

CCS TSI | ERTMS

CCS TSI 2023 (EU) 2023/1695

ERTMS Unit

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21st January 2025 / Warsaw
TSI Open Days Poland 2025



EUROPEAN
UNION
AGENCY
FOR RAILWAYS

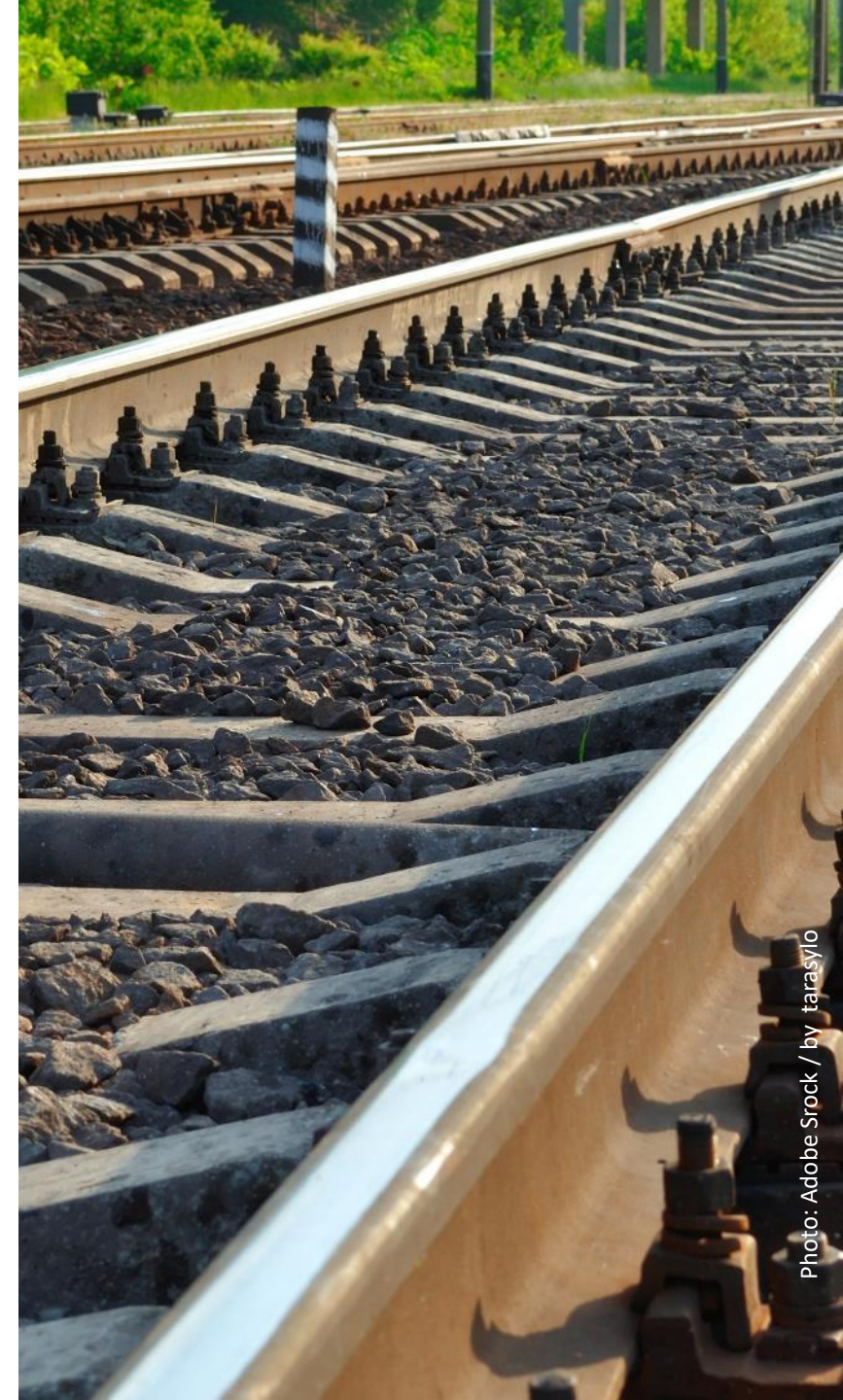
AGENDA

CCS TSI | ERTMS – a general overview

1. *Signaling – principles of train protection*
2. *Migration to ERTMS in Europe – SERA*
3. *Basics on ERTMS*

CCS TSI 2023

4. *Legal framework to remove technical barriers*
5. *CCS TSI Revision 2023*
 1. *Main changes*
 2. *Transition Regime*
 3. *Enhancements and system versions*
6. *ERTMS Unit at ERA*



1. SIGNALLING – PRINCIPLES OF TRAIN PROTECTION



Why an ATP ?

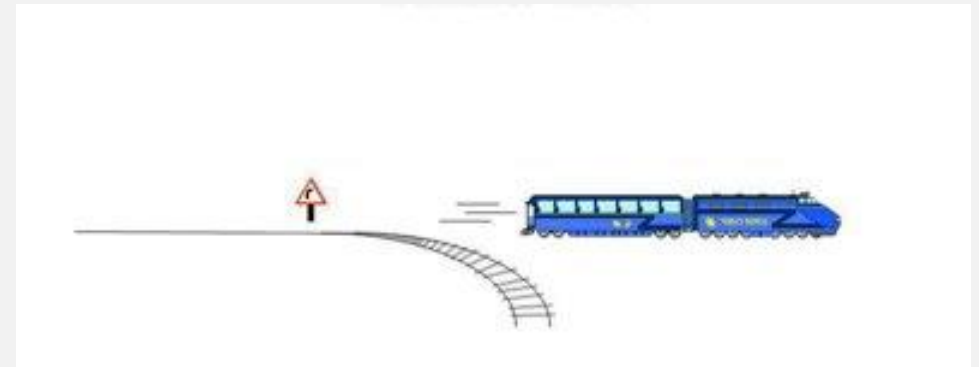
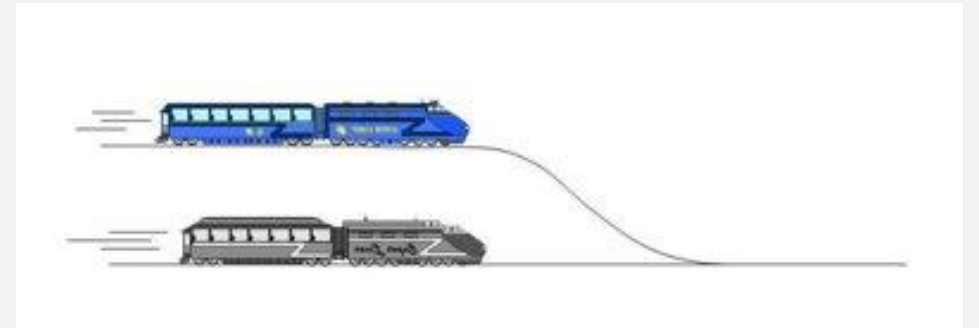
History has shown that, despite the presence of traffic lights and speed limit signs, train collisions and derailments still occur.

