EUROPEAN UNION AGENCY FOR RAILWAYS

Making the railway system work better for society.

ACCOMPANYING REPORT N. ERA-REC-127 AR TO THE RECOMMENDATION N. ERA-REC-127 OF THE EUROPEAN UNION AGENCY FOR RAILWAYS

on

Closing of Open Points and additional modifications in the Commission Regulation (EU) No. 1299/2014 of 18 November 2014 on the technical specifications for interoperability relating to the 'infrastructure' subsystem of the rail system in the European Union ('INF TSI')

Contents

1. Executive summary

The aim of this report is to provide an update on the activities that the Agency and the Infrastructure Working Party have performed after the entry into force of Commission Regulation (EU) No. 1299/2014 of 18 November 2014 on the technical specifications for interoperability relating to the 'infrastructure' subsystem of the rail system in the European Union ('INF TSI') and has to be read in conjuction with the Recommendation ERA-REC-127.

More specifically, this report and the joint Recommendation aspires to define harmonised requirements for some of the open points of the INF TSI and to provide the European Commission with a proposal for the modification of the text of the INF TSI. In addition to that, some changes to the main text of the INF TSI are proposed, mainly to improve clarity and to correct wrong references.

Points from 7.2.1 to 7.2.9 expand on the rationale behind the proposals and conclude with a recommendation to close or to keep open an 'open point' of the INF TSI.

The recommendation ERA-REC-127 provides for a proposal of amendment in the text of the INF TSI.

2. Introduction

The Project is based on the Agency Work Programme 2015, Activity 2 - Removing Technical Barriers, Project 2.2 Harmonized EU rules for networks (including all structural TSIs).

It forms part of the outcome identified with the number 40 in the Work Programme 2015, "TSI INF - Progress in the closure of open points - study reports".

Legal basis supporting this activity before the entering into force of the 4th railway package can be found in:

- Agency Regulation [3] Art. 12,
- Directive 2008/57/EC [1] Art. 6
- Commission Decision C(2010)2576 of 29th April 2010 concerning a mandate to the European Railway Agency to develop and review Technical Specifications for Interoperability with a view to extending their scope to the whole rail system in the European Union – point 2.2.1

Legal basis of the 4th Railway Package that support this activity are:

- Directive 2016/797 [8] art. 4
- Agency Regulation 2016/796 [9] art. 19
- Commission Delegated decision 2017/1474 [7] art. 3

The main objective of the activities of the Infrastructure Working Party is the closure of the following open points that are listed in Appendix R (6) of the INF TSI:

Element of the INF subsystem	Point of the INF TSI	Actions foreseen and closure feasibility
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	Compatibility with concerned network to be checked. Research project on going (ECUC). Different requirements among the MSs.
Minimum factor alpha (α) for Traffic codes P1520 and F1520	4.2.7.1.1	No agreement among MSs sharing 1520mm track gauge. Additional activities of the Structure Subgroup will be needed to validate this factor.

Immediate action limits for isolated defects in alignment for speeds of more than 300 km/h	4.2.8.1	On-going work in CEN. Closure depending on the revision of EN13848-5
Immediate action limits for isolated defects in longitudinal level for speeds of more than 300 km/h	4.2.8.2	On-going work in CEN. Closure depending on the revision of EN13848-5
The minimum allowed value of distance between track centres for the uniform structure gauge IRL3	7.7.18.2	Gauges IRL1,2 and3 are not agreed between Ireland and Northern Ireland (UK)
EN Line Category – Associated Speed [km/h] for Traffic codes P1, P2, P3a, P4a, P1520, P1600, F1520 and F1600	Appendix E, tables 38 and 39	On-going work in CEN. Closure depending on the revision of EN15528
EN Line Category – Associated Speed [km/h] for Traffic codes P1, P2, P1600 and F1600	Appendix F, tables 40 and 41	On-going work in CEN. Closure depending on the revision of EN15528.
Rules and drawings related to gauges IRL1, IRL2 and IRL3	Appendix O	Gauges IRL1,2 and3 are not agreed between Ireland and Northern Ireland (UK)
Requirements for mitigating the risk related to the "ballast pick up" phenomenon (point 4.2.10.3)	4.2.10.3 (open point also in the LOC&PAS TSI)	On-going work within CEN (for the rolling stock). Open point also in TSI LOC&PAS

