trackside supported levels in the Transition Zone (TZ) prior to an ETCS with signals area where a proceed aspect on the border signal is not displayed shall be, in descending order of priority, Level 3 (where required), Level 2, Level NTC (NID_NTC=21), Level NTC (NID_NTC=20), and Level 0.

ETrckSS-1446

Status: Normative

CCMS:	64375796
Version:	4.00
Date:	25/11/21

Rationale: To define the acceptable levels within the TZ when a train has not been authorised to enter the zone.

Guidance: Trains passing the border signal at danger without authority will transition to Level 2 or 3 and be tripped.
Where authorised to operate in ETCS, having acknowledged the trip, the driver undertakes Start of Mission in Level 2 or 3. The inclusion of Level NTC (NID_NTC=20) supports the degraded scenario where a train fails to establish communication.
Drivers not authorised to operate in ETCS select Level NTC (NID_NTC=21) when authorised to proceed by the signaller.
This requirement assumes that the Train Protection and Warning System is the Class B system provided.

Topics: N1-1

Safety Where a train is routed into an ETCS area, with or without signals, the ETCS Trackside shall send a Level Transition Announcement (LTA) and Movement Authority (MA) in the same radio message unless the train is operating in Level NTC (NID_NTC=21). ETrckSS-379

Status: Normative

Rationale: To provide a train with the MA applicable after the level transition unless the train has been configured not to transition. The LTA provides the instruction for a train in Level NTC (NID_NTC=20) to transition at the border on entry to an ETCS with signals area where a Conditional Level Transition Order will be transmitted by the Border Balise Group. Safety requirement implementing safety measures SM-512 & SM-551

Guidance: Sending the MA with the LTA prevents the train tripping when it transitions into the ETCS.
Where the driver has selected Level NTC (NID_NTC=21), the radio message is not sent and the signal protecting the ETCS without signals area remains at 'danger'.
A driver who is not authorised to operate trains in the ETCS selects Level NTC (NID_NTC=21).

Topics: N2-1, N2-2

The balise message containing a Level Transition Order with the highest priority being Level 1 shall include the order to establish a safe radio connection. ETrckSS-727
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Status: Application-Specific

Rationale: To commence the process of connecting to the Radio Block Centre, which will instruct the subsequent transition to Level 2 or 3.

Guidance: Level 1 Launch locations will be specified on an application basis.

Topics: N1-1

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10.4 ATO Trackside Sub-system Requirements

None identified.

10.5 ETCS Onboard Sub-system Requirements for New Trains

The following requirements have been extracted from RIS-0798-CCS [R5] – extracted text is in italics. Additional information on applicable topics, project phase, exported status, and applicability has been included.

4.2.4 AWS/TPWS onboard subsystem suppression

4.2.4.1 The AWS/TPWS shall be suppressed when the ETCS onboard subsystem is operating in all levels other than Levels NTC, NID_NTC=20 and 21. (Normative)

Rationale

G 4.2.4.2 Integration with Class B CCS systems: When the ETCS is operating in a level other than Level NTC, NID_NTC=20 and 21, the train protection function is provided by the ETCS. In this case, the AWS/TPWS train protection function is suppressed.

G 4.2.4.3 Safe integration: This requirement is used to control Hazard OB-H020.

Guidance

G 4.2.4.4 In accordance with the strict definition of the ETCS Levels, only Level NTC, NID_NTC=20 and 21 requires that the AWS/TPWS is energised. Whilst AWS/TPWS could be energised in Level 0, suppression aligns more correctly with the intent of the CCS TSI.

4.2.5 AWS/TPWS onboard subsystem unsuppression

4.2.5.1 The ETCS onboard subsystem shall unsuppress the AWS / TPWS when operating in Levels NTC, NID_NTC=20 or 21. (Normative)

Rationale

G 4.2.5.2 Integration with Class B CCS systems: The Class A train protection functionality provided by the ETCS is not available when the train is operated in Level NTC. The Class B system AWS/TPWS provides the train protection functionality when operating in Levels NTC, NID_NTC=20 or 21.

G 4.2.5.3 Safe integration: This requirement is used to control Hazard OB-H021.

Guidance

4.2.9 AWS/TPWS 'Operational Ready' state timing

4.2.9.1 The AWS/TPWS system shall be in the 'Operational Ready' state no later than 5 s after the point of level transition to Level NTC, NID_NTC=20 or 21. (Normative)

Rationale

G 4.2.9.2 Technical compatibility with the ETCS trackside subsystem: No AWS/TPWS trackside equipment will be positioned within 5 s of the border at the permissible speed.

Guidance

G 4.2.9.3 RIS-0775-CCS specifies the 'Operational Ready' state. The 'Operational Ready' state is equivalent to the 'Data Available' state in Subset-035.

G 4.2.9.4 Class A: Class B train protection system transitions will be configured so that trains moving at the permissible speed will not reach an interface with the AWS/TPWS trackside subsystem within 5 s of passing the point of level transition to Level NTC, NID_NTC=20 or 21.

3.13.1 ETCS default level list: Level NTC (NID_NTC=20 and 21)

3.13.1.1 Level NTC (NID_NTC=20 and 21) shall be included in the default list configured in the ETCS onboard subsystem. (Normative)

Rationale

CCMS:	64375796
Version:	4.00
Date:	25/11/21

G 3.13.1.2 Integration with train operations: This is necessary so that Level NTC (NID_NTC=20 and 21) can be selected by the train driver when the trackside supported level is not available on-board. The default list is configured onboard.

Guidance

G 3.13.1.3 Level NTC, NID_NTC=20 and 21, is described in 4.2 of RIS-0798-CCS.

10.6 ATO Onboard Sub-system Requirements for New Trains

None identified.

