The CCS TSI 2023 insights within the transition regime and the error correction process explained

ERTMS Conference 2024 | Valenciennes

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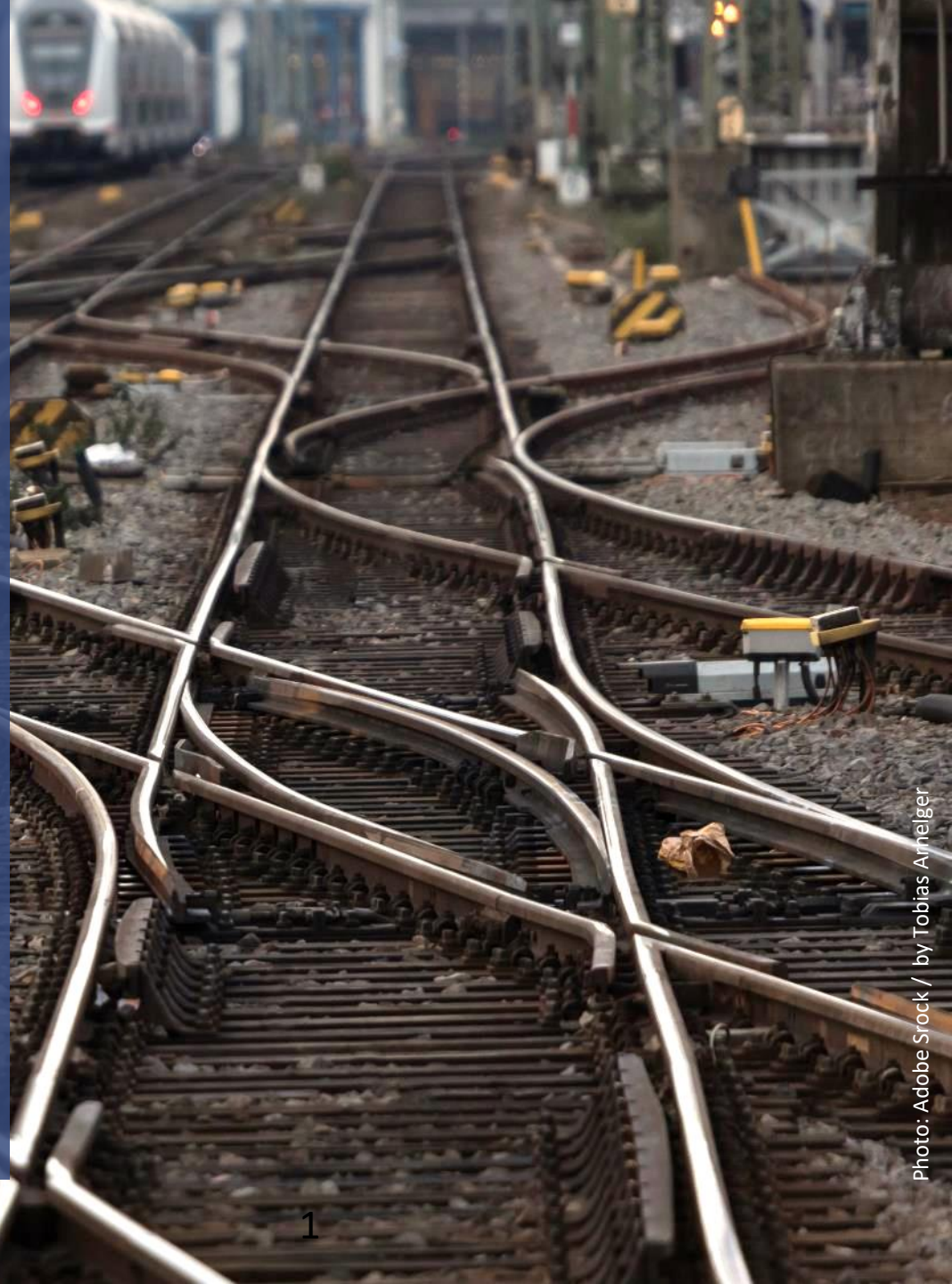

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Agenda

- **Topic 1: ERTMS Specifications inside CCS TSI 2023/1695**
- Topic 2: Examples of Transition Regime inside CCS TSI 2023/1695
- Topic 3: Summary of transition Regime inside CCS TSI 2023/1695

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ERTMS Specifications – Digital and Green Rail

Mandate/scope for specifications in CCS TSI 2023/1695	Link with strategic objectives	Status
Automated Train Operation GoA 1 and 2	ATO provides capacity benefits and reduces energy consumption (green rail).	
ETCS Readiness for FRMCS 5G based communication	GSM-R (2G) will become obsolete between 2035-2040 and shall be replaced by FRMCS (5G). Further digitalisation of rail as 5G opens many possibilities.	
Digital ETCS reducing trackside assets	Hybrid Train Detection: Train integrity allows capacity increase and/or reduced trackside train detection systems. Note: merge of ETCS L2 & ETCS L3 + missing safety requirements. Supervised manoeuvres: Supervised manoeuvres allow safety increase and when using digital automatic coupling will allow to get rid of shunting signals	
On-board modularity	On-board modularity enables further market opening which allows integration of different interoperability constituents/subsystems from different suppliers (open market). ERTMS specifications include additional specifications which provide on-board modularity focusing on a common Ethernet based system and providing harmonised interfaces between ATO, ETCS, FRMCS parts and RST-subsystem.	
Additional changes to further optimise capacity, safety & security, cost reductions	The ERTMS specifications are further optimised with additional change requests based on return of experience of ERTMS projects.	

