



Easing legal and administrative obstacles in EU border regions

Case Study No. 5

Rail transport

Technical interoperability and investment coordination between national railway systems



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to the Final Report for the European Commission

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Abstract

Lacking technical interoperability and investment coordination between national railway systems

The case study deals with the border obstacles caused by lacking technical interoperability between national railway systems as well as infrastructure bottlenecks caused by insufficient coordination of investment between countries. It particularly looks at the example of the railway link between Austria and Slovenia, which is part of the railway corridors linking central and western Europe to South-East Europe. The following main problems have been identified:

- Lack of technical interoperability (electrification, train control systems) requiring multi-system locomotives or change of locomotives at the border
- Infrastructure bottlenecks hampering capacity and speed (single track sections, limited axle load), mainly due to problems with the coordination of investment and investment prioritisation between different Member-States (MS)

The major consequences of the lack of interoperability and infrastructure bottlenecks are:

- waiting times at the border hamper commercial speed and therefore lead to lower attractiveness for customers and to higher operational costs for the railway undertaking;
- problems with reliability and punctuality due to frequent delays
- financial costs for expensive multi-system equipment

On top of these operational aspects, such bottlenecks aggravate the existing operational weaknesses of rail transport and contribute to the declining attractiveness of cross-border rail connections. This is particularly detrimental to the development of concerned (border) regions where competitive rail connections are crucial for certain industries and for cross-border labour mobility.

The EU railway sector has been thoroughly reformed in the past 25 years. In freight and long-distance passenger transport, railway infrastructure is now open in a non-discriminatory way to all licensed railway undertakings. The building blocks of the ongoing reform process for overcoming border-crossing obstacles are:

- 1) Technical Specifications for Interoperability (TSI), i.e. the EU-wide harmonisation of technical standards and homologation procedures
- 2) The corridor approach as an attempt to foster EU-wide investment coordination

There are European and bilateral cooperation structures in place tackling the cross-border obstacles and some progress is being made. However, the necessary investment in infrastructure and rolling stock is bound to take a long time and border regions rarely have priority in either country concerned.

1 Outline of the obstacle (legal and administrative) and the policy context

1.1 Main obstacles and underlying challenges

This case study deals with the obstacles caused by the lack of technical interoperability between the national railway systems as well as infrastructure bottlenecks caused by insufficient coordination of investment between countries. This, together, results in long waiting times for passenger and freight trains at border crossing points or stations with negative impacts for the border regions and for the whole network-area.

The railway link between Austria (AT) and Slovenia (SI) has been chosen as an example for these obstacles but similar situations exist at most other land borders.

1.1.1 The wider geographical perspective

The three railway border crossings between Austria and Slovenia are part of the railway corridors, which link Central, and Western Europe with South-Eastern Europe, i.e. the Baltic-Adriatic Corridor BAC (PL via CZ/SK/AT to SI/IT) and Corridor X (AT/DE/HU via SI/HR/RS/FYROM/BG to EL/TR). From a macro-perspective, these corridors can be considered as the links between the northern and the southern European seaports¹.

TEN-T Core Network Corridors such as the Baltic-Adriatic Corridor were mainly established to facilitate long-distance transport. One has to be aware of the fact that today international transport represents 50 % of total rail freight transport in South-East Europe². The most important market for rail freight transport is container shuttle trains providing hinterland transport from the main European container ports. The minimum distance for profitable rail freight operations is usually considered at 300-500 km, which usually implies crossing one or more borders. Therefore, impediments to specific railway border crossings have far-reaching systemic consequences on the functioning of Europe-wide supply chains and logistics networks and hamper the development of regions that are hundreds of kilometres away from the border under consideration. In the case of international passenger transport, the competitiveness of rail services for long-distance travel is severely compromised as compared to private car or bus transport.

The situation of the rail sector in Europe is challenged by key indicators related to performance, with speed and reliability being essential ingredients for success on the transport market. Current market shares (modal split) reflect the low competitiveness of the rail sector. Rail modal split is generally low in the EU (EU average 2013):

- Passenger transport by rail represents 6.6 % (stable) – compared to 72.3 % for passenger car, 8.1 % for bus transport and 9 % intra-EU air (growing)
- Freight transport by rail represents 11.7 % (decreasing) – compared to 49.4 % by road (growing), and 31.3 % by seaways.

