Application of the TSIs INF,ENE and SRT

II JORNADAS DE CERTIFICAÇÃO FERROVIÁRIA

27.03.2025 Porto – Portugal Pedro MESTRE

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Structural and functional barriers

- Railways have greater or lesser interoperability depending on their conformity to standards of track gauge, couplings, brakes, signalling, communications, loading gauge, operating rules, etc.

- The EU **Technical Specifications for Interoperability** (TSIs) aim at removing these obstacles

Technical Specifications for Interoperability

- The TSIs are EU Regulations
- The TSIs are **NOT a design manual**
- The TSIs are as concise as possible, as extensive as necessary
  - only technical aspects critical for interoperability
  - only functional requirements, no specific technical solutions
- TSIs may refer to (part of) EU standards, making them compulsory
- The TSIs cover both structural and functional aspects of the railway system

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Scope of Fixed installations TSIs

- TSIs are not a manual on how to build a subsystem;
- TSIs contain only requirements, which have to be harmonized at EU level and are important for interoperability – mainly interfaces with RST;
- There are MANY of other technical, safety requirements – not in TSIs- which have to be fulfilled by ANY (not only interoperable) railway system and ANY construction;
- Fixed installations are “constructions” which have to fulfil the construction code requirements, procedures and other legislation;
- It is not possible to build any fixed installations based on and put in service only on the TSIs basis.

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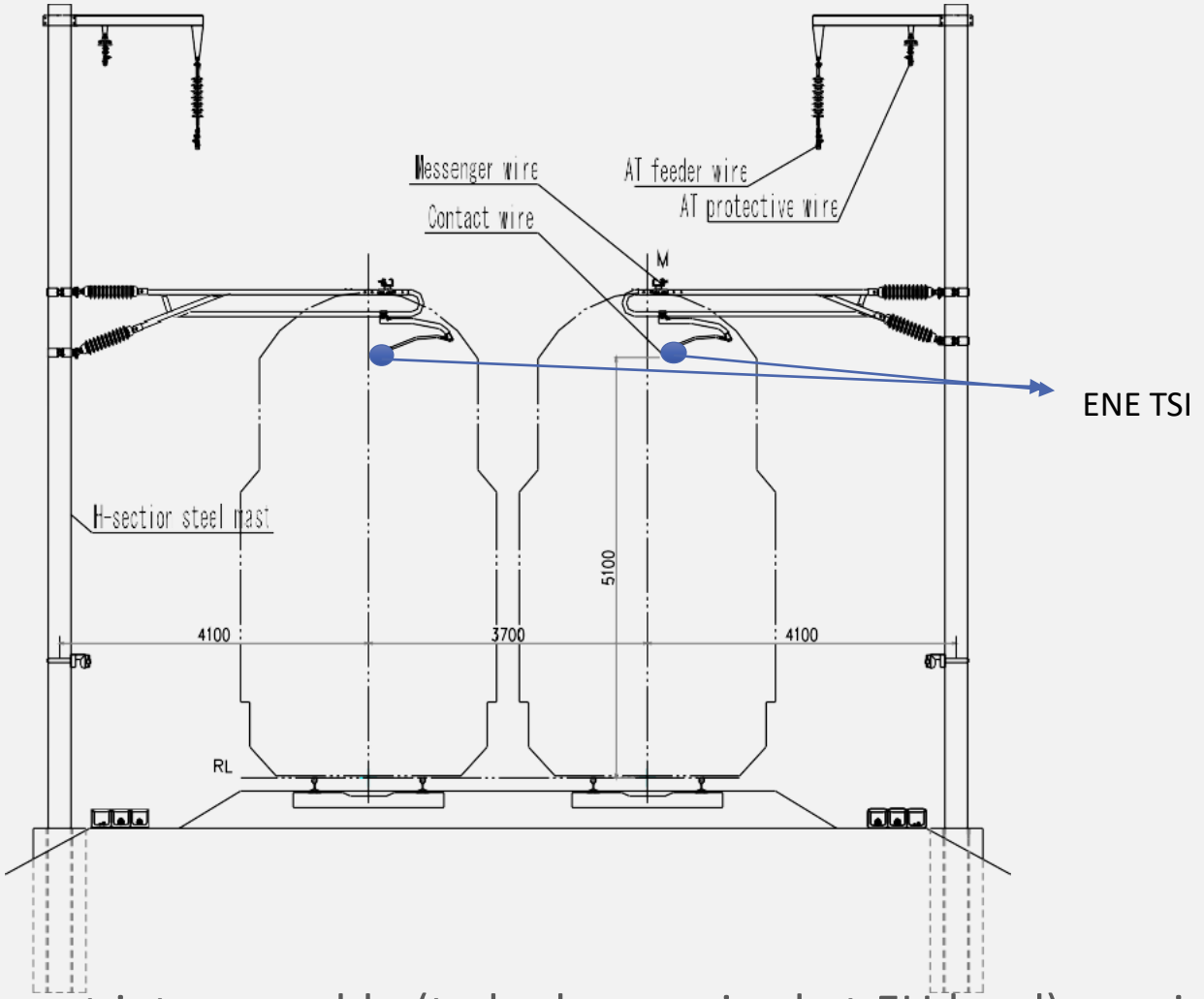
TSI ENE (e.g. OCL)