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ERTMS Specifications – Evolution of ETCS Baselines/ETCS System versions

CCS TSI 2016/919

set #1

ETCS B2

(envelope of ETCS system versions up to 1.0)

set # 2

ETCS B3 MR1

(envelope of ETCS system versions up to 2.0)

(= B2 functions + error corrections and functional enhancements incl. harmonised braking curves and limited supervision)

set #3

ETCS B3 R2

(envelope of ETCS system versions up to 2.1)

(= B3MR1 functions up to 2.0 + error corrections and functional enhancements incl. online key management and GPRS/PS)

CCS TSI 2023/1695 with ETCS Baseline 4 (Release 1)

ETCS B4 R1

(envelope of ETCS system versions up to **2.1**)

(= B3R2 functions + all error corrections + relocation without linking CR 1370)

SS-153 indicates which on-board requirements/documents do not apply or are modified compared to ETCS up to system version 3.0

ETCS B4 R1

(envelope of ETCS system versions up to **2.2**)

(= B4 R1 functions up to 2.1 + ATO)

SS-153 indicates which on requirements/documents do not apply or are modified compared to B4R1 (ETCS up to system version 3.0)

ETCS B4 R1

(envelope of ETCS system versions up to **3.0**)

(=B4R1 functions up to 2.2 + all other functional enhancements incl. ETCS readiness for FRMCS/DAC)

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ERTMS Specifications – Transition regime of ETCS Baselines/ETCS System versions

- **EU Policy: SERA - Why are there multiple ETCS B4R1 OBU configurations in the CCS TSI 2023/1695?**

- Removal of partial fulfilment. Clause on partial fulfilment is used in many different situations leading to restrictions/deviations in operation, uncoordinated development of multiple ETCS OBU variants with associated high assessment costs. The removal of partial fulfilment requires the definition of the ETCS standard configurations.

- **Which market segments are identified for the short-term and mid-term?**
  - ETCS B4R1 (up to SV2.1): required short-term as mandatory functionality (incl. relocation without linking).

Note: this configuration is the maintenance of ETCS B3R2 OBU including all error CRs which could prevent normal service linked to existing functionality and includes enhancement 'relocation without linking' required for some existing L1 LS trackside implementations.

  - ETCS B4R1 (up to SV2.2): required short-term as optional in case of implementing ATO-functionality.

  - ETCS B4R1 (up to SV3.0): required mid-term as mandatory functionality (i.e. ETCS ready for 'FRMCS' and 'Supervised Manoeuvres' incl. DAC). Mid-term strategy shall be defined by Member State (NIP) and expected outcome is that ETCS SV3.0 will be triggered by GSM-R obsolescence.

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ERTMS Specifications – Appendix B1.1 – Transition Regime

- **Transition regime concept is introduced across all on-board related TSIs and based on 4 categories for the vehicle:**
  - Design phase started after TSI enters into force (linked to first/new authorisation of a vehicle type);
  - Design phase started before TSI enters into force (linked to first/new authorisation of a vehicle type);
  - Production phase (linked to C2T-authorisation);
  - Vehicles in Operation (linked to vehicles in operation, incl. extension area of use);

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

- **Why is this transition regime concept introduced in the TSIs?**
  - The return of experience of vehicle authorisations (i.e. assessors being involved in vehicle authorisation) demonstrated the need to align the transition regime across TSIs and would be facilitated by providing details on transition regime for each TSI change in a coherent way (i.e. delta approach).

  - For each TSI change, the CCS TSI 2023/1695 states the conditions ‘if’ the TSI change is mandatory (e.g. ETCS is installed for the first time, functionality notified by the IM) and the timeframe ‘when’ it becomes mandatory (as described in Appendix B);

ERTMS Specifications – Phasing out set #1, #2 and #3 – Transition Regime

- **ETCS OBU: Gradual phasing out set # 2 and # 3 from CCS TSI 2016/919 (see row 9 & 10)**

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
Former sets of specifications #2 and #3							
9	Appendix A – Table A 2	Appendix A – Table A 2 2 – Set of specification #2	The specifications in Appendix A – Table A 2 does not include ETCS system version 2.0, since the minimum reduced on-board envelope is the envelope up to ETCS system version 2.1.	Applicable 3 years after entry into force of the TSI In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.	Applicable from 1 January 2030 In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.	Applicable on newly built vehicles from 1 January 2030 In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.	Not applicable In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.
10	Appendix A – Table A 2	Appendix A – Table A 2 3 – Set of specification #3	The specifications in Appendix A – Table A 2 have the agreed error corrected version of former set #3	Applicable 3 years after entry into force of the TSI In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.	Applicable from 1 January 2030 In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.	Applicable on newly built vehicles from 1 January 2032 In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.	Not applicable In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.

ERTMS Specifications – Phasing out set #1, #2 and #3 – Transition Regime

- **ETCS OBU: Additional clarification in CCS TSI Application Guide (cascading principle)**

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
10	Appendix A - Table A 2	Appendix A - Table A 2 3 – Set of specification #3	The specifications in Appendix A - Table A 2 have the agreed error corrected version of former set #3	Applicable - if design phase starts on or after 28th September 2026 or - if design phase ends on or after 01st January 2030 ~~3 years after entry into force of the TSI~~ In any case the error correction provisions	Applicable if design phase ends on or after ~~from~~ 01st January 2030 In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.	Applicable on newly built vehicles placed on the market from 01st January 2032 In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be	Not applicable In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.