10.7 ETCS On-board Sub-system Requirements for Retrofit Trains

The following requirements have been extracted from RIS-0797-CCS [R5] – extracted text is in italics. Additional information on applicable topics, project phase, exported status, and applicability has been included.

4.2.3 AWS/TPWS onboard subsystem suppression

4.2.3.1 The AWS/TPWS shall be suppressed when the ETCS onboard subsystem is operating in all levels other than Levels NTC, NID_NTC=20 and 21. (Normative)

Rationale

G 4.2.3.2 Integration with Class B CCS systems: When the ETCS is operating in a level other than Level NTC, NID_NTC=20 and 21, the train protection function is provided by the ETCS. In this case, the AWS/TPWS train protection function is suppressed.

G 4.2.3.3 Safe integration: This requirement is used to control Hazard OB-H020.

Guidance

G 4.2.3.4 In accordance with the strict definition of the ETCS Levels, only Level NTC, NID_NTC=20 and 21 requires that the AWS/TPWS is energised. Whilst AWS/TPWS could be energised in Level 0, suppression aligns more correctly with the intent of the CCS TSI.

4.2.4 AWS/TPWS onboard subsystem unsuppression

4.2.4.1 The ETCS onboard subsystem shall unsuppress the AWS / TPWS when operating in Levels NTC, NID_NTC=20 or 21. (Normative)

Rationale

G 4.2.4.2 Integration with Class B CCS systems: The Class A train protection functionality provided by the ETCS is not available when the train is operated in Level NTC. The Class B system AWS/TPWS provides the train protection functionality when operating in Levels NTC, NID_NTC=20 or 21.

G 4.2.4.3 Safe integration: This requirement is used to control Hazard OB-H021.

Guidance

3.13.1 ETCS default level list: Level NTC (NID_NTC=20 and 21)

3.13.1.1 Level NTC (NID_NTC=20 and 21) shall be included in the default list configured in the ETCS onboard subsystem. (Normative)

Rationale

G 3.13.1.2 Integration with train operations: This is necessary so that Level NTC (NID_NTC=20 and 21) can be selected by the train driver when the trackside supported level is not available on-board. The default list is configured onboard.

Guidance

10.8 ATO Onboard Sub-system Requirements for Retrofit Trains

None identified.

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10.9 Telecommunication Sub-System Requirements

None identified.

10.10 Operational Sub-System Requirements

Safety

Locations where the driver is normally required to select ETCS Level 2 or 3 manually shall be clearly documented and communicated to the relevant users.

EOPSS-781

Status: Normative

Rationale: To raise drivers' awareness of where a manual switchover to Level 2 or 3 may be required. Safety requirement for hazard N-H052a

Guidance: These locations are expected to be rare but could be used to support stage works or testing. Documentation could include drivers route publications provided in support of route assessment.

Topics: N3

Project Phase:Deployment Readiness

Exported: No

Applicability: L2 no signals, L2 with signals, HL3 no signals, HL3 with signals, ATO

Driver training shall include the required driver reaction and subsequent actions where a train is brought to a stand by the ETCS at, or when passing, a signal displaying a proceed aspect at an ETCS boundary.

EOPSS-178

Status: Normative

Rationale: To enable drivers to understand what action needs to be taken in order for the train to continue on its journey.

Guidance: At the entrance to an ETCS area trains not operating in Level NTC NID_NTC=21, transition to ETCS in accordance with the instruction from the Border Balise Group which is placed close to the signal. A train entering ETCS without a movement authority stored on board, or transmitted from the same balise group in the case of Level 1 launch, immediately transitions to ETCS L2/L3 and trips. Where the train has entered an ETCS only area, the driver contacts the signaller in order to follow the 'trip' procedure. Where the train has entered an ETCS with signals area, the driver contacts the signaller to establish whether the train is to proceed in ETCS or revert to Level NTC. In either case the driver follows the 'trip' procedure before resuming the movement in ETCS or selecting Level NTC to continue.

Topics: N1-1, N1-2, N1-2, N2-1

Project Phase:Deployment Readiness

CCMS:	64375796
Version:	4.00
Date:	25/11/21

Exported: No

Applicability: L2 no signals, L2 with signals, HL3 no signals, HL3 with signals, ATO

Safety

Driver training shall include automatic and manual transitions, and failures to transition.

EOPSS-857

Status: Normative

Rationale: To equip drivers with the skills and capability to transition, or to take appropriate steps where intervention is necessary. Safety requirement for hazards N-H020a, N-H020b.

Topics: N1-1, N1-2, N2-1, N2-2, N3, O2, W

Project Phase:Deployment Readiness

Exported: No

Applicability: L2 no signals, L2 with signals, HL3 no signals, HL3 with signals, ATO

Safety

Driver training shall include the locations and the expected sequence of events during a running level transition to ETCS operation on an ETCS-fitted line with signals, and the response to a failure of any of the expected events.

EOPSS-861

Status: Normative

Rationale: To assist drivers in identifying faults and failures during the running level transition process and help them respond appropriately. Safety requirement for hazards N-H043, N-H044.

Guidance: The core driver training covers the expected behaviour of the system and the management of degraded scenarios in accordance with Module S7 of the Rule Book.
As part of route familiarisation drivers are trained on where transitions can occur.

Topics: N2-2

Project Phase:Deployment Readiness

Exported: No

Applicability: L2 no signals, L2 with signals, HL3 no signals, HL3 with signals, ATO

The operational needs for shunting from a Level 1 launch area onto the running line and back into the depot, siding or yard shall be specified for each area it takes place.

EOPSS-1463

CCMS:	64375796
Version:	4.00
Date:	25/11/21

Status: Normative

Rationale: To enable the ETCS Trackside to be designed to support the required operations and manage associated risks.