1.1.2 The challenge of technical interoperability

An obvious challenge in terms of technical interoperability is the patchwork of national railway systems in Europe; a patchwork rooted in history, which limits the smooth and efficient operation across Europe.

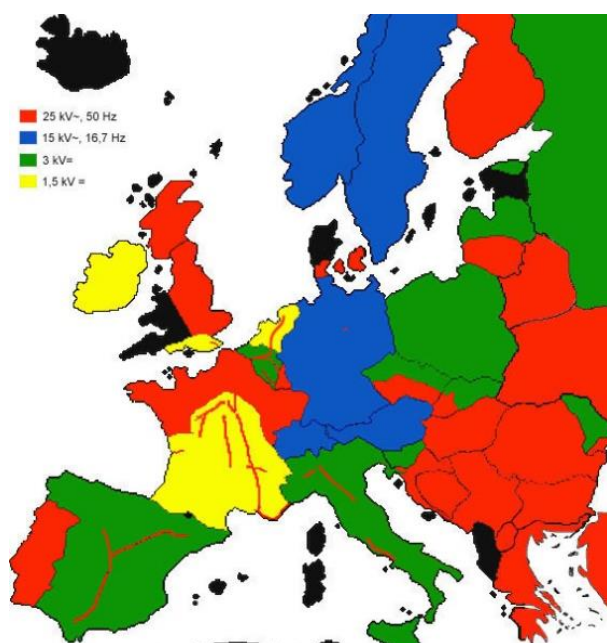
Taking a closer look at the resulting patchwork, one can notice widely differing historic national standards across Europe, most notably:

¹ The case study also takes into consideration results concerning SETA corridor (AT/SK via HU to HR/SI/IT). The latter corridor does not directly affect the AT/SI border. However, since the SETA study has been the model for the later studies on BAC, it provides valuable insight for the topic at hand.

² p. 109 in: World Bank (2011), Railway Reform in South East Europe and Turkey - On the Right Track?, Transport Unit, Sustainable Development, Europe and Central Asia Region, Report No. 60223-ECA, March 2011.

- Gauge: the standard gauge has 1435 mm; the major part of the network in broad gauge can be found in Finland and the Baltic States (Russian broad gauge, 1520-1524 mm), Spain and Portugal (Iberian Broad Gauge, 1668 mm), IE (1600 mm)
- Traction current: the main systems are 15 kV 16.7 Hz AC³ (Germany, Austria, Switzerland, Sweden, Norway), 25 kV 50 Hz AC (Northern France, England, large parts of CEEC, Portugal), 3 kV DC (Italy, Russia, Poland, Spain, Belgium), 1.5 kV DC (Southern France, the Netherlands)
- Train protection systems: often purely national systems, joint systems are applied e.g. by AT and DE (Indusi PZB 90⁴, LZB⁵), SI also partly uses PZB 90; however, older systems are also still in use.

Figure 1. Traction current systems in Europe



Source: <http://www.bahnstatistik.de/Stromsysteme.htm>

1.1.3 The challenge of investment coordination

Historical perspectives tend to persist since railway investment is evaluated by national governments and national infrastructure managers. Since border sections often have less traffic than the main national corridors, there is an inherent tendency to a lower ranking of these projects in the national investment priorities. Additionally, infrastructure managers tend to view it as domestic investment while the benefits on foreign territory might outweigh the domestic ones.

1.2 The policy context: steps towards a Single European Railway Area

Given the declining relevance of the railway transport mode and the problematic financial situation of European railways, the EU railway sector has been thoroughly reformed over the past 25 years, mainly at the instigation of the EC. In freight and long-distance passenger transport, railway infrastructure is now open in a non-discriminatory way to all licensed railway undertakings applying for train paths and paying infrastructure fees. The essential elements of the ongoing reform process towards a so-called "Single European Railway Area" that are relevant in the context of

³ kV ... Kilovolt, Hz ... Hertz, AC ... alternating current, DC ... direct current

⁴ Punktformige Zugbeeinflussung", i.e. intermittent automatic train running control

⁵ „Linienzugbeeinflussung", i.e. continuous train control

the challenges at hand (Technical Specifications for Interoperability, corridor development) together with earlier or complementary initiatives (international agreements, industry initiatives) will be presented in the following sections.