ERTMS Specifications – ATO GoA2 and ETCS B4R1 (up to SV2.2) – Transition Regime

- **ATO GoA2 Trackside implementation:**
  - ATO trackside can be implemented on any ETCS TS system version (X=1; X=2 or X=3);
  - Transition regime: ATO trackside implementation is optional, however if implemented it shall be compliant to the specifications in the CCS TSI 2023/1695 (see row 4 of Appendix B2); Implementation of ATO trackside will depend on the National Implementation Plan.

- **ATO GoA2 On-Board/vehicle implementation:**
  - ATO on-board functionality requires ATO OB, ETCS B4R1 (ETCS up to SV2.2; ETCS up to SV3.0) and additional radio implementation for ATO (based on PS);

  - Transition regime: ATO on-board implementation is mandatory in case

a) 'If': ETCS is implemented for the first time in a vehicle design
b) 'If': IM has notified the use of ATO on certain lines of its network
c) 'When': according to the timeframes included in Appendix B1.1 (see row 6 & 12).

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ERTMS Specifications – ATO GoA2 and ETCS B4R1 (up to SV2.2) – Transition Regime

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
12	4.2.18 + Point 7.2.9.2	Not applicable	ATO on-board specification and implementation requirements	Design phase started after notification from IM and notification is done after 1 January 2025: ATO on-board requirements are directly applicable. Design phase started before notification from IM or notification is done before 1 January 2025: ATO On-board requirements are applicable if the design phase is not ended within the latest date between following dates: — 1 January 2030; — 5 years after the notification date from the IM.	ATO on-board requirements are applicable if the design phase is not ended within the latest date between following dates: — 1 January 2030; — 5 years after the notification date from the IM.	Not applicable	Not applicable

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ERTMS Specifications – FRMCS and ETCS B4R1 (up to SV3.0) – Transition Regime

- **FRMCS Trackside:**
  - Full set of FRMCS-specifications is not part of CCS TSI 2023/1695;

  - Transition regime: FRMCS implementation plan as part of NIP (even if specifications are not yet part of the CCS TSI 2023/1695). Note: CCS TSI provides the obligation to IMs to provide at least a minimum notification period of 5 years before GSM-R services are stopped (timeframe only starts when FRMCS-specifications for on-board are part of the CCS TSI).

- **FRMCS On-Board/vehicle:**
  - FRMCS on-board functionality will require FRMCS OB, ETCS B4R1 (ETCS up to SV3.0) integrated into the vehicle;

  - Full set of FRMCS on-board specifications are not part of the CCS TSI 2023/1695. ETCS B4R1 (ETCS up to SV3.0) specifications are part of CCS TSI 2023/1695, so ETCS suppliers can develop these products.

  - Transition regime: FRMCS and ETCS up to SV3.0 are not mandatory yet (see row 7 & 15). Vehicle projects can contract and implement ETCS B4R1 (ETCS up to SV3.0) on a voluntary base based on the available set of specifications.

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ERTMS Specifications – FRMCS and ETCS B4R1 (up to SV3.0) – Transition Regime

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
15	Point 7.3.2.2	Not applicable	FRMCS on-board implementation (3)	Not applicable. *Note:* Transition regime after TSI amendment: Design phase started after notification from IM and notification is done after 2 years of the entry into force of CCS TSI amendment: FRMCS on-board implementation is directly applicable.	Not applicable. *Note:* Transition regime after TSI amendment: FRMCS on-board is applicable if the design phase is not ended within the latest date between following dates: — 5 years after the CCS TSI amendment; — 5 years after the notification date from the IM.	Not applicable. *Note:* The FRMCS on-board implementation is mandatory when required for compatibility with FRMCS only trackside implementation	Not applicable. *Note:* The FRMCS on-board implementation is mandatory when required for compatibility with FRMCS only trackside implementation
				Design phase started before notification from IM: see transition regime in column 'Design phase started before TSI set into force'.			

