INTERNATIONAL UNION
OF RAILWAYS

X-BORDER SUBGROUP - DRAFT 0.13

Name of body concerned:	**UIC X-border subgroup**
Date:	February 1st 2021
Location:	PARIS

Concept for an ideal border section

Content

Abbreviations

Abbreviation	Explanation
ATP	Automatic Train Protection
CEO	Chief Executive Officer
CER	Community of European Railway and Infrastructure Companies
ERA	European Union Agency for Railways
ERFA	European Rail Freight Association
EU COM	European Commission
ETCS	European Train Control System
GSM-R	Global System for Mobile Communications – Railway
IM	Infrastructure Manager
MS	Member State
NSA	National Safety Authority
RFC	Rail Freight Corridor
RNE	RailNetEurope
RU	Railway Undertaking
TSI	Technical Specification for Interoperability
UIC	International Union of Railways

Glossary

Term	Definition
(Train) driver	As defined in Article 3 of Directive 2007/59/EC, a person capable and authorised to drive trains, including locomotives, shunting locomotives, work trains, maintenance railway vehicles or trains for the carriage of passengers or goods by rail in an autonomous, responsible and safe manner.
Exceptional transport	A vehicle and/or the load carried which because of construction/design, dimensions or weight does not meet the parameters of the route and requires special authority for the movement and may require special conditions over part or all of its journey.
Infrastructure Manager	Any body or undertaking that is responsible in particular for establishing and maintaining railway infrastructure, or a part thereof, as defined in Article 3 of Directive 91/440/EEC, which may also include the management of infrastructure control and safety systems. The functions of the infrastructure manager on a network or part of a network may be allocated to different bodies or undertakings.
Multi system / single system	A “multi system” loco is a locomotive equipped to operate on more than one power supply system; a “single system” loco is equipped for only one power supply system.
National rules	All rules containing railway safety requirements imposed at Member State level and applicable to more than one railway undertaking, irrespective of the body issuing them.
Operating language	The language or languages used in daily operation by an infrastructure manager and published in its Network Statement, for the communication of operational or safety-related messages between the staff of the infrastructure manager and the railway undertaking.
Railway Undertaking	Any railway undertaking as defined in Directive 2001/14/EC, and any other public or private undertaking, the activity of which is to provide transport of goods and/or passengers by rail on the basis that the undertaking must ensure traction. This also includes undertakings which provide traction only.
Route	A particular section or sections of line.
Staff	Employees working for a railway undertaking or an infrastructure manager, or their contractors.
Station	Any station or yard where a train can start or end, or where the possibility exists to change the locomotion of a train.
Timetable	Document or system that gives details of a train(s) schedule over a particular route.
Train	One or more traction units with or without coupled railway vehicles with train data available operating between two or more defined points.

Preamble

Introduction

European railways need seamless and reliable transport at border sections to handle the interfaces between the different national systems built at various points in the history of rail. Therefore, following a request from the European Commission and with a mandate from the CEO Task Force, RUs are compiling a list of barriers to interoperability in order to identify the issues and ultimately, to ease operations at the borders. RUs must be involved in all phases – from the conception of all infrastructure measures on border sections to their implementation – to ensure a cost-efficient and seamless railway transport system.

Target groups of this document:

- EU COM;
- ERA;
- MSs / NSAs;
- RUs;
- IMs.

Other addressees in order to advance the topics raised may include:

- RFCs;
- Organisations such as CER, ERFA, EIM, RNE, UIC, etc…

Objective of the document

This document should serve as a (technical) reference for:

- the interpretation of “similar network characteristics” (see Interoperability Directive (EU) 2016/797 and Safety Directive (EU) 2016/798);
- the modernisation of infrastructure (and funding of infrastructure);
- “small” adaptations to existing border stations/sections;
- the optimisation of RU processes, RU/IM processes and IM processes;
- discussion on changes in law;
- changes in border agreements and new border agreements.

1. Definition of “cross-border section” / “cross-border area”

1.1. Interoperability

EU railway law is striving for the realization of a “Single European Railway Area”[1]. In the ideal scenario, interoperability covers all Europe and seamless railway operation is possible everywhere.