1.2.1 Technical Specifications for Interoperability (TSI)

A cornerstone in the introduction of a single European railway market is the interoperability and harmonisation of technical rules and standards via Technical Specifications for Interoperability⁶ (TSI). The legal background consists of the so-called Interoperability Directive 2008/57/EC⁷ with its respective transpositions into national MS law (AT: Eisenbahngesetz 1957, SI: Railway Transport Safety Act, Railway Transport Act). Since January 1st, 2015, TSI apply to all newly constructed railway lines including regional railway lines, not only to TEN-T⁸. An important element of TSI is the European Rail Traffic Management System (ERTMS) with its main component, the European Train Control System (ETCS), which together form a joint standard for train protection systems⁹.

According to the European Railway Agency (ERA), there are 16,000 national technical and safety rules in the EU. About 9,000 of them are considered as redundant with the application of TSI to all railway lines, another 5,000 may be reduced. This would mean that only 2,000 national rules are considered operational rules, which do not concern infrastructure or vehicles¹⁰. However, the complete replacement of national standards by TSI still seems to be very far away, given the long depreciation periods of railway infrastructure and rolling stock (20-100 years) as well as the long replacement cycles needed for the relatively robust and long-lived railway equipment.

Based on Regulation (EC) No 1335/2008¹¹, the ERA was established to draft the TSI and as system authority for ERTMS. Anna Gigantino of ERA expects the Fourth Railway Package to be in force June/July 2016, Three years later, the ERA will also be responsible for vehicle authorization in international traffic and for safety certificates. ERA is also an option for national traffic, but national authorization is also possible¹². "Then a vehicle authorized by ERA can circulate in all Member States.", according to the interviewee from ERA¹³.

A secondary element linked to interoperability is the Train Driver Directive¹⁴, which foresees harmonized training and certification of train drivers. The Directive seeks to introduce a license valid in the whole EU combined with a certification only valid for specific infrastructure and rolling stock and thereby facilitating border crossing operation.

1.2.2 Corridor development

A second cornerstone of European transport policy is the corridor approach, which is closely linked to the concept of TEN-T defining so-called Core Network Corridors. For non-MS, so-called Pan-European Corridors were introduced. RailNetEurope (RNE), established 2004, is an association of European infrastructure managers aiming at

⁶ "A TSI sets all the conditions with which an interoperability constituent must conform, and the procedure to be followed in assessing conformity." (Recital 15 of Directive 2008/57/EU)

⁷ 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)

⁸ Interview with Anna Gigantino, Head of Interoperability Unit, European Railway Agency, on 20.04.2016

⁹ European Union (2012), Commission Decision of 25 January 2012 on the technical specification for interoperability relating to the control-command and signalling subsystems of the trans-European rail system (ERTMS Decision), 2012/88/EU,

¹⁰ Interview with Anna Gigantino, Head of Interoperability Unit, European Railway Agency, on 20.04.2016

¹¹ Regulation (EC) No 1335/2008 of the European Parliament and of the Council of 16 December 2008 amending Regulation (EC) No 881/2004 establishing a European Railway Agency (Agency Regulation)

¹² Klaus Gstettenbauer, Bundesministerium für Verkehr, Innovation und Technologie (Federal Ministry for Transport, Innovation and Technology, AT), Sektion IV – Verkehr, email 27.04.2016.

¹³ Interview with Anna Gigantino, Head of Interoperability Unit, European Railway Agency, on 20.04.2016

¹⁴ Directive 2007/59/EC of the European Parliament and of the Council of 23 October 2007 on the certification of train drivers operating locomotives and trains on the railway system in the Community

facilitating access to European rail infrastructure. RNE defined eleven international corridors with dedicated steering groups and corridor managers. Regulation (EU) 913/2010 introduced rail freight corridors that are largely congruent with TEN-T¹⁵. The basic idea behind the various corridor approaches is a corridor-specific governance structure helping to coordinate investment and the creation of so-called one-stop-shops to obtain corridor-wide train paths (timetable slots for freight trains).

1.2.3 International agreements

Border agreements are bilateral treaties between MS dealing mainly with administrative procedures. For the negotiations on border-crossing rail transport, in general, the following partners have to be involved: Ministries of Transport, Ministries of Foreign Affairs (bilateral treaty), Ministries of Finance (customs control), Ministries of Interior (border police), Ministries of Agriculture (veterinary and phytosanitary control) and the rail infrastructure managers. The AT-SI border agreement additionally had to pass the respective national assemblies.