This is why RUs and IMs were forced by governments to find a more suitable solution and started to develop Automatic Train Protection (ATP) systems to reduce or eliminate driver errors leading to fatal accidents.

ATP (Automatic Train Protection) system:

Automatic train protection system is a system that continuously checks that the speed of a train is below the permitted speed given by signalling and include also an automatic stopping at certain aspects of the signal, otherwise, ATP activates an emergency brake to stop the train.

For this purpose, a transmission of information from the track to the train is needed.



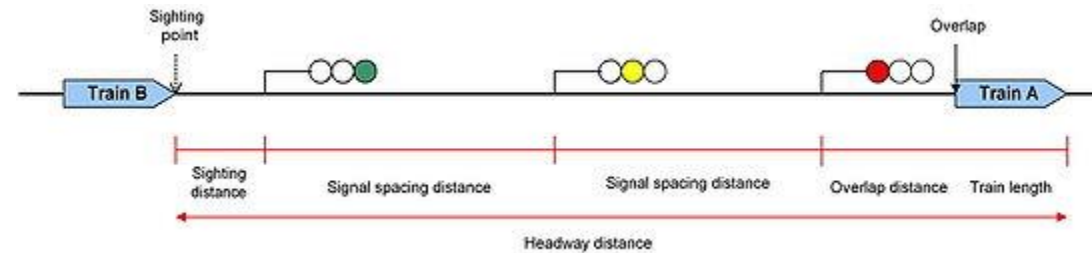
Different types of signalling systems

- Block signalling



Token block

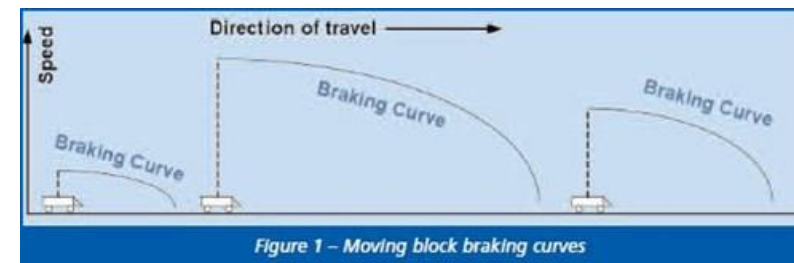
- Fixed block



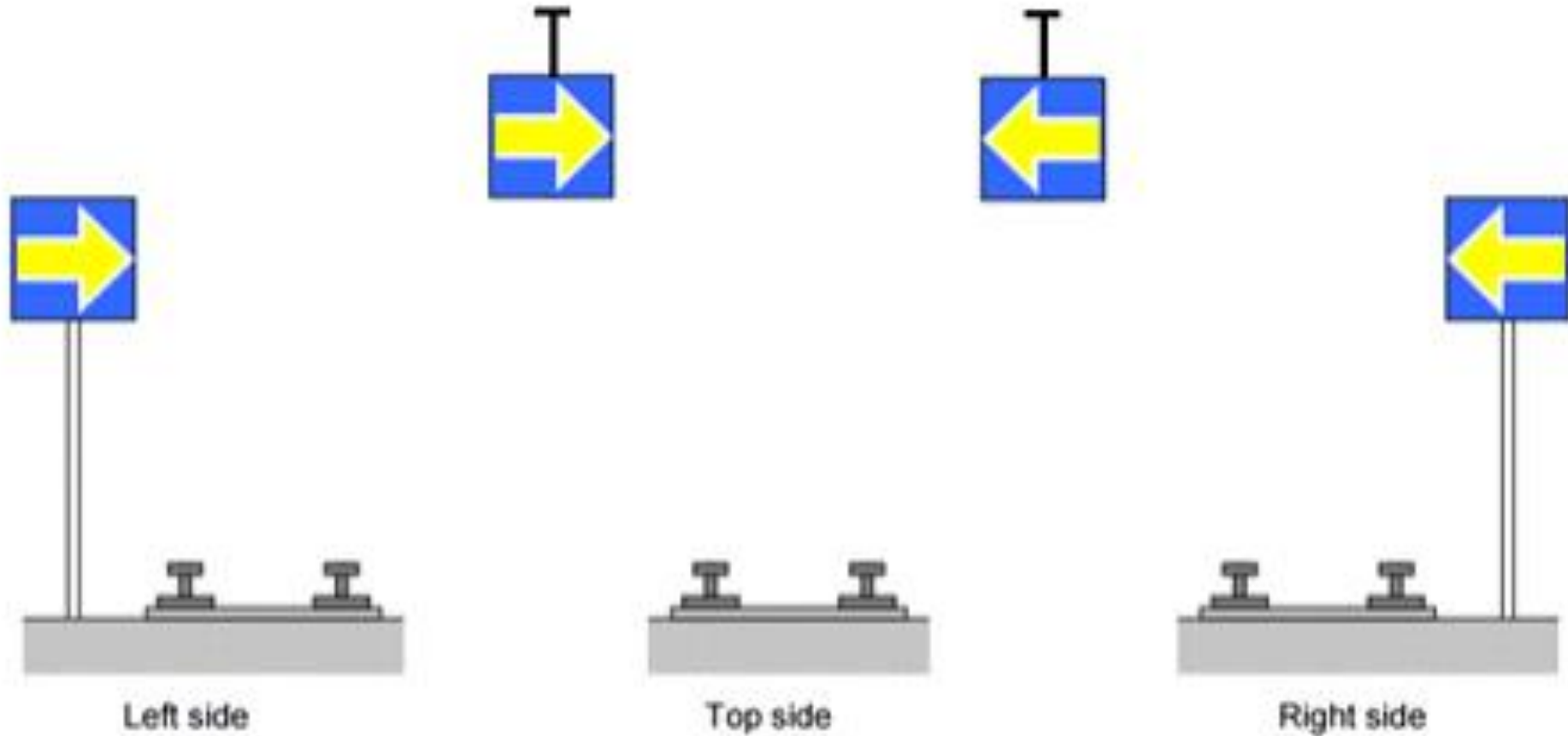
- ATP with punctual information (ETCS L1)
- ATP with punctual supervision (ETCS L1 LS)
- ATP with continuous supervision (ETCS L1/L2)
- ATP with continuous information (ETCS L2)



- Moving block (ETCS L2+TIMS)



2.- MIGRATION TO ERTMS IN EUROPE - SERA



ERTMS and CCS TSI

Main Signaling systems used in EU Member States



Systems vary in functionality :

- simple -> complex
- warning -> stop
- Stop -> full train protection

In order to facilitate the establishment of a “**Single European Railway Area**” (SERA), there is a need for a harmonized Signalling system
-> This is ERTMS !

The Single European Rail Area (SERA)

Conventional approach for Driver Machine Interface:
Simply adding legacy display systems does not work!



