EUROPEAN UNION AGENCY FOR RAILWAYS

Moving Europe towards a sustainable and safe railway system without frontiers.

OPINION
ERA/OPI/2026-4

of
THE EUROPEAN UNION AGENCY FOR RAILWAYS

for
THE EUROPEAN COMISSION

regarding
the definition of interoperability constituents related to train detection systems.

Contents

1. Introduction

On 22 October 2025, the European Commission (EC) requested a technical opinion (TO) from the European Union Agency for Railways (the Agency) pursuant to Article 6(2) Directive (EU) 2016/797 [2] and Art. 10 Regulation (EU) 2016/796 [3] concerning train detection systems. Reference to the opinion which is complemented by the report. (see ANNEX 2)

Article 19 (1) (d) Regulation (EU) 2016/796[3], empowers the Agency to issue opinions which constitute acceptable means of compliance concerning deficiencies in TSIs, in accordance with Article 6(4) Directive (EU) 2016/797[2] and address those opinions to the EC.

2. Context

Within the CCS TSI [4][5] the parts of train detection (table 4.1) consist of:

- the basic parameter for train detection systems defined in point 4.2.10, specifying the interface requirements between trackside train detection systems and rolling stock, related to vehicle design and operation, as well as,
- the basic parameter defined in point 4.2.11 electromagnetic compatibility between rolling stock and control-command and signalling trackside equipment, specifying the interface requirements for electromagnetic compatibility between rolling stock and trackside train detection equipment.

Detailed requirements are furthermore provided in ERA/ERTMS/033281 [1] referenced in index 77 of Appendix A to the Annex of the CCS TSI [4][5].

Train detection systems can be axle counters, track circuits and for specific applications like level crossings (LX), also so-called loops. Only the axle counters are specified as interoperability constituents in chapter 5 although harmonised requirements for other types of train detection systems like loops or the track circuits should be defined as well. The different treatment of axle counters as compared to the other train detection systems allegedly leads to different treatment in the authorisation process of the respective trackside assets, leading notably to a multiplication of testing and certification by different conformity assessment bodies.

EC identifies this lack of coherence as a deficiency in the CCS TSI and therefore requests the Agency to issue an ERA technical opinion in accordance with Art. 6 Directive (EU) 2016/797 and Art. 10(2) and 19(1) Regulation (EU) 2016/796 (6), with the following objectives:

1. Address an opinion to EC on the identification of the target train detection system(s) that allows a harmonised, cost-efficient, trackside implementation and the reduction of compliance requirements related to rolling stock (“exported constraints”).
2. Analyse the current definition of interoperability constituents related to train detection systems and how the notion of interoperability constituents could be extended to other train detection systems to support a harmonised national authorisation process and independent certification for off-the shelf products.
3. Moreover, the opinion shall set out (voluntary) acceptable means of compliance for all train detection systems defined as interoperability constituent(s), which can be integrated in the CCS TSI under a future revision as harmonised requirements and assessment methods, guiding certification to be used in future vehicle authorisation process.

3. Analysis

ERA/ERTMS/033281 [1] sets out the requirements for the axle counter train detection system as an interoperability constituent in Table 16. The relevant requirements are based on the requirements defined for vehicles in sections 3.1 and 3.2 of ERA/ERTMS/033281. These requirements are missing for the train detection systems such as wheel sensors, track circuits and loops (level crossings) in Table 16.

- The wheel sensors that also belong to the train detection systems (without direction detection) are not listed. For these sensors, a subset of the requirements for axle counters is necessary for interoperability, but not all of them.
- The parameters for the track circuits are incomplete for the assessment at subsystem level. The parameter 3.1.9, which is the most relevant for a track circuit at IC level, is missing together with the additional information from which operational and relevant technical requirements result.
- For the Loops (Level Crossings), reference is made to section 3.1.7.2, but the references to the loops are missing or are insufficiently defined for the evaluation.

