



Organisation intergouvernementale pour les transports internationaux ferroviaires
Zwischenstaatliche Organisation für den internationalen Eisenbahnverkehr
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**Commission d'experts techniques
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DEVELOPMENT OF PROVISIONS COVERING INFRASTRUCTURE

Draft strategy paper

1. INTRODUCTION

At the 32nd session of WG TECH which took place on 12 and 13 September 2017 in Brussels the development of technical infrastructure requirements in the scope of COTIF was discussed. The Secretariat was requested to prepare a discussion paper for the 33rd session of WG TECH and subsequently to amend it for the 34th session of WG TECH.

2. LEGAL BASIS

Article 2 COTIF sets out that the aim of the Organisation is to promote, improve and facilitate, in all respects, international traffic by rail, including the following points which are relevant for this paper:

- c) contributing to interoperability and technical harmonisation in the railway field by the validation of technical standards and the adoption of uniform technical prescriptions;*
- d) establishing a uniform procedure for the technical admission of railway material intended for use in international traffic.*

Under this umbrella the Appendices to COTIF provide more detail on these aims. In particular, the APTU Uniform Rules lay down, for railway material intended to be used in international traffic, the procedure for the validation of technical standards and the adoption of Uniform Technical Prescriptions (UTP).

APTU Article 8 § 2 states as follows:

In principle, each subsystem shall be subject to one UTP. Where relevant, a subsystem may be covered by several UTP and one UTP may cover several subsystems.

The ATMF Uniform Rules lay down, for railway vehicles, the procedure for the admission to circulation or use in international traffic. ATMF states that railway material in the context of ATMF, as defined in Article 2 letter v), includes both railway vehicles and railway infrastructure. ATMF Article 8, Prescriptions applicable to railway infrastructure, lays down that:

§ 1 Railway infrastructure must comply with

- a) the provisions contained in the UTP and*
- b) where applicable, the provisions contained in RID*
- c) all other specifications in order to fulfil the applicable essential requirements.*

§ 2 Admission of infrastructure and supervision of its maintenance remain subject to the provisions in force in the Contracting State in which the infrastructure is located.

§ 3 Article 7 and 7a shall apply mutatis mutandis to infrastructure.

ATMF does not break infrastructure down into different fixed installations. ATMF Article 6 § 2 says that vehicles should be operated only on compatible *infrastructure*. It is understood that infrastructure in the context of ATMF concerns all fixed installations which have interfaces with vehicles. For this reason, and unless specified differently, “infrastructure” in the context of this document is meant to include all stationary railway material which shares interfaces with vehicles. Infrastructure therefore includes all fixed installations such as, where relevant, rails, catenary, track-side signalling systems, platforms, etc.

‘Infrastructure’ is also a subsystem as defined in UTP GEN-B as one of the three fixed installation subsystems. In addition to infrastructure, the energy subsystem and the trackside control-command and signalling subsystem are listed. These subsystems are only in the scope to the extent related to interfaces with vehicles. Where this document refers to the *subsystem infrastructure* only, it will be explicitly mentioned, otherwise *infrastructure* refers to all fixed installations subsystems.

3. SCOPE AND USE OF POSSIBLE INFRASTRUCTURE REQUIREMENTS IN COTIF

The following guiding principles can be derived from the legal basis described in the previous section:

- Requirements concerning infrastructure should be developed,
- The requirements may be covered in one or more UTPs,
- The UTP(s) should only cover the infrastructure parameters relevant for compatibility with vehicles, and
- The UTP(s) could not contain binding requirements concerning the admission of infrastructure, as this would remain a national competence.