Railway associations initiated agreements between countries or between operators:

- UIC (Union internationale des chemins de fer): Multilateral agreement¹⁶ on the use of freight rolling stock between ca. 600 wagon owners and railway undertakings, a standard usually used by non-UIC members, too; RIC (International Coach Regulations) defining technical requirements for passenger coaches in Europe.
- OTIF (intergovernmental organisation governing international rail transport) with 50 members in Europe, Africa and the Middle East. COTIF (Convention concerning International Carriage by Rail): concerns border crossing transports of freight and passengers.
- CIV (International Convention for the transportation of Passengers): uniform rules of European railway operators for covering international journeys.

Industry initiatives

UIC also tries to implement international standards via its “leaflets” promoting interoperability. Joint initiatives of incumbent state railway undertakings like Cargo 10 (SI, HR, RS) are problematic because of potential cartel structures¹⁷. There are also private vehicle pools providing multi-system traction for purchase, lease or rent like Mitsui Rail Capital Europe B.V. (former Siemens-Dispolok) or Angel Trains Limited and Alpha Trains Luxembourg S.à r.l. (former Angel Trains International)¹⁸. Especially the traction provided by Siemens-Dispolok played a major role in rail freight liberalisation in Central Europe.

¹⁵ p. 109 of: World Bank (2011), *Railway Reform in South East Europe and Turkey - On the Right Track?*, Transport Unit, Sustainable Development, Europe and Central Asia Region, Report No. 60223-ECA,, March 2011 ; and Regulation (EU) No 913/2010 of the European Parliament and of the Council of 22 September 2010 concerning a European rail network for competitive freight

¹⁶ “General Contract on the Use of Wagons”, see <http://www.gcubureau.org/>

¹⁷ see Commission Decision of 15 July 2015 relating to proceedings under Article 101 of the Treaty on the Functioning of the European Union - Case AT.40098 — Blocktrains, where Austrian and German railway operators were fined for having formed a cartel with their joint products ‘Balkantrain’ and ‘Soptrain’

¹⁸ <http://www.mrce-dispolok.com/>; <https://www.angeltrains.co.uk/>; <http://www.alpha-trains.eu/index.php>

2 Case Study Context

2.1 The AT/SI railway border crossings

2.1.1 Spielfeld-Straß/Sentilj

The route of Graz-Spielfeld-Straß/Sentilj-Maribor is used rather intensely on the Austrian side¹⁹. It is part of the Baltic-Adriatic Core Network Corridor²⁰ defined in the Trans-European Transport Network (TEN-T) Regulation²¹ and connects the Polish Baltic Sea ports via the Czech Republic, Slovakia and Austria with the Slovenian and Northern Italian Adriatic ports. There is considerable international freight transport on the line, but cross-border passenger transport has been reduced to Slovenian trains crossing the border and stopping at Spielfeld as well as a single Eurocity train pair between Graz and Ljubljana per day. Several infrastructure bottlenecks exist on that line:²²

- AT: Werndorf-Spielfeld-Straß/Sentilj (30 km): electrified single track line
- SI: Spielfeld-Straß/Sentilj-Pragersko (17 km): electrified single track line, v_{max} 80 km/h (benchmark would be 100 km/h)
- Spielfeld-Maribor suboptimal axle load class²³
- further towards Zidani Most, at some stations, the side tracks are too short for freight trains and sidewalks are low (Pragersko, Celje)
- Zidani Most-Ljubljana: mostly suboptimal axle load class²⁴; on 40 % of the line v_{max} lower than 100 km/h; partially suboptimal train control system (no block system)

Investments have been planned, but from the current perspective, these have to be considered as mid- to long-term since infrastructure capacity is considered as sufficient to cover the demand. On the Austrian side a second track to the Slovene border is planned to be built but the project is not included in the current Framework Plan 2016-2021²⁵. The estimated investment amounts to about 100 -150 million EUR²⁶. On the Slovenian side, studies for upgrading and building the second track have already been carried out.