The requirements for the train detection systems wheel sensors, track circuits and Loops (Level Crossings) relevant for defining them as an "Interoperability Constituent" in the context of an EC conformity assessment can be derived generically from the vehicle requirements of sections 3.1 and 3.2 from ERA/ERTMS/033281 [1]. The introduction of these additional types of train detection systems is technically feasible however requires specific changes in the following legal documents:

3.1. Changes in Chapter 4 in ERA/ERTMS/033281

The proposed modifications concern in general Chapter 4 “Conformity assessment”. The requirements were derived from the respective sections 3.1 and 3.2 according to their relevance for the relevant train detection systems.

3.1.1. Changes in Table 16

In chapter 4, table 16, where the requirements for conformity assessment at IC level and at subsystem level are listed, needs to be revised as follows (modifications are in *red*):

Train Detection System	Parameters	Relevant for Interoperability Constituent (IC) certification	Relevant for application engineering (assessed at subsystem level)
Axle Counters	***Axle distances***		
	3.1.2.1. Maximum distance between following axles	X (**)	X (*)
	3.1.2.2. Minimum distance between following axles	X	
	3.1.2.3. Minimum distance between first and last axle	X	
	3.1.2.4. Maximum distance between front/rear end of train and first/last axle for trains running exclusively on High Speed lines	X (**)	X (*)
	3.1.2.5. Maximum distance between front/rear end of train and first/last axle for trains running on other lines	X (**)	X (*)
	Wheel geometry		
	3.1.3.1. Geometric dimension of the rim width	X	
	3.1.3.2. Minimum wheel diameter	X (***)	X (***)
	3.1.3.3. Geometric dimension of flange thickness	X	
	3.1.3.4. Geometric dimension of the flange height	X	

	3.1.3.5 Metal and inductive components-free space between wheels	X	
	3.1.3.6. Wheel material	X	
	Electromagnetic compatibility		
	3.2.1. Electromagnetic fields	X	
Wheel sensors	***Wheel geometry***		
	3.1.3.1. Geometric dimension of the rim width	*X*	
	3.1.3.2. Minimum wheel diameter	*X (***)*	*X (***)*
	3.1.3.3. Geometric dimension of flange thickness	*X*	
	3.1.3.4. Geometric dimension of the flange height	*X*	
	3.1.3.5 Metal and inductive components-free space between wheels	*X*	
	3.1.3.6. Wheel material	*X*	
	Electromagnetic compatibility		
	3.2.1. Electromagnetic fields	*X*	
Track Circuits	***Axle distances***		
	3.1.2.1. Maximum distance between following axles		
	3.1.2.3. Minimum distance between first and last axle	*X (**)*	*X (*)*
	3.1.2.4. Maximum distance between front/rear end of train and first/last axle for trains running exclusively on High Speed lines		X (*)
	3.1.2.5. Maximum distance between front/rear end of train and first/last axle for trains running on other lines		X (*)
	Wheel geometry		
	3.1.9. Impedance between wheels	*X*	
	Electromagnetic compatibility		
	3.2.2.4. 25 kV AC, 50 Hz Electromagnetic interference limits for traction current	*X(****)*	X (*)
	3.2.2.5. 15kV AC, 16,7Hz Electromagnetic interference limits for traction current	*X(****)*	X (*)
	3.2.2.6. DC (3kV, 1.5kV) Electromagnetic interference limits for traction current	*X(****)*	X (*)
Loops (LX)	***Vehicle axle load and metal construction***		
	3.1.7.2. Vehicle metal construction	*X*	
Other train detection systems	*Depending on the technology used and/or the task of the train detection system* *Note: There shall be no new requirements for interoperable vehicles. (see TSI LOC&PAS / TSI WAG)*	*Assessed as part of an IC certification or at subsystem level*	

Note: The IC wheel sensor only detects the presence of one or more wheels, but not for counting axles.

The parameters which are **not** listed above, are not relevant for the conformity assessment of the trackside train detection system.

Train detection systems, which are part of the Control-Command and Signalling Trackside, shall be designed in such a way that they are able to detect a vehicle or consist under the conditions specified by the parameters in this specification (see scope).