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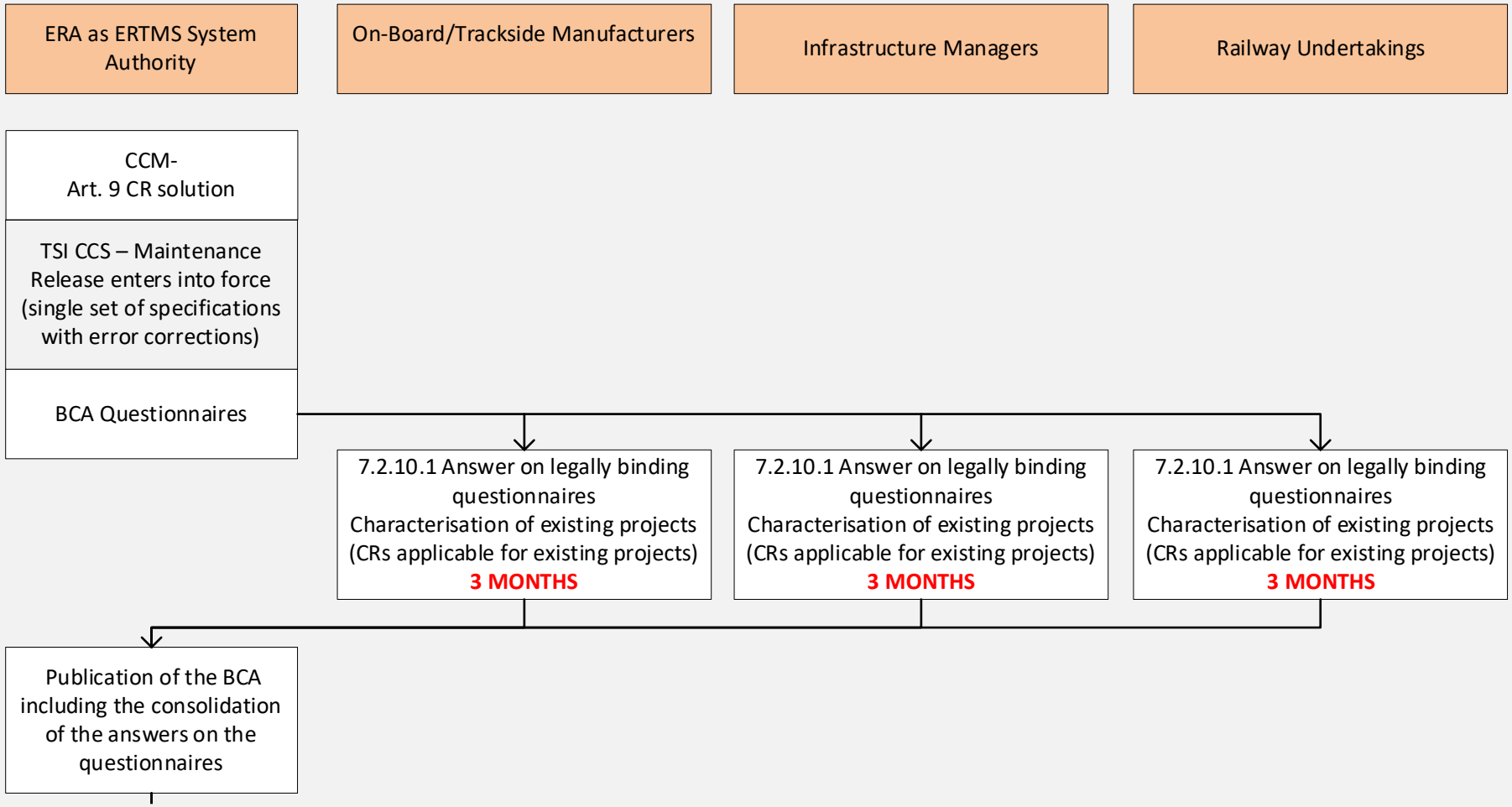
ERTMS Specifications – Error corrections – Transition Regime (7.2.10)



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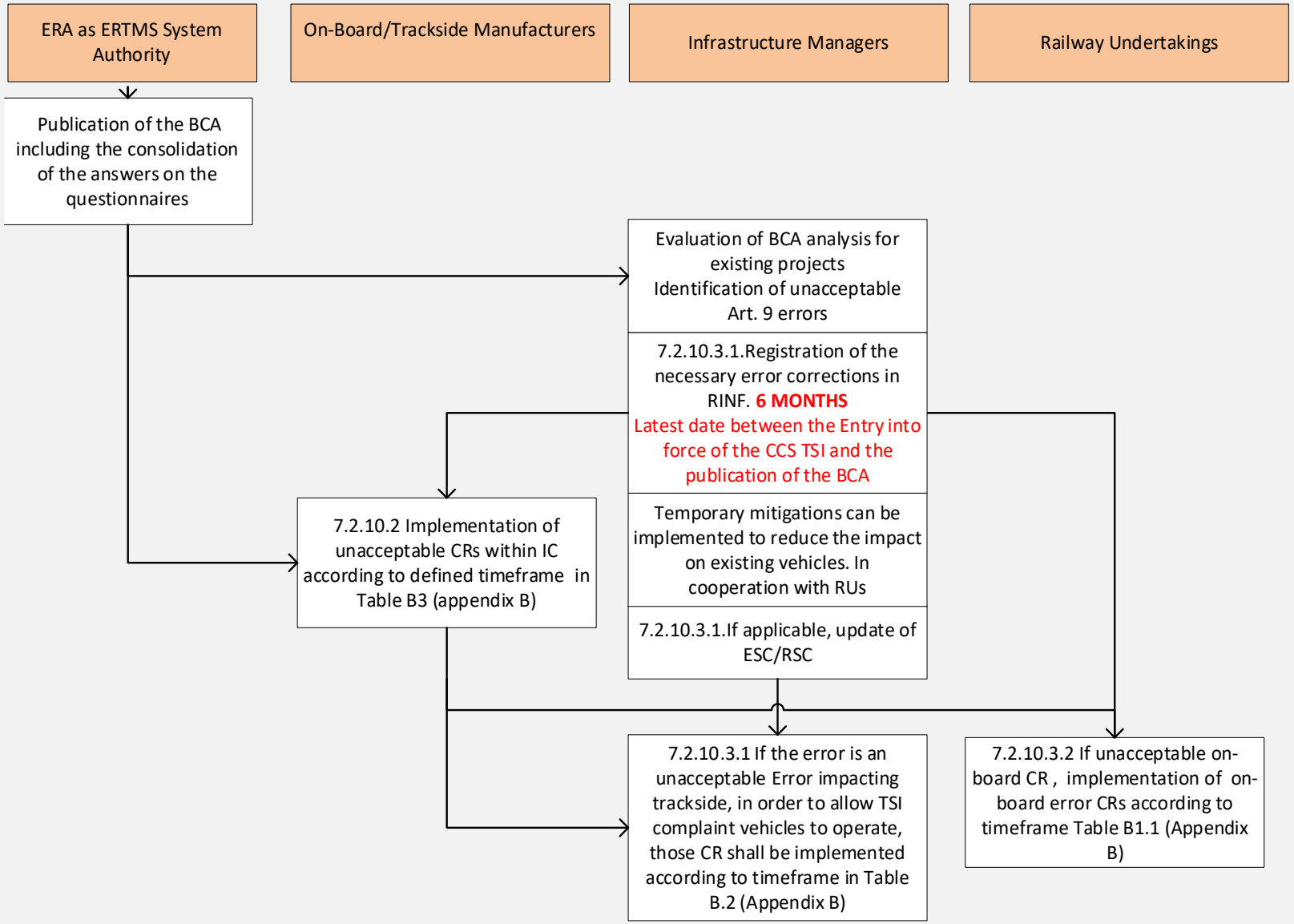
ERTMS Specifications – Error corrections – Transition Regime (7.2.10)