3. Abbreviations

Table 1. Table of abbreviations

Abbreviation	*Description*
CEN	European Committee for standardization
CENELEC	European Committee for Electrotechnical Standardization
CER	Community of European Railway and Infrastructure Companies
CIS	Commonwealth of Independent States
CWR	Continuous Welded Rail
EC	European Commission
EIM	European Rail Infrastructure Managers
EN	European Standard
IM	Infrastructure manager
INF	Infrastructure
ECB	Eddy Current Braking system
EU	European Union
LOC&PAS	Locomotives and Passenger Carriages

Abbreviation	*Description*
MS	Member State
NSA	National Safety Authority
prEN	Draft European Standard
RfS	Requirement for a Standard (issued by the Agency)
RINF	Register of Infrastructure
SNiP	Construction codes and regulation (translated from Russian)
TSI	Technical Specification for Interoperability
The Agency	European Union Agency for Railways
WG	Working Group
WP	Working Party (organised by the Agency)

4. Reference documents

Table 2. Table of reference documents

N°	*Title*	*Reference*	*Version*
[1]	Requirement for a Standard	*No 37*	*Ver. 0.0 21.10.2010*

5. Reference legislation

Table 3. Table of reference legislation

N°	*Title*	*Reference*	*Version*
[1]	Directive 2008/57/EC of the European Parliament and of the Council of 17 June 2008 on the interoperability of the rail system within the Community (Recast)	*OJ L 91, 18.7.2008, p.1*	
[2]	Commission Directive 2011/18/EU of 1 March 2011 amending Annexes II, V and VI to the Directive 2008/57/EC of the European Parliament and of the Council of 17 June 2008 on the interoperability of the rail system within the Community	*OJ L 57, 02.03.2011, p.21*	
[3]	Regulation (EC) No 881/2004 of the European Parliament and of the Council of 29 April 2004 establishing a European Railway Agency (Agency Regulation)	*OJ L 220, 21.6.2004, p.3*	
[4]	Regulation (EC) No 1335/2008 of the European Parliament and of the Council of 16 December 2008 amending Regulation (EC) No 881/2004	*OJ L 354, 31.12.2008, p. 51*	

N°	Title	Reference	Version
	establishing a European Railway Agency (Agency Regulation)		
[5]	Commission Regulation (EU) No 1299/2014 of 18 November 2014 on the technical specification for interoperability relating to the 'infrastructure' subsystem of the rail system in the Union	*OJ L356, 12.12.2014, p.1*	
[6]	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 L356, 12.12.2014, p.228*	
[7]	COMMISSION DELEGATED DECISION (EU) 2017/1474 of 8 June 2017 supplementing Directive (EU) 2016/797 of the European Parliament and of the Council with regard to specific objectives for the drafting, adoption and review of technical specifications for interoperability	*OJ L210, 15.08.2017, p.5*	
[8]	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 L138, 26.05.2016, p.44*	
[9]	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 L138, 26.05.2016, p.1*	

6. Workgroups

The activities that held up the closure of some open points in the INF TSI have been supported by the **Infrastructure Working Party**, as already established for drafting the INF TSI.

The current composition of the Infrastructure working party is shown in Table 4

ORGANISATION	REPRESENTATIVE
CER	Frank BUCHMANN
CER	Michael WALTER
CER	Emmanuel LAURANS
EIM	Jesus POUSADA
EIM	Johan GUNNARSSON
EIM	Frode TEIGEN
UNIFE	Helmut JAEGER