ENE TSI sets out interoperable (to be harmonised at EU level) requirements for the ENE subsystem.

Other requirements and rules, aspects of performance of a whole (or part) railway system, which contains several other elements and has influence on other (not railway) systems, are beyond the TSIs scope.

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New infrastructure and energy subsystems

No transition regime apply to INF and ENE TSIs – Application since **28 September 2023**

- TSI INF - 7.2 Application of this TSI to a **new infrastructure subsystem**:
  - (1) For a new infrastructure subsystem, the application of this TSI shall be compulsory.
  - (2) A 'new infrastructure subsystem' means an infrastructure subsystem placed into service after 28 September 2023 which creates a route or a part of a route where none currently exists.

    Any other infrastructure subsystems shall be considered as '**existing infrastructure subsystems**'
- TSI ENE - 7.2 Application of this TSI to a **new energy subsystem**:
  - (1) For a new energy subsystem, the application of this TSI shall be compulsory.
  - (2) A 'new energy subsystem' means an energy subsystem placed into service after 28 September 2023, which is created where no traction power supply and OCL previously existed.

    Any other energy subsystem shall be considered as an '**existing energy subsystem**'.

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TSI SRT

- TSI SRT - 7.1 Application of this TSI to a **new subsystem**:

  TSI is applicable to all subsystems in its scope which are placed into service after the date of application of this TSI, except when defined otherwise

- TSI SRT - 7.2 Application of this TSI to **subsystems already in service**:

  In case of the upgrade or renewal of a tunnel, according to Article 15(7) and Annex IV of Directive (EU) 2016/797, the notified body issues certificates of verification for those parts of the subsystem composing the tunnel under the scope of the upgrade or renewal.

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Application of INF and ENE TSIs to existing subsystems

- **Implementation of policy for the events of “upgrading”**

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Implementation of policy for the events of “upgrading”

Objective:

Using the “upgrading” events in infrastructure and/ or energy existing subsystems as an opportunity to streamline a TSI compliant fixed installation, in a more effective way.

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Cases considered as upgrading and not as the placing into service of a new infrastructure and/or energy subsystem

In 7.2 (3) of both INF and ENE TSIs:

- (a) the realignment of part of an existing route;
- (b) the creation of a bypass;
- (c) the addition of one or more tracks on an existing route, regardless of the distance between the original tracks and the additional tracks.

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Performance criteria of the infrastructure subsystem

In addition to the cases referred to in point 7.2.(3), **‘upgrading’ is a major modification work** of an existing infrastructure subsystem **resulting in at least compliance with one additional traffic code or a change in the declared combination of traffic codes** (referred to Table 2 and Table 3 in point 4.2.1).

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Performance criteria of the energy subsystem

In addition to the cases referred to in point 7.2.(3), **‘upgrading’ is a major modification work** of an existing energy subsystem **resulting in an increase of the line speed of more than 30km/h**.

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Application of the TSI to the existing infrastructure or energy subsystem

For the **upgraded infrastructure or energy subsystem**, **the application of the TSI* shall be compulsory**, and **applied to the upgraded subsystem within the geographical coverage of the upgrading**. The geographical coverage of the upgrading shall be defined based on locations on tracks and metric references and shall result in the compliance of all basic parameters of the infrastructure or energy subsystem associated with the tracks that are subject to the upgrading of the subsystem.