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ERTMS Specifications – Error corrections – Transition Regime (phase 1)

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
CCS On-Board Error corrections							
1	Appendix A + point 7.2.10.3	No mandatory implementation of error corrections published in technical opinions	CCS Subsystems with mandatory implementation of registered error corrections for functionality ETCS up to system version 2.1 and GSM-R.	For legal releases (with maintenance of specifications) published before 1 January 2026: If one or more registered errors are identified for the area of use for which a new authorisation is required: the CCS subsystem integrated into a vehicle type shall implement the necessary error corrections at the latest 6 months after the update of the concerned interoperability constituents. *Note:* If one or more registered errors are identified for the area of use for which no new authorisation is required, the CCS subsystem integrated into a vehicle type is considered compliant with the update of the concerned interoperability constituents (as defined in Table B3).		For legal releases (with maintenance of specifications) published before 1 January 2026: If one or more registered errors are identified for the area of use: the CCS subsystem integrated into a vehicle shall implement the necessary error corrections the latest — 1 year after the update of the concerned interoperability constituents (as defined in Table B3) in the case no new authorisation is required; or — 1 year after the update of the vehicle type in the case a new authorisation is required;

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ERTMS Specifications – Error corrections – Transition Regime (phase 2)

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
				For legal releases (with maintenance of specifications) published after 1 January 2026: If one or more registered errors are identified for the area of use for which a new authorisation is required: the CCS subsystem integrated into a vehicle type shall implement the full maintenance package of error corrections at the latest 6 months after the update of the concerned interoperability constituents. *Note:* If one or more registered errors are identified for the area of use for which no new authorisation is required, the CCS subsystem integrated into a vehicle type is considered compliant with the update of the concerned interoperability constituents (as defined in Table B3).	For legal releases (with maintenance of specifications) published after 1 January 2026: If one or more registered errors are identified for the area of use: the CCS subsystem integrated into a vehicle shall implement the full maintenance package of error corrections the latest — 1 year after the update of the concerned interoperability constituents (as defined in Table B3) in the case no new authorisation is required; or — 1 year after the update of the vehicle type in the case a new authorisation is required;

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CCS TSI 2023/1695 – Transition regimes for innovations based on National Implementation Plans

- **Balancing IM/RU economic interests:**

How to handle innovations for the railway system which have a different business case for the Infrastructure Managers and Railway Undertakings.

Example: Reduce trackside assets ('digital rail') might require new mandatory on-board functions to be implemented for existing and new vehicles (e.g. Digital Automatic Coupling, Train Integrity, FRMCS and associated changes to interface ETCS with FRMCS).

- **CCS TSI 2023/1695:**

- **National Implementation Plan**: Member State's obligation to balance different expressed needs between impacted stakeholders (IM and RUs) to decide on ATO implementation, new FRMCS radio system or new ETCS system version;

- If implementation of new functions occurs, **framework** of a minimum timeframe (notification period) of **at least 5 years** shall be provided.

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CCS TSI 2023/1695 – Transition regimes for error corrections (maintenance process)

- **EU Policy objective:** Providing fully compliant ERTMS products (without errors/deviations/partial fulfilment) allowing vehicles to operate across the EU (without additional restrictions/modifications if the area of use of a vehicle is extended).