New development:
Central ETCS display
→ single interface for driver

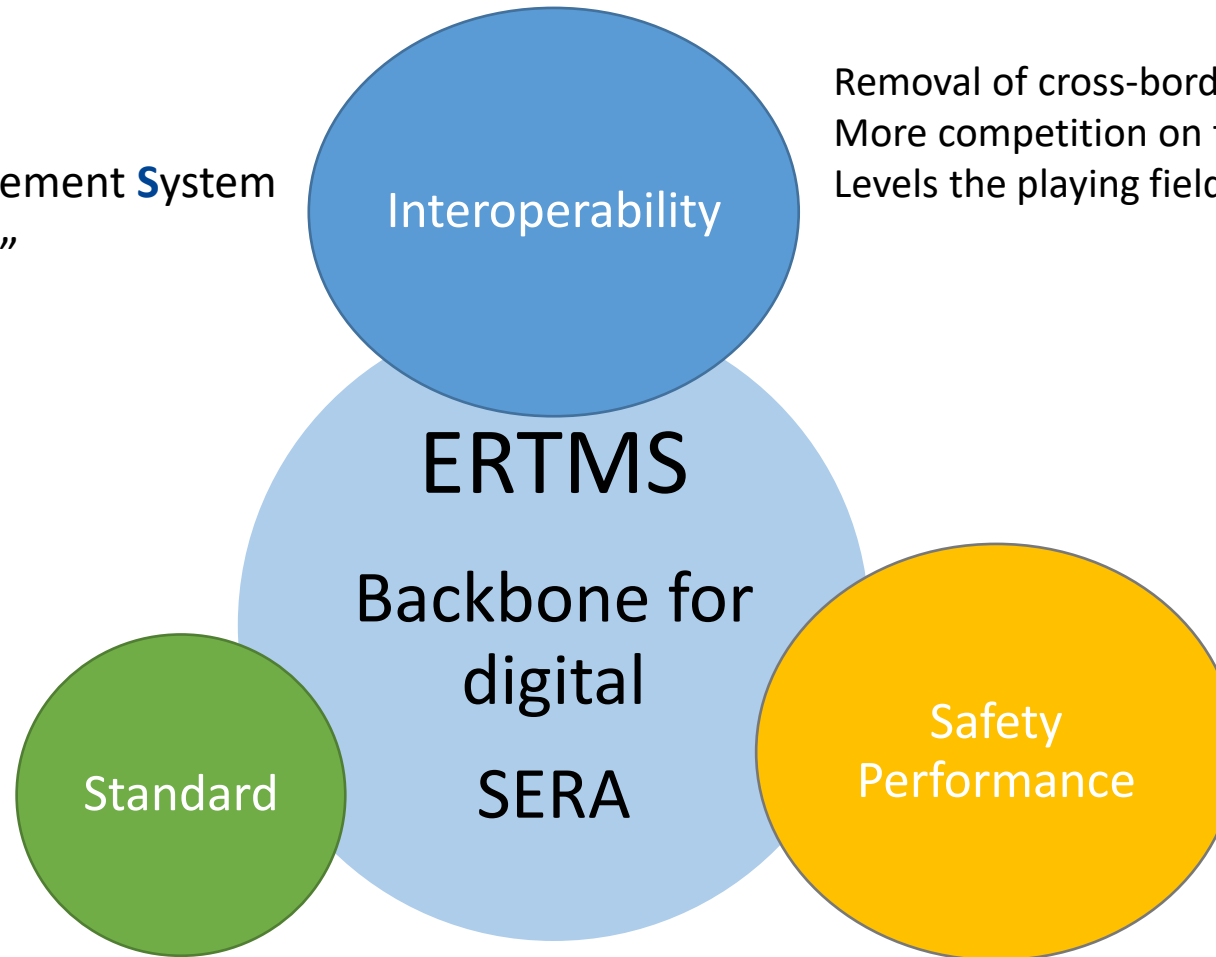


Standard TRAXX driver's desk

European Rail Traffic Management System

"One system to rule them all"

Universal system
Standardised products
One system, multiple suppliers
Opening worldwide market
opportunities for suppliers



Removal of cross-border barrier
More competition on the railway market
Levels the playing field with road transport

Increase capacity and speed
Improved safety
Increased reliability and reduced journey times
Cost decrease (capital, maintenance and training)

3. BASICS ON ERTMS



ERTMS and CCS TSI

European **R**ailway **T**raffic **M**anagement **S**ystem

ETCS (European Train Control System) = ATP
(Automatic Train protection system)

+

RMR (Railway Mobile Radio) **GSM-R** (2G)/**FRMCS** (5G)
= Radio communication for Voice and Data applications

+

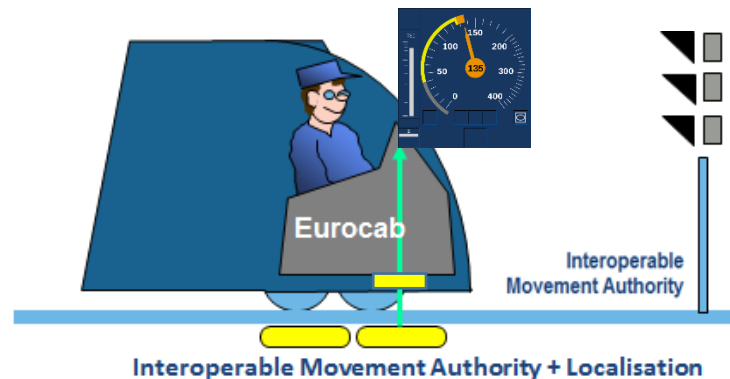
ATO (Automatic Train Operation)



What is ERTMS ?

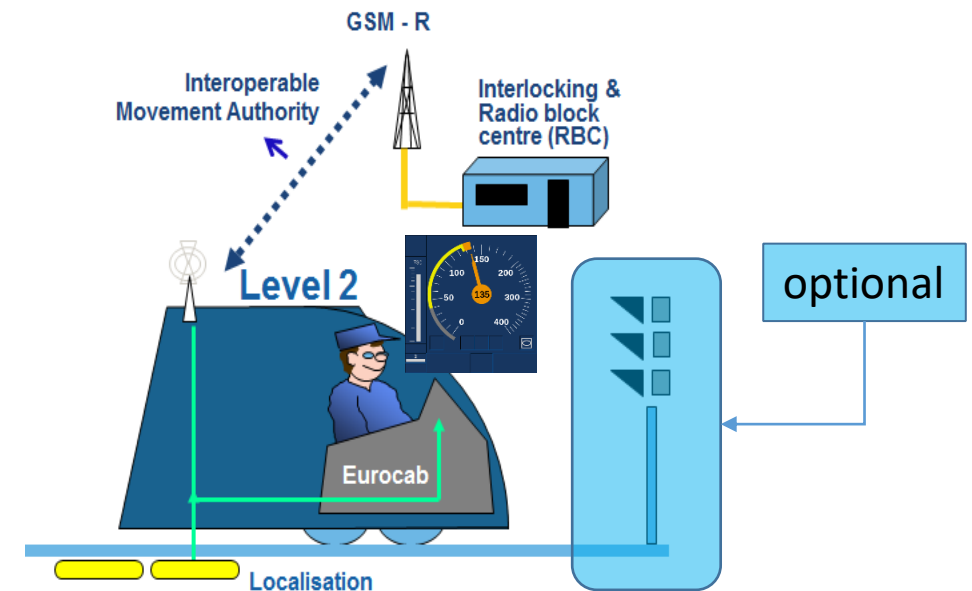
• ETCS Level 1

- Transmission of data Track → Train via Balises
- ETCS-messages are generated “locally” @ the signals
- Line side signals are still present
- Information for the driver is visible on DMI (Driver-Machine Interface)