~~The main use of infrastructure requirements in UTPs would be for states to apply them when building, upgrading or renewing infrastructure on their territory for the purpose of international traffic.~~

There is a difference in principle between the application of COTIF to vehicles and the application of COTIF to infrastructure. As vehicles cross borders, it is very important that they can be accepted for use on the networks of all Contracting States. In this context, vehicles compatible with all UTP requirements and admitted to operation in accordance with the conditions of ATMF Article 6 § 3 acquire the right to be used in international traffic, because they are mutually accepted by all Contracting States. Fixed installations, on the contrary, remain stationary in one state and are not subject to acceptance by other states.

However, the interfaces between trains and infrastructure should be managed in order to allow safe international traffic. The purpose of possible infrastructure requirements should therefore be to focus only on compatibility with vehicles and trains and compatibility between neighbouring lines and networks. This is in line with the observations made in document TECH-17036-WGT32-5a/b submitted to the 32nd session of WG TECH, which stated:

It is obvious that without compatible infrastructure, international traffic would be very difficult. It is therefore definitely in the interest of the Organisation to harmonise the characteristics of infrastructure and fixed installations. However, two important elements must be taken into account:

- *Most rail infrastructure for international traffic is also used - and often mainly - for domestic traffic. It is therefore important for states to maintain control over the characteristics of their infrastructure.*
- *Unlike vehicles, infrastructure does not “move” across borders and does not therefore have to be mutually accepted between states.*

The interfaces between vehicles and fixed installations are critical for successful and safe railway operations. So far, only requirements which directly or indirectly concern vehicles have been developed under APTU and ATMF. One could argue that by defining the vehicle parameters that interface with fixed installations, which are available through the UTPs, such as, for example, the wheel profile and the gauge, each state could derive the corresponding infrastructure parameters suitable to accommodate these vehicles.

According to this logic, it would not be necessary to develop harmonised infrastructure parameters. For relatively simple constructions, such as freight wagons, which have limited interfaces, both in number and in complexity, the existing specifications are probably sufficient.

However, this logic is applicable mainly in a railway network where international transport takes place by exchanging wagons (or passenger coaches) between the networks, with dedicated locomotives on each network to haul the wagons. If railway transport is to become truly international in its operations by allowing complete trains to cross borders without reconfiguring them at border crossing stations, a more harmonised approach to managing the interfaces between trains and infrastructure would be required.

The type and volume of international traffic may be very different in different states. In addition, all Member States of OTIF have existing infrastructure on their territory and it is probably in their interest to ensure that all old, new or upgraded infrastructures allow similar vehicles to operate. It is therefore likely that there is no one-size-fits-all solution when it comes to infrastructure specifications.

In line with what was done for UTPs containing vehicle provisions, UTP specifications for the different fixed installations could also be based on EU provisions; however, the EU provisions cater for many types of rail transport, whereas COTIF only covers international railway transport and in practice most of it is freight. The extent to which this discrepancy is relevant should be investigated further.

4. THE AIMS OF INFRASTRUCTURE REQUIREMENTS

The aims of infrastructure requirements in COTIF should be to promote all new, renewed and upgraded rail infrastructure so that it:

- can be safely and efficiently used for the operation of trains in international traffic,
- can be designed and constructed in an economically feasible manner,
- will allow states to maintain the necessary compatibility with existing lines and networks.

In order to meet these aims:

- All interfaces between infrastructure and vehicles should be comprehensively covered. For the parts of rail infrastructure which do not share an interface with vehicles there should be freedom to design, construct and, where relevant, certify their infrastructure in accordance with the norms and standards applicable in each State.
- Different classes or categories of lines should be envisaged so that all lines can be constructed in the most economically viable way, whilst avoiding an excessive number of different classes or categories of lines; an optimum level of harmonisation should be pursued.
- The provisions should take into account the need to maintain compatibility between new, upgraded or renewed lines and the networks to which they are connected or in which they are integrated. This may for example concern compatibility with lines used for domestic traffic or with lines in neighbouring States.