*TSI INF for the case of upgrading of infrastructure subsystem and TSI ENE for the case of the upgrading of energy subsystem.

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Application of the TSI to the existing infrastructure or energy subsystem

In the event of a change other than an upgrading of the existing subsystem, the application of the TSI* for each basic parameters (referred to in point 4.2.2) affected by a change shall be compulsory when the change requires to carry out a **new 'EC' verification procedure** in accordance with **Implementing Regulation (EU) 2019/250***. **Provisions defined in Articles 6 and 7 of Implementing Regulation (EU) 2019/250 shall apply.**

***TSI INF for the case of the infrastructure subsystem and TSI ENE for the case of the energy subsystem.

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“Categorisation of lines”

- **TSI Categories of line**
- **Open Points** closed in **Appendix E**

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TSI Categories of lines
Changes in Table 2 and 3

Table 2

Infrastructure performance parameters for passenger traffic

– Route compatibility checks are subject to point 4.2.2.5 and Appendix D.1 of the OPE TSI

Traffic code	Structure gauge	Axle load [t]	Line speed [km/h]	Usable length of platform [m]
P1	*GC*	*17(1) / 21.5(2)*	*250-350*	*400*
P2	GB	20(1)/ 22.5(2)	200-250	200-400
P3	DE3	22,5(3)	120-200	200-400
P4	GB	22,5(3)	120-200	200-400
P5	GA	20(3)	80-120	50-200
P6	G1	12(3)	n.a.	n.a.
P1520	S	22,5(3)	80-160	35-400
P1600	IRL1	22,5(3)	80-160	75-240

(1) Minimum required values of axle load to be used for checks of bridges using a dynamic appraisal, based on design mass in working order for power heads and locomotives and operational mass under normal payload for vehicles capable of carrying a payload of passengers or luggage (mass definitions in accordance with the specification referenced in Appendix T Index [1].

(2) Minimum required values of axle load to be used for checks of infrastructure using a static loading, based on design mass under exceptional payload for vehicles capable of carrying a payload of passengers or luggage (mass definitions in accordance with the specification referenced in Appendix T Index [1] with regard of the specification referenced in Appendix T Index [2]). This axle load may be linked to limited speed.

(3) To be used for checks of infrastructure used for static loading, based on design mass in working order for power heads and locomotives and design mass under exceptional payload for other vehicles (mass definitions in accordance with the specification referenced in Appendix T Index [1] with regard of the specification referenced in Appendix T Index [2]). This axle load may be linked to limited speed.

Table 3

Infrastructure performance parameters for freight traffic

Route compatibility checks are subject to point 4.2.2.5 and Appendix D.1 of the OPE TSI

Traffic code	Structure gauge	Axle load [t]	Line speed [km/h]	Train length [m]
F1	GC	22,5(1)	100-120	740-1050
F2	GB	22,5(1)	100-120	600-1050
F3	GA	20(1)	60-100	500-1050
F4	G1	18(1)	n.a.	n.a.
F1520	S	25(1)	50-120	1050
F1600	IRL1	22,5(1)	50-100	150-450

(1) To be used for static checks of infrastructure, based on design mass in working order for power heads and locomotives and design mass under normal payload for other vehicles (mass definitions in accordance with the specification referenced in Appendix T Index [1]). This axle load may be linked to limited speed.

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TSI Categories of lines
New Table 2

Axle load values for P1 and P2 **cover** both dynamic and static based loadings requirements:

P1: 17 t (checks of bridges)

P1: 21.5 t (checks of infrastructure)

P2: 20 t (checks of bridges)

P2: 22.5 t (checks of infrastructure)

Table 2

Infrastructure performance parameters for passenger traffic

– Route compatibility checks are subject to point 4.2.2.5 and Appendix D.1 of the OPE TSI

Traffic code	Structure gauge	Axle load [t]	Line speed [km/h]	Usable length of platform [m]
P1	*GC*	*17(1) / 21.5(2)*	*250-350*	*400*
P2	GB	20(1)/ 22.5(2)	200-250	200-400
P3	DE3	22,5(3)	120-200	200-400
P4	GB	22,5(3)	120-200	200-400
P5	GA	20(3)	80-120	50-200
P6	G1	12(3)	n.a.	n.a.
P1520	S	22,5(3)	80-160	35-400
P1600	IRL1	22,5(3)	80-160	75-240

(1) Minimum required values of axle load to be used for checks of bridges using a dynamic appraisal, based on design mass in working order for power heads and locomotives and operational mass under normal payload for vehicles capable of carrying a payload of passengers or luggage (mass definitions in accordance with the specification referenced in Appendix T Index [1].