Guidance: This includes propelling movements onto and off the running line, and shunting movements that are not supervised by the ETCS. Typically, this information is documented in the Operational Requirements Specification for the application project.

Topics: N1-2Project Phase: Deployment Readiness

Exported: No

Applicability: L2 no signals, L2 with signals, HL3 no signals, HL3 with signals, ATO

Operational Rules and Instructions shall make provision for the driver selecting an alternative ETCS Level.

EOPSS-120

Status: Normative

Rationale: To put in place a process and instructions that define when it is appropriate to change ETCS Level and how this is to be achieved.

Guidance: This includes the process specifying how and when a driver selects Level NTC.

Topics: N3, O1-1, O1-2, W

Operational Rules and Instructions shall make provision for entering an ETCS line from a depot, siding or yard.

EOPSS-950

Status: Application-Specific

Rationale: To enable safe entry to the rail network from a depot, siding or yard.

Guidance: In Level NTC (TPWS or L2/NTC), the Train Protection and Warning System (TPWS) / Automatic Warning System (AWS) sub-system may be suppressed when Shunting (SH) is selected. Trains are not authorised on running lines without a protection system. Due to the constraints of the ETCS (as defined in Subset-026), it may not be technically possible to stop a train in SH from entering a running line.

Topics: N1-1, N1-2, P3-2

Operational Rules and Instructions shall make provision for the driver selecting an ETCS level having completed shunting activities in a Transition Zone.

EOPSS-1557

Status: Normative

Rationale: To define when it is appropriate for the driver to select an ETCS Level, and the interaction required between the driver, person in charge and signaller.

Guidance: Whilst shunting activities into an ETCS area not in an ETCS level will normally result in the train returning to the non ETCS area, occasions may exist where the shunting activity is completed with the train in the ETCS area.
In these situations the rules describe the process for the driver, person in charge of shunting and signaller to agree that the driver should select ETCS and for the movement to be supervised by the ETCS.

Topics : N1-2

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Safety

Operational Rules shall cover the management of Temporary and Emergency Speed Restrictions (TSRs and ESRs) on ETCS-fitted lines, including in the vicinity of transitions.

EOPSS-957

- Status:** Normative
- Rationale:** To enable TSRs and ESRs to be implemented, withdrawn and managed accurately and safely, and with due regard to performance and driver workload. Safety requirement implementing safety measures SM-58, SM-165, SM-166, SM-167, SM-168, SM-287, SM-344, SM-345, SM394, SM-427, SM-548, SM-549, SM-579, SM-593, SM-624 & SM-959
- Guidance:** The design process for TSRs and ESRs on ETCS-fitted lines takes account of design rules that are set out in the ETCS Trackside Subsystem requirements.
- Topics:** F1, N2-1, N2-2

Operational Rules shall define recovery procedures for trains that are not permitted to operate in an ETCS-only area, but which pass the entry signal at 'Danger'.

EOPSS-956

- Status:** Normative
- Rationale:** To allow recovery of the situation and a return to normal operation.
- Guidance:** This includes trains that are not permitted to operate in ETCS-only areas, i.e. unfitted trains and trains driven by drivers who do not have the competency to operate in ETCS-only areas.
- Topics:** N1-1, N1-2, N2-1

Safety

Driver Training shall include the required behaviour when 'Entering FS' or 'Entering OS' is displayed on the ETCS Driver Machine Interface (DMI).

EOPSS-1554

- Status:** Normative
- Rationale:** To provide drivers with the knowledge to manage the movement safely until the rear of the train is supervised by the ETCS. Safety requirement implementing safety measure SM-282
- Guidance:** This occurs where the ETCS Onboard has not been supplied with the speed and gradient profiles applicable to the whole train. The displayed speed on the ETCS DMI may be higher than the restriction applicable to the rear of the train. The messages may be displayed following transition to ETCS operation, as part of the Start of Mission process or when the train has been operating in Staff Responsible mode and receives a Movement Authority.
- The ETCS Trackside is designed to reduce the instances of these messages.
- Topics:** G1-1, G1-2, G1-3, G1-4, N1-1, N1-2

CCMS: 64375796

Version: 4.00

Date: 25/11/21

Safety

Training for Infrastructure Manager (IM) staff shall include the design and implementation of Temporary Speed Restrictions (TSRs) and Emergency Speed Restrictions (ESRs) to cover ETCS only areas and ETCS with signals areas, and in the vicinity of transitions.

EOPSS-860

Status: Normative

Rationale: To provide relevant staff with the skills to design and apply TSRs and ESRs on an ETCS railway. Safety requirement implementing safety measures SM-761 & SM-762

Guidance: In ETCS areas, TSR/ESR application is via a Speed Restriction Management System (SRMS). In ETCS with signals areas, the design of the lineside signage, provision of temporary Automatic Warning System (AWS), and the use of SRMS are co-ordinated.

In the vicinity of transition, special rules apply as regards avoiding a driver not being able to manage the train correctly based on the information provided to them.

In areas of ETCS with signals, or in the vicinity of transitions, signallers apply Operational Rules until the TSR/ESR is fully implemented.

Topics: F1, N2-1, N2-2

10.11 Assumptions

On receipt of an LTO announcing a transition to a change in Level, the ETCS Onboard will immediately update its table of priority of ETCS Trackside-supported levels so that they are listed in the LTO and available for manual selection.

10.12 Exported requirements

None identified

11 Issues**11.1 Proposed changes to current Requirements**

During the latest review of this Topic and analysis to support the East Coast Project, it was identified that some of the requirements should be considered for amendment to improve the driveability and operation of transitions. The changes will be submitted as a formal Change Request.

Balise Groups necessary for network registration and establishing a communication session with the Radio Block Centre (RBC) shall be positioned on the approach to the level transition **into Levels 2 or 3** such that a train can normally transition without braking.