¹⁹ Bruck/Mur-Graz: 240 trains per workday (high level of traffic); continuing towards the border Werndorf-Leibnitz 112 trains per workday on a single track section (relatively high)

²⁰ European Commission website, Mobility and Transport, Infrastructure TEN-T Connecting Europe, Baltic-Adriatic Core Network Corridor, http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/bal-adr_en.htm

²¹ European Union (2013), Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU, L348/1, 2.12.2013

²² European Commission website, Mobility and Transport, Baltic-Adriatic Core Network Corridor Study – Final Report, December 2014. https://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/bal-adr_en

²³ C3 (20 t; 7.2 t/m) - as opposed to the benchmark standard D4 (22.5 t; 8 t/m) - The suboptimal axle load classes on the Slovenian side cause problems since many modern locomotives, especially the "Taurus" class mainly used by ÖBB, require an axle load of 22.5 t. Therefore, they cannot enter the Slovenian network and locomotives have to be changed at the borders which causes relatively long waiting times (Interview with Mr. Spiegel, Austrian Federal Ministry for Transport, Innovation and Technology, 15.09.2016).

²⁴ D3 (7.2 t/m instead of D4 8 t/m)

²⁵ Bundesministerium für Verkehr, Innovation und Technologie (2016), Rahmenplan der ÖBB-Infrastruktur AG und ASFINAG 2016-2021, Feb.2016, https://www.bmvit.gv.at/verkehr/gesamtverkehr/ausbauplan/downloads/rahmenplan_oebb_2016.pdf; and Interview with Mr. Spiegel, Austrian Federal Ministry for Transport, Innovation and Technology, 15.09.2016.

²⁶ Eurailpress.de website, Zweigleisiger Ausbau der Suedbahn, <http://www.eurailpress.de/news/wirtschaft-unternehmen/single-view/news/oebb-zweigleisiger-ausbau-der-suedbahn-1.html>

Figure 2. Baltic-Adriatic Core Network Corridor



Source: http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/doc/baltic_adriatic_map.pdf

2.1.2 Rosenbach-Jesenice

The border crossing is part of the Villach-Nova Gorica-Trieste connection. It is a single-track electrified line with the exception of the 8 km double-track Karawanks Tunnel between Rosenbach and Jesenice. There is no long-distance passenger transport anymore on that line. On the Austrian side, hourly regional services connect Villach to Rosenbach, whereas only three train pairs per day cross the border and connect Villach to Jesenice. The route is also used for international freight traffic and provides a backup for the BAC via Spielfeld/Sentilj.

In 2015, Slovenia and Austria as well as their respective railway companies signed an agreement on the rehabilitation of the Karawanks Tunnel. Because of new safety regulations, tunnel tracks will have to be reduced to single-track traffic. The investment for the Austrian part is estimated at 76 million EUR. It is planned that the works will be finished by 2019²⁷. A second track would require a separate tunnel; however, current demand would not justify the investment²⁸.

2.1.3 Bleiburg-Prevalje²⁹

The border crossing is part of a Klagenfurt-Maribor connection. The Slovenian railway company Slovenske železnice (SZ) runs a few regional passenger trains across the border from Maribor to Bleiburg. Cross-border rail freight operations stopped in 2011. At this time, the Austrian railway company Österreichische Bundesbahnen (ÖBB) announced plans to shut down the line because a complete renewal would require a double-digit million EUR investment. Since the adjacent regions in AT and SI support the preservation of the line, a study on the railway's transport potentials has been commissioned by the SZ and the ÖBB. The results are expected to be published in autumn 2016. Additionally, an agreement between the Federal State of Carinthia and the ÖBB on renovating and upgrading the Austrian section has been signed.

²⁷ Interview with Mr. Hans Schuschnig, Federal State of Carinthia (AT), 03.08.2016; and: Bundesministerium für Verkehr, Innovation und Technologie (2016), Rahmenplan der ÖBB-Infrastruktur AG und ASFINAG 2016-2021, Kärnten, Feb.2016, <https://www.bmvit.gv.at/verkehr/gesamtverkehr/ausbauplan/projekteOebbAsfinag/kaernten.pdf>

²⁸ Interview with Mr. Spiegel, Austrian Federal Ministry for Transport, Innovation and Technology, 15.09.2016.

²⁹ Interview with Mr. Hans Schuschnig, Federal State of Carinthia (AT), 03.08.2016;

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To sum up: while the AT/SI border crossings are relevant for freight transport, there are only few cross-border passenger connections in place and their number has constantly decreased over the past decade. There is a risk that the border crossing of Bleiburg/Prevalje will be shut down completely. The main obstacles at the AT/SI railway border crossings are summed up in Box 1.

Box 1. Obstacles at the railway border crossings between AT/SI

- Differing technical standards, for electric traction systems (AT: 15 kV AC, 16.7 Hz; SI: 3 kV DC) and train protection systems, requiring either double-system locomotives or changes of traction at the border³⁰;
- Infrastructure bottlenecks hampering capacity and speed, sometimes requiring change of traction; usually high percentage of single track lines; lack of electrification and limited axle loads.