1.2. Interfaces between different parts of the European railway network

Despite ongoing harmonisation, the European railway network is still a patchwork of different national laws and regulations, different technical characteristics, and different operational principles to be fulfilled. While some of the barriers will disappear with harmonisation, other differences and barriers will remain for a long time or even forever (e.g. different electrical power systems).

Interfaces exist within the European railway network at places[2] where at least one of the following aspects changes:

- geographical/political aspect (state border);
- legal aspect;
- technical aspect;
- operational aspect.

In this context, “borders” do not always mean state borders but borders that prevent seamless railway transport. Nevertheless, interfaces are usually present at state borders as at least some of the above-mentioned aspects change.

1.3. Ideal interface area

Until interoperability is fully realised, railway traffic can pass through interfaces when:

- the two different aspects are fulfilled (duplication / double equipment of rolling stock);
- actions or component changes are performed at the interface to comply with different aspects on both sides of the section.

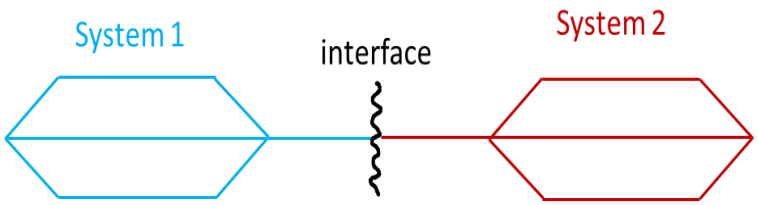
Ideally the interfaces of these aspects are concentrated in a single station, but they may

- be spread over different stations within the interface area for effective use of capacity;
- overlap in order to apply in either version within the interface area.

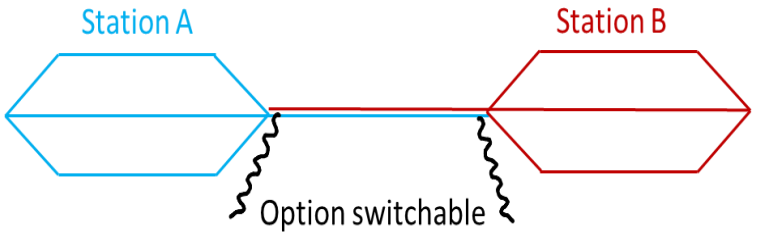
Traditionally the term “border section” has been used to describe a section between two stations where the interfaces are located within these stations or on the open line in between. In this document the term “interface area” has been created in order to show that the concept described here does not have to be focused on one section.

[1] See Art. 1 (1) of the Interoperability Directive (EU) 2016/797.
[2] *Interfaces between different legal, technical and operational systems also exist within countries.*

a. Interface on open line (no overlapping / overlapping / switchable)

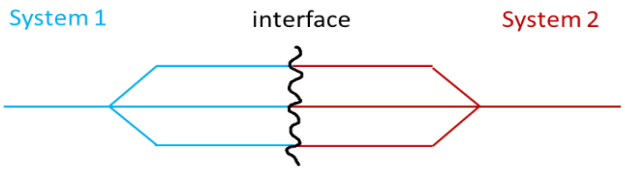


No overlapping

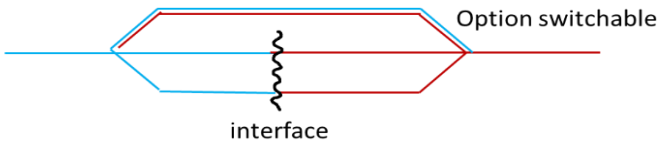


Overlapping

b. Interface in a station/yard (no overlapping / overlapping / switchable)

