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Version:	**4.1**
Date:	**6/12/21**

ERTMS Reference Design
Topic: F

Applying Speed Restrictions

This Topic covers the core technical requirements for applying Temporary Speed Restrictions (TSRs) on a European Train Control System (ETCS) fitted railway or Automatic Train Operation (ATO) over ETCS (AoE) railway. The Topic covers both overlay and non-overlay railways.

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

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PM-061221-186 Date: 6/12/21

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RNG-091221-415 Date: 9/12/21

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Version:	**4.1**
Date:	**6/12/21**

Version History

Issue	Date	Comments
1.0	02/05/14	Issued for ESB/OSG review
1.1	22/05/14	Working Version issued
1.2	09/10/14	Technical Author & Requirements update
1.3	06/02/15	Document updated in accordance with comments received
1.4	09/03/15	Incorporating HazID outcome
1.5	21/08/15	Document updated in accordance with combined comments received
1.6	01/09/15	Incorporating additional comments
1.7	09/09/15	Incorporating TLWG comments
1.8	25/09/15	Incorporating additional comments
1.9	10/12/15	Incorporating additional comments following requirements extraction
1.10	12/01/16	Incorporating additional comments
1.11	08/02/16	Incorporating CCP comments
1.12	18/02/16	Technical Author Review and Issued to ESB/OSG for Consideration
2.0	19/04/16	Endorsed as Release Version
2.1	01/09/16	New template
3.0	21/09/16	Topic complete – with requirements
3.1	07/09/19	ATO Draft ready for RIC review, incl. internal review comments update
3.2	02/10/19	ATO - Updated to reflect second round of internal review comments
3.3	03/10/19	ATO - Further review comment updates
3.4	10/10/19	ATO - Technical Author updates
3.5	05/12/19	ATO - Updated to address RIC comments
3.6	12/12/19	ATO - TF formatting updated & replies to SR comments (RIC comments)
3.7	12/02/20	New template – 2019/2020 topic updates Updated to L0 assurance review comments and incorporated ATO content
3.8	08/04/20	Updated to TA review and carried out requirements linking and topic mark-up exercise
3.9	03/06/20	Updated to L1 review comments
3.10	10/06/20	Updated to TA comments ready for RIC review
3.11	16/06/20	Updated to QC comments ready for RIC review
3.12	17/08/20	Updated to RIC comments
3.13	23/11/20	New Requirements numbering
3.14	10/05/21	Update
3.15	12/07/21	Pass 2 Update
3.16	09/09/21	Pass 3 Update
3.17	29/09/21	Pass 3 Update Comments addressed and tracked changed removed
4.0	16/11/21	Final formatting for signatures and Issue
4.1	6/12/21	Cross reference correction.

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1 Introduction

1.1 Background and Context

The content of this topic describes the means by which the ETCS Trackside uses speed restriction input from an external system and sends this information to the ETCS Onboard within the Movement Authority (MA) issued to the train. A national Speed Restriction Management System (SRMS) process is required to manage the application, imposition and de-activation of Temporary Speed Restrictions (TSRs), providing assurance that the correct data is being input to the external system, and that speed restrictions are removed only when there is a safety justification for removing them. The TSR process and the actors involved in the various stages of the process are outside of the scope of this topic and have yet to be developed. When the TSR process has been developed, the content of Topic F will need to be reviewed and updated, as necessary.

Safe operation of the railway requires all trains to operate within their permissible speed at each location. The permissible speed may vary; it is based on the infrastructure capability, which may be amended according to train characteristics and as infrastructure conditions change. These changes may take place with immediate effect when a fault occurs, or be planned for implementation at a later time, and will be in place for a specified period of time.

The ability to apply, impose and de-activate temporary changes to the permissible speed via TSRs is essential to protect the railway infrastructure and trains at various times.

The ETCS can provide different technical solutions for imposing TSRs: a TSR could be sent within a packet (Option F1) or, alternatively, a TSR could be included within the Static Speed Profile (SSP) (Option F2).

Note: The examples given in Options F1 and F2 are not prescriptive ways of achieving the outcome of imposing speed restrictions.

Speed restrictions may be imposed for a variety of reasons, including:

- track, civil and other infrastructure faults;
- staff protection;
- protection of newly installed infrastructure;
- engineering works; and
- weather conditions.

An external system will be used to aid in the design and application/removal of TSRs and will be the origin of TSR data (*see* Figure 1). This system will be referred to as the Speed Restriction Management System (SRMS) throughout this topic.

The system specifications for the SRMS have yet to be developed and are outside of the scope of this topic. The SRMS is discussed within this topic as it is an integral feature for describing the flow of TSR data to the digital systems requiring the information.

The proposed SRMS is intended to be interfaced with the ETCS Trackside and the Traffic Management System (TMS). The TMS will then distribute the TSR data to the ATO Trackside (ATO-TS) sub-system.

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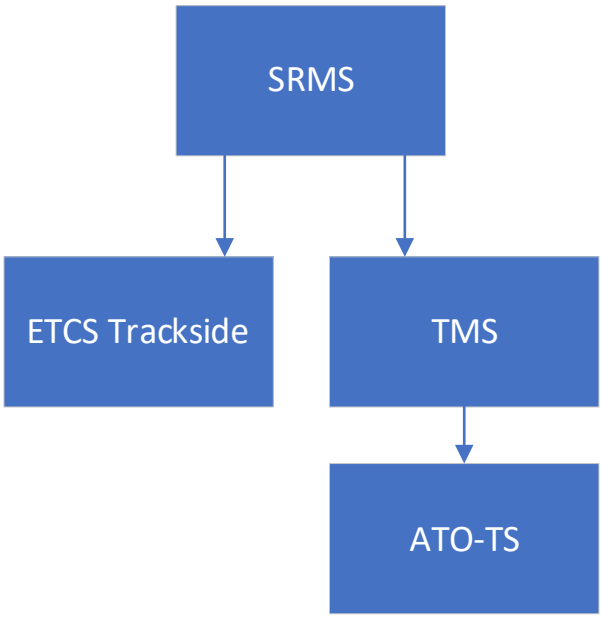

Figure 1 - TSR data flow

TSRs are sent to the ATO Onboard's sub-systems as an Additional Speed Restriction (ASR). ASRs will reflect any TSR data that is defined within the SRMS.

Note: When Imposed, ASR and TSR data will not be identical where differential speed restrictions are used.

Grade of Automation 2 (GoA2) (automatic driving with a driver present in the cab) will be used, and the functionality for GoA1 (manual driving with driver advisory information) will also be available; both of these will be covered within this topic.

Throughout this document, 'imposed', 'applied', 'activated', and 'de-activated' will be used as follows in respect of TSRs:

Imposed	Refers to appropriate speed restrictions enforced either by TSR Packets, Static Speed Profile (SSP) amendments or TSR/Emergency Speed Restriction (ESR) Lineside signs
Applied	Describes the input of TSR data to the SRMS.
Activated	Indicates that an action has been made to send the TSR data to the ETCS trackside (user switching on, configurable time passing etc). TSR is now Active (imposed on traffic following confirmation from the ETCS Trackside).
De-activated	Indicates that the TSR is no longer imposed and line speed is to be used.

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An overview of the stages associated with the input and activation / de-activation of TSRs is presented in the diagram below:

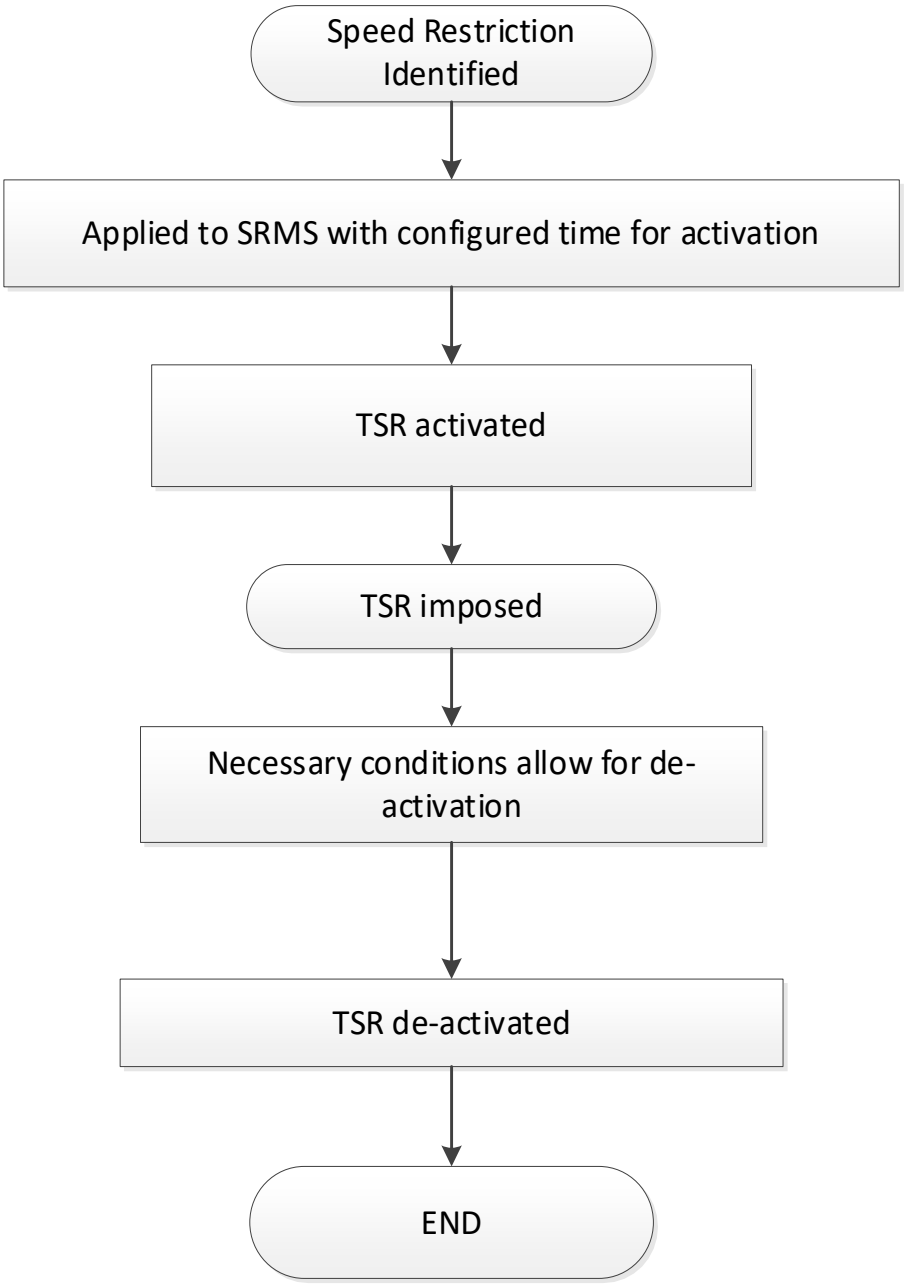

Figure 2 - Speed restriction stages

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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
AoE	ATO over ETCS
ASR	Additional Speed Restriction
ATO	Automatic Train Operation
ATO-OB	ATO Onboard
ATO-TS	ATO Trackside
DAS	Driver Advisory System
DMI	Driver Machine Interface
ESR	Emergency Speed Restriction
ETCS	European Train Control System
GoA1, 2	Grade of Automation 1, 2
JP	Journey Profile
L-NTC	Level NTC
LRBG	Last Relevant Balise Group
MA	Movement Authority
NTSN OPE	National Technical Specification Notice: Operation and Traffic Management
RBC	Radio Block Centre
SRMS	Speed Restriction Management System
SSP	Static Speed Profile
TSI	Technical Specification for Interoperability
TSR	Temporary Speed Restriction

2 Option Selection

2.1 Selection of Options / Variants

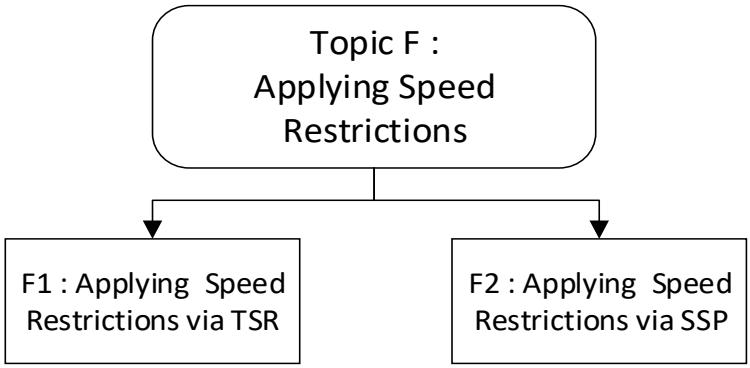

Figure 3 - Topic Options

2.1.1 Option F1: Applying Speed Restrictions via TSR Packet

This option describes the application of speed restrictions using a TSR packet. The ETCS Trackside uses the TSR data sent from the SRMS and the train data to create a train-specific TSR speed through the affected area.

2.1.2 Option F2: Applying Speed Restrictions via Static Speed Profile

This option describes the application of static speed restrictions via an amendment to the SSP. The ETCS Trackside uses the TSR data sent from the SRMS to change the SSP; the amended SSP will then be used by all trains travelling through the affected area.

2.2 Options not developed

The use of temporary balises in place of current trackside equipment has been discounted on the basis that it requires staff to attend trackside sites, which can lead to risk of trackside injury, misplacement of equipment, and programming errors. [ETrckSS-117]

In ETCS Level 2 only areas, ESRs have been discounted as an ETCS solution because there is no longer a need to differentiate between different types of speed restriction since the information for all types is available to the driver in the same way on the ETCS Driver Machine Interface (DMI). There will still be operational differences for TSRs that have been pre-planned and those that need to be imposed immediately. These will be explained within this topic.

In ETCS Level 2 only areas, the publication of a TSR to a driver has been discounted as an ETCS solution for managing TSRs; it is no longer relevant because information regarding all TSRs is displayed on the ETCS DMI in advance. TSR information will still be made available to users.

Solutions for speed masking have not been developed within this Reference Design Topic. Speed masking occurs when a second reduction in speed (in close proximity to the first reduction) may only be displayed on the ETCS DMI after the train has passed the point where the driver can react without a brake intervention occurring. Speed masking was an issue for early deployments and has since been rectified in Baseline 3 Release 2 (3.6.0) of Subset-026 [R1], which the Reference Design has been updated

to reflect. Speed masking will still need to be managed by projects that have used an earlier baseline.

For AoE – If the Railway Undertaking (RU) or Infrastructure Manager (IM) requires the issue of a non-safety-related speed restriction, the restricted speed can be issued within the ASR data and applied via ATO only. When speed restrictions are applied via ATO only, the ETCS braking intervention calculations will still be based on the permitted speed rather than the restricted ASR speed contained within the Journey Profile (JP).

The decision to discount the option of using non-safety-related ASRs for ATO was made during the Hazard Identification (HAZID) workshop on 04/06/19. It was based on the assumption that TSR data and non-safety-related ASR data would be applied by the same person; this introduced a greater risk of confusion when removing safety-related speed restrictions and non-safety-related speed restrictions. This decision was reinforced by the group not having a justifiable reason for applying non-safety-related speed restrictions.

2.3 Applicability

Table 1 - Applicability Matrix

Option	Variant (s)	Level 2 no signals	Level 2 signals	Hybrid Level 3 no signals	Hybrid Level 3 signals	ATO	Moving Block
F1	Only one variant	Y	Y	Y	Y	Y#	TBD
F2	Only one variant	Y	Y	Y	Y	Y#	TBD

- Applies up to Grade of Automation level 2 (GoA2)

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3 Applying Speed Restrictions

3.1 User Requirements

The user requirements set out in this section are applicable to both Options in this topic.

Any speed changes made on the network are to be made in accordance with The Network Code [R2].

The ETCS will issue modified permissible speeds to relevant trains in accordance with instructions from an external system. [ESR-162] & [ESR-161]

A TSR process will be required to manage and maintain speed restrictions. [ESR-162]

Note: The TSR process will need to identify the responsibilities of the actors involved and the necessary steps required when TSR data comparisons do not align.

Each train must receive an MA which includes the permissible speed at which to travel. [ESR-1055]

The ETCS application design will not introduce unwanted system braking interventions. [ESR-11]

TSRs will be managed by an external system and this will be the origin for TSR data flow. [ESR-162]

TSR signs will only be provided where essential.

Note: Areas where non-fitted trains, or trains in Level NTC (L-NTC), are operating will be considered areas where it is essential to provide TSR signs. [ESR-648]

The TSR will not be removed until the necessary conditions are satisfied, e.g. corrective work has taken place, environmental conditions have changed, or other controls have been applied. [ESR-1068]

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PART 1

4 Option F1 - Applying a Speed Restriction via TSR Packet

4.1 Level 2, no signals

4.1.1 Specific user requirements for this option

None identified

4.1.2 System States and user information

The method used for an ETCS Trackside to send the required TSRs to an ETCS Onboard may vary between suppliers. This section describes a method (TSR packets) that can be used, but it is not a prescriptive solution. Whilst the system application may differ, the information provided to the users should be consistent.

TSR data will be retained at all times, until there is a safety justification that permits its removal (as per the TSR process). [ETrckSS-1183] & [ETrckSS-714]

System checks will need to be made, and safety measures be in place to provide assurance that activated speed restrictions continue to be imposed by the ETCS Trackside following a system start up. [ETrckSS- 1185] & [ETrckSS-1186]

When speed restrictions are imposed in ETCS-only areas, there will be no requirement for lineside signage. [ETrckSS-118]

Provision will be made for the safe operation of trains unable to receive TSR data from the ETCS Trackside. [EOPSS-227] (*see* National Technical Specification Notice: Operation and Traffic (NTSN OPE) for Written Orders (WOs) and Topic S for Degraded working).