UNIFE	Imrich KORPANEC
UNIFE (deputy)	Albert JOERG
UITP	Peter HAERING
NBRail	Thomas BRANDT
NBRail	Riccardo TROISI
NSA Austria	Johannes BRUNNER
NSA Denmark	Isabelle RIVAS
NSA Finland	Une TYYNILA
NSA France	Morgan POIRIER
NSA France	Cécilia LE GAL
NSA Germany	Lothar MATTNER
NSA Poland	Eugeniusz GARGAŁA
NSA Italy	Marco POGGI
NSA Italy	Pasquale SAIENNI
NSA Italy	Generoso CIOCIA
NSA Latvia	Arijs TUNKELIS
NSA Norway	Geir HAGBØ
NSA Spain	Carlos ARAUZO
NSA Spain	Antonio CORRAL PEREZ
NSA Sweden	Alexander ÖSTMAN
NSA UK	Bridget EICKHOFF
NSA UK	Luisa FREITAS

Table 4. INF WP composition

As some of these open points require specific expertise in the field of structures dynamic design, a dedicated 'Structures Task Force' has advised the Agency in order to support the INF WP in defining the requirements that would allow the closure of the above-mentioned 'Open Points'. Composition of the Structure Task force is shown in Table 5

COMPANY/ORGANISATION	NAME
SNCF	Céline ANICOTTE (from 09/2015 to 05/2016)
UPM (University of Madrid)	Jose Maria GOICOLEA
DB	Peter LIPPERT
OEBB	Manfred MAUTNER
NETWORKRAIL	Ben WILKINSON

Table 5. Structure Task – Force Composition

As some other open points are linked with the revision of EN standards, cooperation with the CEN Convenors of the WGs revising the standards, was needed.

Agency staff involved in the above mentioned activities activity is shown in Table 6

Project Officer Fixed Installation Sector – INF Team	Maurizio GRECO
Project Officer Fixed Installation Sector – INF Team	Iñigo MENDEZ CARBAJO
Head of Fixed Installation Sector.	Andrzej HARASSEK

Table 6. EU Agency for Railways staff

7. Working methods

7.1. Working Party and other meetings

Since the finalization of the INF TSI, the INF working party has met 9 times, addressing the issues of the remaining open points

Date	*Meeting*
23 October 2014	INF WP n. 22 (Kick off meeting)
12 March 2015	INF WP n. 24
18 June 2015	INF WP n.25
22 October 2015	INF WP n. 26
25 February 2016	INF WP n. 27
1 June 2016	INF WP 28 + Structure Task Force meeting n. 3
5 October 2016	INF WP 29 + Structure Task Force meeting n. 4
2nd February 2017	INF WP 30
8th June 2017	INF WP 31

A dedicated interface LOC&PAS – INF meeting has been held in March 2016, where members of both Working Parties 'Locomotives&Passengers' and 'Infrastructure' attended and in which open points that are common between INF and LOC&PAS TSI were addressed.

Date	*Meeting*
11 March 2015	Interface LOC&PAS - INF WP

The task force dedicated to tackle open points related to 'Structure' met two times, on top of the joint meeting with the INF WP:

Date	*Meeting*
30 September 2015	Structure Task Force meeting n. 1
20 January 2016	Structure Task Force meeting n. 2

For the open points that affect the 1520 track gauge system, a dedicated information session was organized in Vilnius (Lithuania), where representatives and experts from the three Baltic States (Estonia, Lithuania and Latvia) attended. Representatives of other 1520 track gauge networks (Slovak Republic and Poland) were informed via e-mail.

Date	*Meeting*
29 October 2015	Open points in the 1520 mm track gauge system - Meeting

7.2. Developments in the definition of requirements for the Open Points

7.2.1. Requirements for the design of track, including switches and crossings, which are compatible with the use of eddy current braking systems (point 4.2.6.2.2)

This open point deals with the requirements that tracks, including S&C, should comply with in order to be compatible with the use of the eddy current braking systems (ECB). More specifically, these braking systems generate in the rails additional stresses (mainly, temperature increase that results in longitudinal stress in the Continuous Welded Rail (CWR) and, to a certain extent, vertical stress) on top of those usually provoked by other braking systems. This may have a detrimental effect on lateral stability of the track, increasing then the risk of track buckling, especially in those tracks with poor lateral resistance.