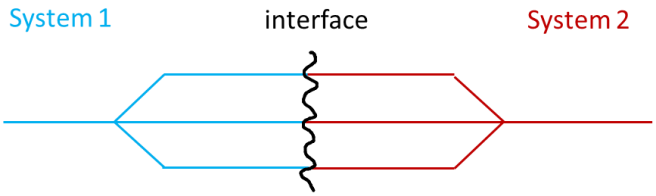


No overlapping

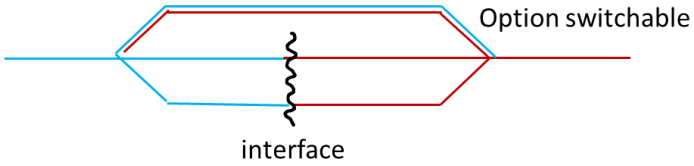


Overlapping

c. In an interface area



No overlapping



Overlapping

2. Legal aspects

In the interface area, all existing and future legislation must fulfil the approach of cross acceptance. The interface for legal aspects shall be designed so that an RU can reach any location in the interface area applying the law of **only one** of the two neighbouring Member States. This means that in one Member State the trains can be handled applying the law of the neighbouring Member State. Therefore, Member States are obliged to sign dedicated bilateral agreements defining which regulations best fit the operational concept of the RU.

For legal aspects, the three types of interfaces described above are possible:

a) Interface on open line: Train operation on this section must completely fulfil the legal aspects valid on each side of the border. If they are contradictory, no traffic is possible.
b) Interface in a station: A station is defined as interface area, trains can reach (and leave) this area by fulfilling the law of only one country. Within the station, the legislation of two Member States overlaps. Actions can be taken to ensure the train complies with the legal aspects of the destination.

Interface in an area (overlapping): In a defined area, trains can reach (and leave) this area by fulfilling the law of only one country. Actions can be taken to ensure the train complies with the legal aspects of the destination.

2.1. EU railway legislation

EU railway legislation has already foreseen a provision which allows the realisation of the general principle postulated above. Thanks to the “Fourth Railway Package”, EU law has been changed to legally create the “Single European Railway Area”. This affects the provisions on safety certification and vehicle authorisation, in particular.

2.1.1. Interoperability Directive and Safety Directive (Safety Certificate / Area of Operation)

Dedicated provisions in Art. 10 (8) of Directive (EU) 2016/798 and Art. 21 (8) of Directive (EU) 2016/797 concern interface areas: In the case of

- lines to “stations in neighbouring Member States”;
- with “similar network characteristics and similar operating rules”;
- “when those stations are close to the border”

an area of operation, respectively an area of use, defined to one Member State covers these sections in the neighbouring Member States as well.

For most cross-border lines between Member States, there are bilateral agreements which provide practical and proven provisions for operation on these lines. These existing agreements are considered “agreements between Member States”[3].

[3] According Art. 10 Nr. 8 of Directive (EU) 2016/798 and Art. 21 (8) of Directive (EU) 2016/797.

2.1.2. TSI OPE

This TSI contains the framework for staff and trains with special regard to cross-border sections. Additionally, it supports the provisions of Art. 10 of the Safety Directive.

2.1.3. Directive 2005/47/EC: Working conditions of mobile workers engaged in interoperable services in the railway sector

This directive covers certain aspects of working conditions for railway staff in cross-border traffic. This enables the harmonisation of working time regulations all over the EU and also applies to drivers performing border-crossing work. However, where neighbouring states are not members of the EU, conflicting national working time regulations can apply. A conflicting legal regime could cause conflicts for the work of RU staff. This can be a problem if the neighbouring state is outside the EU, with a single border to an EU Member State. It can cause an even more critical situation where the non-EU state is situated between two (or more) EU Member States and transit is necessary for transport between the neighbouring EU Member States.

2.2. Non-railway legislation

2.2.1. Working time and working conditions regulations

Mobile staff should be able to cross borders under a single regime of working time conditions. The conditions of the employing RU should always be applicable. In addition, ground staff should work in the neighbouring country under the same working time regulations of the employing RU. Both kinds of staff should not need a separate work permit in the neighbouring country.

Where Directive 2005/47/EC does not apply, measures must be organised for working regulations.

2.2.2. Health protection laws/ health and safety at work

Within an RU only one set of regulations should be applicable.

