Scope and content of TSIs on structural subsystems

Part 3 – TSIs related to fixed installations

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1. Applicable to **all new, upgraded or renewed** (‘infrastructure’ or ‘energy’) subsystems of the rail system in the European Union as defined in point 2.1 of Annex I to Directive 2008/57/EC.

2. The TSI shall not apply to existing infrastructure of the rail system in the European Union, except when it is subject to renewal or upgrading in accordance with Article 20 of Directive 2008/57/EC and Section 7.3 of the Annex.

3. The TSI shall apply to the following networks:
   a) the **trans-European conventional rail system network (TEN)** as defined in Annex I, point 1.1 of Directive 2008/57/EC;
   b) the **trans-European high-speed rail system network** as defined in Annex I, point 2.1 of Directive 2008/57/EC;
   c) other parts of the network of the rail system in the Union;
   and excludes the cases referred to in Article 1(3) of Directive 2008/57/EC.

4. The TSI shall apply to networks with the following **nominal track gauges**: 1435 mm, 1520 mm, 1524 mm, 1600 mm and 1668 mm.

5. **Metric gauge is excluded from the technical scope of this TSI.**
TSI INF

technical specifications for interoperability relating to the ‘infrastructure’ subsystem of the rail system in the European Union
What is covered by the **Infrastructure Subsystem**?

**DIRECTIVE 2008/57/EC**
as amended by 2011/18/EU

**2.1. Infrastructure**
The track, points, engineering structures (bridges, tunnels, etc.), associated station infrastructure (platforms, zones of access, including the needs of persons with reduced mobility, etc.), safety and protective equipment.
The TSI category of line shall be a combination of traffic codes. For lines where only one type of traffic is carried (for example a freight only line) a single code can be used to describe the requirements; where mixed traffic runs the category will be described by one or more codes for passenger and freight. The combined traffic codes describe the envelope within which the desired mix of traffic can be accommodated.

- no differentiation between High Speed and Conventional Railway lines
- no distinction between lines of TEN and Off-TEN network
- Classification now includes the type of traffic and the value of performance parameter (e.g. ‘P4’)
- no distinction between “new” and “upgraded” lines
- performance parameters as set out in the CR INF TSI are suitable

### Table 2: Performance parameters for passenger traffic

<table>
<thead>
<tr>
<th>Traffic code</th>
<th>Gauge</th>
<th>Axle load [t]</th>
<th>Line speed [km/h]</th>
<th>Usable length of platform [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>GC</td>
<td>17*</td>
<td>250-350</td>
<td>400</td>
</tr>
<tr>
<td>P2</td>
<td>GB</td>
<td>20*</td>
<td>200-250</td>
<td>200-400</td>
</tr>
<tr>
<td>P3</td>
<td>DE3</td>
<td>22.5**</td>
<td>120-200</td>
<td>200-400</td>
</tr>
<tr>
<td>P4</td>
<td>GB</td>
<td>22.5**</td>
<td>120-200</td>
<td>200-400</td>
</tr>
<tr>
<td>P5</td>
<td>GA</td>
<td>20**</td>
<td>80-120</td>
<td>50-200</td>
</tr>
<tr>
<td>P6</td>
<td>G1</td>
<td>12**</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>P1520</td>
<td>S</td>
<td>22.5**</td>
<td>80-160</td>
<td>35-400</td>
</tr>
<tr>
<td>P1600</td>
<td>IRL1</td>
<td>22.5**</td>
<td>80-160</td>
<td>75-240</td>
</tr>
</tbody>
</table>

### Table 3: Performance parameters for freight traffic

<table>
<thead>
<tr>
<th>Traffic code</th>
<th>Gauge</th>
<th>Axle load [t]</th>
<th>Line speed [km/h]</th>
<th>Train length [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>GC</td>
<td>22.5**</td>
<td>100-120</td>
<td>740-1050</td>
</tr>
<tr>
<td>F2</td>
<td>GB</td>
<td>22.5**</td>
<td>100-120</td>
<td>600-1050</td>
</tr>
<tr>
<td>F3</td>
<td>GA</td>
<td>20**</td>
<td>60-100</td>
<td>500-1050</td>
</tr>
<tr>
<td>F4</td>
<td>G1</td>
<td>18**</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>F1520</td>
<td>S</td>
<td>25**</td>
<td>50-120</td>
<td>1050</td>
</tr>
<tr>
<td>F1600</td>
<td>IRL1</td>
<td>22.5**</td>
<td>50-100</td>
<td>150-450</td>
</tr>
</tbody>
</table>