4. INFRASTRUCTURE SPECIFICATIONS

5. EXISTING INTERNATIONAL INFRASTRUCTURE SPECIFICATIONS

5.1. EUROPEAN UNION LINE CATEGORIES

The line categories specified by the EU TSI on the infrastructure subsystem are:

TSI infrastructure subsystem performance parameters for passenger traffic

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

TSI infrastructure subsystem performance parameters for freight traffic

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

5.2. UNECE LINE CATEGORIES

~~It is relevant to mention here that~~ The European Agreement on Main International Railway Lines¹ (AGC) of the United Nations Economic Commission for Europe (UNECE), reference ECE/TRANS/63/Rev.3 of 31 May 1985 also sets out infrastructure requirements. This agreement lists the railway lines and the parameters applicable to these lines. The table below summarises the requirements:

	Existing lines and lines to be renewed or upgraded	New lines for passenger traffic only	New lines for mixed traffic

¹ <https://www.unece.org/fileadmin/DAM/trans/doc/2017/sc2/ECE-TRANS-63-Rev.3e.pdf>

Number of tracks	-	2	2
Vehicle loading gauge	UIC B	UIC C1	UIC C1
Minimum distance between track centres	4.0 m	4.2 m	4.2 m
Nominal minimum speed	160 km/h	300 km/h	250 km/h
Authorized mass per axle:			
Locomotives (≤ 200 km/h)	22.5 t	-	22.5 t
Rail cars and rail motor sets (≤ 300 km/h)	17 t	17 t	17 t
Carriages	16 t	-	16 t
Wagons ≤ 100 km/h	20 t	-	22.5 t
120 km/h	20 t	-	20 t
140 km/h	18 t	-	18 t
Authorized mass per linear metre	8 t	-	8 t
Test train (bridge design)	UIC 71	-	UIC 71
Maximum gradient	-	35 mm/m	12.5 mm/m
Minimum platform length in principal stations	400 m	400 m	400 m
Minimum useful siding length	750 m	-	750 m
Level crossings	None	None	None

5.3. ESCAP SPECIFICATIONS

The Intergovernmental Agreement on the Trans-Asian Railway (TAR) Network was opened for signature on 10 November 2006 in Busan, Republic of Korea. On that day, 18 Member States signed the Intergovernmental Agreement. Four more States signed it during 2007 and 2008. The Intergovernmental Agreement on the Trans-Asian Railway Network² entered into force on 11 June 2009.

The agreement is not very detailed on technical provisions concerning infrastructure, which may be explained by the fact that the 29 TAR member countries have no less than five different track gauges between them.

The technical characteristics are therefore limited to functional and rather general requirements, such as, for example:

- Lines must provide adequate capacity;
- The loading gauge must allow unhindered movement of 20-foot ISO containers;
- The infrastructure and equipment should meet international requirements.

It should be noted that several member countries are members of OSJD, or OTIF, or both.

² <http://www.unescap.org/sites/default/files/TAR%20Agreement-Consolidated-14June2017-En.pdf>

5.4. FERRMED SPECIFICATIONS

FERRMED, a sector initiative which aims to improve rail freight transportation and industrial competitiveness in Europe, devised infrastructure specifications which promote the development of infrastructure with the following main characteristics:

	<u>Existing lines and lines to be renewed or upgraded</u>	<u>Comment</u>
<u>Number of tracks</u> <u>[two parallel rail lines (double track each) in each rail freight corridor]</u>	<u>2</u>	<u>Conventional lines, giving priority or exclusive use to freight traffic rather than passenger</u>
	<u>2</u>	<u>High performance lines preferentially for passenger and light freight transport connected with the main airport network</u>
<u>Width of the track</u>	<u>UIC 1435 mm</u>	
<u>Vehicle loading gauge</u>	<u>UIC C</u>	
<u>Axle load</u>	<u>22.5 ÷ 25 t</u>	<u>Lines suitable for freight trains</u>
<u>ERTMS</u>	<u>Level 2</u>	<u>At least level 2, with both way control</u>
<u>Maximum gradient</u>	<u>12 ‰</u>	<u>15 ‰ exceptionally, for distances not exceeding a few hundred meters</u>
<u>Train length up to</u>	<u>1500 m</u>	<u>Maximum length of the train</u>
<u>Train loading capacity</u>	<u>3.600 ÷ 5000 t</u>	
<u>Usable length of sidings and terminals</u>	<u>1500 m</u>	<u>For 1,500 meter length trains</u>
<u>Electrified lines</u>	<u>25 kV</u>	<u>Preferentially</u>
<u>Unified management, monitoring and tracking system</u>		<u>Coordinated at EU level, including pre-arranged train paths and reserve capacity</u>
<u>Availability of the rail capacities</u>	<u>24/7</u>	