ETrckSS-287

Status: Normative

Rationale: To minimise the impact on performance.

Guidance: The position takes into account the time required for network registration and establishment of a communication session, as well as the time required for the

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entry signal to be cleared and to display the appropriate proceed aspect. It may be sensible to allow 40 seconds for the train to connect. This is configured to happen before the driver of the approaching train sights, and begins reacting to, the first restrictive aspect associated with the signal authorising movements over the transition border at danger, assuming there are no other trains in the transition area. To avoid undefined Onboard behaviour, it is good practice not to transmit both Packets 42 and 45 within the same Eurobalise message.

Topics: N2-1, N2-2

Safety

Transition orders leading to a transition from Level NTC to Level 2 or 3 shall be configured such that the transition acknowledgement request is presented to the driver when the transition occurs.

ETrckSS-301

Status: Normative

Rationale: To provide a consistent presentation of the level transition acknowledgement to the driver. Safety requirement implementing safety measures SM-25, SM-137, SM-185, SM-507 & SM-868

Guidance: Where the transition requires acknowledgement, the driver has 5 seconds to complete the acknowledgement before the service brake is initiated. **Where the ETCS Onboard has implemented the solution to CR1166 the driver is not required to acknowledge the transition from NTC to Levels 2 or 3.**

Topics: N2-1, N2-2, O2, O3

Safety

Where a train **operating in Level NTC or Level 0** is routed into an ETCS area, with or without signals, the ETCS Trackside shall send a Level Transition Announcement (LTA) **containing the same priority table as the Border Balise Group** and Movement Authority (MA) in the same radio message unless the train is operating in Level NTC (NID_NTC=21).

ETrckSS-379

Status: Normative

Rationale: To provide a train with the MA applicable after the level transition unless the train has been configured not to transition. The LTA provides the instruction for a train in Level NTC (NID_NTC=20) to transition at the border on entry to an ETCS with signals area where a Conditional Level Transition Order will be transmitted by the Border Balise Group. Safety requirement implementing safety measures SM-512 & SM-551

Guidance: Sending the MA with the LTA prevents the train tripping when it transitions into the ETCS.
Where the driver has selected Level NTC (NID_NTC=21), the radio message is not sent and the signal protecting the ETCS without signals area remains at 'danger'.
A driver who is not authorised to operate trains in the ETCS selects Level NTC (NID_NTC=21).

Topics: N2-1, N2-2

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The Balise Group (BG) at the entrance to a Transition Zone (TZ) shall include within all messages, including the default, the order to establish a safe radio connection, except where shunting is active. ~~The balise message containing a Level Transition Order with the highest priority being Level 1 shall include the order to establish a safe radio connection.~~

ETrckSS-727

Status: Application-Specific

Rationale: To commence the process of connecting to the Radio Block Centre, which will instruct the subsequent transition to Level 2 or 3.

Guidance: Level 1 Launch locations will be specified on an application basis.

Topics: N1-1

The priority table of ETCS Trackside supported levels shall be transmitted as part of a Level Transition Order from the switchable Balise Group (BG) at the entrance to the Transition Zone (TZ) prior to an ETCS-without signals area **except when shunting is active**.

ETrckSS-1439

Status: Normative

Rationale: To cause trains not in Shunting (SH) mode to transition to Level 1 at the entrance to the TZ.

Guidance: Trains are instructed to transition to Level 2 or 3 by the Radio Block Centre (RBC) when a communication session is established. A BG at the end of the TZ updates the table of supported levels for trains not in communication with the RBC.
Where trains can operate in Level NTC within the TZ, a different requirement applies.

Topics: N1-1

A permanently energised Train Protection and Warning System Train Stop Sensor shall be provided at the boundary between a Transition Zone (TZ) ~~in which shunting in Level NTC is permitted~~ and an ETCS without signals area.

ETrckSS-1440

Status: Normative

Rationale: To restrict the movement of trains operating in Level NTC to the TZ.

Guidance: The end of the TZ is marked at the lineside to support the driver in understanding the permitted limit of the shunting movement. The form of the lineside indication is determined on a site-specific basis, following assessment. Rail Industry Standard RIS-0733-CCS catalogues the approved lineside operational signs and sets out the process for proposing new designs of lineside operational signs.

Topics: N1-2

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The default telegram in the Balise Group (BG) at the entrance to a Transition Zone (TZ) shall ~~include the Level Transition Order (LTO)~~ be that associated with no 'proceed' aspect being displayed.

ETrckSS-1443

Status: Normative

Rationale: To manage an unauthorised movement into the TZ by tripping the train.

Guidance: The default telegram is transmitted when the signal is not displaying a 'proceed' aspect.
Trains in Level 0 Unfitted (UN) or Level NTC National System (SN) mode are tripped because no Movement Authority is available from the Border BG.

Topics: N1-1

The priority table of ETCS Trackside supported levels in the Transition Zone (TZ) prior to an ETCS with signals area where shunting is not active and a 'proceed' aspect is displayed on the border signal shall be, in descending order of priority, Level 1, Level 3 (where required), Level 2, Level NTC (NID_NTC=21), ~~Level NTC (NID_NTC=20)~~, and Level 0.

ETrckSS-1444

Status: Normative

Rationale: To initiate the transition to ETCS operation when the driver has been authorised to enter an ETCS with signals area unless the driver is not authorised to operate in ETCS.

Guidance: Trains operating in Level NTC (NID_NTC=21) do not transition on entry to the TZ.
Other trains transition automatically to Level 1. Levels 2 and 3 allow for driver selection if the transition does not occur automatically. Level 3 may be included if the ETCS Trackside supports it; however, since not all trains may be configured for Level 3, Level 2 is also included. Level 0 is included for possessions. ~~The inclusion of Level NTC (NID_NTC=20) supports the degraded scenario in which a train fails to establish communication.~~
Where a train is authorised to enter the TZ for shunting purposes, a different requirement applies.
This requirement assumes that the Train Protection and Warning System is the Class B system provided.