(2) Minimum required values of axle load to be used for checks of infrastructure using a static loading, based on design mass under exceptional payload for vehicles capable of carrying a payload of passengers or luggage (mass definitions in accordance with the specification referenced in Appendix T Index [1] with regard of the specification referenced in Appendix T Index [2]). This axle load may be linked to limited speed.

(3) To be used for checks of infrastructure used for static loading, based on design mass in working order for power heads and locomotives and design mass under exceptional payload for other vehicles (mass definitions in accordance with the specification referenced in Appendix T Index [1] with regard of the specification referenced in Appendix T Index [2]). This axle load may be linked to limited speed.

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Classification of existing structures
Appendix E

- For **passenger traffic** 2 new tables:

  Table 38A - Loading capability requirements for bridges

  Table 38B - Loading capability requirements for geotechnical structures including earthworks

- For **freight traffic** 2 new tables:

  Table 39A - Loading capability requirements for bridges

  Table 39B - Loading capability requirements for geotechnical structures including earthworks

- In all tables the types of traffic are now presented in **two columns:**
  - **Traffic with loco hauled trains;**
  - **Traffic with Electric or Diesel Multiple units, Power Units and Railcars;**

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Closed Open points
Appendix E

Traffic with **Multiple units**:

- **P1** and **P2** open points closed: (**HSLM** + EN Line category/speed or **HSLM** + LM71 to cover dynamic and static based loading requirements)
- **P3a** and **P4a** open points closed: (**Load length L** of the bridge element + EN Line category/speed)
- **Appendix D1 of OPE TSI** to be used where HSLM cannot be achieved – see Note 8

Table 38A - Loading capability requirements for bridges and additional requirements due to dynamic effect – Passenger traffic

Traffic code	Traffic with loco hauled trains: Passenger trains including Carriages (Coaches, Vans and Car Carriers) and Light Freight Wagons and Locomotives and Power Heads[2][3][5][6][4]	Traffic with Electric or Diesel Multiple Units, Power Units and Railcars [2][5][4]
P1	n.a.[7]	HSLM [8] and D2-200 or HSLM [8] and LM71 with $\alpha = 1.0$[14]
P2	HSLM [8] and D2-200 Or HSLM [8] and LM71 with $\alpha = 0.91$[14]	HSLM [8] and D2-200 Or HSLM [8] and LM71 with $\alpha = 0.91$[14]
P3a (> 160 km/h)	L≥4m D2-100 and L<4m D2-200[9][10][15]	L≥4m C2-100 and L<4m C2-200[9][15]
P3b	L≥4m D2-100	L≥4m D2-100

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Codification for combined transport

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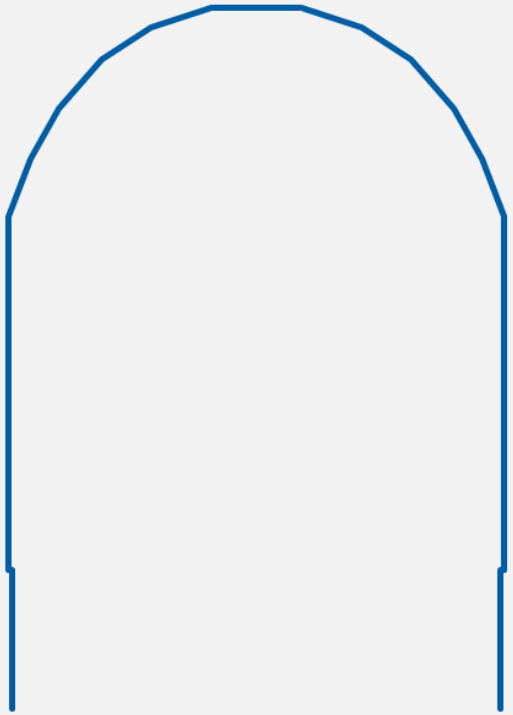
The issue of combined transport