- IMs/RUs **depend on their s**

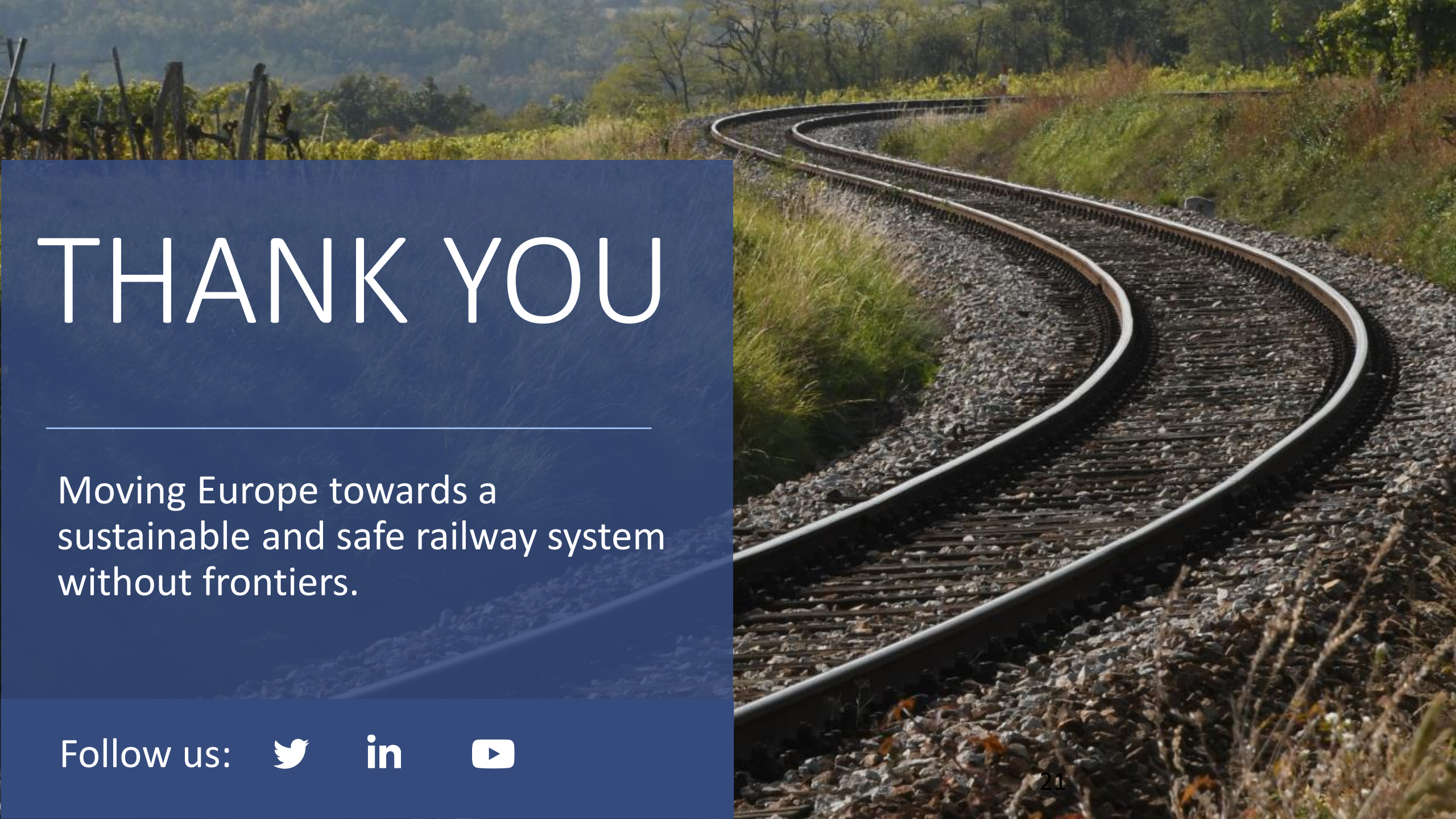
Integration of error correction

↳ Key Commitment #7 of ERT

7. ... manufacturers agree to propose, for future ERTMS projects, updated software ... automatically include the corrections of errors in the ... in the frame of the Change Control Management ... ions. This mechanism shall not encompass new ... he specifications.

- **Balancing IM/RU economi**
  - IMs would like that on-b ... les in order that temporary mitigation measures can be remove
  - RUs would like that track ... projects in order to allow the operation of TSI compliar

- **CCS TSI 2023/1695:** Respo ... liers for implementation of errors corrections in products; If **errors are preventing normal service** in specific projects, IMs and RUs shall implement those corrections within a **maximum timeframe of 3 years.**



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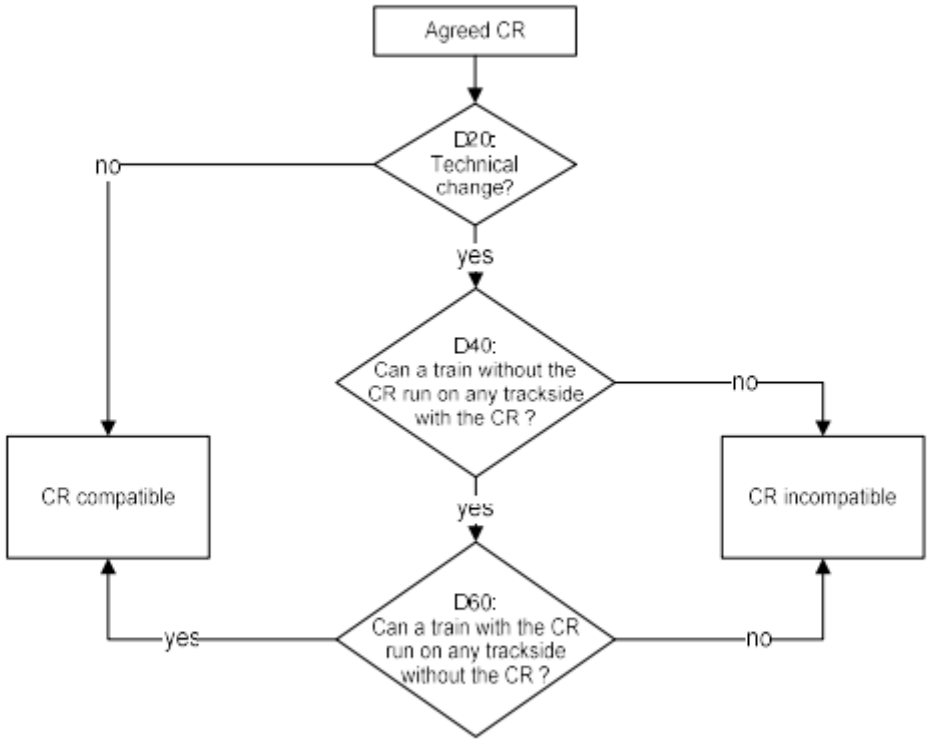
ETCS system version management – Compatible vs incompatible change