2.2.3. Liability towards third parties (insurance)

Liability and insurance requirements should respect the principles of Art. 10 (8) of the Safety Directive which makes it possible for an RU to reach stations near the border in the neighbouring country without the extension of the “area of operation” in its SMS. The liability and insurance requirements for an RU should not change if it operates to stations near the border in neighbouring countries.

2.2.4. Dangerous goods and waste transport[4]

If train composition is not changed within the course of the transport, there should be no additional mandatory checks at the border section.

Acceptance of paperless transports without any derogation will improve safety.

Where transport documents are required for special goods, such as dangerous goods and waste, they should only be checked at the start and no additional checks or physical controls of documents should be compulsory at the interface area. The responsibility for the complete rail transport should lie on the contractual carrier, as defined in COTIF.

[4] This norm requires physical checks and signing of waste transport papers when a shipment is handed over from one carrier to a subsequent one

2.2.5.Other laws

For all regulations not mentioned in this document, only one set of regulations should be applicable within an RU.

3. Technical aspects

3.1. General description of technical interfaces

In general, and in the interface area, the technical characteristics of

- a line (including stations) and
- the train (rolling stock the train is composed of).

are the binding parameters that determine if a train is compatible with the line on which it is intended to be operated.

Crossing technical interfaces with multi system rolling stock is possible but expensive in acquisition and operation. Consequently, interfaces which also allow for the operation of single system rolling stock – at least for fall-back scenarios – are preferable.

The main technical aspects to be considered are as follows:

a) Loading gauge;
b) Power supply;
c) Design of overhead electrification;
d) ATP system;
e) Radio communication system;
f) Track gauge (reference to best practice of borders to the 1 520-mm system).

If the interface is not on the open line but connected with a state border, infrastructure components are installed which are not usually part of, or in use on, the national network.

The tables in the following sub-chapters explain the different interfaces, their options and their usability.

3.1.1.Interface on open line

Interface		Loading gauge	Power supply	Geometry of overhead electrification	ATP system	Radio system	Gauge
Interface on open line	No overlapping		Power supply changes on open line (+ neutral section)	Geometry of overhead electrification changes on open line	ATP system changes at one point of open line	Radio system changes at one point of open line	(---)
	Single system loco		*Not possible*	*Not possible*	*Not possible*	*Not possible*	*(---)*
	Multi system loco		*Required*	*Required*	*Required*	*Required*	*(---)*
	Option: overlapping		(---)	"Overlapping" possible in one direction	It depends on the technical features of two ATP systems whether overlapping is feasible	Two radio systems are installed and in operation	*Overlapping or parallel sections allow the use of several transhipment facilities*
	Single system loco		*Not possible*	*Under certain restrictions*	*Yes, in case of overlapping ATP installations*	*Yes*	*Yes*
	Multi system loco		*Required*	*Yes*	*Yes*	*Yes*	*(---)*
	Option: switchable section		Switchable section of open line	(---)	(---)	(---)	(---)
	Single system loco		*Yes*	*(---)*	*(---)*	*(---)*	*(---)*
	Multi system loco		*Yes*	*(---)*	*(---)*	*(---)*	*(---)*
	General remarks	If loading gauge changes, the rolling stock in each case must follow the values of the smaller loading gauge					An interface of different gauges is a special case: Change of gauges require special rolling stock, change of boogies/axles, or transhipment of goods/passengers