Topics: N1-1

The priority table of ETCS Trackside supported levels shall be transmitted by a Conditional Level Transition Order (CLTO) in a switchable Balise Group (BG) at the entrance to the Transition Zone (TZ) ~~when shunting is active~~ or prior to an ETCS with signals area.

ETrckSS-1445

Status: Normative

Rationale: To manage the transition to Level 1 at the entrance to the TZ based on whether the train is, or is not, in Level NTC (NID_NTC=21).

Guidance: Trains operating in Level NTC (NID_NTC=21) are not instructed to transition. Other trains are instructed to transition to Level 2 or 3 by the Radio Block Centre (RBC) when a communication session is established. A BG at the end of the TZ updates the table of supported levels for trains not in communication with the RBC.

Topics: None

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The priority table of ETCS Trackside supported levels in the Transition Zone (TZ) prior to an ETCS with signals area where a proceed aspect on the border signal is not displayed shall be, in descending order of priority, Level 3 (where required), Level 2, Level NTC (NID_NTC=21), ~~Level NTC (NID_NTC=20)~~, and Level 0.

ETrckSS-1446

- Status:* Normative
- Rationale:* To define the acceptable levels within the TZ when a train has not been authorised to enter the zone.
- Guidance:* Trains passing the border signal at danger without authority will transition to Level 2 or 3 and be tripped.
Where authorised to operate in ETCS, having acknowledged the trip, the driver undertakes Start of Mission in Level 2 or 3. ~~The inclusion of Level NTC (NID_NTC=20) supports the degraded scenario where a train fails to establish communication.~~
Drivers not authorised to operate in ETCS select Level NTC (NID_NTC=21) when authorised to proceed by the signaller.
This requirement assumes that the Train Protection and Warning System is the Class B system provided.
- Topics:* N1-1

Driver Training shall include the lack of a train protection system when operating in Level 0.

EOPSS-1549

- Status:* Normative
- Rationale:* To allow safe and effective movement of ETCS-fitted trains in situations where operation in Level 0 may be necessary.
- Guidance:* Due to the lack of train protection in L0, L0,UN should not be used on running lines. Drivers will need to identify when the use of L0,UN is appropriate
- Topics:* None

11.2 Proposed new requirements

The Priority table of ETCS Trackside supported levels for the Transition Zone (TZ) prior to an ETCS without signals area, where shunting is active and a 'proceed' aspect is displayed on the border signal, shall be transmitted by a Conditional Level Transition Order (CLTO) in a switchable Balise Group (BG) .

ETrckSS-Nxx1

- Status:* Normative
- Rationale:* To enable shunting to be undertaken without a transition to ETCS.
- Guidance:* Trains authorised to shunt into the ETCS area remain in their current level (0 or NTC).
Within the TZ, the driver may, having completed shunting, manually select Level 2 or 3 and enter train data to obtain a Movement Authority.

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Authorisation to enter the TZ is given by a position light aspect unless the end of the TZ is marked by a main lineside signal (ETCS with signals areas), in which case, a main aspect may be displayed. The CLTO is only required where shunting is active, and for all other Pathways from the border signal an LTO is used.

This requirement assumes that the Train Protection and Warning System is the Class B system provided.

Topics: N1-2

When a train is routed into an ETCS area, the ETCS Trackside shall send an updated Level Transition Announcement and Movement Authority (MA) to trains approaching the transition when a position report containing an updated Last Relevant Balise Group is received.

ETrckSS-Nxx2

Status: Normative

Rationale: To manage the confidence interval on approach to the transition leading to the location of the transition being more consistent.

Guidance: Where the initial transition announcement is made a distance from the border, the ETCS Onboard will estimate the distance travelled and may implement the transition at the wrong location. Additionally the information contained in the MA will be subject to a large confidence interval leading to reduced performance.

Topics: N2-1, N2-2

All balise groups marked as linked between the balise group containing the initial session management command and the transition shall include the same session management command.

ETrckSS-Nxx3

Status: Normative

Rationale: To instruct trains to connect where Start of Mission has been undertaken after passing the initial session establishment balise group.

Guidance: Repeating the session establishment message enables trains where Start of Mission has been undertaken to connect before reaching the transition border. Trains operating in Level NTC (NID_NTC=21) may connect and disconnect several times.

Topics: N2-1, N2-2

Driver training shall include the required driver reaction and subsequent action where a transition to ETCS has occurred and driving in ETCS is not within the driver's competency.

EOPSS-Nxx1

Status: Normative

Rationale: To enable drivers to understand what action needs to be taken in order for the train to continue on its journey.

Guidance: If a transition to ETCS has occurred, due to a misrouting error, then the driver should stop the train and contact the signaller. Recovery from the situation will be required for drivers who are not competent to operate the train in ETCS.

Topics: N1-1

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11.3 Arrangements for Temporary and Emergency Speed Restrictions in the vicinity of Transitions

The arrangements described in 5.2.4.2 and 6.3.3.2 are conservative in supporting the driver in entering the ETCS area at the correct speed to avoid an ETCS intervention. It has been identified that these arrangements are prejudicial to the performance of the train service and discussions are ongoing within the issues management process and once resolved the design guidance will be updated.

The use of TSRs in a L1 launch area also needs to be developed.