There is a corresponding open point in LOC&PAS TSI.

The effects the ECB induces in the track have been extensively investigated by the 7th Framework Programme project ECUC (Eddy Current Brake Compatibility), whose detailed recommendation can be found in the deliverable D6.4 "Engineering guidelines for tracks".

Preliminary conclusions suggested that, in order to define harmonised requirements for the design of track compatible with ECB, the INF TSI should set out:

- An acceptable rail temperature increase caused by ECB.
- The possibility for the IM to define a limitation of the use of ECB.

The INF WP launched a survey among European IMs to find out how the use of this braking system is currently managed and to investigate whether the preliminary conclusions above could possibly result in the definition of requirements in the INF TSI.

A vast majority of the IMs responding to the survey have no eddy current braking systems operating on their networks. In some countries law forbids its use. In others, trains equipped with this system may circulate but ECB must be switched off. A very limited number of networks allow the use of ECB mainly for emergency braking and, to a limited extent and under specific restrictions (e.g. on slab track only, limiting the number of trains using the system and only when atmospheric condition are favourable, etc.), for service braking.
It is not possible to define harmonized requirements for an acceptable rail temperature increase caused by ECB because:

- an acceptable rail temperature increase caused by ECB is strongly dependent by the track condition, by the geographical position, by the season of the year, by the time of the day

Additionally, as shown by the ECUC deliverable D6.4 "Engineering guidelines for tracks", the rail temperature increase caused by ECB strongly depends on the number of trains per hour using the ECB and the effect is cumulative: the higher the frequency of trains using ECB is the higher is the rail temperature increase.

The combination of the outcomes above suggests that the requirements for a track design compatible with the use of ECB cannot be easily harmonised and that the use of this braking system is actually and effectively managed at operational level.

Moreover, the Agency had requested to CEN some time ago (RfS n. 37) to develop an EN standard dealing with this braking system. The request was put on hold by CEN, waiting for the completion of the ECUC project above mentioned. Now that ECUC project is finalized, CEN/CENELEC has reiterated its position that, given the limited application of this system and the limited interest of the railway sector, no standard will be developed on the subject until further notice.

Therefore, it is the opinion of the INF WP that no harmonized requirements for the track design should be set out in the INF TSI: the decision on the use of the ECB is purely operational and any limitation/restriction

on its use on a given line shall be stated in the Register of Infrastructure (RINF); no detail requirements shall be set out in the INF TSI.

It shall be recommended that the **open point** in the INF TSI be **closed**

7.2.2. Minimum factor alpha (α) for Traffic codes P1520 and F1520 (point 4.2.7.1.1)

The 1520 track gauge system networks have common load carrying capability needs: design new structures to allow compatibility with CIS countries Rolling Stock.

Russian standard SNiP 2.05.03-84 provides the reference load model to be used to design structures compatible with CIS countries Rolling Stock, named C14 (or S14 in some documents). Some Member States have tried to define an equivalence to the load model C14 by modifying LM71 of the Eurocodes or defining a new load model in the INF TSI. No harmonized requirements are set out: different solutions exist for the same needs.

Infrastructure Manager rules for Estonian network requires the application of a factor $\alpha = 1,46$. Latvian network considers a factor $\alpha = 1,46$ as per the Specific Case in INF TSI 7.7.11.1. Lithuanian network is currently using a National Annex to the EN 1991-2 which requires a factor $\alpha = 1,00$, which the Infrastructure Manager recognises as insufficient for current and foreseeable traffic. Lithuanian representatives declared their willingness to adopt a factor $\alpha = 1,46$.

As a reference, Member State Finland, with a network built in 1524 mm track gauge but compatible with traffic form CIS countries, uses a factor $\alpha = 1,46$ for the design of new bridges.

Member State Slovakia was consulted and found acceptable to define a factor $\alpha = 1,46$ for the traffic code F1520. Member State Poland was consulted but has not issued an opinion.

As a conclusion, the Agency proposes to adopt a minimum factor $\alpha = 1,46$ for the traffic code F1520 (lines exclusively used for freight traffic with an axle load of 25 tons).