3.1.2.Interface in a station

Interface		Loading gauge	Power supply	Geometry of overhead electrification	ATP system	Radio system	Gauge
Interface in a station	No overlapping		Fixed interface between two systems (neutral section)	Fixed interface between two systems (neutral section)	ATP system changes at one point in the station	ATP system changes at one point in the station	
	Single system loco		*Yes, but second loco necessary for shunting*	*Under certain restrictions*	*Under certain restrictions*	*Under certain restrictions*	*Yes*
	Multi system loco		*Yes*	*Yes*	*Yes*	*Yes*	*(---)*
	Option: overlapping		(---)	"Overlapping" possible in one direction	it depends on the technical features of two ATP systems whether overlapping is feasible	Two radios are installed and in operation	
	Single system loco		*(---)*	*Under certain restrictions*	*Yes, in case of overlapping ATP installations*	*Yes*	*(---)*
	Multi system loco		*(---)*	*Yes*	*Yes*	*Yes*	*(---)*
	Option: switchable section		A number of tracks are switchable	(---)	(---)	(---)	(---)
	Single system loco		*Yes*	*(---)*	*(---)*	*(---)*	*(---)*
	Multi system loco		*Yes*	*(---)*	*(---)*	*(---)*	*(---)*
	General remarks	If loading gauge changes, the rolling stock in each case must follow the values of the smaller loading gauge					An interface of different gauges is a special case: Change of gauges require special rolling stock, change of boogies/axles, or transhipment of goods/passengers

3.1.3. Interface in an area

Interface		Loading gauge	Power supply	Geometry of overhead electrification	ATP system	Radio system	Gauge
Interface in an area (overlapping)			(---)	"Overlapping" possible in one direction	It depends on the technical features of two ATP systems whether overlapping is feasible	Two radios are installed and in operation.	(---)
	Single system loco		*(---)*	*Under certain restrictions*	*Yes, in case of overlapping ATP installations*	*Yes*	*(---)*
	Multi system loco		*(---)*	*Yes*	*Yes*	*Yes*	*(---)*
	General remarks	If loading gauge changes, the rolling stock in each case must follow the values of the smaller loading gauge					An interface of different gauges is a special case: Change of gauges require special rolling stock, change of boogies/axles, or transhipment of goods/passengers

3.1.4. Ideal location of interface

Ideally the system interface locates in a station and designed such that:

- single system rolling stock that fulfils the technical standards on only one side of the interface can haul trains into/out of the interface area where the loco is changed;

and

- multi system rolling stock that fulfils the technical standards on both sides of the interface can pass through without stopping (requirement of matching transition concept).

Intermediate/existing solutions contain only some of the technical aspects and do not provide all the positive aspects of the ideal solution.

3.2. General layout of the cross-border section/station

The border station(s) should be designed to account for the capacity of the line(s) and the expected transport volume.

For operational reasons, a sufficient number of additional tracks is necessary (spare capacity for interruptions, construction works, or the impossibility of fully harmonising timetables).

All border stations should provide railway services, e.g.

- rest rooms for drivers and staff;
- diesel filling station;
- possibility for small interventions on wagons and locomotives (workshop);
- parking tracks.

In a border station where Country A and Country B have a different power supply (voltage), the preferred solution is to equip at least some tracks of the station with switchable voltage. Where this is not possible, a shunting team to shunt locomotives and/or wagons should be organised in a non-discriminatory way by the infrastructure manager.

3.3. Power supply on the cross-border section

3.3.1. Same power supply system in Country A and Country B

Generally, the best solution for RU operation is that the power supply (voltage) and the catenary is the same in Country A and Country B. In this case, only the geometry aspects of the overhead electrification should be regarded.

3.3.2. Different power supply system in Country A and Country B

If there are different power supply systems, the interface between the systems may be situated on the open line or in a station. If the interface is in a station, there may be or may not be tracks with switchable power supply.

For RUs, it is generally preferred that the interface between power supply systems is located in a station. The most efficient way is to equip the infrastructure (at least some tracks) with switchable power supply to allow a change of locos (single system to single system) without the use of additional shunting locos.

Where this is not possible, a shunting team to shunt locomotives and/or wagons should be organised in a non-discriminatory way by the infrastructure manager.

3.4. Train protection systems and communication

A clear and reliable time scheme for ETCS and GSM-R installation or upgrade must be published by the IMs.

3.4.1. ETCS System

Ideally the border section and the locomotives allowed to run on the border section are equipped with ETCS Level 1 or higher. If ETCS is installed on the border section, there must be the same level and the same technical specifications on both networks. If there are two different ETCS Levels or specifications required, the IMs must provide a technical solution to change the level without stopping the train on the open line (automatic dynamic transition).