12 References

12.1 Standards

- [R1]. ERTMS System Requirements Specification, SUBSET-026, v3.6.0
- [R2]. RSSB Operational Concept for ERTMS Issue 2, December 2014
- [R3]. Requirements for Minimum Signalling Braking and Deceleration Distances, GKRT0075
- [R4]. Signing of Temporary and Emergency Speed Restrictions, RIS-0735-CCS
- [R5]. RIS-0797-CCS, ERTMS/ETCS Baseline 3 Onboard Subsystem Requirements: Retrofit, Issue 1, September 2018
- [R6]. RIS-0798-CCS, ERTMS/ETCS Baseline 3 Onboard Subsystem Requirements: New Trains, Issue 1, September 2018
- [R7]. Hybrid ERTMS/ETCS Level 3 Principles, Ref 16E042 Version 1C dated 13/07/2018
- [R8]. Commission Implementing Regulation (EU) 2019/773 - Operation and Traffic Management subsystem of the Rail System within the EU
- [R9]. ERA_ERTMS_015560, ETCS Driver Machine Interface, 3.6.0, 13/05/16
- [R10]. RIS-0703-CCS, Signalling the Layout and Signal Aspect Requirements, Issue 1.1, March 2018
- [R11]. [R11] RIS-0708-CCS, ERTMS/ETCS National Values, Issue 1
- [R12]. [R12] Guidance Note 'GSM-R Coverage Assessment and Cell Planning', NEPT/ERTMS/HBK/0403 version 2.1
- [R13]. [R13] EIRENE, GSM-R System Requirements Specification, 16.0.0
- [R14] Guidance Note 'GSM-R Capacity Assessment for ETCS Traffic', NEPT/ERTMS/HBK/0401 version 1.1
- [R15] Safety Requirements for the Technical Interoperability of ETCS in Levels 1 & 2, Subset-091, Issue 3.6.0, Date: 2016-05-12
- [R16] ERTMS/ETCS Proposed GB National Values – NEPT/ERTMS/SYS/0066. Issue 2
- [R17] Passing a signal at danger or an end of authority (EoA) without a movement authority (MA), GERT8000-S5, Issue 9, 05/09/2020
- [R18] RIS-0775-CCS, AWS and TPWS Application Requirements, Issue 2

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13 Appendix A

13.1 L1 launch prior to ETCS without signals (shunting not available)

Starting Level and Mode	Border signal	Leading Cab	Level and Mode in Transition Zone	Other Cabs
Onboard		Switchable BG-1		Switchable BG-1
	Proceed	Pkt 42 (Session) LTO Level 1, Level 3 (optional), Level 2, Level 0 Movement Authority		Pkt 42 (Session) LTO Level 3 (optional), Level 2, Level 0
Level 0, UN		Transition to Level 1, FS or OS (based on MA) Initiates communication session	Level 1, FS or OS	Priority table updated
Level 0, SH		Transition order stored	Level 0, SH	Priority table updated
Level NTC (NID_NTC=20), SN		Transition to Level 1, FS or OS (based on MA) Initiates communication session	Level 1, FS or OS	Priority table updated
Level NTC (NID_NTC=20), SH		Transition order stored	Level NTC (NID_NTC=20), SH	Priority table updated
Level NTC (NID_NTC=21), SN		Transition to Level 1, FS or OS (based on MA) Initiates communication session	Level NTC (NID_NTC=21), SN	Priority table updated
Level NTC (NID_NTC=21), SH		Transition order stored	Level NTC (NID_NTC=21), SH	Priority table updated

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13.2 L1 launch prior to ETCS with signals (shunting not available)

Starting Level and Mode	Border signal	Leading Cab	Level and Mode in Transition Zone	Other Cabs
Onboard		Switchable BG-1		Switchable BG-1
	Proceed	Pkt 42 (Session) CLTO Level 1, Level 3 (optional), Level 2, Level NTC (NID_NTC=21), Level 0 Movement Authority		Pkt 42 (Session) CLTO Level 3 (optional), Level 2, Level NTC (NID_NTC=21), Level 0
Level 0, UN		Priority table updated	Level 0, UN	Priority table updated
Level 0, SH		Priority table updated	Level 0, SH	Priority table updated
Level NTC (NID_NTC=20), SN		Transition to Level 1, FS or OS (based on MA) Initiates communication session	Level 1, FS or OS	Priority table updated
Level NTC (NID_NTC=20), SH		Transition order stored	Level NTC (NID_NTC=20), SH	Priority table updated
Level NTC (NID_NTC=21), SN		Priority table updated	Level NTC (NID_NTC=21), SN	Priority table updated
Level NTC (NID_NTC=21), SH		Priority table updated	Level NTC (NID_NTC=21), SH	Priority table updated

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13.3 L1 launch prior to ETCS without signals (shunting available)

Starting Level and Mode	Border signal	Leading Cab	Level and Mode in Transition Zone	Other Cabs
Onboard		Switchable BG-1		Switchable BG-1
	Proceed (not shunting)	Pkt 42 (Session) LTO Level 1, Level 3 (optional), Level 2, Level 0 Movement Authority		Pkt 42 (Session) LTO Level 3 (optional), Level 2, Level 0
Level 0, UN		Transition to Level 1, FS or OS (based on MA) Initiates communication session	Level 1, FS or OS	Priority table updated
Level 0, SH		Transition order stored	Level 0, SH	Priority table updated
Level NTC (NID_NTC=20), SN		Transition to Level 1, FS or OS (based on MA) Initiates communication session	Level 1, FS or OS	Priority table updated
Level NTC (NID_NTC=20), SH		Transition order stored	Level NTC (NID_NTC=20), SH	Priority table updated
Level NTC (NID_NTC=21), SN		Transition to Level 1, FS or OS (based on MA) Initiates communication session	Level NTC (NID_NTC=21), SN	Priority table updated
Level NTC (NID_NTC=21), SH		Transition order stored	Level NTC (NID_NTC=21), SH	Priority table updated
	Proceed (shunting aspect)	CLTO Level NTC (NID_NTC=20), Level NTC (NID_NTC=21), Level 3 (optional), Level 2, Level 0		Pkt 42 (Session) LTO Level 3 (optional), Level 2, Level 0
Level 0, UN		Priority table updated	Level 0, UN	Priority table updated
Level 0, SH		Priority table updated	Level 0, SH	Priority table updated