For the traffic code P1520 (lines exclusively used for passenger traffic with an axle load of 22,5 tons), the Agency proposes a minimum factor $\alpha = 1,00$, in line with minimum factor α for traffic codes P3 and P4 with the same performance parameter axle load.

Mixed lines P1520/F1520 which are currently the vast majority of the 1520 track gauge network would result in factor $\alpha = 1,46$.

It shall be recommended that the **open point** in the INF TSI be **closed.**

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

The requirements for basic parameters listed in chapter 4 of the INF TSI are valid up to a maximum line speed of 350 km/h (point 4.2.2.2(2)). In that respect, for the basic parameter 'The immediate action limit for alignment', the INF TSI refers to the limits set out in the standard EN13848-5:2008+A1:2010.

Limiting values defined by this standard are valid up to a maximum speed of 300 km/h, being this the main reason that led to consider as 'open point' the requirements for speed greater than 300 km/h.

Meanwhile, the standard EN13848-5 is under revision and the related prEN sets out limits also for speed above 300 km/h. However, those limits are considered as 'informative' because the practical experience with these speeds in the railway networks of the Union is very limited.

In the framework of the 'Infrastructure' Working Party, a questionnaire was launched among IMs already hosting trains running at speed higher than 300 km/h, asking which immediate action limits (IAL) for alignment are currently adopted on their networks

By comparing the answers received with the informative limits of the prEN, the result has been that the limits adopted by the Infrastructure Managers, for the wave - length range D1, are well within the 'informative' limits of the prEN.

However, the decision of the INF WP is that, in order to possibly close this open point, both more operational experience at these speeds and a more stable version of the above-mentioned EN standard are needed.

It shall be recommended that the **point** remain **open.**

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

The requirements for basic parameters listed in chapter 4 of the INF TSI are valid up to a maximum line speed of 350 km/h (point 4.2.2.2(2)). In that respect, for the basic parameter 'The immediate action limit for longitudinal level', the INF TSI refers to the limits set out in the standard EN13848-5:2008+A1:2010.

Limiting values defined by this standard are valid up to a maximum speed of 300 km/h, being this the main reason that led to consider as 'open point' the requirements for speed greater than 300 km/h.

Meanwhile, the standard EN13848-5 is under revision and the related prEN sets out limits also for speed above 300 km/h. However, those limits are be considered as 'informative' because the practical experience with these speeds in the railway networks of the Union is very limited.

In the framework of the 'Infrastructure' Working Party, a questionnaire was launched among IMs already hosting trains running at speed higher than 300 km/h, asking which immediate action limits (IAL) for longitudinal level are currently adopted on their networks.

By comparing the answers received with the informative limits of the prEN, the result has been that the limits adopted by the Infrastructure Managers, for the wave - length range D1, are well within the 'informative' limits of the prEN.

However, the decision of the INF WP is that, in order to possibly close this open point, both more operational experience at these speeds and a more stable version of the above-mentioned EN standard are needed.

It shall be recommended that the **point** remain **open.**

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

Rules and drawings related to the structure gauge IRL3 are an open point in the INF TSI mainly because, at the time of drafting and finalising the INF TSI, no common requirements have been agreed among the representatives of Ireland and of the United Kingdom of Great Britain and Northern Ireland.

The Agency has contacted the respective NSAs in order to determine whether common rules on these gauges had been agreed meanwhile so that the open points could possibly be closed.

At present, the Agency has received no feedback from the Authorities contacted.

It shall be recommended that the **point** remain **open**

7.2.6. EN Line Category –Associated Speed [km/h] for Traffic codes P1, P2, P3a, P4a, P1520, P1600, F1520 and F1600 (Appendix E, tables 38 and 39)

Given the complexity of this Open Point, the study to lead to its closure has been divided according to the type of vehicle and the TSI traffic code. The conclusions of the study are as follows:

7.2.6.1. Appendix E of INF TSI: capacity requirements for structures to withstand loads from loco-hauled passenger trains

There is no need to include requirements for this type of vehicles in P1 or P2 lines. If further technological developments and business needs requires harmonized requirements for structures in relation with this type of vehicles, the process of innovative solutions can be triggered by the manufacturers or infrastructure managers as per Article 10 of the INF TSI.