Codes P1 to P5 and F1 to F2 are generally intended to be applied to TEN lines. P6 and F4 are intended to be the minimum requirements for Off TEN lines: it does not exclude the possibility to apply any other traffic code for Off TEN Lines. P1520 and F1520 are specifically for on 1520 mm track gauge system. P1600 and F1600 are specifically for on 1600 mm track gauge system.
TSI INF: Chapter 4. Technical requirements

INF subsystem

Line Layout
- Track Parameters
- Switches & Crossing
- Track resistance to applied loads
- Structure resistance to traffic loads
- Immediate action limits on track geometry defects

Platforms
- Health, safety and environment
- Provision for operation
- Fixed installations for servicing trains
- Maintenance rules
In case of **INF TSI**, the following **Interoperability Constituents (ICs)** are defined:

- ✓ The rail (5.3.1)
- ✓ The rail fastening systems (5.3.2)
- ✓ Track sleepers (5.3.3)

**Clause 5.3** defines the specifications of rail, rail fastening systems and track sleepers as ICs, and **clause 6.1** defines the conformity assessment procedures.
1. Requirements for the design of track, including switches and crossings, which are compatible with the use of eddy current braking systems (4.2.6.2.2)

2. Minimum factor alpha ($\alpha$) for Traffic codes P1520 and F1520 (4.2.7.1.1)

3. Immediate action limits for isolated defects in alignment for speeds of more than 300 km/h (4.2.8.1)

4. Immediate action limits for isolated defects in longitudinal level for speeds of more than 300 km/h (4.2.8.2)

5. The minimum allowed value of distance between track centres for the uniform structure gauge IRL3 is an open point (7.7.18.2)

6. EN Line Category – Associated Speed [km/h] for Traffic codes P1, P2, P3a, P4a, P1520, P1600, F1520 and F1600 (Appendix E, tables 36 and 37)

7. EN Line Category – Associated Speed [km/h] for Traffic codes P1, P2, P1600 and F1600 (Appendix F, tables 38 and 39)

8. Rules and drawings related to gauges IRL1, IRL2 and IRL3 are an open point (Appendix O)

9. Requirements for mitigating the risk related to the “ballast pick up” phenomenon (point 4.2.10.3) (open point also in the LOC&PAS TSI)
TSI ENE

technical specifications for interoperability relating to the 'energy'
subsystem of the rail system in the European Union
What is covered by the Energy Subsystem?

**DIRECTIVE 2011/18/EU**

2.2. *Energy*

The electrification system, including overhead lines and the trackside of the electricity consumption measuring system.
ENE subsystem

Power supply requirements
- Voltage and frequency
- Supply system performance
- Current capacity, DC systems, trains at standstill
- Regenerative braking
- Electrical protection coordination arrangements
- Harmonics and dynamic effects for AC systems

Geometry of the OCL and quality of current collection
- Geometry of OCL
- Pantograph gauge
- Mean contact force
- Dynamic behaviour and quality of current collection
- Pantograph spacing
- Contact wire material
- Phase separation sections
- System separation sections

On-ground energy data collecting system

Protective provisions against electric shock
POWER SUPPLY SYSTEM 7.2.2

The choice is a **MS competence**.
The decision should be taken on **economic** and **technical** grounds, taking into account at least:

- The *existing* power supply system in the MS;
- Any *connection* to railway line in *neighbouring countries* with an existing electrical power supply;
- Power demand.

New lines with speed greater than **250 km/h** shall be supplied with one of the AC systems as defined in point 4.2.3. of the TSI.
Implementation rules for 1435 mm

- **New lines** with speed $>250$ km/h shall accommodate both 1600 mm and 1950 mm pantographs (*at least 1600mm*)

- **Renewed or upgraded lines** with speed $\geq 250$ km/h shall accommodate *at least* 1600 mm pantograph.

- **Other cases**: the OCL shall be designed for use by *at least one of* the pantographs: 1600 mm or 1950 mm.

