EUROPEAN UNION AGENCY FOR RAILWAYS

Making the railway system work better for society.

OPINION

ERA/OPI/2024-6

OF THE EUROPEAN UNION AGENCY FOR RAILWAYS

for

THE EUROPEAN COMMISSION

regarding

Opinion on vehicles subject to innovative solution in accordance with Article 10 (3) of Commission Regulation (EU) No 1302/2014 (Loc&Pas TSI) related to the use of EPS wheel profile

1. General Context

1.1. Introduction

With its letter referenced Ares (2024)5145502 (see Annex 1) the European Commission (EC) requested the opinion of the European Union Agency for Railways (the Agency) on an innovative solution proposed by Alstom Transportation Germany GmbH in accordance with Article 10 (3) of Commission Regulation (EU) No 1302/2014[1] (containing the Loc&Pas TSI in its Annex).

On Avelia Stream SJ250 project, Alstom Transportation Germany GmbH is using the EPS wheel profile which cannot completely fulfil the limit values for equivalent conicities set out in point 6.2.3.6 of Loc&Pas TSI.

2. Legal reference

Article 10 (3) of Commission Regulation (EU) No 1302/2014[2] (Loc&Pas TSI).

3. Analysis

The proposer of the innovative solution, Alstom Transportation Germany GmbH, established in the European Union, has provided an analysis[3] to justify its choice of wheel profile declaring how it deviates from or complements to the relevant provisions of this TSI and submitted the deviations to the EC for analysis.

The EPS wheel profiles are widely used as a standard profile in Norway, Sweden, United Kingdom , Germany, and several other countries.
According to the proposer, these was developed to provide a reasonable balance between vehicle curving performance and high-speed stability. The EPS wheel profiles generate less Rolling Contact Fatigue (RCF) leading to less frequent rail grinding and rail replacement. Using the EPS can reduce maintenance costs for the railway undertaking and infrastructure manager, since such wheels provide a better contact point distribution and are more persistent due to higher lifetime.

The innovative solution assessed in this technical opinion is the use of the EPS wheel profiles on 1435mm network with rail inclination 1/20, 1/30 and 1/40 for speed up to 250 km/h.

However, when used on a rail inclination of 1/20 for speeds from 230km/h to 250km/h the EPS wheel profiles do not meet the requirements on limit value for equivalent conicity set out in points 4.2.3.4.3.1(2) and 6.2.3.6 of Loc&Pas TSI. For test scenarios 1 and 3, the equivalent conicity is up to 0.244 whereas the limit value is 0.20. The design value for equivalent conicity remains in the range of the test conditions as stated in EN 14363:2016+A2:2022 table 2.

Background information about TSI requirements for equivalent conicities for new wheel profile:

[1] Commission Regulation (EU) No 1302/2014 of 18 November 2014 concerning a technical specification for interoperability relating to the 'rolling stock — locomotives and passenger rolling stock' subsystem of the rail system in the European Union - OJ L 356, 12.12.2014, p. 228–393.
[2] Commission Regulation (EU) No 1302/2014 of 18 November 2014 concerning a technical specification for interoperability relating to the 'rolling stock — locomotives and passenger rolling stock' subsystem of the rail system in the European Union - OJ L 356, 12.12.2014, p. 228–393.
[3] attached to the EC's request to the Agency.

The requirements for limit values of equivalent conicity for rolling stock subsystem appeared in Commission Decision 2008/232/EC[4] (high speed rolling stock TSI) and, since then, remain unchanged for 1435mm networks.
The Loc&Pas TSI sets out in its point *4.2.3.4.3.1. "Design values for new wheel profiles"* the limit design values for equivalent conicity.
The requirements set out in TSI point 6.2.3.6 define the <<starting>> equivalent conicity (with unworn wheel profile). In service, wheel profiles tend to develop in the direction of increasing equivalent conicities.
Lower starting values would give more reserve for wear. The EPS profile provides a better rolling contact forces behaviour to compensate this.

The technical report *CEN/TR 17792:2022 Railway Applications - Wheel-rail contact geometry parameters - Technical report and background information about EN 15302* provides a valuable analysis on the limit values for equivalent conicity as set out in the Loc&Pas TSI.

CEN/TR 17792:2022 §6.3.4 sets forth that the standard *EN 14363:2016+A1:2018 imposes* stricter stability test conditions than those required by TSI for new wheel combined with theoretical rail profiles. The TSI starting equivalent conicity limits make difficult to use wear-adapted wheel profiles, especially for high-speed vehicles, since these profiles might start with a higher equivalent conicity that could remain stable during service. To introduce such profiles, deviations from the TSI's conicity limits might be needed. Safety may be given through monitoring systems and adjusted maintenance regimes to ensure stability. This should be demonstrated during the introduction phase.

CEN/TR 17792:2022 §6.8.2 states that EN 14363 standard requires documenting the equivalent conicity ranges covered by stability testing in the vehicle's technical documentation, as per LOC&PAS TSI and WAG TSI[5] requirements. It also recognizes that higher conicity values may occur in some networks, especially in cases involving different track gauges across member states.