The administrative context of cross-border railway connections is defined by the organisational structure of the national railway sectors, which in turn are highly regulated at EU level. In this way, the main national players are mirrored in each MS.

Infrastructure financing in Austria is subject to a coordinated planning process between the Federal Ministry for Transport, Innovation and Technology (BMVIT), the Ministry of Finance (MoF) and the incumbent rail infrastructure manager ÖBB Infrastruktur AG. The result of this process is a five-year framework plan that is ratified by the government. The latter is based on a long-term strategy until 2025 ("Zielnetz 2025+"). The inclusion of additional measures would require a political decision, a rollup of the planning process and an agreement between Ministry of Transport (MoT) and MoF³¹. Due to the federal structure of Austria, the Länder have a strong influence on investment decisions. The competent Ministry in Slovenia is the Ministry of Infrastructure and Spatial Planning. There is highly institutionalised cooperation between this ministry and the Austrian BMVIT, mainly via working group meetings that have taken place at least once a year since 1995 and that also include representatives of the concerned regional authorities and the railways. Additionally, the Corridor Manager of the BAC, Mr. Bodewig, has initiated cross-border dialogues for all border crossings along the BAC with the AT/SI dialogue being about to be implemented. Additionally, a Memorandum of Understanding between AT and SI is under preparation. For the realisation of common cross-border projects agreements are signed, as for the upgrading of the Karawanks Tunnel and for the upgrading and doubling of tracks on the Maribor - Graz railway line³².

Further administrative bodies of relevance in the context of rail transport are the following:

The **National Safety Authorities (NSA)** are responsible for authorising the servicing of subsystems and rolling stock as well as for supervising the compliance of interoperability constituents with essential requirements of the Interoperability Directive, based on the national transposition of the Safety Directive and the Interoperability Directive. In Austria, the task is managed by a department of BMVIT; in Slovenia this is done by the Public Agency of the Republic of Slovenia for Railway Transport (AŽP). However, with the adoption of the Fourth Railway Package, the NSA will cede some of its tasks to ERA (see above).

³⁰ Border stopping time for the EC 151 between Graz and Ljubljana at Spielfeld is 12 min.

³¹ p. 9.in: GySEV et al., (2013), – South East Transport Axis - Report on development potentials and obstacles based on the assessment of organisational and technical constraints, Version 0.1., 10.01.2013, www.southeast-europe.net/document.cmt?id=686

³² Interview with Mr. Spiegel, Austrian Federal Ministry for Transport, Innovation and Technology, 15.09.2016.

Interview with Mr. Zerak, Ministry of Infrastructure, Republic of Slovenia, 27.09.2016.

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Notified bodies assess compliance of constituents and subsystems with TSI. There are several notified bodies in AT and SI³³.

Infrastructure managers are state companies that are responsible for the design and management of railway infrastructure, producing train paths that are sold to applicants (usually railway undertakings), with open access for freight and long-distance passenger transport (the latter since June 2015 at the latest). Their tasks are mainly based on the national transposition of Directive 2012/34/EU – in Austria by the ÖBB and in Slovenia by the SZ.

Railway undertakings (RU) need a license according to Directive 2012/34/EU and a safety certificate according to Directive 2004/49/EC. There is a distinction made between incumbent state RU and so-called private railway undertakings (in Austria, often owned by regional authorities). According to Directive 2012/34/EU, the incumbents have to be separated from the infrastructure manager regarding management and budget in order to avoid discrimination and competitive distortion; however, joint holding structures are allowed (as is the case with the ÖBB in AT and the SZ in SI).

³³ For a detailed list of notified bodies, see http://ec.europa.eu/growth/tools-databases/nando/index.cfm?fuseaction=directive.notifiedbody&dir_id=30

3 Impact analysis

*"The current market structure is largely characterised by incumbent rail undertakings operating national networks, while trade flows have increasingly become cross-border in nature."*³⁴

The following section discusses the impact of the obstacles at rail border crossings

- at the operational level;
- with an additional section on the impact assessment carried out concerning the introduction of the new harmonised train control standard ERTMS;
- at a regional level;
- with an additional section on general macroeconomic effects of the low competitiveness of the railway system.