4.1.2.1 TSR Proposal and Design

The need for a speed restriction is identified by gathering information from a variety of sources (e.g. track patrolling, engineering works, a route control request).

The following information will be required to design the speed restriction:

- the location of the start and finish of the TSR;
- specific line or Track Identity
- the direction/s in which it is applicable;
- boundaries;
- train type / traction type affected;
- time of activation;
- planned time of de-activation;
- conditions for de-activation;
- whether it applies to the whole of the train or just the front;
- a range of speeds based on train configuration; and
- a unique identity.

Speed restriction information will be available to staff in all roles that require the information to enable them to perform their duties. This includes access to speed information for the signaller during degraded working. [EOPSS-786]

Unless it has been stated otherwise (train type, traction, direction), TSRs will be applied to all trains passing through the area. [ETrckSS-1188]

As the ETCS Trackside uses units of speed in km/h, existing speeds provided in mph will be converted. [EOPSS-215] & [EOPSS-999]

The ETCS Trackside, ATO-TS and SRMS will share a common location reference to enable this data to be correct. [ETrckSS-1026] & [ATrckSS-Fxx5]

4.1.2.2 Activating a TSR

When the TSR design has been validated, the details can be input into the SRMS. When activated, the SRMS will forward the data on to the TMS and ETCS Trackside. [ETrckSS-96] & [ETrckSS-103]

The ETCS Trackside will send an acknowledgment of receipt when a new TSR activation has been requested. [ETrckSS-1365]

4.1.2.3 Configuring the TSR Packet

The ETCS Trackside will utilise the data received from the SRMS to generate the ETCS TSR (Packet 65) appropriate to the MA and type of train. [ETrckSS-796]

The TSR Packet will enable the equivalent of differential TSRs to be imposed, but they will be more flexible than those imposed for a conventionally signalled railway.

Since the ETCS TSR packet does not support different speed profiles for different types of train, the ETCS Trackside will use the validated train data to establish which speed to include within the TSR packet sent to a specific train.

ETCS-validated train data (Packet 11) variables relevant to this document include:

- NC_CDTRAIN – the cant deficiency at which the train can operate;
- NC_TRAIN – the brake setting (which may indicate whether it is passenger or freight);
- M_AXLELOADCAT – the Infrastructure NTSN classification of axle load; and
- M_VOLTAGE – the traction system(s) for the train.

Note: M_VOLTAGE will not be a suitable variable to use where individual trains have multiple traction systems as it only specifies the traction systems the train has, rather than what is being used at the time.

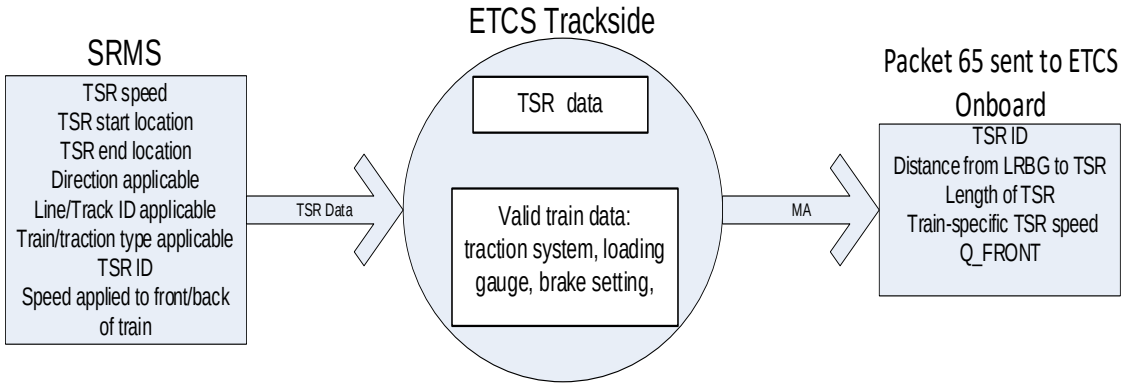

Figure 4 – Train-specific TSR

4.1.2.4 Issuing the TSR Packet with the MA

The ETCS Trackside will issue the MA, including the ETCS TSR (within Packet 65) appropriate to the validated train data. [ETrckSS-796]

The SRMS shall be able to command the ETCS Trackside to send a Temporary Speed Restriction (TSR) to trains which already hold a Movement Authority (MA) through the affected area if.. [EtrckSS-706]

The ETCS Onboard uses all the speed profiles sent from the ETCS Trackside to calculate the Most Restrictive Speed Profile (MRSP). There are no ETCS DMI icons to indicate to the driver that a TSR is in place; the driver will simply observe a reduction in ETCS Onboard-supervised line speed indicated on the ETCS DMI.

The direct update to speed supervision will reduce the need for signaller-driver interaction.

4.1.2.5 Updating/De-activating a TSR

If the TSR data needs to be updated, this can be done via the SRMS. [ETrckSS-1187] This could be due to remedial work having been carried out, or where a worksite which the TSR was protecting has moved.

The change made to the TSR data will need to be validated and the TSR Identification will remain the same.

Once the changes have been activated, the ETCS Trackside will issue the new TSR data packet information within the MA.

The length of time that a TSR is to be active can be advised, but the necessary conditions will need to be satisfied before the TSR can be de-activated. These may include:

- Sign-off on corrective work;
- Sign-off for engineering work; or
- Change of environmental conditions.

When the TSR has been de-activated, the TSR packet will no longer be sent with the MA.

The ETCS Trackside will continue to apply a Temporary Speed Restriction (TSR) until it is revoked by the Speed Restriction Management System (SRMS). [ETrckSS-713]

4.1.2.6 TSR requiring immediate imposition

When the need for immediate imposition of a speed restriction has been identified, the Rail Operating Centre (ROC) will be informed.

Where a speed restriction needs to be implemented immediately, and this cannot be achieved via the SRMS (due to delays in validation of design, access to the SRMS, etc.), the signaller will need to stop and caution trains through the affected area.

The signaller will be advised (probably by the person/s who has/have identified the need to impose the TSR) of a cautionary speed to be applied through the area.

Once the TSR has been applied and activated, the signaller may request confirmation from the driver that the train is being supervised to the appropriate speed. Once confirmation is received, the cautioning of trains can cease and normal operations can continue (at the restricted speed).

4.1.3 Impact on other topics

Topic O defines the arrangements for ETCS level transitions (Level 2 only or overlay to L-NTC).

Topic N defines the arrangements for ETCS level transitions (L-NTC to Level 2).

Topic A defines the arrangements that enable a train to continue to run under the highest available level of supervision.

Topic R defines the arrangements at ETCS Trackside-ETCS Trackside or National Area boundaries.

4.1.4 Design guidance

Operational Rules will specify how TSRs are managed for boundaries and transitions. [EOPS-928], [ETrckSS-354] & [ETckSS-735]

TSR design guidance on entering ETCS areas can be found in Topic N.

TSR design guidance on exiting ETCS areas can be found in Topic O.

Operational Rules, training and the necessary equipment will be provided for staff involved in the design, activation and de-activation of TSRs. [EOPSS-957], [EOPSS-138], [EOPSS-212], [EOPSS-140], [EOPSS-207], [EOPSS-925] & [EOPSS-215]

4.2 Level 2 with signals

4.2.1 Specific user requirements for this option

ETCS processes and requirements for TSR imposition must be followed in conjunction with reference NR/L3/SIG/MG0110 (Imposition and Removal of Emergency and Temporary Speed Restrictions) when applying speed restrictions in areas operating under ETCS L2/L3 with signals.

NR/L3/SIG/MG0110 describes the process for the imposition and removal of speed restrictions by maintenance staff on NR infrastructure with lineside signals and will need to be considered as part of the ETCS TSR Process.

ETCS L2/L3 trains will operate in accordance with the details specified in Section 4.1

Trains operating in L-NTC or unfitted trains will follow GB's rules and standards for conventionally signalled railways and drive to the speeds specified on the ESR/TSR signs.

4.2.2 System States and User Information

ETCS system states and user information in 4.1.2 will still apply for trains operating in ETCS L2/L3. Trains operating in L-NTC or unfitted trains will follow GB's rules and standards specified for conventionally signalled railways and drive to the speeds specified on the ESR/TSR signs.

ETCS speed restrictions will be consistent with the lineside speed restriction signs (where possible). [ETrckSS-120]

The lineside speed signs and the speed shown on the ETCS DMI may be in different units of measurement (mph or km/h). Drivers and signallers will be trained to be aware of lineside and ETCS DMI speed differences. [EOPSS-214] & [EOPSS-215]

When the need for immediate imposition of a TSR has been identified, the ETCS TSR can be activated before ESR signs have been positioned. The signaller will continue to caution all trains through the affected area until the ESR boards are placed lineside.

This provides a facility for continued operations, whilst ensuring appropriate ETCS speed supervision through the affected area.

For pre-planned TSRs, ETCS TSR and lineside TSR signs will be put in place at the appropriate time.