• ETCS Level 2/3 (*)

- Continuous exchange of data track → train and train → track via GSM-R
- ETCS-messages are generated centrally (in the RBC) and then send to the train
- Line side signals are optional
- All information available on DMI



(*) In Baseline 4 the Level 3 has been merged with the Level 2

Standardisation of railway radio communication in EU

- **Until mid 80's:** no standard
- **Mid 80's:** introduction of UIC 751-3 in some European countries
- **End 90's:** introduction of **GSM-R** as target system for Europe
 - *for operational voice communication and ETCS data communication*
 - GSM-R implementation started in 2000; further expansion and midlife upgrades are still ongoing (trackside, on-board)
 - 2006: EU Decision to make GSM-R mandatory all over EU
 - Expected end-of-life: not before 2030
- **FRMCS (Expected 2027-2029):** Future Railway Mobile Communication System
 - Based on 5G and Mission Critical standards
 - Opportunity to decouple railway applications from telecom transport layers in the future. (easy update for 6G,7G,8G,...)



4. LEGAL APPROACH TO REMOVE TECHNICAL BARRIERS

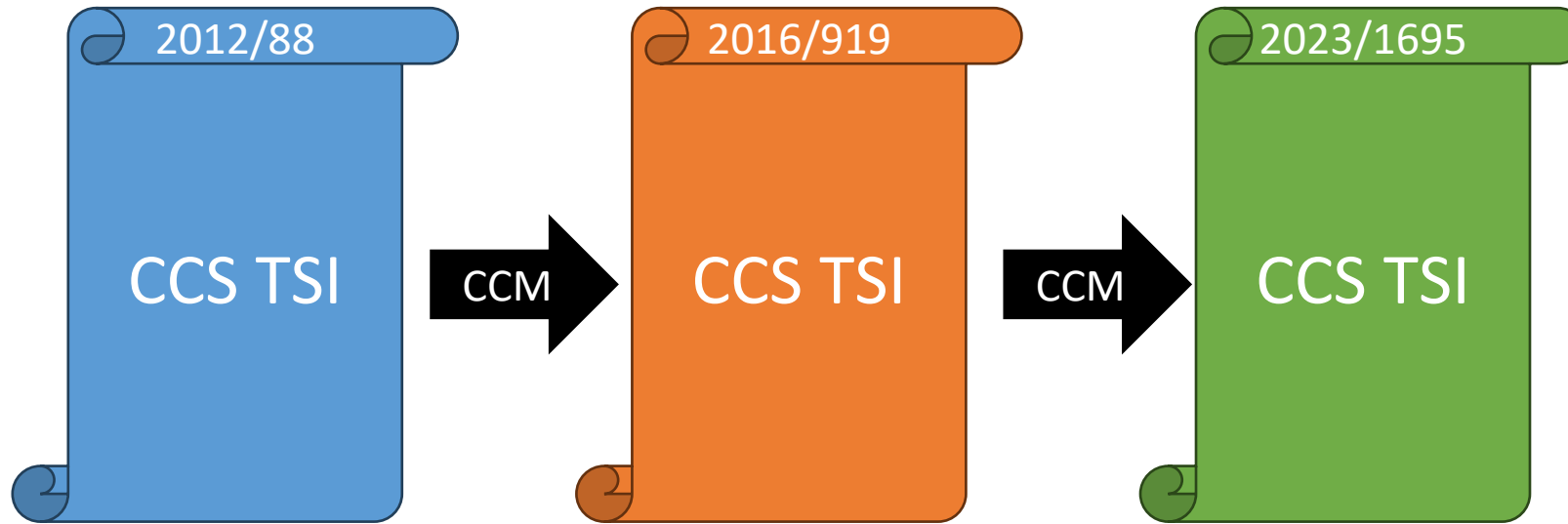




4th Railway Package!!

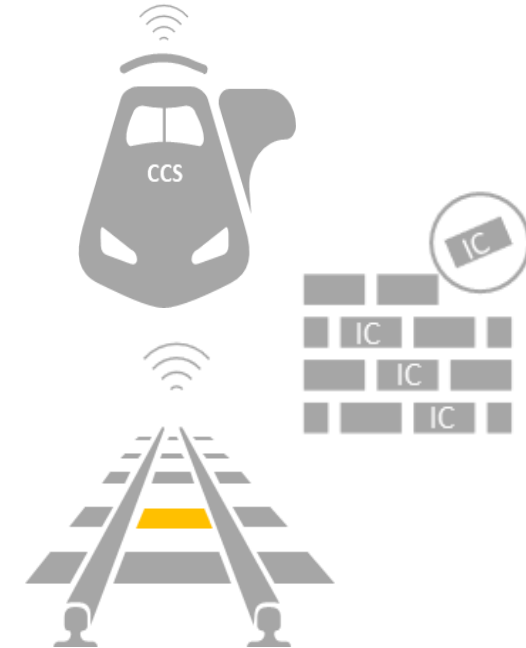
<https://www.youtube.com/watch?v=1iTloymejSM>

- [Regulation \(EU\) 2016/796 on the European Union Agency for Railways and repealing Regulation \(EC\) n° 881/2004](#)
- [Directive \(EU\) 2016/797 on the interoperability of the rail system within the European Union \(Recast of Directive 2008/57/EC\)](#)
- [Directive \(EU\) 2016/798 on railway safety \(Recast of Directive 2004/49/EC\)](#)



- CCS TSI characterizes ERTMS
- Evolution is made with the support of the railway sector
- Formal process to address the required changes is followed
- Final version of the TSI is voted in the RISC Committee by the Member States

- One **TSI** covering **two Subsystems: CCS On-board** and **CCS Trackside**
- It does not cover all the subsystem, optimal level of harmonisation (overlay)
- Much more prescriptive than the other TSI (detail specs in Appendix A)
- Composed of **five parts** (CCS TSI Table 4.1)
 - Train Protection: The **Class A** system is **ETCS** whilst the
 - **Radio voice**: The **Class A radio system** is **RMR (GSM-R / FRMCS)**
 - **Radio data**: The **Class A radio system** is **RMR (GSM-R / FRMCS)**
 - **ATO**: This part is optional.
 - **Train detection**: Only for the **Trackside** Subsystem.
- **Class B**
 - The legacy systems are referred to as **Class B** (ATP, Radio) or **Non-TSI** (Train detection)
 - **Decommissioning** is required by TEN-T Regulation.