It is interesting to compare these FERRMED specifications with the legal provisions available at UN and EU levels, in particular the fact that they are more ambitious with regard to axle loads, train lengths etc.

In addition to the above, the FERRMED Association also promotes other non-technical developments, such as:

- Polycentric Core Network with great socio-economic and intermodal impact.
- Unified coordination at EU level of the allocation of economic funds for the Railway Core Network and implementation of common standards
- Colossal cities with by-passes for freight traffic
- Availability of a network of intermodal terminals with a high level of performance
- Free competition, giving all companies open access to tracks in a non-discriminatory way
- Harmonisation and simplification of the homologation processes, administrative formalities and social legislation
- Competitive management criteria in the global chain of added value, including freight flows balancing

- Favourable and homogeneous fees for the use of infrastructures
- Reduction of the environmental impact of the freight transport system (particularly noise, vibration and CO2 emissions) and an increase in the long distance rail share of land traffic of up to 35%
- Freight locomotive and wagon concepts adapted to FERRMED Technical Standards

4.1.5.5.ANALYSIS OF EXISTING SPECIFICATIONS

It is worth noting that several existing specifications make reference to UIC leaflets. As a sector association with a long history and considerable expertise acting at global level, UIC would be an important partner in exploring changing requirements.

Although it is good that these parameters mentioned in the tables above have been or are being harmonised at international level, they do not cover all compatibility parameters between fixed installations and vehicles, as will be illustrated in the following section.

The EU TSI concerning the energy subsystem defines four different systems:

- AC 25 kV, 50 Hz;
- AC 15 kV, 16.7 Hz;
- DC 3 kV;
- DC 1.5 kV.

This illustrates that even within a group of states that is in the process of creating a single railway area (EU), the energy subsystem will continue to be different. On a positive note it should be mentioned that modern rolling stock traction equipment is capable of dealing with several different types of traction current.

Another example of the difficulty in harmonising existing railway systems is the existence of two different platform heights (550mm and 760mm above the rail) in the EU TSI concerning accessibility for persons with disabilities and persons with reduced mobility (PRM TSI). It is obvious that if a new railway system were to be created from scratch, only one uniform platform height would be defined, but the reality of harmonising existing railway systems demonstrates that suboptimal compromises will be necessary.

From the above, it is clear that there are a couple of problems in terms of harmonising infrastructure requirements. Firstly, not all railway lines are built to similar specifications; different capacities are required in terms of axle load, line speed, train length, etc. Secondly, even if harmonised provisions for line categories were to be established, these would only be applied if lines were constructed, renewed or upgraded. It would not be realistic to assume that all existing lines would be upgraded to similar standards in the foreseeable future and investment in infrastructure is not agreed or organised under the umbrella of COTIF. Finally, there is the question of whether stable and comprehensive specifications are available or could be agreed upon.

Despite all this, it would be useful for international traffic if (neighbouring) states were to coordinate their infrastructure developments. In this context it may be useful if these states could draw on international specifications. Harmonised requirements in rail infrastructure projects may contribute to interoperability and hence the economic viability of railway lines. These requirements may therefore also be interesting for international economic development banks when financing rail infrastructure projects. This is where COTIF could possibly provide added value.