It shall be recommended that the **open point** in the INF TSI related to this combination of vehicles/traffic codes is **closed.**

7.2.6.2. Appendix E of INF TSI: capacity requirements for structures to withstand loads from multiple units

For all traffic codes (P1, P2, P3a and P4a), static requirements according to clause 5.1.1. of EN 15528:2015 are needed but are not sufficient on their own to control risks arising from excessive dynamic effects, including resonance.

For P1 lines, it can be concluded that dynamic requirements set out in point 4.2.7.1.2(2) and 4.2.7.1.2(3) of the INF TSI (requirements as for new structures) would give an optimal solution in terms of the level of interoperability achieved. It would provide also technical continuity of the requirements set out in the HS INF TSI repealed for this type of lines.

In parallel, ongoing process of revision of the HSLM could potentially bring a wider coverage of existing and future multiple units, implying positive effects in terms of increased interoperability.

For P1 lines, minimum static requirements could be given by the combination EN line category – Speed D2-120.

NSA Spain supported the idea of closing this open point, arguing that the proposed requirements would apply only in case of renewal or upgrading and that the impact of such requirements would be minimal because the number of lines operated at speed greater than 250 km/h undergoing a renewal or an upgrade in the coming years is limited.

However, some experts of the Structure Task Force have expressed their doubts in assigning these requirements to existing P1 lines in the INF TSI, mainly because the impact of such decision is at present unknown and because it is likely that not all existing structures would comply with requirements of point 4.2.7.1.2(2).

In March 2016 the Agency launched a survey among structures experts of the EU infrastructure managers. The purpose of the questionnaire was to give, from the perspective of load carrying capability of bridges, an overview of the parameters used in structural design for lines with speeds over 160 km/h and current practice in train-route compatibility checks on existing and new lines.

Eight Member States and Norway answered to the questionnaire, providing data for around 6700 km of lines with speed over 200 km/h and approximately 5100 existing structures.

The results collected so far show a non-homogenous approach to dynamic structural design. In some Member States, the HSLM of EN 1991-2 has been broadly used as the reference load model while in other networks, national defined load models or real trains have been the preferred choice.

According to the data collected:

- only 31% of the existing bridge stock of lines with speed over 200 km/h has been designed according to the HSLM of EN 1991-2.
- the remaining 69% of the existing bridges have been designed to withstand dynamic loads from real trains which run on those lines (or national standards, etc.)

In addition, some infrastructure managers have performed dynamic analysis against the HSLM on 10% of the existing structures not designed according to HSLM, although the outcomes of the check have not been disclosed.

Given the small amount of existing bridges already compliant with the HSLM and the incertitude of the capability of the remaining part (up to 69% of the total number) to withstand the loads of the HSLM defined in the EN 1991-2, it does not appear to be appropriate to set out, at this stage, harmonised requirements whose impact on a vast majority of existing structure of P1 lines is unknown.

A more detailed impact assessment of such proposal to close this open point is necessary and this assessment will possibly be performed in the process of the next revision of the INF TSI.

For this purpose a staged process will be needed involving a number of stakeholders, including IM, RU and manufacturers. The aim of the detailed impact assessment is to mitigate the risk of an increasing level of investment needed to fulfil the requirements to adapt the existing structures to the target requirements defined.

CER/EIM supported the advice of the Structure Task Force experts and was in favour of keeping the point open.

The Agency, although acknowledging that the proposed requirements (point 4.2.7.1.2(2) and 4.2.7.1.2(3) of the INF TSI (requirements as for new structures)) would provide for an optimal solution in terms of the level of interoperability to be achieved and in terms of technical continuity with the repealed HS INF TSI, is of the opinion that the information available so-far does not allow to define harmonized requirements to be included in the INF TSI and that these information shall be complemented with a deeper impact assessment to be carried out during the next revision of the INF TSI.