As the specified parameters relate on vehicles, no one by one correspondence exists for each of these parameters on control-command and signalling trackside in any case. By considering the control-command

and signalling trackside on subsystem level, compatibility of track-side installation can be shown by different ways.

The applicant shall demonstrate that the train detection system is implemented in a way that interoperability is guaranteed.

This shall be done by applying one of the modules specified in the CCS TSI chapter 6.3.2.2. All modules for 'EC' Verification require evidence on (and assessment of) design and implementation.

Independently from the chosen module, the applicant for the trackside subsystem shall provide evidence for assessment.

(*)

The assessment of axle counters or track circuits at subsystem level bases on the following evidence provided by the applicant for subsystem assessment:

1) Design evidence on:
   a) the detection of vehicles with a maximum axle distance (see 3.1.2.1) by axle counters or track circuits integrated in the infrastructure (possible information may be the distance between those axle counters/track circuits which define the begin and the end of a signalling section)
   b) the detection of vehicles with a minimum axle distance between first and last axle (L - (b1 + b2), see 3.1.2.3) by track circuits integrated in the infrastructure (possible information may be the distance of the electrical joints between adjacent track circuits)
   c) the detection of vehicles with a maximum distance between the first/last axle and the nose/tail of the vehicle (see 3.1.2.4 and 3.1.2.5) in relation to relevant infrastructure side points by axle counters or track circuits integrated in the infrastructure (possible information may be the distance between relevant infrastructure side point and axle counter/track circuit). Information about the relevant infrastructure side points shall be provided by the applicant.

      Note:
      The applicant may deviate from the distances related to a), b) and c) if it can be demonstrated that this will not have a negative impact on safety and interoperability of a vehicle defined according to 3.1.2.1, 3.1.2.3, 3.1.2.4 or 3.1.2.5.
2) Implementation evidence on / results of tests / on-site measurements on:
   a) the proof that the conditions and limits of use (including installation rules) of track circuits or the IC axle counter have been fulfilled
   b) the proof that the IC has been installed according to the requirements and criteria defined under 1) - design evidence.

      Note:
      The applicant may deviate from the distances mentioned in 1) a), b) and c) if it can be demonstrated that this will not have a negative impact on safety and interoperability of the vehicle defined in 3.1.2.1, 3.1.2.3, 3.1.2.4 or 3.1.2.5.

(**)

At IC level, it shall be checked that the installation documentation (e.g. manuals, installation procedures) shall consider this requirement.

(***)

The axle counter*/wheel sensor* shall meet the speed requirements *according to* the maximum line speed where it is installed. A condition for use in the certificate of conformity shall indicate the maximum speed for which the axle counter*/wheel sensor* is validated.

(****)

EN 50617-1 is one means of compliance that specifies the technical parameters of track circuits associated with the interference current emissions limits for Rolling Stocks in the context of interoperability defined in the form of Frequency Management in section 6.6 and the validation of immunity for TCs is also covered under section 6.6.2.

3.1.2. Changes in section 4.1

Headline should be amended as follows: 4.1 Interoperability Constituents

Also, Chapter 4.1 of ERA/ERTMS/033281 needs to be revised as follows (modifications are in *red*):

> The EC declaration of conformity *of train detection systems* shall cover all parameters applicable for IC certification *related to the respective train detection systems* (see Table 16).
>
> For the frequency management defined in chapter 3.2.1 for the immunity level of axle counter*/wheel sensors* (magnetic field), a margin of at least +9dB in-band and +3dB out-band shall be observed.
>
> If the architecture of *the train detection system* does not allow the declaration of conformity for all parameters applicable for *the train detection system* (see Table 16), the EC declaration for conformity shall explicitly mention these parameters. These parameters must be checked at subsystem level according to chapter 6.3 of the CCS TSI.