5.6. COMPATIBILITY BETWEEN INFRASTRUCTURE AND VEHICLES

There is a huge number of infrastructure parameters which can or will have an influence on whether or not a particular train is compatible with it.

To illustrate this, a non-exhaustive selection of parameters is listed below, based on the European Union's register of infrastructure specifications³ concerning compatibility with vehicles:

Compatibility parameter relevant to all types of vehicles:

- Axle load capability;
- Temperature range;
- Maximum altitude;
- Existence of severe climatic conditions;
- Gauge;
- Gradient profile;
- Nominal track gauge;
- Gradient for stabling tracks;
- Minimum radius of horizontal curve;
- Minimum radius of vertical curve;
- Fixed installations for servicing trains;
- Cant deficiency;
- Rail inclination;
- Minimum wheel diameter for fixed obtuse crossings;
- Tunnel specifications.

Compatibility parameters specific to trains including passenger vehicles:

- Station and station platform facilities for accessibility;
- Specific tunnel safety requirements and fire category of rolling stock required;
- Specific servicing facilities for waste water discharge, water restocking etc.

Compatibility parameters relevant to vehicles with electric traction using the overhead contact line (OCL):

- Energy supply system (voltage and frequency);
- Maximum train current;
- Maximum current at standstill per pantograph;
- Permission for regenerative braking;
- Maximum contact wire height;
- Minimum contact wire height;
- Accepted pantograph heads;
- Requirements for number of raised pantographs and spacing between them, at the given speed;
- Permitted contact strip material;
- OCL separation sections;
- Phase separation;
- Current or power limitation on board required;
- Contact force permitted;
- Automatic dropping device required;

³ 2014/880/EU: Commission Implementing Decision of 26 November 2014 on the common specifications of the register of railway infrastructure and repealing Implementing Decision 2011/633/EU http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.356.01.0489.01.ENG

- Maximum sanding output;
- Sanding override by driver required;
- Parameters related to electromagnetic interferences.

Compatibility parameters relevant for vehicles with a cab:

- Control — command and signalling system;
- Train protection systems;
- Type and requirements related to train detection system;
- Radio (GSM-R);
- Other radio systems.

Compatibility parameters that relate to, or can be influenced by, operations:

- Maximum train deceleration;
- Maximum permitted speed;
- Use of eddy current brakes;
- Use of magnetic brakes;
- Use of flange lubrication permitted/forbidden.

Some of the parameters are linked to local circumstances, such as climatic conditions and altitude, which are given facts. Other parameters are choices to be made when designing and constructing infrastructure, depending on the type and density of traffic for which the infrastructure is intended to be used. In states where railway infrastructure already exists, many parameters will be practically locked-in with the existing infrastructure, in order to ensure that new infrastructure is compatible with existing lines.

Agreeing on a comprehensive list of parameters and a harmonised way of measuring and or determining the values related to the parameters could be part of the definition of infrastructure parameters in COTIF.

6.7. REGISTERING INFRASTRUCTURE PARAMETERS

~~Before a~~The definition of infrastructure requirements ~~could~~ be included in COTIF, ~~it would be interesting or even necessary to~~ should be based collect and register on the parameters of existing infrastructure parameters, as well as the parameters of new infrastructure; used for international traffic from in different states. These parameters should be collected and registered for this purpose.

It ~~also~~ would be in the interest of international rail traffic if the infrastructure parameters of existing lines open to international traffic were to be published and made accessible. This ~~we~~ould help railway undertakings to ensure that they use vehicles only on compatible infrastructure. It would not be realistic to assume that existing infrastructure would ever be harmonised at global level. The aim of the process would be, e.g.:

- To identify routes or corridors where compatibility exists or could be achieved-;
- To allow manufacturers of rolling stock and their customers to develop vehicles suitable for particular areas of use;
- To assist railway undertakings establish whether rolling stock is compatible with a particular line or corridor;
- To define parameters which, taking into account costs and benefits, can be further harmonised at international level.-;

~~However~~From a procedural point of view, initiatives aimed at harmonising the registration and publication of such parameters would be more suitable in the context of the possible future Appendix

H to COTIF. The OTIF Secretariat submitted a separate document to WG TECH ~~33~~ on this subject, reference TECH-17044.