3.1 Impact of border delays at the operational level

The major detrimental effects of the lack of interoperability at an operational level are:

- waiting times at the border reduce commercial speed which lowers the attractiveness for customers and increases the operational cost for the railway companies;
- problems with reliability and punctuality due to frequent delays;
- financial costs for additional equipment: multi-system locomotives are 10-15% more expensive than single-system locomotives³⁵.

The main immediate and direct effect of interoperability in terms of border obstacles is the reduction of transit times since no change of locomotives is required and hence drivers do not need to switch. On the microeconomic side, the quantifiable impact consists of additional costs for the railway undertakings (and consequently for the shippers and final customers).

Longer transit times increase the variable costs of railways, especially staff cost (about 10 % of total cost) and capital cost for rolling material (20-50 % of total cost)³⁶. Since railway undertakings operate in competitive markets, real cost figures usually are not published. The cost per train-kilometre can be estimated at 6 EUR for regional passenger transport in DE and 10-20 EUR for container block trains in AT/DE³⁷.

3.2 ERTMS impact assessment

ERTMS, the new European train control standard, is the main pillar of rail interoperability. It has been subject to several impact assessment studies, however on an EU-wide scale.

³⁴ p. 112 in: World Bank (2011), Railway Reform in South East Europe and Turkey - On the Right Track?, Transport Unit, Sustainable Development, Europe and Central Asia Region, Report No. 60223-ECA, March 2011.

³⁵ p. 20.in: GySEV et al., (2013), – South East Transport Axis - Report on development potentials and obstacles based on the assessment of organisational and technical constraints, Version 0.1., 10.01.2013, www.southeast-europe.net/document.cmt?id=686

³⁶ Landesnahverkehrs-gesellschaft Niedersachsen – official website, SPNV Finanzierung, Kostenzusammensetzung: <http://www.lnv.de/spnv/finanzierung-spnv/kostenzusammensetzung-im-spnv/?L=0>, and:

Hagenlocher, St. - Wittenbrink, P. (2015), Analyse staatlich induzierter Kostensteigerungen im Schienengüterverkehr am Beispiel von ausgewählten Relationen, commissioned by Interessensgemeinschaft der Bahnspediteure (IBS) e.V., Berlin and UIRR International Union for Road-Rail Combined Transport, Brussels, Karlsruhe 17.04.2015.

³⁷ Thus, a transit time reduction of 20 % for a container block train on the Corridor X route between Central Europe and Turkey might save up to EUR 2,000 per train.

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In 2014, ERA carried out an impact assessment on different variants of ERTMS introduction on the non-TEN-T network³⁸:

- a null variant with no changes, i.e. no mandatory introduction off-TEN-T;
- an evolutionary approach: freezing of existing legacy systems and prohibiting the deployment of new legacy systems according to former national standards;
- a “revolutionary” approach with strict migration requirements (which was not further developed since MS prefer an optimisation at national level).

The impact analysis for the evolutionary approach brought the following results: In the case of simple legacy systems, long-term benefits of ERTMS introduction are below long-term financial costs with a cost-benefit ratio of 0.37. In the case of complex legacy systems, the long-term benefits of system migration exceed long-term costs in 99 % of the cases with a cost-benefit ratio of 7.

A study of ERTMS in NL, based on net present value, came to the following result: “In the end all implementation strategies result in a negative balance compared to the null alternative. However, the total sum of the strategies differs just over 200million EUR between the strategies, differences in costs and benefits are much larger. This is caused by the fact that the most expensive strategy leads also to the largest benefits.”³⁹

The differing results of the two studies reflect to some extent the different points of view of ERA and the European Commission that are actively promoting new interoperable standards, and the more reluctant MS that have to carry the main parts of the additional investment needed and have to consider national economic interests.

3.3 Regional impact

The immediate regional impacts of the lacking harmonisation of rail systems are:

- Freight: Since the strength of rail lies in international block trains over distances of at least 300-500 km, the impact on border regions lies mainly in higher external costs due to road transport passing by that could be shifted to rail (see below under “General macroeconomic effects”).
- Regional passenger transport is affected by less or less attractive cross-border connections due to change of drivers, change of traction.

In terms of socio-economic development, the quality of cross-border railway links defines the attractiveness of major cities as multi-modal hubs in freight transport. Evident socio-economic impact of improved rail connections and competitive rail services are:

- the impact on production and competitiveness of specific productions dependant on large in-/outputs: in particular rail transport cannot easily be replaced for container hinterland transport and bulk transports for heavy industry (if inland waterways are not available)
- the accessibility of labour markets;
- the contribution of rail services to job generation and maintaining jobs; in particular, in challenged regions with otherwise low prospects for economic activities.