3.2. Changes in Table 5.2 CCS TSI

The adjustments in Table 5.2 are necessary to include the other Interoperability Constituents that have been created and to assign the specific requirements to be assessed (modifications are in *red*):

No	Interoperability constituent (IC)	Characteristics	Specific requirements to be assessed by reference to Chapter 4
(…)			
7	Train Detection System Axle counter	Trackside train detection systems (only parameters relevant for axle counters)	4.2.10
		Electromagnetic compatibility (only parameters relevant for axle counters)	4.2.11
	Train Detection System *Wheel sensor*	*Trackside train detection systems (only parameters relevant for wheel sensors)*	*4.2.10*
		Electromagnetic compatibility (only parameters relevant for wheel sensors)	*4.2.11*
	Train Detection System *Track circuit*	*Trackside train detection systems (only parameters relevant for track circuits)*	*4.2.10*
		Electromagnetic compatibility (only parameters relevant for track circuits)	*4.2.11*
	Train Detection System *Loop*	*Electromagnetic compatibility (only parameters relevant for loops (LX))*	*4.2.10*
(…)			

3.3. Changes in Table 6.3 CCS TSI

To properly include the resulting Interoperability Constituents in the track-side tests and to avoid duplicate tests, the designation " Interoperability Constituent axle counters" should be renamed to " Interoperability Constituent train detection systems", resulting in the following changes of table 6.3 in CCS TSI (modifications are in *red*):

No	Aspect	What to assess	Supporting evidence
(…)			
2a	Integration of interoperability constituents in the subsystem Note: Only those with a specific assessment at subsystem level.	Check that the internal interfaces of the subsystem have been installed properly and function properly – Basic parameters 4.2.5, 4.2.7 and conditions specified by the manufacturer. *(N/A for Interoperability Constituent for Train Detection Systems and Marker Boards)*	Checks according to specifications.
2b		Check that additional functions (not specified in this TSI) do not impact the mandatory ones. *(N/A for Interoperability Constituent for Train Detection Systems and Marker Boards)*	Impact analysis.
2c		Check that the values of ETCS IDs are within the allowed range and, if required by this TSI, have unique values – Basic Parameter 4.2.9. *(N/A for Interoperability Constituent for Train Detection Systems and Marker Boards)*	Check of design specifications.
2d		*For Interoperability Constituent for Train Detection Systems:* The integration of the Interoperability Constituent in the subsystem has to be verified: Check index 77 document Chapter 4, table 16 ‘conformity assessment’. Check the correct installation of equipment and conditions specified by the manufacturer and/or the infrastructure manager.	Document check.
2e		(…)	
(…)			

No	Aspect	What to assess	Supporting evidence
4a	Integration with infrastructure *(not applicable for train detection part)*	(…)	(…)
4b		(…)	(…)
(…)			
6a	Integration with Control Command and Signalling On-board Subsystems *(not applicable for train detection part)*	(…)	(…)
6b		(…)	(…)
7	Compatibility of train detection systems *(excluding axle counters, wheel sensors, track circuits and loops)*	*(…)*	*(…)*
…			
9	Integration with Control Command and Signalling On-board Subsystems and rolling stock: tests under conditions representing the intended operation.	(…) (1) the performance of train detection systems – Basic parameters 4.2.10, 4.2.11; (2) that the Control-Command and Signalling Trackside subsystem is compatible with trackside environment – Basic parameter 4.2.16 *(except Train Detection).* These tests will also increase confidence in the absence of systematic failures …	(…)

4. Conclusions

4.1. Main conclusions

The changes described in point 3.1 of this report allow infrastructure managers to integrate all types of train detection systems as Interoperability Constituents into the subsystem. Consequently, complex compatibility tests between vehicle and track can be shifted at IC level thus reducing the complexity of the assessment at subsystem level.

The changes are not yet implemented in the CCS TSI nor in the interface document. They will be implemented in the framework of the next major revision of the CCS TSI. The key findings following from the analysis which provide the basis for the opinion.