The gauge reference profile



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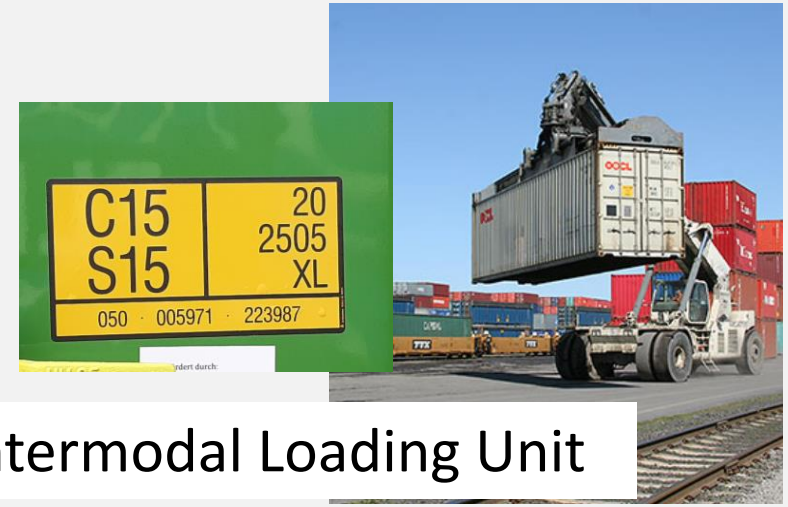
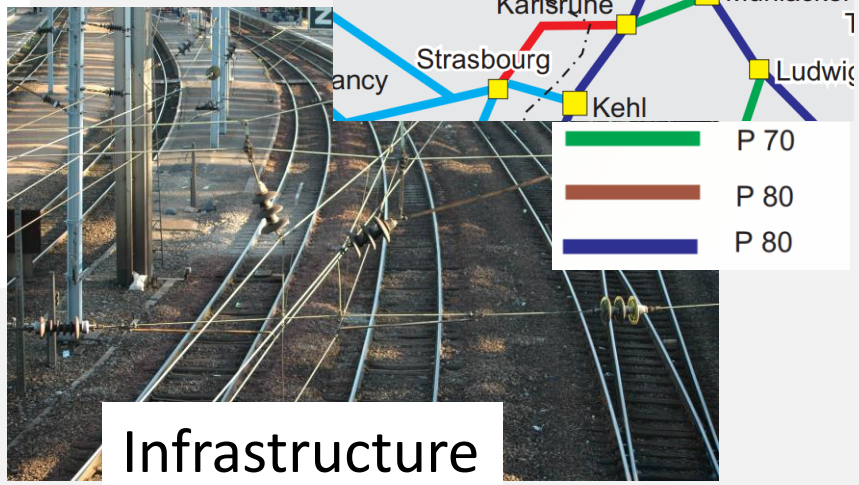
Solution: another codification system