There was a concern that EN 15302 allows for large tolerances in equivalent conicity results, which might conflict with the strict testing requirements of TSIs and EN 14363 standards. During the drafting of EN 14363:2016+A1:2018, it was decided to reduce the reliance on precise conicity values by focusing on dynamic on-track testing below a certain conicity and conducting separate stability tests at high conicity on a short track length.

The requirements set out in TSI point 6.2.3.6 define the <<starting>> equivalent conicity (with unworn wheel profile). In service, wheel profiles tend to develop in the direction of increasing equivalent conicities.
This is the reason why the Loc&Pas TSI point 4.2.3.4.3.*2 In-service values of wheelset equivalent conicity* is mandating a specific analysis in case of reported ride instability, in such case, the joint analysis between the Railway Undertaking and the Infrastructure Manager shall compare the equivalent conicity in service to the equivalent conicities the vehicle was designed and tested for, and not the limits for design values of equivalent conicities set out in point 4.2.3.4.3.1.

In conclusion, it is more important to test the relevant range that is important for the operation of the vehicle – not the value of the starting equivalent conicities.

[4] 2008/232/EC: Commission Decision of 21 February 2008 concerning a technical specification for interoperability relating to the rolling stock sub-system of the trans-European high-speed rail system (notified under document number C (2008) 648) - OJ L 84, 26.3.2008, p. 132–392
[5] Commission Regulation (EU) No 321/2013 of 13 March 2013 concerning the technical specification for interoperability relating to the subsystem rolling stock — freight wagons of the rail system in the European Union and repealing Decision 2006/861/EC as amended

Examination of the case: EPS wheel profiles on 1435mm network with rail inclination 1/20, 1/30 and 1/40 for speed up to 250 km/h.

The dynamic behaviour of a vehicle has a strong influence on running safety and track loading. It is an essential function for safety.

The unit shall be assessed against all the parameters of EN 14363:2016+A2:2022 mandated by point 4.2.3.4.2 and 4.2.3.4.3 of Loc&Pas TSI. The assessment shall be performed for all test conditions required by the TSI and by table 2 of EN 14363:2016+A2:2022.

The vehicles shall fulfil all the limit values mandated by TSI point 4.2.3.4.2 to ensure that running safety and track loading are appropriate to ensure safety.

As a result, the running safety and the track loading will be satisfied within a range of equivalent conicities wider that the one mandated by Loc&Pas TSI point 4.2.3.4.3.

As a matter of fact, the limit values for equivalent conicity as set out in points 4.2.3.4.3.1 and 6.2.3.6 Loc&Pas TSI will be exceeded for some test conditions (namely test condition 1 and 3). Theses limit values will be recorded in the technical documentation as specified in Loc&Pas TSI point 4.2.3.4.2(a)(3).

Furthermore:

- **the vehicle is equipped with yaw dampers to guarantee a stable running behaviour, the yaw damper failure will be tested according to EN 14363.**
- **Any case of unstable running will be detected by the Instability Monitoring System. This function fulfils the safety integrity level SIL2. In the case of an instability detection the train would be forced to slow down to be operated in a stable condition. As this system identifies instabilities regardless of the cause, it would also react if the worn wheel profile would be the reason due to its high equivalent conicities.**
- **During the introduction phase, the profile development of the wheel (due to wear) shall also be exemplary monitored till the first regular reprofiling of the wheels.**

3.1. Impact assessment

See Annex 2.

4. The opinion

The Agency is of the opinion that the application of Alstom Transportation Germany GmbH for authorising the EPS wheel profile as an innovative solution complies with the conditions in Article 10 of the TSI Loc&Pas.

The Agency is of the opinion that the proposed alternative requirements and methods allow for an authorisation of the respectively equipped vehicles. Accordingly, the EPS wheel profile can be used on 1435mm network with rail inclination 1/20, 1/30 and 1/40 for speed up to 250 km/h with the following conditions:

- The vehicle shall be fully designed and assessed against all the parameters of EN 14363:2016+A2:2022 mandated by point 4.2.3.4.2 and 4.2.3.4.3 of Loc&Pas TSI. The vehicle can deviate only from the design limits for equivalent conicity stated in Loc&Pas TSI point 6.2.3.6. but must stay in the test range provided by EN14363:2016+A2:2022.
- In addition, the following measures shall be taken:
    - The vehicle shall be equipped with yaw dampers to guarantee a stable running behaviour, the Yaw damper failure will be tested according to EN 14363**.** A failure of the system shall

lead to the reduction of the speed to avoid any instability until the system is brought back to normal functional state.

- The vehicle shall be equipped with Instability Monitoring System. This function shall fulfil, at least, the safety integrity level SIL2. In the case of an instability detection the train shall be slowed down to be operated in a stable condition. A failure of the system shall lead to the reduction of the speed to avoid any instability until the system is brought back to normal functional state.