4.2. Conclusions on the specific objectives

The Commission addressed the following objectives to the Agency in the context of the request for a TO:

Advise the Commission on the identification of the target train detection system(s) that allows a harmonised, cost-efficient, trackside implementation trackside and the reduction of compliance requirements related to rolling stock ("exported constraints").

In 2024, The Agency analysed the situation in all EU Member States with regards to the use of train detection systems. The report of this analysis reveals that all the 4 types of train detection systems (axle counter, wheel sensor, track circuit, loop) are used for train detection. However, some infrastructure managers in Member States (e.g. in DE, LU) prefer to replace all track circuits by axle counters in the mid- or long-term. The actual version of the interface document (chapter 3.2.2.8) as well as the CCS TSI (Art. 13 (2)) takes this strategy into account allowing infrastructure managers to notify to the Agency the frequency bands of track circuits to be used in their networks. If no track circuits are installed, such notification could indicate, that no frequency bands are used. As a conclusion, with the proposed modification in CCS TSI and the interface document, all relevant types of train detection systems are identified which can be considered as target train detection systems.

Analyse the current definition of interoperability constituents related to train detection systems and how the notion of interoperability constituents could be extended to other train detection systems to support a harmonised national authorisation process and independent certification for off-the shelf products.

This objective is fully addressed in point 3.1 of this report showing the necessary changes in the interface document as well as in the CCS TSI to introduce all types of train detection systems as ICs.

The opinion shall deliver acceptable means of compliance for all train detection systems defined as interoperability constituent(s), which can be integrated in CCS TSI under a future revision as harmonised requirements and assessment methods, guiding certification to be used in future vehicle authorisation process.

A certification of train detection systems at IC and subsystem level following the modified requirements as described in chapter 3 of this TO can be considered as acceptable means of compliance for all train detection systems.

5. Opinion

The Agency is of the opinion that the Train Detection Systems on Trackside would better harmonise with the introduction of the interoperability constituent notion. The Agency confirms with this opinion the need of updating the CCS TSI and the interface document ERA/ERTMS/033281.

Qualified electronic signature by: OANA

RODICA GHERGHINESCU

Date 2026-06-04 18:43:39 UTC

Valenciennes,

Oana GHERGHINESCU
Executive Director

Annex 1 References

Reference documents

Ref N°	*Title*	*Reference*	*Version*
[1]	Interfaces between control-command and signalling trackside and other subsystems	ERA/ERTMS/033281	5.1

Reference legislation

Ref N°	*Title*	*Reference*	*Version*
[2]	Directive (EU) 2016/797 of the European Parliament and of the Council of 11 May 2016 on the interoperability of the rail system within the European Union (recast)	OJ L 138 26.5.2016, p. 44	N.A.
[3]	Regulation (EU) 2016/796 of the European Parliament and of the Council of 11 May 2016 on the European Union Agency for Railways and repealing Regulation (EC) No 881/2004	OJ L 138, 26.5.2016, p. 1.	N.A.
[4]	Commission Implementing Regulation (EU) 2023/1695 of 10 August 2023 on the technical specification for interoperability relating to the control-command and signalling subsystems of the rail system in the European Union and repealing Regulation (EU) 2016/919 (Text with EEA relevance)	OJ L 222, 8.9.2023, pp. 380–560	N.A.
[5]	Commission Implementing Regulation (EU) 2026/693 of 19 March 2026 amending Implementing Regulation (EU) 2023/1695 as regards new testing specifications, a set of reduced specifications and transitional measures	OJ L, 2026/693, 15.4.2026	N.A.

Annex 2 Request for a Technical Opinion

Request for a Technical Opinion according to Article 6 of Commission Decision (EU) 797/2016 – ARES (2025) 901916 – 22/10/2025

EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR MOBILITY AND TRANSPORT

Directorate C – Land
The Director

Brussels
MOVE.DDG2.C.4/SZ

Subject: **Request for a technical opinion according to Article 6 of Commission Directive (EU) 797/2016**

Dear [redacted]

According to paragraph 2 of Article 6 of Commission Directive (EU) 797/2016 ([1]) together with Art. 10 of Commission Regulation (EU) 796/2016 ([2]), we would like to request a technical opinion concerning train detection systems.