This will mean that trains operating under ETCS supervision and those in L-NTC are receiving the same speed profile information.

ETCS TSR and lineside TSR/ESR signs will be removed at the same time.

4.2.3 Impact on other topics

Topic O defines the arrangements for ETCS level transitions (Level 2 only or overlay to L-NTC).

Topic N defines the arrangements for ETCS level transitions (L-NTC to Level 2).

Topic A defines the arrangements that enable a train to run smoothly under the highest available level of supervision.

Topic R defines the arrangements at ETCS Trackside-ETCS Trackside or National Area boundaries.

4.2.4 Design guidance

Operational Rules will specify how TSRs are managed for boundaries and transitions. [EOPSS-928], [ETrckSS-354], [EOPSS-860] & [ETrckSS-735]

TSR design guidance on entering ETCS areas can be found in Topic N.

TSR design guidance on exiting ETCS areas can be found in Topic O. [ETrckSS-918], [ETrckSS-919] & [ETrckSS-1382]

Operational Rules, training and the necessary equipment will be provided for staff involved in the design and imposition of TSRs. [EOPSS-138], [EOPSS-212], [EOPSS-140], [EOPSS-207], [EOPSS-774], [EOPSS-925] & [EOPSS-999]

Speed restriction information will be published in metric and imperial units for L2/L3 with signals. [EOPSS-69]

4.3 Hybrid L3 no signals

Same as Level 2, no signals (*see* 4.1), but reading references to Level 2 as Hybrid Level 3

4.4 Hybrid L3 with signals

Same as Level 2, with signals (*see* 4.2), but reading references to Level 2 as Hybrid Level 3

4.5 ATO

4.5.1 Specific user requirements for this option

The TMS will be responsible for transmitting TSR data to the ATO Trackside (ATO-TS). [ASR-Fxx5]

This assumes that Shift 2 Rail, X2Rail-1, and Work Package 4 have identified that this will be included within the next release of the ATO specifications. The pending update of ATO specifications for TMS responsibility has been added to the ATO open point list.

The conditions and requirements for TSRs in Options F1 and F2 will remain the same when operating in ATO.

4.5.2 System States and User Information

In an AoE area, the TSR data is defined by the SRMS and transmitted to the ATO-TS via the TMS. This information will be issued to the ATO-OB within the JP as the ASR. [ATrckSS-Fxx2]

Note: Where differential speed restrictions are used, the ASR and TSR sent to the train will not be identical, as the TSR will be based on the train variables, which are not available to the ATO-TS. The train will be supervised to the speed sent with the ETCS Movement Authority (MA).

The ATO-OB will need to be in communication with the ATO-TS to receive the JP containing the speed restriction information within the ASR (unless this data has been stored on board).

If the ATO-OB does not receive the updated JP, it will continue to drive to the existing JP, but within the TSR limitations provided to the ETCS Onboard.

The ATO-OB will drive the train in accordance with the data specified within the SP and JP, including the speed restriction data contained within the JP as the ASR. The ATO-OB will always drive the train within the ETCS speed profile (which will include the TSR).

The ASR will be applied to the front of the train or the whole of the train, depending on the design of the TSR. [EtrckSS-Fx13] & [EtrckSS-96]

Where a speed restriction needs to be imposed immediately, and this cannot be achieved via the SRMS (due to delays in validation of design, access to the SRMS, etc), the signaller will need to stop and caution trains through the affected area. The signaller will be advised of a cautionary speed to be applied through the area.

ATO will be disengaged when the train is being cautioned through the affected area so that the driver is in control of the signaller-advised train speed. [EOPSS-1431]

Once the TSR has been applied and activated, the signaller may request confirmation from the driver that the train is being supervised to the appropriate speed. The cautioning of trains can cease, ATO can be engaged (if all engagement conditions are satisfied), and normal operations can continue (at the restricted speed) once confirmation is received.

4.5.2.1 Driving in GoA1 with Driver Advisory information

Provided that all the ATO engagement conditions have been met, if the driver has not engaged ATO, and driver advisory information is not inhibited in the JP, then the ETCS DMI will indicate that ATO is Ready for Engagement (RE) (*see* Figure 5 – highlighted red).

Note: If driving in an ATO inhibition zone where Automatic Driving (AD) mode is inhibited, then the ATO-OB state will be Not Available (NA), and the 'ATO Ready' icon will not be displayed (*see* Topic PP).

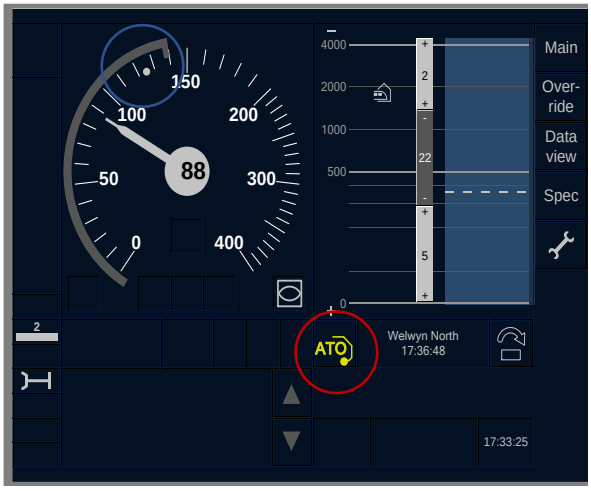

Figure 5 – ATO ready with DAS information displayed

The Driver Advisory System (DAS) indication within the speed gauge (*see* Figure 5 – ATO ready with DAS information displayed – highlighted blue) will advise the driver of the most efficient speed, based on the information provided within the JP, including ASR data.

4.5.2.2 Driving in GoA2

When driving in GoA2, provided that the ATO engagement conditions have been met, the ETCS DMI will indicate that the ATO is engaged (*see* Figure 6) and the ATO-OB will calculate the most efficient driving speed, based on the information provided within the JP, including ASR data.

CCMS:	**64406799**
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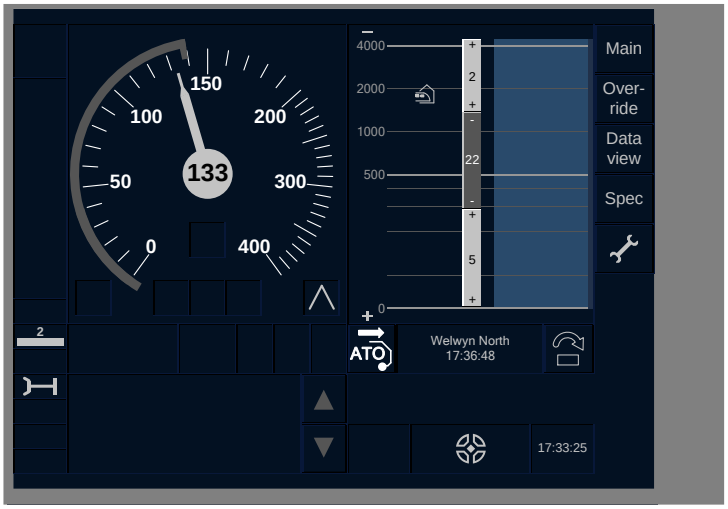

Figure 6 – ATO engaged

4.5.3 Impact on/of other Topics

ATO Reference Design Topic PP – Mid-Journey ATO Transitions

ATO Reference Design Topic SS – JP and SP data

4.5.4 Design Guidance

The SRMS will send the same TSR information to both the ETCS Trackside and the TMS/ATO-OB. As the ETCS Trackside may adjust the speed restriction based on train characteristics, the ETCS Onboard and ATO-OB may receive different speed restrictions in their respective TSR and ASR packets. The impact on performance and timetable adherence will need to be considered when a TSR is applied in this way; this will form part of the TSR process.

If TMS functionality allows, ASRs can be sent to individual trains as JPs that are unique to each train. However, where this functionality does not exist, the ASR will be the same for all trains in the area.

4.6 Moving Block

To be developed

CCMS:	**64406799**
Version:	**4.1**
Date:	**6/12/21**

PART 2

5 Option F2 - Applying a Speed Restriction via SSP

5.1 Level 2, no signals

5.1.1 Specific user requirements for this option

None

5.1.2 System States and user information

The method used for an ETCS Trackside to send the required TSRs to an ETCS Onboard may vary between suppliers. This section will describe a method (SSP amendment) that can be used, but which is not a prescriptive solution. The system application may differ, but the information provided to the users should be consistent.

The details found in Option F1 (*see* 4.1.2) are to be used for this option, the differences are specified below.

5.1.2.1 Updating the SSP

Once the TSR is activated, The ETCS Trackside will utilise the data received from the SRMS to amend the SSP (*see* Figure 7 and Figure 8.)