- **Track gauge systems different than 1435mm**

  - The OCL shall be designed for use by at least one of the 3 pantographs: 1600 mm or 1950 mm or 2260 mm.
Within 2 years after the ‘open point’ (specification related to interface protocols between EMS and DCS and transferred data format) is closed, Member States shall ensure that an on-ground energy data collecting system capable to exchange compiled energy billing data (CEBD) will be implemented.
TSI CCS

technical specification for interoperability relating to the control-command and signalling subsystems of the trans-European rail system
The CCS TSI specifies requirements for two subsystems: **CCS on-board** and **CCS Track-side**, to be authorised separately.

The CCS TSI in force (2012/88/EU) applies to the TEN network (HS and CR). The amendment voted in June 2014 extends the scope to the whole EU network, with the exclusion of:

- “...the cases referred to in Article 1(3) of Directive 2008/57/EC”
- “...short border crossing lines with 1520 mm track gauges that are connected to the network of third countries”

To take into account the normal practice when CCS is upgraded in existing track-side and vehicles, the CCS subsystems are subdivided in “parts” that can be installed and authorised separately:

- **CCS On-board** is subdivided in *train protection* (ETCS) and *radio communication* (GSM-R)
- **CCS Track-side** is subdivided in *train protection* (ETCS), *radio communication* (GSM-R) and *train detection*
Chapter 3 of the CCS TSI describes the **essential requirements** applicable to the on-board and trackside CCS subsystems:
- Where an aspect is already covered by EU and/or national legislation compatible with interoperability, the CCS TSI does not repeat requirements. This is the case, for example, of “health”.

Chapter 4 specifies the **basic parameters** that must be complied with, to respect the essential requirements while ensuring the compatibility between on-board and track-side, necessary to allow “uninterrupted train movement”:
- The basic parameters specify **functions** (that must be implemented on-board and/or track-side), **interfaces** between on-board and track-side CCS subsystems and **performance** that must be respected by the CCS subsystems.

Chapter 4 makes reference to legally binding specifications listed in Annex A of the CCS TSI:
- For **train protection** the specifications of ETCS are referenced;
- For **radio communication** the specifications of GSM-R are referenced;
- For **train detection** a specification is referenced, containing the values of parameters which are relevant for compatibility with vehicles.
The Agency is taking care, through the *Change Control Management* procedures, of the necessary error correction and functional evolution of ETCS and GSM-R:

- This is a continuous activity, based on return of experience and technological development; it is planned in close cooperation with stakeholders (Memorandum of Understanding)
- Note: to permit a smooth evolution, it is still possible to install ETCS “baseline 2” or the new “baseline 3”. Vehicles equipped with “baseline 3” ETCS can run on “baseline 2” ETCS track-side (backward compatibility)

In particular, work is in progress to manage the evolution of radio communication, in view of the future obsolescence of GSM.

For train detection systems (axle counters, track circuits) the CCS TSI only specifies compatibility requirements with vehicles:

- Several parameters are harmonised (e.g. dimensions of wheels, distances between them, etc.). Other parameters are still open points (harmonics in traction currents; work is in progress in cooperation with research activities like EUREMCO)
- CCS TSI establishes requirements on train detection systems; LOC&PAS and WAG TSIs establish corresponding requirements for vehicles, making reference to the same parameters (specification listed as Index 77 in Annex A to CCS TSI)
Chapter 5 of the CCS TSI specifies the Interoperability Constituents

Chapter 6 of the CCS TSI sets requirements for the certification of interoperability constituents and the verification of on-board and track-side CCS subsystems:
- List of checks to be performed
- *Modules* that can be applied (possible selection between “CB + CD or CF” and “CH1” for Interoperability Constituents, and “SB + SD or SF” and “SH1” for subsystems. For track-side subsystem also selection of “SG” is possible).

Chapter 7 of the CCS TSI specifies the rules for implementation:
- Conditions are specified where, in case of upgrades or major works, *train detection* must be made compliant with CCS TSI compatibility requirements
- specification of *train protection* legacy systems are “frozen”; reference to the **ERTMS Deployment plan** is made; in addition, ETCS is mandatory for
  - new and upgraded train protection in HS lines and vehicles or in EU-funded projects
  - new vehicles
- GSM-R must be installed in case of new installations or upgrade of *radio communication* track-side and on vehicles intended to run on lines equipped with GSM-R (note: GSM-R data communication is required only where ETCS level 2 or 3 is installed)
Thank you!