Objective: towards a Single European Railway Area (SERA)

ERTMS

TRACKSIDE SUBSYSTEM

ETCS PART

- 1. Interoperability Constituent (IC)
- 2. Interoperability Constituent (IC)
- n. Interoperability Constituent (IC)

RADIO VOICE PART

- 1. Interoperability Constituent (IC)
- 2. Interoperability Constituent (IC)
- n. Interoperability Constituent (IC)

RADIO DATA PART

- 1. Interoperability Constituent (IC)
- 2. Interoperability Constituent (IC)
- n. Interoperability Constituent (IC)

ATO (OPTIONAL) PART

TRAIN DETECTION PART

ON-BOARD SUBSYSTEM

ETCS PART

- 1. Interoperability Constituent (IC)
- 2. Interoperability Constituent (IC)
- n. Interoperability Constituent (IC)

RADIO VOICE PART

- 1. Interoperability Constituent (IC)
- 2. Interoperability Constituent (IC)
- n. Interoperability Constituent (IC)

RADIO DATA PART

- 1. Interoperability Constituent (IC)
- 2. Interoperability Constituent (IC)
- n. Interoperability Constituent (IC)

ATO (OPTIONAL) PART

5.- CCS TSI 2023 Revision



Main changes in the CCS TSI (EU) 2023/1695



CCS TSI Text Recast

- Framework to manage the specification changes
 - Error Corrections (Section 7.2.10)
 - B4R1 set of specs in Appendix A
 - Removal of partial fulfilment (Appendix G)
- Stronger deployment requirements
- Transition regimes (Appendix B) and notification from IM (in RINF)



Appendix A – Technical changes

- ATO up to GoA2 (As a new optional part)
- First complete Level 2 + train integrity specifications (Former Level 3 - Merged)
- ETCS readiness for FRMCS and DAC (the interface and needed functionality as far as possible)
- System versions 2.2 and 3.0



Train Detection Compatibility

- Target system defined. Specific Cases for non-TSI compliant systems to allow unique authorization



Others

- Cleaning NTR & revised interface with RST (SS-034)
- OPE aligned up to SV 2.2.
- Updated parameters in ERATV and RINF
- Only **one** remaining open point: Reliability



- Published in the official journal on the **08/09/2023** ([EUR-Lex link](#))
- Entry into force 20 days after (28/09/2023)
- Appendix A documents ([link](#)).

Main changes in the CCS TSI (EU) 2023/1695



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Specifications error corrections workflow

7.2.10.1
EECT process
“Art 10” CR
List

- **Sector** agreement on specification errors preventing normal service (also known as “**Art 10” CR**)¹
- Questionnaires sent to suppliers, RUs and IMs to analyse the impact on existing products /projects.

7.2.10.3.1
IMs

- **Check list of “Art 10” CRs** with the ETCS implementations on their network
- Evaluate impact of “Art 10” CRs on current fleet to *optionally* **implement mitigation measures**².
- Publish in **RINF** the final list of **applicable “Art 10” CRs** required for each section.

7.2.10.3.2
RUs

- Compare the applicable list from RINF with the system implemented on the vehicles² to identify **if it is necessary to implement the error correction**. If so implement the change on **the concerned vehicles**³.

7.2.10.2
Suppliers

- Suppliers to **update** the impacted **ICs** according to transition requirements.

¹ This is the current process already followed since 2016 for the Agency OPI 2017-02 and 2020-02. In the revised CCS TSI the old “Article 10” about error corrections is now “Article 9” .

² The evaluation is done on the basis of information provided in the questionnaires. Mitigation measures can be implemented on a voluntary basis by the IMs

³ The change shall be evaluated according with the BDCs if requiring or not a new authorisation.

CCS TSI Amendment 2024 (CR 644)

Error correction

A sequence of events if needed to define a proper process

- **2 conditions to start the process:**

1. Entry into force of the TSI **AND**
2. Publication of BCA and answers to the questionnaires

- **Updated deadline for IM registering the CR in RINF:**

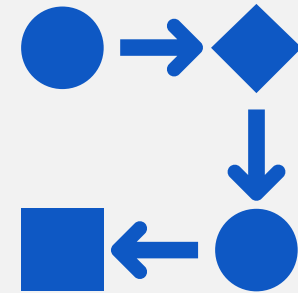
- 6 months from the start conditions.
- Next events follows This registration.

7.2.10.3.1. Infrastructure Manager responsibilities

The Infrastructure Manager shall register in the related RINF¹ parameter which error corrections are applicable (i.e. the errors preventing normal service in the network) for the on-board. This shall be registered at the latest ~~12~~ 6 months after the ~~lastest date between the~~ entry into force of the ~~is~~ TSI and the ~~Baseline Compatibilty Analysis (BCA) including the answers to the questionnaires is published by the Agency.~~ This shall be also registered in case of new or upgrade trackside implementation within its network.

- **Remove Appendix B references to “IM Decision”:**

- Table B2 row 1 and Table B3 rows 1 and 3 to remove the term "publication of IM decision" by "registration in RINF of the applicable CR".



CCS TSI 2024 amendment

Is CCS TSI 2023/1695 annex A complete?

99%

- 3 groups of documents postponed
 - **SS-153** Reduced envelopes
 - **SS-076/94** ETCS OB IC test specs
 - **SS-151** ATO TS/OB test specs

➡ Delivered **end 2024 (pending voting)**



CCS TSI 2024 amendment

Return form experience on CCS TSI

- **Corrigendum:** Editorial and translation errors
- **Appendix B** transition tables
- **Error correction** dates and events
- **Editorial** amendments
- Other **adjustments** and **clarifications**



Removal of partial fulfilment

Obtain a **better alignment** between the products and the specifications.

- In case **new errors** are detected (mostly for newly introduced functionality) proprietary solutions are allowed until an harmonised solution is agreed, based on validation of the CR - Point 6.5 (2).
- “**Overspecification**”: Create a CR to amend the specifications.
- **Exceptional cases**: Appendix G
 - DMI SIL-0 in case of B2 fleet upgrade.
 - Functions for on-board SV 2.1 and 2.2.
 - SS-034 options at IC (catenary independent engines).
- Trigger events for the update.