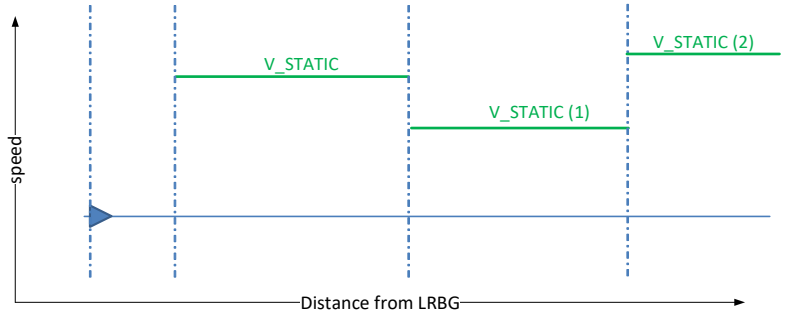

Figure 7 - Simple representation of SSP

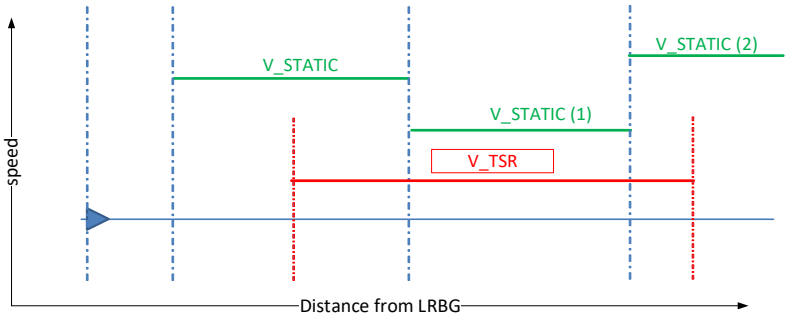

Figure 8 - Simple representation of TSR within SSP

The speed restriction data will now form part of the SSP that will be issued, within the MA, to all trains.

5.1.2.2 Issuing the updated SSP with the MA

The ETCS Trackside will issue the MA, including the updated SSP. [ETrckSS-796]

5.1.2.3 Updating/De-activating a TSR

When the TSR has been de-activated, the restrictions to the SSP can be reversed.

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Date:	**6/12/21**

5.1.3 Impact on other topics

See section 4.1.3

5.1.4 Design guidance

See section 4.1.4

5.2 Level 2 with signals

Same as Option F1 Level 2, with signals (*see* 4.2)

5.3 Hybrid L3 no signals

Same as Level 2, no signals (*see* 5.1), but reading references to Level 2 as Hybrid Level 3

5.4 Hybrid L3 with signals

Same as Option F1 Level 2, with signals (*see* 5.2), but reading references to Level 2 as Hybrid Level 3

5.5 ATO

Same as Option F1 ATO (*see* 4.5)

5.6 Moving Block

To be developed

CCMS:	**64406799**
Version:	**4.1**
Date:	**6/12/21**

6 Requirements

6.1 ETCS System Requirements

Safety

The ETCS shall issue modified permissible speeds to relevant trains in accordance with instructions from an external system.

ESR-162

Status: Normative

Rationale: To enable speed restrictions for a section of track, or class of train, to be implemented at any time in response to issues identified. Safety requirement implementing safety measure SM-1106

Guidance: A Temporary Speed Restriction (TSR) process is required to manage the application, imposition and de-activation of TSRs, providing assurance that the correct data is being input to the external system, and that speed restrictions are removed only when there is a safety justification for removing them. It needs to be possible to apply and change TSRs and Emergency Speed Restrictions (ESRs) at any time during the life of the system. The external system is referred to as the Speed Restriction Management System (SRMS). The scope and specifications of this system are yet to be defined. The system will provide TSR data to all other systems that require the data and will be the origin of TSR data flow.

Topics: F1, F2

The ETCS application design shall not generate unwarranted system braking interventions.

ESR-11

Status: Normative

Rationale: To reduce the potential for unwarranted system braking interventions negatively impacting on service performance, causing secondary safety issues and reducing user confidence in the ETCS.

Guidance: The odometer is corrected each time the Last Relevant Balise Group (LRBG) changes. The change in location data can result in a brake application if the train is closer to the End of Authority (EOA) than the old reading had suggested.
The timing of messages (such as alterations in speed profile or track condition) from the ETCS Trackside result in sudden changes in momentum if not considered as part of the overall system design. Other sources of unwanted brake interventions, such as on-train faults, are also considered. Secondary safety issues arising from unwarranted system braking interventions may include passengers and staff being injured as a result of a slip, trip or fall caused by sudden braking.

Topics: A1-1, A1-2, J3, J4, J5, Y1

Safety Exported

The Speed Restriction Management System (SRMS) shall have sufficient integrity that the ETCS can implement the Temporary Speed Restriction (TSR) information provided by the SRMS without performing further validation of the TSR information.

ESR-1068

Status: Normative

Rationale: To avoid the need for further validation or amendment of the TSR information within the ETCS, which could delay the implementation of TSRs, introduce errors and result in the TSR information being applied by the ETCS becoming misaligned with that used by other systems. Safety requirement implementing safety measure SM-443

Guidance: A TSR process is required to manage the application, imposition and de-activation of TSRs, providing assurance that the correct data is being input to the SRMS, and that speed restrictions are removed only when there is a safety justification for removing them. When changes are made to an existing TSR, the process avoids the risk of them being relaxed or removed prematurely.
The ETCS concept of TSRs incorporates the GB Rule Book concepts of TSRs and Emergency Speed Restrictions (ESRs).
The scope and specifications of a generic SRMS are yet to be defined. It is envisaged that a generic SRMS will make TSR data available to all other systems that require the data and will be the origin of TSR data flow.

Topics: None

ETCS shall enable improved management of permissible speeds, including temporary restrictions, when compared with application of speed restrictions under conventional signalling.

ESR-161

Status: Normative

Rationale: To enable more complex speed profiles to be managed safely to optimise capacity, and to enable the rapid and effective implementation of temporary restrictions applicable to all or some trains to reflect the current condition of the infrastructure (track and structures).

Guidance: Speed profiles with frequent changes in speed are difficult to implement and for the driver to manage. The ETCS can be configured to provide more information and supervision than current arrangements.
The ETCS allows more effective imposition and supervision of temporary and emergency speed restrictions, including the management of differential speeds.

Topics: F1, F2

Tools shall be provided to aid personnel in the placing of speed restriction boards in order to achieve consistency with ETCS speed restrictions details.

ESR-648

Status: Normative

Rationale: To provide consistent information for all trains irrespective of operating level.

Guidance: The location of the speed boards and the position of ETCS speed restrictions may not be aligned due to trackside conditions.

Topics: F2

The correct speed restrictions shall be issued to the correct train.

ESR-1055

Status: Normative

Rationale: To manage the speed of each train in accordance with short-term restrictions applicable to it.

Guidance: This is achieved through a combination of technical solutions and operational processes.
The ETCS allows the speed restriction to be based on the characteristics of the train (i.e. a differential speed restriction).

Topics: None

6.2 ATO System Requirements

The Traffic Management System (TMS) shall have the capability of applying and revoking Additional Speed Restrictions (ASRs) for trains operating in Automatic Driving mode.

ASR-Fxx5

Status: Normative

Rationale: To enable the signaller to respond to changes in the maximum speed of trains that the infrastructure can support when driving in Automatic Train Operation (ATO).

Guidance: This is an addition to a current Traffic Management System Customer Requirement (CRS-TMS-74) to enable the same methods for applying and revoking speed restrictions to the ETCS Trackside to apply to the ATO-TS. TSRs should include both planned and unplanned speed restrictions.

Topics: F1, F2

Project Phase: Product Specification

Exported: Yes - Traffic Management System

Applicability: L2 no signals, L2 with Signals, HL3 no signals, HL3 with signals, ATO

6.3 ETCS Trackside Sub-system Requirements

Safety

Dynamic safety constraints shall be restored and applied prior to the resumption of normal operation of the ETCS Trackside.

ETrckSS-1183

Status: Normative

Rationale: To restore safe operation of the ETCS. Safety requirement implementing safety measure SM-1480

Guidance: This requirement is informed by Rail Accident Investigation Branch Report 17/2019, exploring the issues surrounding an unannounced loss of TSR information in connection with a reset of the ETCS Trackside sub-system on the Cambrian line.
Dynamic safety constraint information includes: Temporary Speed Restrictions (TSRs), Track Condition functions, Technician Controls, and relevant Signaller's Controls (inhibits and reminders, etc).
Methods of restoration include non-volatile storage, refresh from an external system, or re-entry of validated data by staff.
This applies when the ETCS Trackside, or part thereof, is reset which may result from maintenance or a loss of power.

Topics: F1

CCMS:	**64406799**
Version:	**4.1**
Date:	**6/12/21**

Safety

Following system start up or reset, and prior to resuming normal operations, the ETCS Trackside shall compare any recovered dynamic safety constraints against other systems that hold this data.