Therefore, it shall be recommended that the **point** in the INF TSI related to this combination of vehicles/traffic codes remains **open.**

For P2, P3a and P4a lines, point 4.2.7. of the INF TSI, that establish requirements described in the Eurocode, does not provide an optimal solution. The Eurocode is not covering the performance parameters of the mentioned traffic codes: 20t (Normal Operation Mass) at 200 to 250 Km/h for P2 and 22.5t (Exceptional Design Mass) at 120 to 200 Km/h for P3 and P4. On the other hand, making reference to MU classes described in EN 15528:2015 results in a very good level of interoperability but introduces another risk because MU Classes have not been checked against existing bridge stock. This could potentially lead to an increasing level of investment needed to fulfil the requirements.

It shall be recommended that the **point** in the INF TSI related to this combination of vehicles/traffic codes remains **open.**

7.2.6.3. Appendix E of INF TSI: capacity requirements for structures for traffic codes F1520 and P1520

The EN 15528 is not applied in the 1520 track gauge system for the classification of the existing infrastructure and vehicles. General practice in the 1520 track gauge system is to consider requirements for new structures for the reinforcement of small structures. More important existing structures undergo a specific study with real trains to allow compatibility with CIS countries Rolling Stock.

As far as the EN 15528 is not used in the 1520 track gauge system, further studies are needed to define an alternative harmonised methodology to define missing requirements in Appendix E for F1520 and P1520.

It shall be recommended that the **point** in the INF TSI related to this combination of vehicles/traffic codes remains **open.**

7.2.7. EN Line Category –Associated Speed [km/h] for Traffic codes P1, P2, P1600 and F1600 (Appendix F, tables 40 and 41)

Appendix F of the INF TSI follows the same structure as the Appendix E. Instead of referring to the EN Line Categories as set out in EN 15528:2008+A:2012, the capability requirements are defined in Table 40 and Table 41 by a combined quantity comprising of the Route Availability number and a corresponding maximum speed. Route Availability numbers are defined in the national technical rules notified for this purpose.

The solutions proposed in point 7.2.6.1 above apply as well for Appendix F, following a conversion to Route Availability numbers according to the national technical rules. Hence, for loco hauled trains running on P1 and P2 lines, it shall be recommended that the **open point** be **closed.**

The solution proposed in point 7.2.6.2 above applies as well for Appendix F.

7.2.8. Rules and drawings related to gauges IRL1, IRL2 and IRL3 (Appendix O)

Rules and drawings related to structure gauges IRL1, IRL2 and IRL3 are an open point in the INF TSI mainly because, at the time of drafting and finalising the INF TSI, no common requirements have been agreed among the representatives of Ireland and of the United Kingdom of Great Britain and Northern Ireland.

The Agency has contacted respective NSAs in order to determine whether common rules on these gauges had been agreed meanwhile so that the open points could possibly be closed.

At present, the Agency has received no feedback from the Authorities contacted.

It shall be recommended that the **point** remain **open**

7.2.9. Requirements for mitigating the risk related to the "ballast pick up" phenomenon (point 4.2.10.3)

Point 4.2.10.3 of the INF TSI states:

(1) The aerodynamic interaction between rolling stock and infrastructure may cause the lifting and further blowing away of ballast stones from the track bed.

(2) The requirements for the infrastructure subsystem aimed at mitigating the risk for 'ballast pick up' apply only to lines with maximum speed greater than or equal to 200 km/h.

(3) The requirements of point (2) above are an open point.

There is a similar open point in the LOC&PAS TSI (4.2.6.2.5) concerning the aerodynamic performances of Rolling Stock vis à vis the phenomenon of ballast pick up, that states:

(1) This requirement applies to units of maximum design speed higher than or equal to 190 km/h.

(2) The requirement on the aerodynamic effect of trains on ballasted tracks, in order to limit risks induced by the projection of ballast (ballast pick up), is an open point.