CCS TSI Transition Regimes

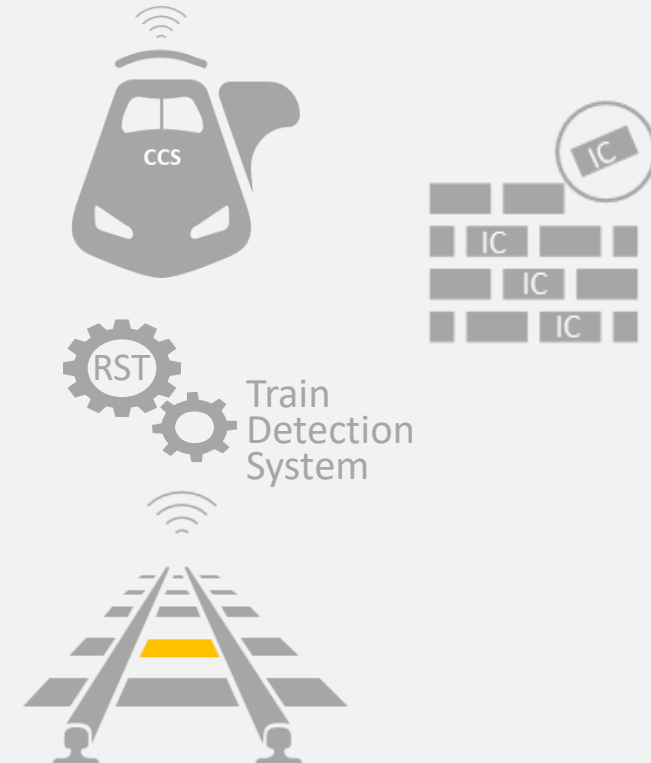
Introduced for the first time in the CCS TSI (Appendix B):

- Synchronised approach for the vehicle.
- Cascade principle.

Specific requirements for:

- CCS On-board Subsystems (Table B1.1).
- RST Subsystem (TDC) (Table B1.2).
- CCS Trackside Subsystems (Table B2).
- CCS Interoperability Constituents (Table B3*).

*CCS Subsystem transition periods apply unless specified in this table.



CCS On-board example

No	TSI point(s)	TSI point(s) in previous version	Explanation on TSI change	Transition regime			
				Design phase started after TSI enters into force	Design phase started before TSI enters into force	Production phase	Vehicle in operation
<u>CMD</u>							
11	4.2.2 (b) – Cold Movement Detection	CMD Optional	CMD Mandatory	Directly applicable when ETCS is installed for the first time into a vehicle design.	Applicable <u>if design phase ends after from</u> 1 January 2028 when ETCS is installed for the first time into a vehicle design.	Applicable on newly built vehicles placed on the market from 1 January 2030.	Not applicable

Certification -- CR696

7.2.4.1.3. Validity of the EC type or design examination certificate

From 28 September 2023~~When a revision of this TSI comes into force~~, the EC type or design examination certificate for the subsystem remains issued according to CCS TSI 2016/919 valid unless it is required to be revised according to the specific transition regime of ~~a~~CCS TSI 2023/1695 change as defined in Appendix B ~~of this TSI~~.

Proposed in the CCS TSI Amendment, not official version

Main changes in the CCS TSI (EU) 2023/1695



Appendix A – Technical changes

- ATO up to GoA2 (As a new optional part)
- First complete Level 2 + train integrity specifications (Former Level 3 - Merged)
- ETCS readiness for FRMCS and DAC (the interface and needed functionality as far as possible)
- System versions 2.2 and 3.0



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New Features in Appendix A

ATO

Introduction GoA 2



Modularity



Reduced envelope
SS-153

(B4R1 set of specifications)



FRMCS v1

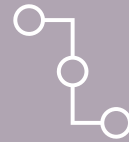
ETCS/ATO readiness for
FRMCS



Train Detection
Compatibility
updated to V5.0
(closing all related
open points)

Level 2

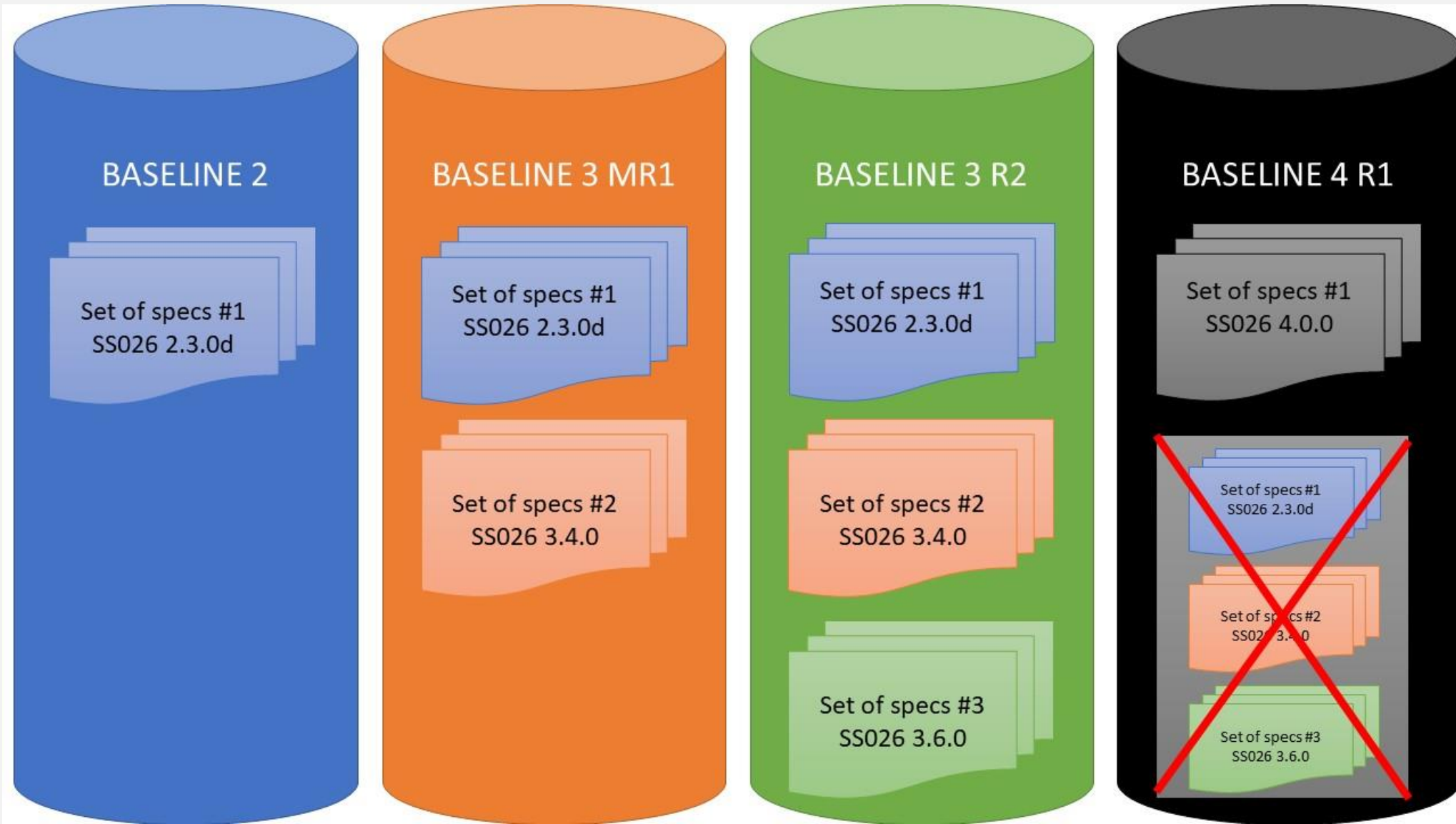
with/without train
integrity
(merge level 2 and 3)