ETrckSS-1185

Status: Normative

Rationale: To determine that the systems hold the same dynamic safety constraints. Safety requirement implementing safety measure SM-1480

Guidance: This requirement is informed by Rail Accident Investigation Branch Report 17/2019, exploring the issues surrounding an unannounced loss of TSR information in connection with a reset of the ETCS Trackside sub-system on the Cambrian line.
The dynamic safety constraints which have been stored may no longer be valid due to changes in other systems. This includes new constraints added and others which are no longer applicable.
Where reliance cannot be placed on the stored constraints, a process is followed to recover information from other sources and validate the result.
Dynamic safety constraint information includes: Temporary Speed Restrictions (TSRs), Track Condition functions, Technician Controls, and relevant Signaller's Controls (inhibits and reminders, etc).
The 'other' systems include the Traffic Management System (TMS) and the Speed Restriction Management System (SRMS).

Topics: F1

Safety

Following ETCS Trackside sub-system start up or reset, no Movement Authorities (MAs) shall be issued until the dynamic safety constraints have been validated by an authorised person.

ETrckSS-1186

Status: Normative

Rationale: To restore safe operation of the ETCS. Safety requirement implementing safety measure SM-1301

Guidance: This requirement is informed by Rail Accident Investigation Branch Report 17/2019, exploring the issues surrounding an unannounced loss of TSR information in connection with a reset of the ETCS Trackside sub-system on the Cambrian line.
The system partially automates the restoration of dynamic safety constraints and the confirmation with other systems of the current constraints. As a final check, an authorised person reviews the evidence to confirm that the process has been completed satisfactorily. They may also apply sample checks on the applicable data.
Dynamic safety constraint information includes: Temporary Speed Restrictions (TSRs), Track Condition functions, Technician Controls, and relevant Signaller's Controls (inhibits and reminders, etc).

Topics: F1

The ETCS Trackside shall enable a Temporary Speed Restriction (TSR) to be tailored to the characteristics of the train to which it is to be applied.

ETrckSS-1188

Status: Generic Product

Rationale: To enable performance optimisation by permitting different speeds to be applied to trains with different characteristics.

Guidance: This may be achieved by the ETCS Trackside deciding what TSR data to send to the train, based on the validated train data in the ETCS Trackside's possession. Alternatively, this may be achieved by the ETCS Trackside sending modified speed profiles, enabling the ETCS Onboard to generate the applicable supervised speed profile.
The Speed Restriction Management System provides the TSR data to the ETCS Trackside.

Topics: F1

No temporary lineside speed signage shall be deployed within an ETCS without signals area when Temporary Speed Restrictions (TSRs) are imposed.

ETrckSS-118

Status: Normative

Rationale: To avoid drivers being distracted by unnecessary lineside signage.

Guidance: All TSR information for the driver to control the train is provided on the ETCS Driver Machine Interface (DMI). TSR signs may be applied on the approach to the transition border of an ETCS without signals area for a TSR within the area - see Topic N for guidance on TSRs when entering ETCS areas.
Emergency Speed Restrictions are managed as TSRs in ETCS without signals areas. The signaller cautions all trains, in accordance with the Rule Book, until the TSR is applied.

Topics: F1

The ETCS Trackside shall continue to apply a Temporary Speed Restriction (TSR) until it is revoked by the Speed Restriction Management System (SRMS).

ETrckSS-713

Status: Generic Product

Rationale: To maintain safe application of TSRs.

Guidance: The SRMS instructs the ETCS Trackside to apply and revoke TSRs. The timing may be influenced by other factors or require authorisation.

Topics: F1

The ETCS Trackside shall accept and implement all Temporary Speed Restriction (TSR) data from the Speed Restriction Management System (SRMS).

ETrckSS-103

Status: Generic Product

Rationale: To allow the SRMS to impose or revoke TSRs via the ETCS.

Guidance: The TSR data is configured to inform the ETCS Trackside whether it is only to be sent when a new Movement Authority is issued for a train movement through the affected area or whether it is to be sent to all affected trains immediately. The former is the normal arrangement, but the latter may apply in the case of a long block section or where the application of the speed restriction is in response to an immediate safety concern.
Emergency Speed Restrictions are managed as TSRs in ETCS without signals areas. The signaller cautions all trains, in accordance with the Rule Book, until the ESR/TSR is fully implemented.

Topics: F1

Exported

It shall be possible for Temporary Speed Restrictions (TSRs) to be established across a Radio Block Centre (RBC)-RBC handover border.

ETrckSS-354

Status: Normative

Rationale: To allow a single TSR to apply across an RBC-RBC handover border.

Guidance: The Speed Restriction Management System applies a TSR in both RBC areas to achieve this requirement.

Topics: F1

Safety Exported

The Speed Restriction Management System (SRMS) shall be able to command the ETCS Trackside to send a Temporary Speed Restriction (TSR) to trains which already hold a Movement Authority (MA) through the affected area.

ETrckSS-706

Status: Generic Product

Rationale: To avoid a brake intervention on a train that has already received a Movement Authority (MA), and which is approaching, or within, the TSR, unless the intervention is absolutely necessary. Safety requirement implementing safety measures SM-1202 & SM-1477

Guidance: The TSR data is configured to inform the ETCS Trackside whether it is only to be sent when a new MA is issued for a train movement through the affected area or whether it is to be sent to all affected trains immediately. The former is the normal arrangement, but the latter may apply in the case of a long block section or where application of the speed restriction is in response to an immediate safety concern.
This feature may apply where the operator has identified that there are immediate safety concerns, the supervision of the train is unlikely to be adversely affected, or in response to an automatic safety monitoring system, such as flood detection for a bridge.

Topics: F1

Safety

The ETCS Trackside shall send applicable Temporary Speed Restriction (TSR) information with each Movement Authority (MA).

ETrckSS-796

Status: Generic Product

Rationale: To provide the ETCS Onboard with relevant TSR data applicable to the extent of the MA. Safety requirement implementing safety measures SM-498, SM-872, SM-1439 & SM-1449

Guidance: Sending the TSR with the MA avoids a speed profile currently being supervised by the ETCS Onboard being updated, leading to an intervention. An applicable TSR is one which covers a portion of line over which the train is to pass and is relevant to the characteristics of the train.
Applicable TSR information is normally only sent with the MA which authorises the train to enter the area where the TSR is active; however, the

Speed Restriction Management System may command that the TSR be issued immediately.

Topics: A1, A2, F1, F2

The implementation of a Temporary Speed Restriction (TSR) shall not be dependent on the use of temporary balises.

ETrckSS-117

Status: Normative

Rationale: To improve the time that it takes to apply a TSR and avoid staff having to go trackside, with the associated risk that entails.

Topics: F1

The ETCS Trackside and Speed Restriction Management System (SRMS) shall share a common location reference system.

ETrckSS-1026

Status: Normative

Rationale: To maintain a common reference system for the application of Temporary Speed Restrictions (TSRs).

Guidance: NR/L1/ADG/004 regarding Geospatial Referencing can be used to inform the selection of a common location referencing system.

Topics: F1

The Radio Block Centre (RBC) shall be able to store sufficient active Temporary Speed Restrictions (TSRs) to address application-specific operational requirements.

ETrckSS-714

Status: Application-Specific

Rationale: To enable the RBC to store and apply all applicable TSRs.

Guidance: The number of active TSRs to be stored in an RBC area takes account of the peak number of TSRs historically experienced in the RBC area, with an allowance for contingency.
The RBC does not store TSR data which is not currently applicable.

Topics: F1

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

In ETCS with signals areas, Temporary Speed Restriction (TSR) lineside signage shall be consistent with the speed restrictions applied to ETCS Level 2 or 3 operated trains.

ETrckSS-120

Status: Normative

Rationale: To avoid drivers becoming confused due to different information provided on the ETCS Driver Machine Interface (DMI) and at the lineside.

Guidance: In this requirement, ‘consistent’ applies to both locational and displayed speed where the units used for ETCS and non-ETCS trains are the same. There will be slight differences in what the driver perceives lineside compared to the ETCS DMI display due to the conversion of speeds, the speed at which the train is travelling, and the ETCS Onboard’s processing reactions.
ETCS speed profiles are transmitted in multiples of 5km/h and GE/RT8402, Issue 3 details the conversion to mph. For any imperial speed displayed at the lineside, the ETCS metric speed which results in the correct imperial speed on the ETCS DMI is transmitted.

Topics: F1

The ETCS Trackside shall interface with a Speed Restriction Management System (SRMS) to obtain Temporary Speed Restriction (TSR) information.

ETrckSS-96

Status: Generic Product

Rationale: To enable ETCS Tracksides to obtain information on TSRs from a reliable source consistent with the information being provided to other systems.

Guidance: The ETCS concept of TSRs incorporates both what the GB Rule Book describes as TSRs and Emergency Speed Restrictions (ESRs).
The SRMS is a unified system used to create, validate, store, activate, deactivate, and delete TSR data.
TSRs may span the boundaries between ETCS Tracksides implemented by different projects or suppliers.
The information provided by the SRMS includes:
a. a unique identity;
b. the location of the start and finish of the TSR using an agreed common referencing system;
c. the directions in which it is applicable;
d. whether it applies to the whole of the train or just the front;
e. a range of speeds based on train configuration; and
f. whether the TSR is only to be sent with an MA.