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Starting Level and Mode	Border signal	Leading Cab	Level and Mode in Transition Zone	Other Cabs
Onboard		Switchable BG-1		Switchable BG-1
Level NTC (NID_NTC=20), SN		Priority table updated	Level NTC (NID_NTC=20), SN	Priority table updated
Level NTC (NID_NTC=20), SH		Priority table updated	Level NTC (NID_NTC=20), SH	Priority table updated
Level NTC (NID_NTC=21), SN		Priority table updated	Level NTC (NID_NTC=21), SN	Priority table updated
Level NTC (NID_NTC=21), SH		Priority table updated	Level NTC (NID_NTC=21), SH	Priority table updated

13.4 L1 launch prior to ETCS with signals (shunting not available)

Starting Level and Mode	Border signal	Leading Cab	Level and Mode in Transition Zone	Other Cabs
Onboard		Switchable BG-1		Switchable BG-1
	Proceed (not shunting)	Pkt 42 (Session) CLTO Level 1, Level 3 (optional), Level 2, Level NTC (NID_NTC=21), Level 0 Movement Authority		Pkt 42 (Session) CLTO Level 3 (optional), Level 2, Level NTC (NID_NTC=21), Level 0
Level 0, UN		Priority table updated	Level 0, UN	Priority table updated
Level 0, SH		Priority table updated	Level 0, SH	Priority table updated
Level NTC (NID_NTC=20), SN		Transition to Level 1, FS or OS (based on MA) Initiates communication session	Level 1, FS or OS	Priority table updated

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Starting Level and Mode	Border signal	Leading Cab	Level and Mode in Transition Zone	Other Cabs
Onboard		Switchable BG-1		Switchable BG-1
Level NTC (NID_NTC=20), SH		Transition order stored	Level NTC (NID_NTC=20), SH	Priority table updated
Level NTC (NID_NTC=21), SN		Priority table updated	Level NTC (NID_NTC=21), SN	Priority table updated
Level NTC (NID_NTC=21), SH		Priority table updated	Level NTC (NID_NTC=21), SH	Priority table updated
	Proceed (shunting aspect)	CLTO Level NTC (NID_NTC=20), Level NTC (NID_NTC=21), Level 3 (optional), Level 2, Level 0		Pkt 42 (Session) CLTO Level 3 (optional), Level 2, Level NTC (NID_NTC=21), Level 0
Level 0, UN		Priority table updated	Level 0, UN	Priority table updated
Level 0, SH		Priority table updated	Level 0, SH	Priority table updated
Level NTC (NID_NTC=20), SN		Priority table updated	Level NTC (NID_NTC=20), SN	Priority table updated
Level NTC (NID_NTC=20), SH		Priority table updated	Level NTC (NID_NTC=20), SH	Priority table updated
Level NTC (NID_NTC=21), SN		Priority table updated	Level NTC (NID_NTC=21), SN	Priority table updated
Level NTC (NID_NTC=21), SH		Priority table updated	Level NTC (NID_NTC=21), SH	Priority table updated

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13.5 Transition Zone to ETCS without signals

Starting Level and Mode	RBC Response to established session	Onboard (Leading Cab)	End of Transition Zone	Leading Cab Level and Mode	Other Cabs
Onboard	LTO		BG-2		BG-2
	LTO Level 3 (optional), Level 2, Level 0 Movement Authority		LTO Level 3 (optional), Level 2, Level 0		
Level 1 FS or OS	Transition to L3/2, MA updated	Level 3/2, FS or OS	Priority table updated	Level 3/2, FS or OS	Priority table updated
Level 0 UN	No session	Level 0 UN	Priority table updated	Level 0 UN	Priority table updated
Level 0 SH	No session	Level 0 SH	Priority table updated	Level 0 SH	Priority table updated
Level NTC (20) SN	No session	Level NTC (20) SN	Transition to Level 3/2, Trip	Level 3/2, TR	Priority table updated
Level NTC (20) SH	No session	Level NTC (20) SH	Transition order stored	Level NTC (20) SH	Priority table updated
Level NTC (21) SN	No session	Level NTC (21) SN	Transition to Level 3/2, Trip	Level 3/2, TR	Priority table updated
Level NTC (21) SH	No session	Level NTC (21) SH	Transition order stored	Level NTC (21) SH	Priority table updated

13.6 Transition Zone to ETCS with signals

Starting Level and Mode	RBC Response to established session	Onboard (Leading Cab)	End of Transition Zone	Leading Cab Level and Mode	Other Cabs
Onboard	LTO		BG-2		BG-2
	Terminate session is Level NTC (NID_NTC=21) LTO Level 3 (optional), Level 2, Level NTC (NID_NTC=21), Level NTC (NID_NTC=20), Level 0 Movement Authority		CLTO Level 3 (optional), Level 2, Level NTC (NID_NTC=21), Level NTC (NID_NTC=20), Level 0		
Level 1 FS or OS	Transition to L3/2, MA updated	Level 3/2, FS or OS	Priority table updated	Level 3/2, FS or OS	Priority table updated