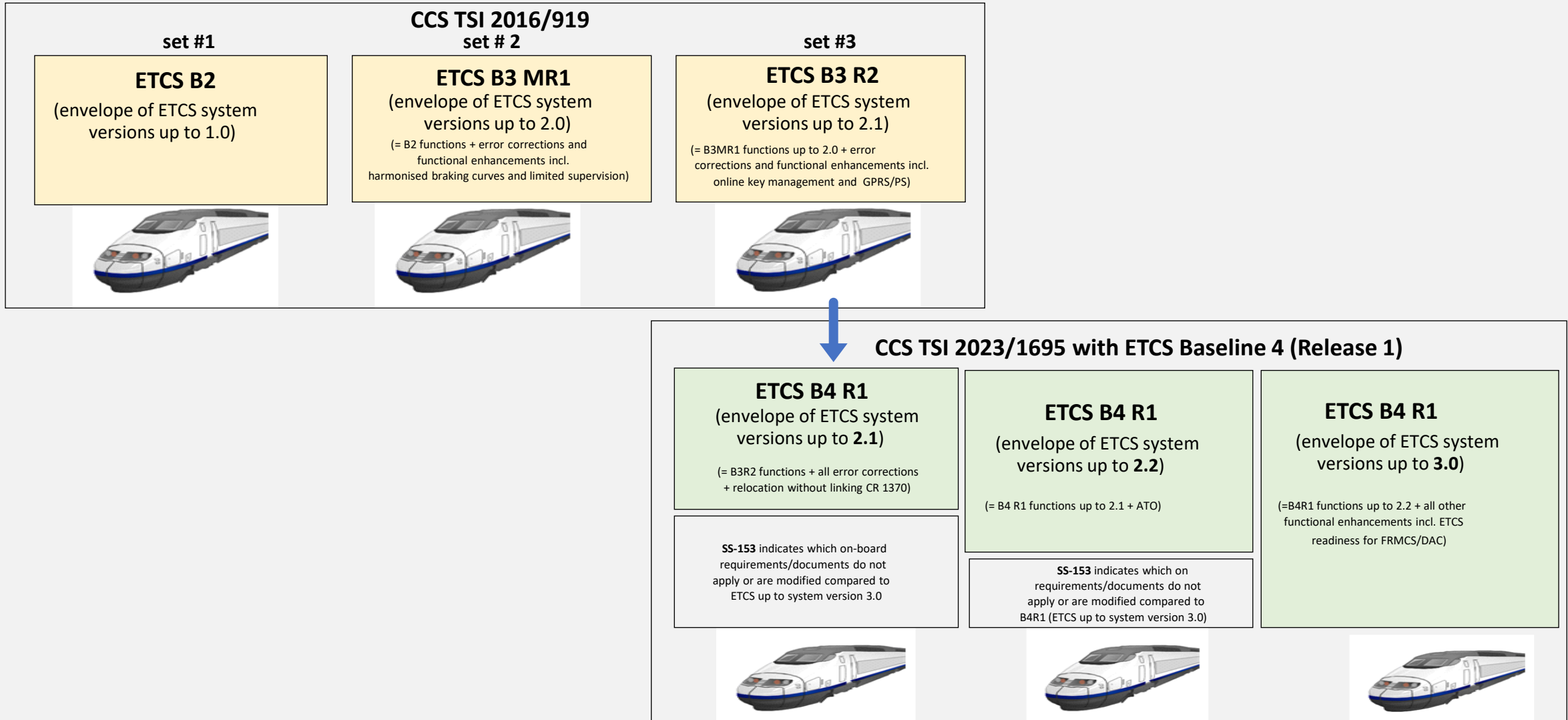
ETCS DAC readiness



Evolution of Appendix A sets of specs

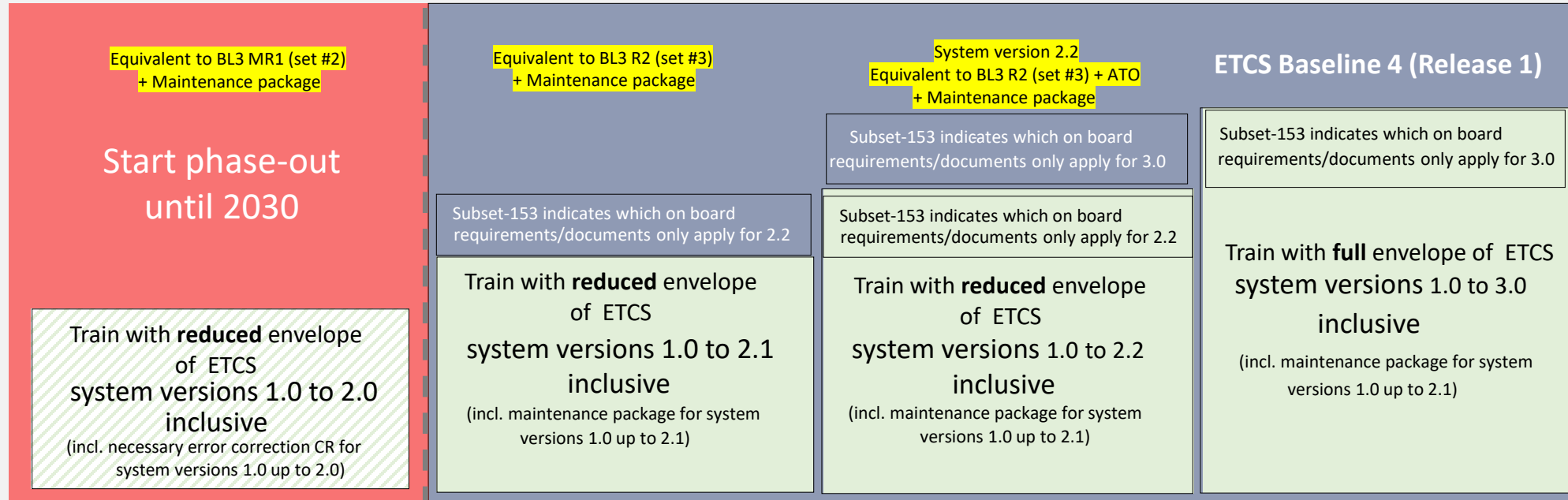


ERTMS Specifications – Evolution of ETCS Baselines/ETCS System versions



B4R1 set of specifications

On-board reduced envelope and SS-153



Out of scope SS-153

Consolidated specifications (SS-153) for the reduced **on-board** defining the not applicable clauses for envelopes up to 2.1 and 2.2.