Topics: F1

Safety Exported

The design rules for Temporary Speed Restrictions (TSRs) and Emergency Speed Restrictions (ESRs) shall include the need to place a TSR/ESR commencement board readable from the Level 2 or 3 to Level NTC transition border if the speed restriction starts at or before the border and extends across it.

ETrckSS-918

Status: Normative

Rationale: To provide the driver with information on TSRs or ESRs applicable after a level transition. Safety requirement implementing safety measures SM-670, SM-671, SM-958 & SM-961

Guidance: This acts as a reminder to drivers when transitioning to Level NTC. The location of the TSR or ESR commencement board after the transition border considers the speed at which the train crosses the border and that the driver is expected to require at least 4s to observe and read the board.
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, F2, O1-1, O2, O3

Safety Exported

The design rules for Temporary Speed Restrictions (TSRs) and Emergency Speed Restrictions (ESRs) shall include the need for the TSR/ESR to be extended to start at, or on the approach to, the Level 2 or 3 to Level NTC transition border if it is not possible to place the Advance Warning Indicators in a compliant location after the first signal.

ETrckSS-919

Status: Normative

Rationale: To provide drivers with information on TSRs or ESRs applicable after a level transition. Safety requirement implementing safety measures SM-31, SM-863, SM-864 & SM-865

Guidance: The requirement applies when transitioning from a Level 2 or 3 area to an area where the train operates in Level NTC.
Where the extension of the TSR/ESR results in a significant performance impact, then an intermediate TSR/ESR may be applied in the ETCS area such that a warning board applicable to the original TSR/ESR can be placed after the first signal with sufficient deceleration distance.
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, F2, O2

Safety Exported

The Speed Restriction Management System (SRMS) shall support the amendment of an active Temporary Speed Restriction (TSR) without premature removal of the TSR.

ETrckSS-1187

Status: Normative

Rationale: To reduce the risk of Movement Authorities being issued with an unsafe speed profile whilst the details of an active TSR are amended. Safety requirement implementing safety measure SM-443

Guidance: The SRMS communicates changes in the applicable TSRs to the ETCS Trackside for communication to the relevant trains.

The SRMS may achieve this by sending a new TSR to be applied before revoking the old TSR or, if supported in the interface, by sending an update to an existing applicable TSR.

Topics: F1

Safety

The ETCS Trackside shall confirm receipt and successful implementation of all Temporary Speed Restriction (TSR) data from the Speed Restriction Management System (SRMS).

ETrckSS-1365

Status: Generic Product

Rationale: To prevent loss of data between the SRMS and the ETCS, as well as providing all users with the ability to check that a temporary change is active. Safety requirement implementing safety measure SM-1355

Guidance: Messages from the SRMS to be implemented by the ETCS Trackside specify the application, amendment or removal of temporary speed restrictions.

Topics: F1

Safety Exported

The design rules for Temporary Speed Restrictions (TSRs) and Emergency Speed Restrictions (ESRs) shall include the need to extend the TSR/ESR into the Level NTC area where the transition from Level 2 or 3 could lead to the driver accelerating the train before the rear of the train has left the restriction.

ETrckSS-1382

Status: Normative

Rationale: To reduce the risk of drivers increasing speed to an unacceptable level after the level transition while the rear of the train is still in a lower speed section. Safety requirement implementing safety measure SM-1446

Guidance: TSRs and ESRs are not differentiated on the ETCS Driver Machine Interface (DMI), and the driver may not be aware of the need to manage the speed of the train until it has left the restriction.
Following the transition to Level NTC the ETCS DMI no longer provides the driver with information on the permitted speed applicable to the whole length of their train or the location of the end of the TSR/ESR; this may pre-empt an overspeed event. Extending the TSR/ESR to end within the Level NTC area supports the driver in controlling the speed of their train correctly by introducing lineside signage, indicating the permitted speed within the TSR/ESR and providing a position reference for the end of the TSR/ESR.
The train length may be the maximum train length permitted to operate on GB's railway network, or a site-specific maximum train length that manages the risk of overspeed at that location to an acceptable level. Where trains of different lengths operate that fall into standard lineside differential speed categories, then the extension of the TSR/ESR into the Level NTC area may only apply to trains of the longer length.
Where the transition from Level 2 or 3 is into an unsignalled area (as described in ETCS Reference Design Topic O3), this requirement only applies if the TSR/ESR speed is less than the speed applicable in the unsignalled 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, O2, O3

Safety

The ETCS Trackside shall only send an applicable Temporary Speed Restriction (TSR) to an ETCS Onboard already holding a Movement Authority (MA) for all or part of the TSR area if the data received from the Speed Restriction Management System (SRMS) specifies this.

ETrckSS-1457

Status: Generic Product

Rationale: To avoid unnecessary updates to the speed profile being supervised by the ETCS Onboard. Safety requirement implementing safety measures SM-1439 & SM-1477

Guidance: The SRMS instructs the TSR to be issued immediately, which may result in a brake intervention where safety concerns dictate that the restriction is to be applied immediately. Normally, a TSR is only issued with a new MA for the affected area.
An applicable TSR is one which covers a portion of line over which the train is to pass and is relevant to the characteristics of the train.

Topics: F1

6.4 ATO Trackside Sub-System Requirements

Safety

Additional Speed Restrictions (ASRs) in Journey Profiles (JPs) shall be updated when a Temporary Speed Restriction (TSR) is imposed/revoked.

ATrckSS-Fxx2

Status: Normative

Rationale: To avoid inconsistent responses to TSRs when a train is being driven automatically. Safety Requirement for SM-ATO-120

Guidance: The TSR data will be sent to the Automatic Train Operation Trackside (ATO-TS) via the Traffic Management System (TMS), which receives the data from the TSR Management System (TSR-MS).

Topics: F1, F2, JJ1-2

Project Phase: Product

Exported: No

Applicability: ATO

A common location and speed reference shall be used by the Temporary Speed Restriction Management System (TSR-MS) and Automatic Train Operation (ATO) Trackside sub-system.

ATrckSS-Fxx5

Status: Normative/

Rationale: To enable ATO to apply the temporary change to the speed profile at the intended location.

Guidance: ATO replication of ETrcKSS-707- A common location will need to be a fixed point along the railway that is unlikely to change- for example the location of a bridge, viaduct, station etc, and can be used by both systems as a known reference point.

Topics: F

Project Phase: Deployment Design

Exported: No

Applicability: L2 no signals, L2 with Signals, HL3 no signals, HL3 with signals, ATO

The Automatic Train Operating (ATO) Trackside sub-system shall continue to impose a Temporary Speed Restrictions (TSR) as an Additional Speed Restrictions (ASR) until they are removed by the TSR Management System (TSR-MS).

ATrckSS-Fxx7

Status:	Generic Product
Rationale:	To maintain safety.
Guidance:	ATO replica of ETrckSS-713
Topics:	F
Project Phase:	Product
Exported:	No
Applicability:	L2 no signals, L2 with Signals, HL3 no signals, HL3 with signals, ATO

The Automatic Train Operating (ATO)Trackside sub-system shall accept and confirm receipt of all Temporary Speed Restriction (TSR) data from the TSR Management System (TSR-MS).

ATrckSS-Fxx8

Status:	Generic Product.
Rationale:	To prevent loss of information between the TSR-MS and ATO, as well as to provide all users with the ability to check that the temporary change is active.
Guidance:	ATO replica of ETrckSS-103
Topics:	F
Project Phase:	Product
Exported:	No

The Traffic Management System (TMS) shall only consider Temporary Speed Restrictions (TSRs) imposed in the ATO Trackside when a confirmation has been received.

ATrckSS-Fxx9

Status:	Normative
Rationale:	To confirm that ATO is using the correct line speed information for planning activities.
Guidance:	If confirmation of the receipt is not received after multiple attempts of activation, then the failure will need to be investigated. This is an ATO replica of ETrckSS-1181
Topics:	F
Project Phase:	Product
Exported:	Yes
Applicability:	ATO

6.5 ETCS Onboard Sub-system Requirements for new trains

2.5 Speed Profile Discontinuity Information

2.5.1 ERA_ERTMS_015560 applies in all respects for the speed profile discontinuity information display, except as shown below.

G 2.5.1.1 **Rationale for 2.5.1**: To be consistent with ERA_ERTMS_015560, except where speed display is required to be in mph.

G 2.5.1.2 Section 8.3.6 of ERA_ERTMS_015560 specifies the arrangements for displaying the speed profile discontinuity information in areas D6 and D7 respectively (see Figure x)

2.5.2 Where the onboard implemented version of ERA_ERTMS_015560 requires the display of speed profile discontinuity values, the values shall be displayed in the

same units as used for the circular speed gauge.

2.5.3 When speed profile discontinuity values are to be displayed in mph, the value to be displayed shall be calculated by divding the km/h value received from the ETCS trackside by 1.609 and rounding the result to the nearest multiple of 5.