5.3 Evaluation of a single CR

5.3.1 Decision chart



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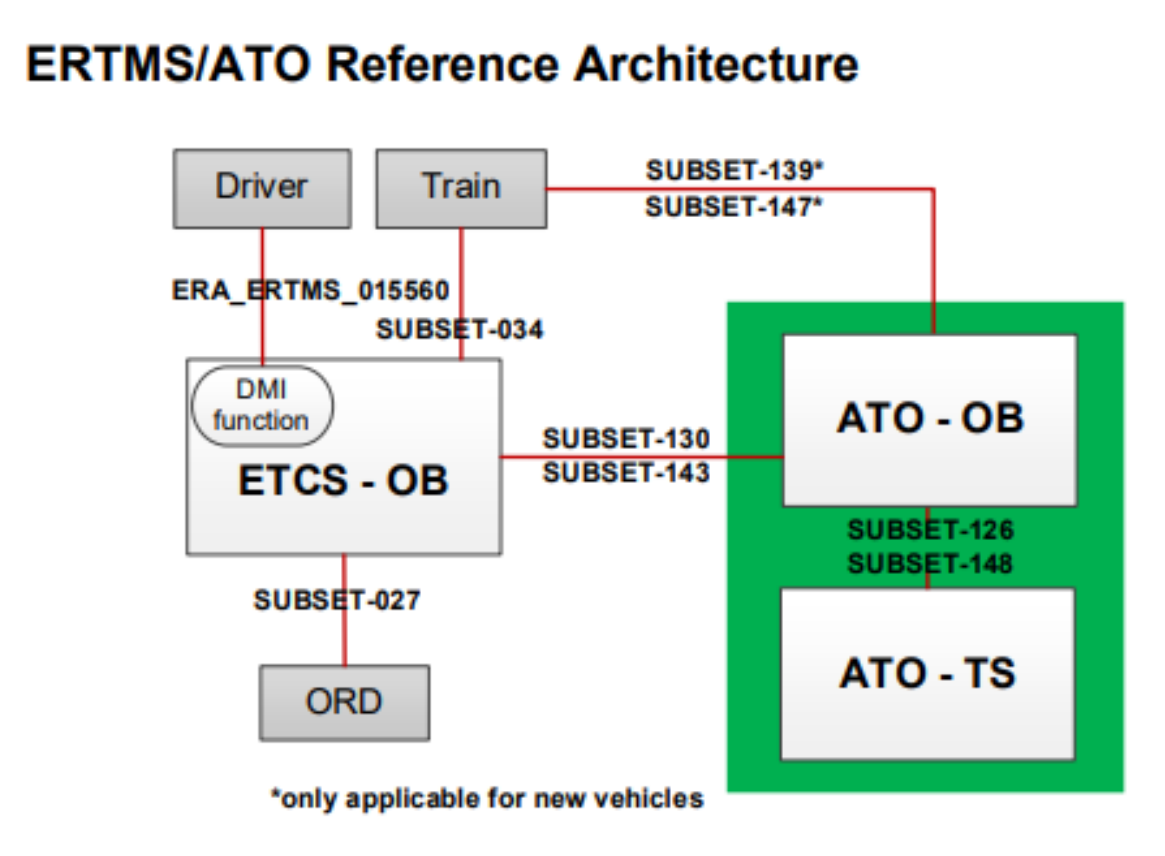
ATO and link with ETCS



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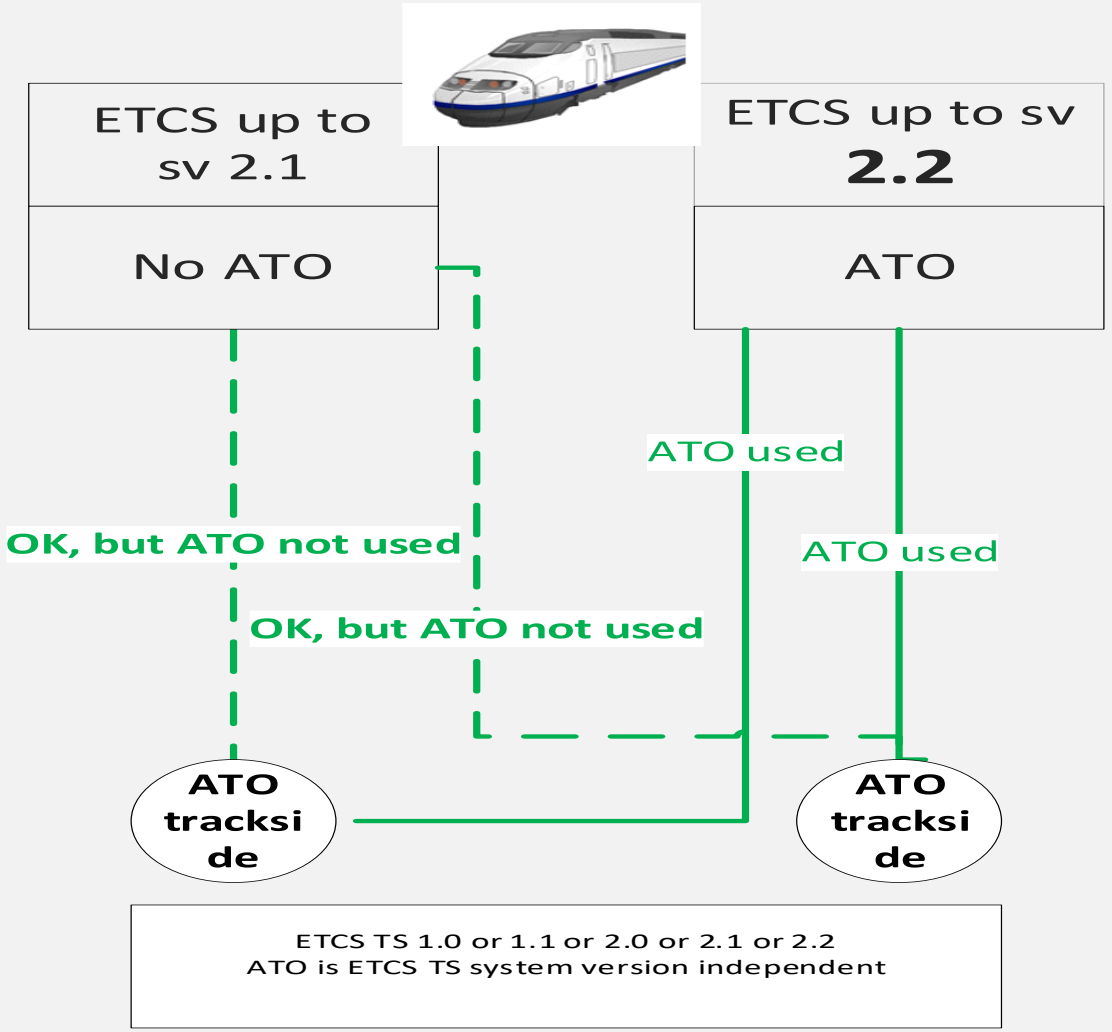
ATO classified as compatible change