7.8. PROPOSED WAY OF DEALING WITH INFRASTRUCTURE IN COTIF

There is a legal basis in COTIF for defining requirements applicable to infrastructure; the question is which kind of requirements would be useful? Unlike vehicles, which need to be mutually accepted by states in order for them to circulate in international traffic, infrastructure is not subject to mutual acceptance between states.

The EU States have agreed their target system for the different fixed installation subsystems in the TSIs concerning infrastructure, energy, safety in railway tunnels, control, command and signalling and accessibility. Obviously this is valuable experience on which non-EU OTIF States could draw, but at the same time, it is not obvious that transposing these provisions into COTIF would be useful or necessary, for a number of reasons.

First of all, it is in the interest of each state, when constructing new infrastructure, to ensure compatibility with its existing infrastructure. Secondly most lines are not used exclusively for international traffic, which means that it is questionable as to whether it is justified to develop binding rules for infrastructure for the purpose of international traffic.

At the same time, harmonised provisions at international level could lead to the convergence of networks, which would be in the interest of international railway traffic. Many of the OTIF MSs are party to the UNECE agreement on main international railway lines, suggesting that there is a will to harmonise. However, these UNECE provisions are rudimentary and do not address interoperability aspects, such as signalling, energy supply etc.

Moreover, the TSI provisions may not cater to the needs of all. Some (potential) OTIF States are developing new lines or even a completely new railway system from scratch. As an example, the Gulf Cooperation Council States are creating a network with the primary purpose of moving goods and as such they have designed the infrastructure to accommodate double stack wagons⁴ and 32.4 tonnes/axle and train lengths up to 2000m. Existing TSI line categories do not include such high capacity categories, although the TSI does not hinder or forbid exceeding the TSI limits.

It may be appropriate to start with an inventory of specifications used by non-EU States when building or upgrading railway lines. Where possible, this inventory should also include significant railway projects of states which are not members of OTIF, e.g. the Gulf Cooperation Council States and China.

Analysis of specifications may reveal commonalities which could be incorporated into recommended practices, and where there are gaps, their impact could be assessed and a way forward proposed. Simply transposing TSIs in UTPs as a starting point is not recommended.

If it is concluded that particular provisions should not be of a binding nature, the correct legal form under COTIF should be defined. In this context it is noted that the competences of the Committee of Technical Experts include the validation of standards and the adoption of uniform technical prescriptions, but making recommendations is not specifically mentioned. Nevertheless, due to the particular relevance of infrastructure to the success of international traffic, it would be useful if the CTE could work on non-binding provisions on this subject, which is recommended. A legal analysis should point out the form in which such non-binding provisions could be made available under COTIF.

⁴ Wagons capable of carrying two containers on top of each other.

9. PROPOSAL FOR CTE DECISION

1. The CTE takes note of the document.
2. The CTE agrees with the proposed scope and aims as defined in chapters 3 and 4.
3. The CTE requests the OTIF Secretariat to contact Member States and non-Member States and other partners, in particular ERA and UIC, with a view to collecting data on the main characteristics and specifications of modern infrastructure applied in Europe, Asia and Africa.
4. The data gathered under point 3 should be catalogued to allow analysis and provide input for further steps.
5. The CTE mandates the WG TECH to develop proposals for suitable and feasible provisions concerning infrastructure.
6. The developments should include analysis of the need for and potential use of an international infrastructure register, or registers, including the relevant specifications.