- During the introduction phase, the profile development of the wheel (acc. to wear) and the ride instabilities shall also be exemplary monitored till the first regular reprofiling of the wheels.

A specific non coded restriction will be added to the authorisation to request a report on the profile development of the wheel (due to wear) and the ride instabilities occurred during a period of one year. In case the report is not provided or shows safety issues, the authorisation will be suspended as well as the operation of the vehicles until the situation comes back to normal.

The Loc&Pas TSI shall be amended to specify under which conditions the rolling stock is allowed to deviate from the limit design values for equivalent conicity stated in TSI point 6.2.3.6. The conclusion of the Working party on TSI revision for this matter may differ from the conclusion of the present opinion.

Valenciennes, 08/10/2024

Digitally signed by:
JOSEF DOPPELBAUER (EUROPEAN UNION AGENCY FOR RAILWAYS (ERA))
Date: 2024-10-08 12:51:41 UTC

Josef DOPPELBAUER
Executive Director

ANNEX 1: Request for technical opinion according to article 10 of Commission regulation (EU) 1302/2014

EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR MOBILITY AND TRANSPORT

Directorate C – Land
The Director

Subject: Request for technical opinion according to article 10 of Commission regulation (EU) 1302/2014

Dear Mr Doppelbauer,

Paragraph 3 of Article 10 of Commission Regulation (EU) 1302/2014 (TSI Loc&Pas) allows for a dedicated process to authorise vehicles subject to innovative solutions, not yet regulated in current EU legislation, involving as an intermediary step a technical opinion of the Agency.

Alstom Transportation Germany GmbH applies to the Commission for authorising an innovative solution in accordance with Article 10 of the TSI Loc&Pas for the vehicle authorisations of the Avelia Stream SJ250 project, registered as ERA pre-engagement case P-2023728-001 with Alstom Transportation Germany GmbH. The applicant justifies its request by confirming to the Commission that the assessment methods set out in the Annex to TSI Loc&Pas cannot be complied with, especially the requirements set out in Point 6.2.3.6 of TSI Loc&Pas specifying starting values for equivalent conicities, which cannot completely be met for the deployed wheel profile EPS with the respective assessment methods.

In a first and informal exchange, representatives of Alstom Transportation Germany GmbH, the respective project officers at the Agency and the experts of CEN/Cenelec concluded that the applicants request covers indeed an innovative solution, which could lead to an amendment of the TSI Loc&Pas in due course, should it be confirmed as relevant for the further development of the TSI.

Based on the above, the Commission requests the Agency to deliver a technical opinion within 2 months, that assesses if the application complies with the conditions in Article 10

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Annex 2

Impact Note

Regarding vehicles subject to innovative solution

Issued as per Art. 8(1) of Regulation (EU) 2016/796 and the Impact Assessment procedure adopted by the ERA Management Board (Decision n.290, 16/03/2022)

1. Context and assessment of impacts

1.1. Scope

Following a request by Alstom Transportation Germany GmbH to introduce an innovative solution pursuant to LOC & PAS TSI (EU 1302/2014) Art 10 (3), the European Commission requested ERA to draft a Technical Opinion. The request concerns the fitting of EPS wheels for the Avelia Stream SJ250 project, which cannot completely fulfil the limit values for equivalent conicities set out in point 6.2.3.6 of LOC & PAS TSI when used on a rail inclination of 1/20 with speeds from 230km/h to 250km/h.

1.2. Assessment of impacts

The analysis showed that the dynamic behaviour of the vehicle has a strong influence on running safety and track loading and found that it is more important to test the relevant range that is important for the operation of the vehicle.

The Agency is of the opinion that the EPS wheel equipped vehicles can be authorised to run under the specified conditions if, beyond the mandated basic design and assessment requirements:

- The vehicle shall be equipped with yaw dampers.
- The vehicle shall be equipped with an Instability Monitoring System
- During the introduction phase, the profile development of the wheel and the ride instabilities shall be monitored till the first regular reprofiling of the wheels.

The applicant concurs (see Annex 1). The cost of these safety measures is offset by the benefits in terms of speed, comfort, and lower maintenance costs.

1.3. Stakeholders affected

Railway undertakings (RU)	☒	Member States (MS)	☐
Infrastructure managers (IM)	☒	Third Countries	☐
Manufacturers	☒	National safety authorities (NSA)	☒
Keepers	☐	European Commission (EC)	☐
Entity Managing the Change (EMC)	☐	European Union Agency for Railways (ERA)	☒
Notified Bodies (NoBo)	☐	Shippers	☐
Associations	☐	Other (Please specify) …	☐

2. Preferred option

2.1. Conclusion

This impact note concludes that, considering the Opinion's analysis and additional conditions, the expected negative impacts are negligible whereas the benefits are acknowledged. The conditions can be reviewed in light of the anticipated amendment of LOC & PAS TSI as per Art 10(4).