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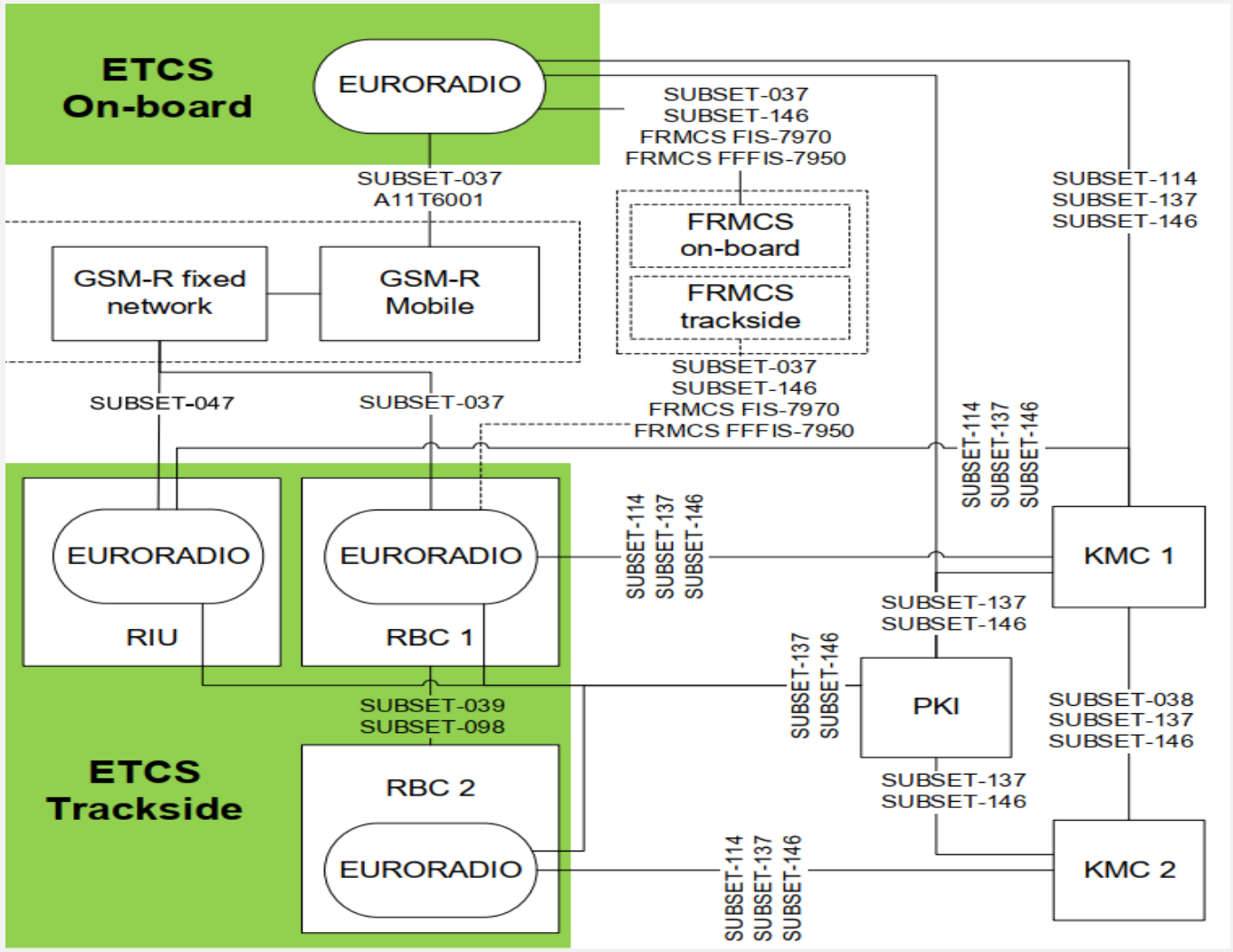
FRMCS and link with ETCS



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FRMCS classified as incompatible change in case GSM-R services are stopped