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DEVELOPMENT OF PROVISIONS COVERING INFRASTRUCTURE

Draft strategy paper

Tel. +41 (0) 31 359 10 10 Fax +41 (0) 31 359 10 11 info@otif.org Gryphenhübeliweg 30 CH - 3006 Bern

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.

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.*

4. INFRASTRUCTURE SPECIFICATIONS

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.

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

It is relevant to mention here the European Agreement on Main International Railway Lines[1] (AGC) of the United Nations Economic Commission for Europe (UNECE), reference ECE/TRANS/63/Rev.3 of 31 May 1985. 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
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

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

Although it is good that these parameters have been 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. This is where COTIF could possibly provide added value.

5. 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 specifications[2] concerning compatibility with vehicles:

Compatibility parameter relevant to all types of vehicles:

- Axle load capability;
- Temperature range;
- Maximum altitude;
- Existence of severe climatic conditions;

[2] 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

- 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;
- 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. REGISTERING INFRASTRUCTURE PARAMETERS

Before a definition of infrastructure requirements could be included in COTIF, it would be interesting or even necessary to collect and register the parameters of existing infrastructure, as well as the parameters of new infrastructure, from different states.

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 could help railway undertakings to ensure that they use vehicles only on compatible infrastructure. However, 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. 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 or 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 wagons[3] 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.

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[3] Wagons capable of carrying two containers on top of another.