ERTMS Specifications – Evolution of ETCS Baselines/ETCS System versions

Translation table between System Version and Baseline/SRS/Set of specs

System Version	Baseline	SRS versión	Set of specs
1.0	B2	2.3.0d	#1
2.0	B3MR1	3.4.0	#2
2.1	B3R2	3.6.0	#3
2.1	B4R1	4.0.0 + SS-153	TSI 2023/1695
2.2	B4R1	4.0.0 + SS-153	TSI 2023/1695
3.0	B4R1	4.0.0	TSI 2023/1695

The difference between SV 2.1 B3R2 and SV 2.1 B4R1 are the error corrections.

Main changes in the CCS TSI (EU) 2023/1695



Train Detection Compatibility

- Target system defined. Specific Cases for non-TSI compliant systems to allow unique authorization



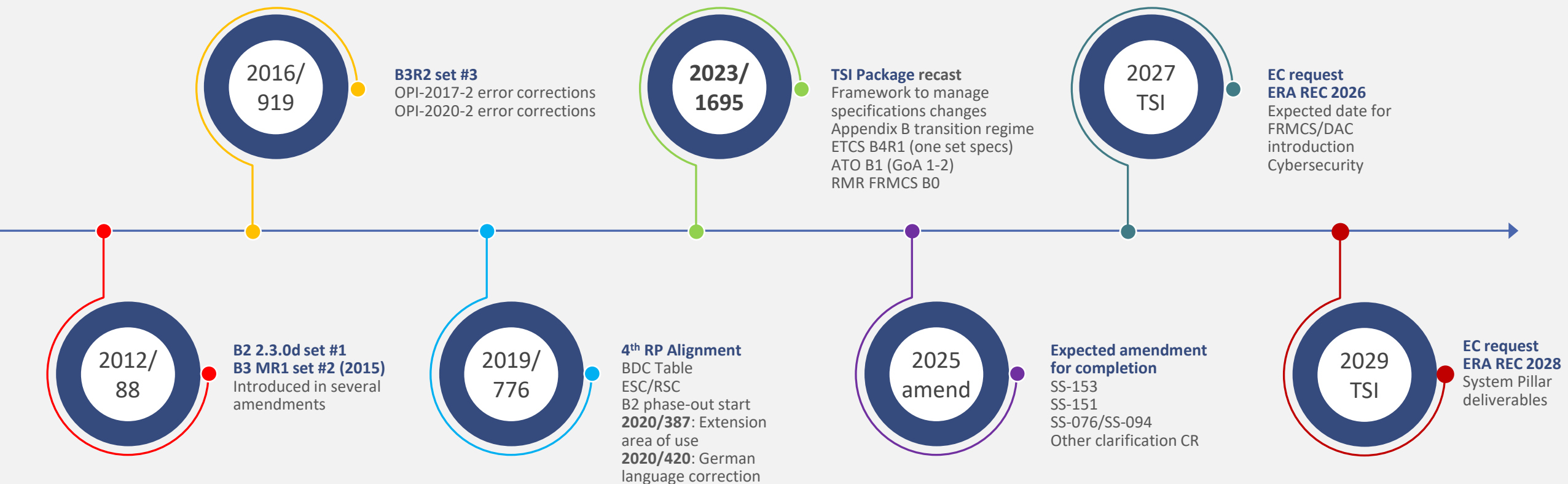
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- Appendix A documents ([link](#)).

CCS TSI Evolution → Next Steps



6.- ERMTS Unit at ERA



ERTMS Unit at ERA



- Inside Railway System Department
- HoU + 15 Project Officers

ERTMS = ETCS + RMR (GSM-R, FRMCS) + ATO

- Mainly dealing with Control Command and Signalling (**CCS**) subsystems (on-board and trackside) and the interfaces with the rest of the railway system.

Main task of ERTMS Unit

ERTMS SYSTEM AUTHORITY

- CCS TSI Working Party
- ERTMS Control Group
- EECT (ECTS & Radio)

Support to **DG MOVE** (RISC)

Cooperation with ERJU (**System Pillar**)



INTERFACES/STAKEHOLDERS

- Operational Harmonisation (OH) -> OPE
- Train Detection Compatibility (TDC) -> RST
- ERTMS NSA Network
- ERTMS NoBo Network
- Group with ERTMS Lab on Testing
- National rules Assessment
- Topical Working Groups (ESC, Engineering...)

4th RAILWAY PACKAGE

- Vehicle Authorisation (VA)
- Trackside Approval (TSA)
- General support on the application of the CCS TSI

Questions & Answers



Special Vehicles

1.1 Technical scope (Proposed Amendment not official version)

- (2) **special vehicles**, such as on-track machines, if equipped with a driving cab ~~and~~ intended to be used in running mode on its own wheels.

7.4. ETCS SPECIFIC IMPLEMENTATION RULES

7.4.3 NATIONAL RULES

- 7.4.3.2. Member States may decide to exclude **special vehicles** as defined in point 2.2.2 (C) of the LOC&PAS TSI, including road-rail vehicles, from the obligation to equip them with ETCS, RMR or ATO on a specific area of use if the operation of these vehicles does not prevent the Class B decommissioning. This shall be notified and shall be listed in the Network Statement as part of Article 27 of Directive 2012/34/EU.

Special Vehicles.

Table B1.1 (Transition regime example. Proposed amendment, not official version)

3	Points 7.4.2.2 <u>and</u> <u>7.4.3.</u>	7.4.2.2 only applicable to upgrade of existing high- speed vehicles	7.4.2.2 applicable to vehicle type and/or vehicles requiring a new authorisation	Directly applicable For special vehicles applicable <u>unless</u> <u>Member States</u> <u>have issued</u> <u>decisions in</u> <u>accordance with</u> <u>7.4.3.2:</u> - <u>if design</u> <u>phase starts on or</u> <u>after from</u> 1 January 2026; <u>or</u>	Applicable <u>if design</u> <u>phase ends on or after</u> <u>from</u> 1 January 2028 <i>Note:</i> Remains directly applicable to high-speed vehicles according to previous CCS TSI. For special vehicles applicable <u>if design</u> <u>phase ends on or after</u> <u>from</u> 1 January 2030 <u>unless Member States</u> <u>have issued decisions</u>	Not applicable <i>Note:</i> <u>Remains</u> <u>directly</u> <u>applicable to</u> <u>high-speed</u> <u>vehicles</u> <u>according to</u> <u>previous CCS</u> <u>TSI.</u>	Not applicable
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