G 2.4.2.1 **Rationale for 2.5.2**: This provides for the speed profile discontinuity values to be displayed in the same units as the speed indicated around the circular speed gauge in area B0.

G 2.4.2.2 **Rationale for 2.5.3**: This aligns with the conversion of existing mph speeds to km/h equivalents utilised by the trackside design.

G2.4.2.3 This requirement applies to ETCS onboards compliant with version 3.6.0, and later versions, of ERA-ERTMS_015560 that require the display of speed values as part of the speed profile discontinuity information.

6.6 ATO Onboard Sub-system Requirements for new trains

None identified

6.7 ETCS Onboard Sub-system Requirements for Retro fit Trains

None identified

6.8 ATO Onboard Sub-system Requirement for Retro fit Trains

None identified

6.9 Telecommunication Sub-system Requirements

None identified

6.10 Operations Requirements

Safety

Speed restrictions shall be published in the appropriate units displayed on the ETCS Driver Machine Interface (DMI).

EOPSS-69

Status: Normative

Rationale: To enable the speed restriction information to be published in speed units appropriate to an ETCS-fitted vehicle. Safety requirement implementing safety measure SM-438

Guidance: Speed restrictions published in the Sectional Appendix, Weekly Operating Notices, Late Notice Cases, DOTE or other documents are shown in the units applicable to train operations (ETCS-fitted and unfitted) on the route, which may include both imperial and metric.

Topics: F1, Y1

Speed restriction planner training shall make provision for the relationship of restrictions to ceiling speeds imposed by bespoke and National Values (NV).

EOPSS-227

Status: Normative

Rationale: To provide planners with the training necessary to enable them to deal with speed restrictions between the NV for Staff Responsible (SR) mode ceiling

speed and proposed bespoke SR ceiling speeds for planned degraded working.

Topics: F1

Tools shall be provided to aid personnel placing speed restriction boards in achieving consistency with ETCS speed restrictions details.

EOPSS-774

Status: Normative

Rationale: To provide consistent information for all drivers, regardless of the operating level.

Guidance: Due to trackside conditions, the location of the Temporary and Emergency Speed Restriction boards and the position of an ETCS speed restriction displayed on the ETCS Driver Machine Interface may not be consistent.

Topics: F1

Safety

Temporary Speed Restriction (TSR) data from the TSR Management System (TSR-MS) shall be available to all roles that require TSR information on the railway under their responsibility.

EOPSS-786

Status: Normative

Rationale: To enable all TSR users to access and action current TSR information. Safety requirement implementing safety measures SM-1110 & 1401

Guidance: Signallers, planners and maintainers require this information.

Topics: F1

Safety

Operating Rules shall support the efficient application of Temporary Speed Restrictions (TSRs) in an ETCS-fitted area.

EOPSS-925

Status: Normative

Rationale: To allow the speed of trains to be reduced when required. Safety requirement implementing safety measures SM-340, SM-548, SM-549, SM-593, SM-624, SM-1107, SM-1108 & SM-1298

Guidance: The term ‘efficient' covers provision of the correct information required by the user at the optimum time for them to implement or withdraw TSRs in an ETCS-fitted area without the introduction of unnecessary steps.

Topics: F1

Safety

Operational Rules and Instructions shall make provision for the imposition of blanket speed restrictions on an ETCS railway.

EOPSS-138

Status: Normative

Rationale: To achieve safety and performance benefits under abnormal conditions. Safety requirement implementing safety measures SM-167, SM-168 & SM-393

Guidance: Rules, regulations and instructions make provision for the imposition of blanket speed restrictions; drivers are notified of these restrictions via Global System for Radio Communications – Railway (GSM-R) broadcast or prior to the commencement of service.
A blanket speed restriction is described in the Rule Book as: 'A speed restriction which applies to an area rather than a geographical location'.

Topics: F1

Operational Rules and Instructions shall make provision for movable speed restrictions on an ETCS railway.

EOPSS-140

Status: Normative

Rationale: To protect moving engineering work.

Guidance: Moving engineering work is protected by movable or 'dagger' speed restrictions, and the capabilities and functionally of the ETCS can be used to support this.
The location information provided to the ETCS is updated prior to every movement of the speed restriction in addition to the positioning of any boards, if appropriate.

Topics: F1

Safety

Operational Rules and Instructions shall be provided to cover Temporary Speed Restrictions (TSRs) that extend beyond the boundary of one area into another area.

EOPSS-928

Status: Normative

Rationale: To enable safe and consistent application of a TSR to be maintained across boundaries. Safety requirement implementing safety measures SM-287 & SM-548

Guidance: This includes signaller control areas, national boundaries, and level transitions.

Topics: F1, O2, O3

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, SM-394, 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 Sub-system requirements.

Topics: F1

Operator training shall include the imposition of speed restrictions on a bi-directional line.

EOPSS-207

Status: Normative

Rationale: To enable signallers and other authorised staff to understand that speed restrictions can be applied in both directions on a bi-directional line.

Guidance: Speed restrictions could be the same, or they could differ, depending on the direction of travel.

Topics: F1

Staff training shall include imposing a speed restriction in Level NTC, ETCS Level 1, 2 or 3 areas.

EOPSS-212

Status: Normative

Rationale: To provide staff with the skills and capabilities to impose speed restrictions on an ETCS railway.

Guidance: For the purposes of this requirement, staff includes all those involved in the planning and implementation of speed restrictions (for example, possession planners, signallers, maintainers).

Topics: F1

Driver and signaller training shall include awareness of potential differences between supervised speed and lineside signage.

EOPSS-214

Status: Normative

Rationale: To make drivers and signallers aware of the possibility that the differential speed to which the train is being supervised may be different to that displayed on the lineside signage.

Guidance: The ETCS has the capability to supervise a greater number of differential speeds than it is permissible to indicate via lineside signage.
This requirement only applies where lineside speed signage is provided.

Topics: None

Signaller training shall include the conversion of units of distance and speed.

EOPSS-215

Status: Normative

Rationale: To make signallers on an ETCS railway aware of which units of speed and distance measurement are in use and enable them to calculate unit conversions where required.

Guidance: Speeds are normally displayed automatically in the correct units by the system but may require conversion in exceptional circumstances.
It is preferable to configure the railway such that it is not necessary for

signallers to convert units to limit the potential for errors.
Signallers will need support in converting units, as required.

Topics: F1

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

Safety

Infrastructure Manager designer and maintainer training shall make provision for deploying the correct Temporary Speed Restriction (TSR) and Emergency Speed Restriction (ESR) speed signage in ETCS with signals and transition areas.

EOPSS-999

Status: Normative

Rationale: To enable TSRs and ESRs to be calculated correctly and signed in dual speed (mph / km/h) areas. Safety Requirement implementing safety measure SM-287

Guidance: This requirement is applicable throughout ETCS with signals areas, and to transitions into and out of ETCS with signals and ETCS only areas.

Topics: F1

Operational Rules and Instructions shall require drivers to disengage Automatic Train Operation (ATO) when the signaller instructs them to proceed at caution through an ATO area.

EOPSS-1431

Status: Normative

Rationale: To reduce the risk of train movements taking place at an excessive speed, or with the driver insufficiently alert in circumstances where they are expected to examine the line.

Guidance: The situation covered by this requirement may arise when the need for a speed restriction has been identified but it has yet to be imposed via technical means, and thus cannot be provided to the ATO Onboard, or when there is a need for the driver to examine the line.

Topics: F1

6.11 Exported Requirements

Exported requirements are tagged as exported in the previous sections.

7 Assumptions

The European ATO specifications are currently in an advanced state of development and scheduled for inclusion in the 2022 update of the CCS TSI.

Shift 2 Rail, X2Rail-1, and Work Package 4 have identified that TSR information will be communicated to the ATO-TS via the TMS. This will be included within the next release of the ATO specifications. The pending update to ATO specifications for TMS responsibility has been added to the ATO open point list.

A TSR process is currently being developed which includes the steps for design, activation, amendment and removal of TSRs for ETCS with and without signals. All necessary actors will be identified for the process, and their individual responsibilities specified.

8 Issues

The safety of the line is dependent on the TSR data being correct. There is currently no national ETCS TSR process to confirm that speed restrictions are only applied after they have been designed by a competent person, independently verified, and removed when there has been a safety justification to support the removal.

The absence of this process introduces the risk of trains not receiving the correct speed profile, which could be exacerbated by operating in AD through the affected area. This has been raised in the Reference ERTMS issues log (Issue Tracker 332).

9 References

9.1 Standards

[R1]. ERTMS System Requirements Specification, Subset-026, v3.6.0

[R2]. The Network Code, 01 April 2020

9.2 Meetings

9.2.1 Hazard Workshops

Topic F - Hazard Forum Record, ETCS/HAZF/06, v1.0

Topic F HAZID GB AoE Requirements Batch A/B HAZID Report, Vertex, v1.0

ETCS Reference Design Hazid Worshop1 27/02/20

9.2.2 CCP Meetings

CCP meeting, Topic F, CCMS 65551878