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Starting Level and Mode	RBC Response to established session	Onboard (Leading Cab)	End of Transition Zone	Leading Cab Level and Mode	Other Cabs
Onboard	LTO		BG-2		BG-2
Level 0 UN	No session	Level 0 UN	Priority table updated	Level 0 UN	Priority table updated
Level 0 SH	No session	Level 0 SH	Priority table updated	Level 0 SH	Priority table updated
Level NTC (20) SN	No session	Level NTC (20) SN	Priority table updated	Level NTC (20) SN	Priority table updated
Level NTC (20) SH	No session	Level NTC (20) SH	Priority table updated	Level NTC (20) SH	Priority table updated
Level NTC (21) SN	No session	Level NTC (21) SN	Priority table updated	Level NTC (21) SN	Priority table updated
Level NTC (21) SH	No session	Level NTC (21) SH	Priority table updated	Level NTC (21) SH	Priority table updated

13.7 Running Transition at the Entry to an L2 or Hybrid Level 3 (HL3) without signals area

Starting Level and Mode	Session Establishment	RBC Response	Position Reports	Border (Leading Cab)	Border (Other Cabs)	Leading Cab Level and Mode
Onboard	BG-E	RBC	Onboard/RBC	LTA/BG-T	BG-T	Onboard
	Pkt 42	LTA Level 3 (optional), Level 2, Level 0 Movement Authority	Triggered by BG	LTA/LTO Level 3 (optional), Level 2, Level 0	LTO Level 3 (optional), Level 2, Level 0	
Level 0 UN	Leading Cab establishes session	LTA for border stored Level 3/2 announced Movement Authority for proved sections stored	On receipt of new LRBG, RBC sends updated MA and LTA	Transition to L2 or L3, driver requested to acknowledge. Priority table updated	Priority table updated	Level 2 or 3, FS or OS depending on MA.
Level 0 SH (e.g. possession)	No session established	N/A Border signal remains at danger.	N/A	Priority table updated. No transition until exit SH.	Priority table updated	Level 0 SH

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Starting Level and Mode	Session Establishment	RBC Response	Position Reports	Border (Leading Cab)	Border (Other Cabs)	Leading Cab Level and Mode
Onboard	BG-E	RBC	Onboard/RBC	LTA/BG-T	BG-T	Onboard
Level NTC (20) SN	Leading Cab establishes session	LTA for border stored Level 3/2 announced Movement Authority for proved sections stored	On receipt of new LRBG, RBC sends updated MA and LTA	Transition to L2 or L3, driver requested to acknowledge. Priority table updated.	Priority table updated	Level 2 or 3, FS or OS depending on MA.
Level NTC (20) SH	No session established	N/A Border signal remains at danger.	N/A	Priority table updated. No transition until exit SH.	Priority table updated	Level NTC (20) SH
Level NTC (20) SN with override active	Leading Cab establishes session	No LTA or MA transmitted Border signal remains at danger.	N/A	Transition to L2 or L3, Entry to SR, driver requested to acknowledge. Priority table updated	Priority table updated	Level 2 or 3 SR
Level NTC (21) SN	Leading Cab establishes session	RBC requests termination of session on receipt of position report with NID_NTC=21 Border signal remains at danger.	N/A	Transition to L2 or L3, TR – emergency brake applied. Priority table updated.	Priority table updated	Level 2 or 3 TR/PT
Level NTC (21) SH	No session established	N/A Border signal remains at danger.	N/A	Priority table updated. No transition until exit SH.	Priority table updated	Level NTC (21) SH
Level 2 or 3 FS or OS	Session already established	LTA accepted Movement Authority for proved sections stored	On receipt of new LRBG, RBC sends updated MA and LTA	Priority table updated. No change to Level or Mode	Priority table updated.	Level 2 or 3 FS or OS

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13.8 Running Transition at the Entry to an L2 or Hybrid Level 3 (HL3) with signals area

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Starting Level and Mode	Session Establishment	RBC Response	Position Reports	Border (Leading Cab)	Border (Other Cabs)	Leading Cab Level and Mode
Onboard	BG-E	RBC	Onboard/RBC	LTA/BG-T	BG-T	Onboard
	Pkt 42	Terminate session is Level NTC (NID_NTC=21) LTA Level 3 (optional), Level 2, Level NTC (NID_NTC=21), Level NTC (NID_NTC=20), Level 0 Movement Authority	Triggered by BG	LTA Level 3 (optional), Level 2, Level NTC (21), Level NTC (20) Level 0	CLTO Level 3 (optional), Level 2, Level NTC (21), Level NTC (20) Level 0	
Level 0 UN	Leading Cab establishes session	LTA for border stored Level 3/2 announced Movement Authority for proved sections stored	On receipt of new LRBG, RBC sends updated MA and LTA	Transition to L2 or L3, driver requested to acknowledge. Priority table updated	Priority table updated	Level 2, FS or OS depending on MA.
Level 0 SH (e.g. possession)	No session established	N/A Border signal unrestricted.	N/A	Priority table updated.	Priority table updated	Level 0 SH
Level NTC (20) SN	Leading Cab establishes session	LTA for border stored Level 3/2 announced Movement Authority for proved sections stored	On receipt of new LRBG, RBC sends updated MA and LTA	Transition to L2 or L3, driver requested to acknowledge. Priority table updated	Priority table updated	Level 2, FS or OS depending on MA.
Level NTC (20) SH	No session established	N/A Border signal unrestricted.	N/A	Priority table updated.	Priority table updated	Level NTC (20) SH

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Level NTC (20) SN (comms problem)	Leading Cab fails to establish session	N/A Border signal unrestricted.	N/A	Priority table updated	Priority table updated	Level NTC (20) SN
Level NTC (21) SN	Leading Cab establishes session	RBC requests termination of session on receipt of position report with NID_NTC=21 Border signal unrestricted.	N/A	Priority table updated	Priority table updated	Level NTC (21) SN
Level NTC (21) SH	No session established	N/A Border signal unrestricted.	N/A	Priority table updated.	Priority table updated	Level NTC (21) SH