Intermodal Loading Unit

Operations



Infrastructure

Wagon

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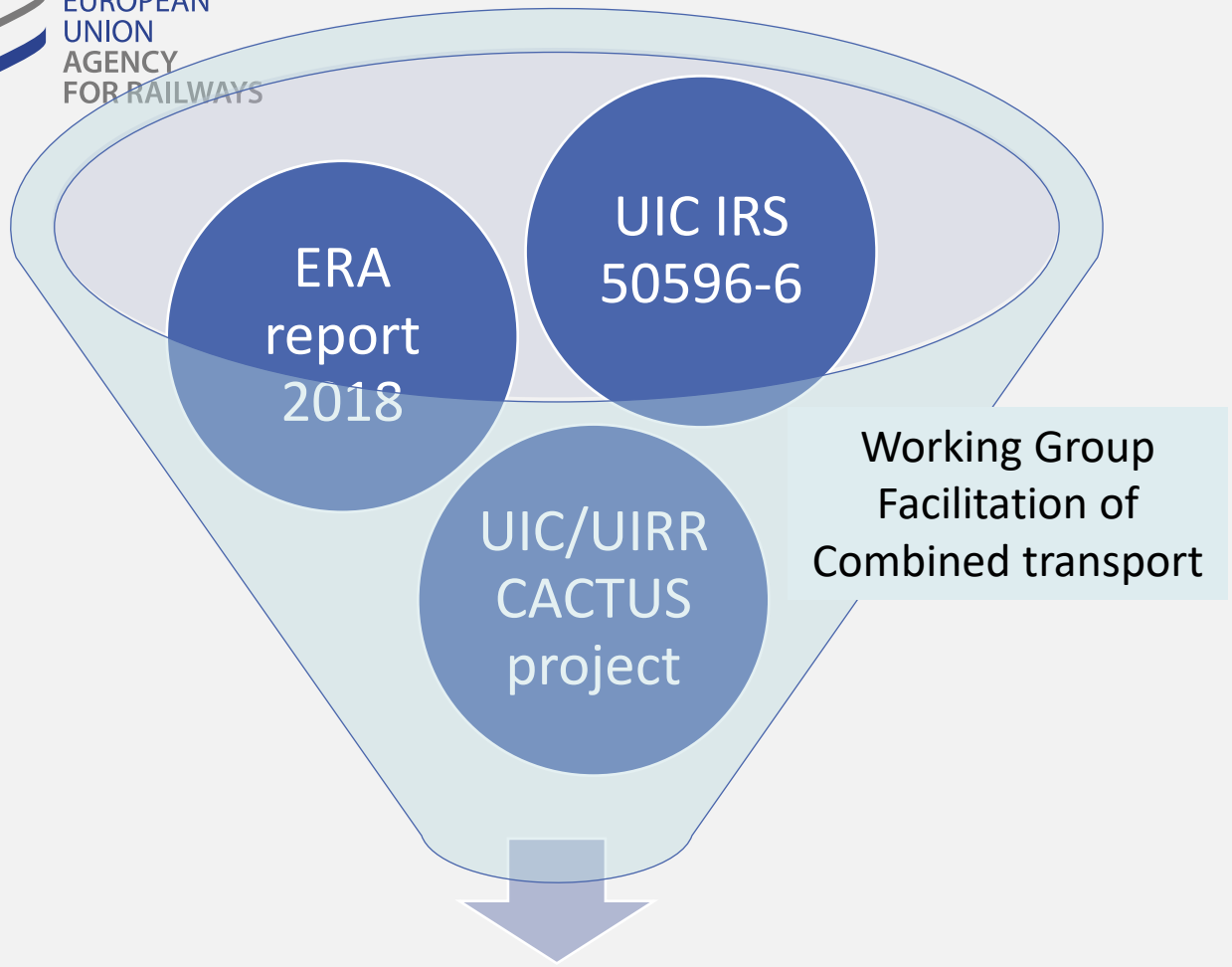

Amendments of TSI WAG, INF, OPE

Amendment of RINF

Technical document ERA/TD/2023-01/CCT

Application guide specific to the codification for combined transport

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Evolution of the ENE TSI to facilitate the charging of traction batteries

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Evolution of the ENE TSI to facilitate the charging of traction batteries

PROBLEM:

ENE TSI, section 4.2.5 and LOC&PAS TSI, section 4.2.8.2.5, limit the maximum current at standstill and it limits the charging capacity for battery trains

"4.2.5 Current at standstill

The OCL shall be designed to sustain at least the values of current at standstill per pantograph, in accordance with the specification referenced in Appendix E, Index [2].";

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Evolution of the ENE TSI to facilitate the charging of traction batteries

SOLUTION:

Include reference to new version of standard EN50367:2012+A1:2022 in both TSIs

Limit values of current at standstill can be exceeded for battery trains when charging

(3) For trains equipped with electric energy storage for traction purposes:

– The maximum current per pantograph at vehicle standstill in DC systems can be exceeded only for charging electric energy storage for traction, in allowed locations and under the specific conditions defined in the register of infrastructure. Only in that case, it shall be possible for a unit to enable the capacity to exceed the maximum current at standstill for DC systems.

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Multiple pantograph operation (more than 2)

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Multiple pantograph operation (more than 2)

Design of the OCL and pantograph distribution
in case of multiple pantograph operation (more than 2):

Analysis of rules in different Member States

Analysis of results from measurements and simulations

Check of actual TSI regarding necessary improvements

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Multiple pantograph operation (more than 2)

It was concluded that more measurements/simulations are necessary to finally define TSI adjustments

Definition of necessary future research steps for general use of proposed rules

Adjustment in the text for a consistent use:

- ENE TSI, sections 4.2.12 and 4.2.13
- LOC&PAS TSI, sections 4.2.8.2.9.7 and 6.2.3.21

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Harmonics and dynamic effects

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Harmonics and dynamic effects

Update of:

- TSI ENE section 4.2.8 Harmonics and dynamic effects for AC traction power supply systems
- TSI LOC&PAS section 4.2.8.2.7 Harmonics and dynamic effects for AC systems

with the reference to new version of EN 50388-1:2022

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Harmonics and dynamic effects

Main improvements:

- Update to last state of art in the subject
- It opens the possibility to use common codes of practices alternatively to the compatibility study (subject to complete development of series EN 50388)

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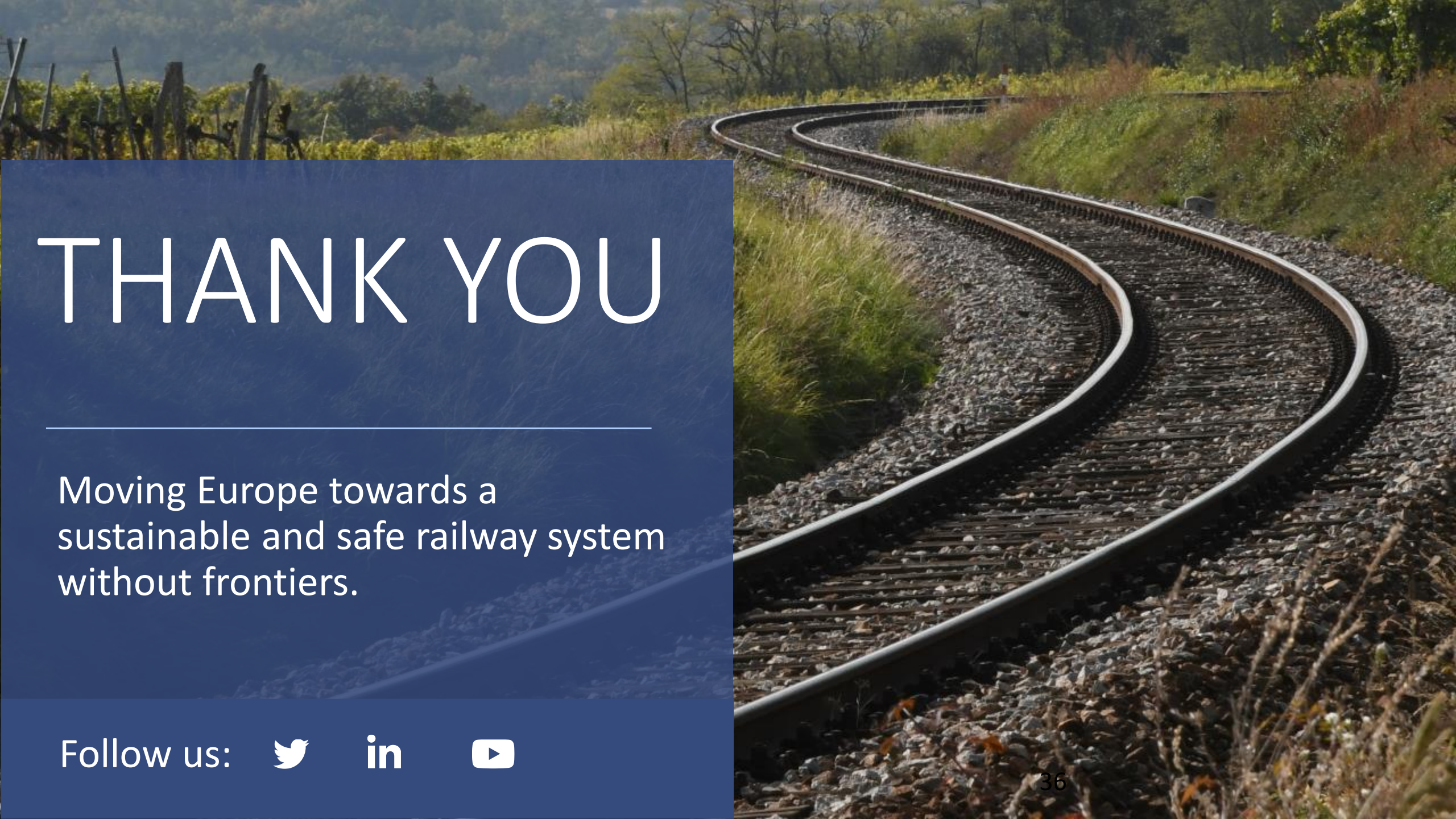

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