The subject clearly represents an interface between the 'rolling stock' and the 'infrastructure' subsystem. Countries having experienced this phenomenon have adopted or are developing national rules that can help in defining the requirements to close the open point.

Upon recommendation of the CEN aerodynamic experts and after consultations within both INF and LOC&PAS WP, it has been agreed that the phenomenon of ballast pick up is not an issue for speed below 250 km/h and that the requirements in the TSIs should reflect this.

The Agency launched a survey among European Infrastructure Managers in order to find out which measures have been taken, both at design/construction and maintenance phases, to limit the risk of flying ballast on HS lines.

The results of this survey can be summarised as follows:

- Ballast pick up is a clear interface parameter, there should be requirements for both subsystems, Infrastructure and Rolling Stock;
- Ballast Pick up is not an issue for speed lower than or equal to 250 km/h and for tracks equipped with bi-block sleepers;
- On the rolling stock side, a clear reference limit for aerodynamic effect causing ballast pick up should be established for new, renewed and upgraded vehicles in order to be authorised;
- On the infrastructure side, design, construction and maintenance measures that have proved to be effective and that could be harmonized in the TSI are:
    - For tracks equipped with mono block sleepers, lowering of the ballast cross section between the rails, at least 3 cm with respect to the top of the sleeper;
    - Provide for maintenance procedures that avoid holding of ballast stone on top of the sleepers and fastening.

Indeed, the risk of ballast pick up is effectively mitigated when existing HS rolling stocks run at speed between 250 km/h and 300 km/h on infrastructure whose ballast profile has been lowered as above described.

However, according to experience from one IM (SNCF), lowering of the ballast might not be necessary in cases where there is a good aerodynamic interaction between track and rolling stock. The current European normative framework provides for a methodology on how to measure the aerodynamic impact of rolling stocks in terms of ballast pick - up but, unfortunately, it does not provide for a pass-fail criteria. However, the revision of the LOC&PAS TSI foresees as a temporary measure, in its point 7.1.1.8, that units whose "*.... underside geometry and relevant equipment are the same as those of a train already operated on ballasted tracks of the European network at the same or higher speed before 31st December 2017.*" comply with the LOC&PAS TSI requirements for the aerodynamics effects on ballasted track (Ballast pick-up).

It's appropriate, then, to introduce the possibility to refer to, as a technical solution giving presumption of conformity at design stage, an existing track design on which vehicles complying with the point of the LOC&PAS TSI above mentioned operates or have operated.

Therefore, it shall be recommended that the **open point** in the INF TSI be **closed** for speeds up to 300 km/h, by adding requirements for lowering of the ballast as above described and by introducing a new clause in point 6.2.5 'Technical solutions giving presumption of conformity at design stage'.

For speeds greater than 300 km/h, due to the limited experience on the European high-speed network, it shall be recommended that the **point** remain **open.**

7.3. Additional modification to the text of the INF TSI

In the recommendation ERA-REC-127, other than the proposals to close some open points, a number of modifications to the main text of the INF TSI are proposed. These modifications do not set out any additional requirement nor do they modify the already existing requirements.

They simply aim at improving the clarity of the text, by correcting mistakes of wrong reference and/or wrong terminology.

As part of the additional modifications to the INF TSI, the existence of new versions of EN standards referenced in the TSI has been checked. The appropriateness of updating references to them has been assessed, considering aspects as the impact on current requirements in the INF TSI or the maturity of the standard.

The result of the assessment for updating references to standards shows that:

- the EN 14636:2016 introduces new limit for the quasi-static vertical wheel force for vehicles with maximum static wheelset force between 225 kN and 250 kN and therefore the impact for the design of F1520 lines needs to be analysed in more detail. Reference will not be updated.
- the EN 15273 has been amended in 2016. However, a new full revision of the standard is ongoing and it is appropriate to wait until the new version is available. Reference will not be updated.
- With regards to the references to the EN 15528:2008+A1:2012, it is appropriate to update them to the EN 15528:2015 version as far as it will allow the INF TSI to keep up with developments in the field of management of the interface between loading of the vehicles and the infrastructure. References will be updated.