3.4.2. Class B ATP system

If operation on the border section is not yet organised by ETCS and “old” national ATP systems are installed, the national ATP systems of both Country A and Country B should be installed (if technically possible) in the tracks on the border section so that single mode locomotives can run to the border station in the neighbouring country. Where the overlapping of two Class B systems is technically not possible, a safe procedure for running with an excluded signalling system must be established.

3.4.3. Radio communication

Ideally the GSM-R standard is used for communication between driver and signal boxes. In addition, the two GSM-R providers must have a roaming agreement. If this standard is not yet achieved on the border section or there is no roaming agreement between the two GSM-R network providers, the two neighbouring radio communication systems or the two GSM-R networks should be installed overlapping. This ensures that a train from Country A can reach the border station in Country B using the radio communication system of Country A (and vice versa).

3.4.4. Signalling system

Ideally the signal aspects are identical in Country A and Country B, preferably in using ETCS Level 1 or higher. If the signals are different, the IMs must indicate clearly which signals are installed/shown on the border section and the RUs must train the drivers accordingly. The smallest necessary subset of signal aspects should be used in this case in order to minimise the learning required for drivers.

3.5. Transition

If a multi system loco is in use, the procedure to change from the technical feature(s) of one system to the feature(s) of the second system at the interface of both systems is called “transition”.

The transition is regularly necessary for one or more of the following aspects:

a) Power system
b) ATP system
c) Radio system

The transition might be combined with other aspects (e.g. use of pantograph, input of differently required train data).

The location of the transition and the transition procedure have a high influence on the fluidity of the railway traffic.

3.5.1. Transition – modes of transition

In principle there are two forms of transition:

a) Transition in motion
    a. Transition triggered automatically (e.g. by balises)
    b. Transition triggered manually (e.g. by signals)

b) Transition at standstill
    a. In a switchable section
    b. In a non-switchable section

3.5.2. Transition – factors to be considered

The transition procedure for any technical aspect requires interaction between the train (loco) and the infrastructure, therefore a design agreed between IM and RUs is necessary.

Generally, an automatically triggered transition in motion is the best and safest way, but the most cost-effective way for both IM/RUs should be chosen by the design team.

The location where the transition in motion takes place must be defined carefully, considering especially:

a) Time/way needed for transition (concrete actions required from the locomotive driver to be considered)
b) (Minimum) speed of train to enter transition section and expected speed of train after transition has been carried out
c) Gradient in section where transition is to be carried out
d) If more than one aspect is the subject of transition: sequence of the transition. The sequence of the transition should be the same at all interfaces between two networks.

4. RU-IM interface processes

4.1. Commercial conditions of IMs

The following table shows how the commercial conditions of the IMs should be designed. This is independent of the technical and operational set-up of the border section.

Technical interface	Technical description	Network statement	Path allocation timetabling	Procurement of electrical energy	Language for commercial purposes	
Currently often observed						
On open line, no overlapping	Two subsequent documents = one document for each IM		Split responsibilities between IMs make it difficult for RUs	Split responsibilities between IMs make it difficult for RUs	Each IM uses own language	
In one station						
Overlapping						
Required						
On open line, no overlapping	One document		Principle of OSS: according to agreement between IMs	Principle of OSS: according to agreement between IMs	RUs should be able to use only one of the two neighbouring languages with both IMs	
In one station						
Overlapping						
Remarks:	Particularities related to the border station should be described.				Alternative: use of English for commercial purposes	

4.2. Operational rules

4.2.1. Operational rules on the cross-border section

On the cross-border section, the principle should apply that the operational rules should be valid up to the border station of the neighbouring country. The operational rules of the railway infrastructure network with the main part of the cross-border section should be valid and must change in the border station in a way that inbound trains run on the rules of the former railway network and outbound trains leave the border yard according to the rules of the next railway network. A change of the rules and signalling system on the open line must be avoided.

4.2.2. Information / documentation / media concerning the cross-border section

Infrastructure managers provide a multilingual document for RUs with all train- and driver-related mandatory information. Multilingual means the operational languages of both infrastructures as well as English ultimately.