Within CCS TSI ([3]) the parts of train detection (table 4.1) consist of

- the basic parameter for train detection systems defined in point 4.2.10, specifying the interface requirements between trackside train detection systems and rolling stock, related to vehicle design and operation, as well as
- the basic parameter defined in point 4.2.11 electromagnetic compatibility between rolling stock and control-command and signalling trackside equipment, specifying the interface requirements for electromagnetic compatibility between rolling stock and trackside train detection equipment. Detailed requirements are furthermore provided in ERA/ERTMS/033281 ([4]) referenced in index 77 of Appendix A to the Annex of CCS TSI ([5]).

([1]) Directive (EU) 2016/797 of the European Parliament and of the Council of 11 May 2016 on the interoperability of the rail system within the European Union, OJ L 138, 26.5.2016, pp. 44–101

([2]) Regulation (EU) 2016/796 of the European Parliament and of the Council of 11 May 2016 on the European Union Agency for Railways and repealing Regulation (EC) No 881/2004 OJ L 138, 26.5.2016, pp. 1–43

([3]) Directive (EU) 2016/797 of the European Parliament and of the Council of 11 May 2016 on the interoperability of the rail system within the European Union (recast), OJ L 138, 26.5.2016, pp. 44–101

([4]) INTERFACES BETWEEN CONTROL-COMMAND AND SIGNALLING TRACKSIDE AND OTHER SUBSYSTEMS, https://www.era.europa.eu/system/files/2023-09/index077_-_ERA_ERTMS_033281_v5.pdf [14/10/2025]

([5]) Commission Implementing Regulation (EU) 2023/1695 of 10 August 2023 on the technical specification for interoperability relating to the control-command and signalling subsystems of the rail system in the European Union and repealing Regulation (EU) 2016/919, OJ L 222, 8.9.2023, pp. 380–560

Commission européenne/Europese Commissie, 1049 Bruxelles/Brussel, BELGIQUE/BELGIË – Tel. +32 22991111
Office: DM28 04/111 – Tel. direct line +32 229-86851

[redacted]

Train detection systems can be axle counters, track circuits and for specific applications like level crossings, also so-called loops. Only the axle counters are specified as interoperability constituents in chapter 5, Compare table 5.2 index 7, whereas in the ERA/ERTMS/033281 document requirements for harmonised track circuits are defined as well. The different treatment of axle counters as compared to the other train detection systems allegedly leads to different treatment in the authorisation process of the respective trackside assets, leading notably to a multiplication of testing and certification by different conformity assessment bodies.

The Commission identifies this lack of coherence as a deficiency in CCS TSI and therefore requests the Agency to issue an ERA technical opinion in accordance with Art. 6 Commission Directive (EU) 797/2016 and Art. 10 (2) and 19(1) of Commission Regulation (EU) 796/2016 ([6]), with the following objectives:

1. Advise the Commission on the identification of the target train detection system(s) that allows a harmonised, cost-efficient, trackside implementation trackside and the reduction of compliance requirements related to rolling stock ("exported constraints").
2. Analyse the current definition of interoperability constituents related to train detection systems and how the notion of interoperability constituents could be extended to other train detection systems to support a harmonised national authorisation process and independent certification for off-the shelf products.
3. Moreover, the opinion shall deliver acceptable means of compliance for all train detection systems defined as interoperability constituent(s), which can be integrated in CCS TSI under a future revision as harmonised requirements and assessment methods, guiding certification to be used in future vehicle authorisation process.

Please provide us with the respective technical opinion(s) by 31 March 2026.

Yours sincerely,

[redacted]

[redacted]

[redacted]

([6]) Regulation (EU) 2016/796 of the European Parliament and of the Council of 11 May 2016 on the European Union Agency for Railways and repealing Regulation (EC) No 881/2004; OJ L 138, 26.5.2016, pp. 1–43