The documentation must contain a schematic track line diagram with signal positions, facility locations and any particularities of the route, as well as simplified operational rules and decision support in case of multiple options. Any contact details needed on the route (signal boxes, etc.) must be also part of the leaflet.

4.2.3. Information processes IM-RU

The information processes between IMs and RUs on the border section should be managed by only one IM:

- Real-time timetable information;
- Short-term instructions.

4.2.4. Route knowledge and station knowledge

The route knowledge on the cross-border section includes the track line and the locations of the signals, the possible aspects of the signals as well as the geographical and technical particularities of the route. So long as national route knowledge rules are not removed, the rule for achieving route knowledge of one country should be accepted by the other country in the interface area.

4.2.5. Rear end signal

So long as different rear end signals are required by the two neighbouring IMs, both rear end signals must be accepted on the cross-border section. The ultimate aim is to have just one regime of rear end train signals, as defined in TSI OPE.

4.2.6. Rules on exceptional transports

RUs organise exceptional transports before the start of the train. To ensure smooth, safe and capacity-efficient cross-border traffic, even in the event of delays, etc., the paths/timetable must have the same validity. To avoid stops of exceptional transports at an interface, both IMs should establish – in co-operation with the RUs – a procedure. The principle described in § 4.2.3 should apply.

4.3. Operational language(s)

4.3.1. Bilingual border sections/stations

In general, RUs expect border sections and border stations to be bilingual. That means that the IM(s) publish two operational languages for this section. Consequently, a driver can communicate with the IM personnel throughout in one language.

From a safety point of view, this solution is preferable, and it has strong macro-economic advantages. This is due to the ratio between the staff required and the staff that need to learn and speak a second language. The number of IM personnel is much lower than the number of RU personnel, with a ratio of between 1:3 to 1:7.

Therefore, existing bilingual sections/stations should continue to exist, and new such offers should be established by the IMs.

4.3.2. Pilot sections for “derogations” from B1 level

In the light of the revised Annex VI to Directive 2007/59/EC dated 3/4/2019 which allows derogation to the language level prerequisite B1, the opportunity should be taken to “explore alternative options to the current language requirements” through the means of pilots dealing with “more targeted language requirements” or “lower general language level combined with alternative technological means”.

Although it is important that infrastructure managers and railways undertakings take the initiative with these pilots, the financial impact of these pilots also needs to be taken into consideration and external funding possibilities should be analysed.

4.3.3. List of situations / vocabulary / bilingual glossary

For each border section, the bilateral document issued by the infrastructure manager should explicitly address the language aspect dealing with vocabulary and communication. These language elements should refer to a common framework of predefined messages validated by RUs and IMs. This will ensure that communication on every cross-border section will comply with a high level of safety, thanks to communication based on standard situations. This aspect refers to the 5th meeting of the RNE-UIC-ERFA Language Programme at which the list was approved.

4.4. Train composition, braking rules, wagon inspection

For the interface area: If a train starts/ends in the border station going to/coming from the other country, the rules of the other country should apply, and cross-border acceptance must prevail for

- train composition rules;
- train preparation procedure;
- braking rules (including “long locomotive”, braking calculation schemes, braking performance requirements, holding force requirements, brake tests, etc.);
- technical wagon inspection.

The ultimate objective is to harmonise train composition rules throughout Europe.

4.5. RU: commercial procedures

RUs (“contractual carriers” according to COTIF[5]) have the freedom to decide if a transport is carried out fully within their own responsibility and with their own resources or if contractors are engaged for defined services, e.g. sections of the route (“substitute carriers” according to COTIF).

To simplify transportation, no compulsory hand-over and check of transport documents should be necessary when handing over a train to a substitute carrier (contractor) or when changing the driver. Electronic documents for all processes should exist and should be transferred electronically between the partners involved.

[5] “COTIF 1999 - Convention concerning International carriage by Rail”, appendix B “CIM - Uniform Rules Concerning the Contract of International Carriage of Goods by Rail”, article 3, paragraph a); “substitute carrier” is defined in the subsequent paragraph b).