³⁸ p. 6-8 and 25-28 in: Malfait, W. (2014), ERA Economic Evaluation Unit – Final Report – TSI CCS scope extension, 14.05.2014

³⁹ p. 87 in: Decisio B.V. and SYSTRA S.A (2010), Social Cost Benefit Analysis of implementation strategies for ERTMS in the Netherlands, study commissioned by the Ministry of Transport, Public Works and Water Management, Amsterdam, 08.01.2010, <http://docplayer.net/2179604-Social-cost-benefit-analysis-of-implementation-strategies-for-ertms-in-the-netherlands-ministry-of-transport-public-works-and-water-management.html>

With a view to bulk transport, an AT study quantifies the number of jobs generated directly and indirectly by the timber and paper industry in the peripheral Austrian regions of Carinthia and Styria at 28,000. The industry depends on railway transports⁴⁰. At the same time, Graz as well as Maribor developed into industrial as well as logistics centres or hubs. Such functions depend on high-grade rail infrastructure.

Another evident aspect is the accessibility of labour markets across borders. Rail is clearly the preferred mode for regional mass passenger transport – although commuter density along the border-crossing corridor between Austria and Slovenia is not comparable to the density of movements in cross-border functional areas in other parts of Europe.

A third aspect is the role of railways in generating jobs. Traditionally, railways have been among the most important employers in the country, providing relatively well-paid jobs for apprentices and skilled workers even in peripheral and border regions⁴¹. It can be expected that economically more successful railways will generate considerable effects on jobs.

For the implementation of the Baltic-Adriatic Corridor, a 2012 cost-benefit analysis predicted a significant aggregate value added of 0.1 to 0.6 % for the AT and SI border regions.⁴²

3.4 General macroeconomic impact of a railway system lacking competitiveness

Delays in railway border crossings negatively influence the performance of the European railway system as a whole leading to wide-ranging consequences at EU level.

The main consumer of final energy in the EU is transport, since it consumes 31.6% of total energy (2013). At the same time, the EU has to import 53.2% of its energy (oil and products 87.4 %)⁴³. Besides considerably contributing to the Continent's strategic vulnerability, this fact adds external costs. The main factors of external costs of transportation are: congestion (road) or scarcity (rail); accidents; noise; air pollution; climate change; effects on nature and landscape, water and soil; and specific costs in urban areas (e.g. separation costs for pedestrians, costs of scarcity for non-motorised traffic)⁴⁴.

The external costs for electrified passenger rail transport are about five times lower than for private cars, and three times lower than for bus transport. The relation between heavy duty road vehicles and freight trains with electric traction is calculated with the same factor (five). In total, road transport caused 93 % of total EU external cost of transportation (314 billion EUR p.a. in 2008, excluding congestion), rail transport 2 % (10 billion EUR p.a. in 2008)⁴⁵. The low and sinking modal share of railways translates directly into higher external cost of transportation in the EU.

⁴⁰ Economica Institut für Wirtschaftsforschung (2013), Schienengüterverkehr: Markt und Wettbewerbssituation (commissioned by Industriellenvereinigung), Vienna, 11/2013, p. 34-42

⁴¹ E.g. ÖBB employs ca. 40,000 people as the 7th largest employer in AT and trains approx. 1,600 apprentices as the largest apprentices' master in AT.

⁴² Koren, M., Riebesmaier, B., Schwarzbauer, W., Wehr, H. (2012), Baltisch-Adriatische-Achse - Gesamtwirtschaftliche Studie, Presentation held at ÖBB Infrastruktur, Vienna, on 25.01.2012,

⁴³ European Commission (2015), EU Energy in Figures 2015 Statistical Pocketbook 2015, http://ec.europa.eu/energy/sites/ener/files/documents/PocketBook_ENERGY_2015%20PDF%20final.pdf, p. 21-24 in:

⁴⁴ p. 8-9 Of: Gibson, Gena et al. (2014), Update of the Handbook on External Costs of Transport – Final Report, Ricardo AEA, commissioned by the European Commission: DG MOVE, 08.01.2014, <http://ec.europa.eu/transport/sites/transport/files/themes/sustainable/studies/doc/2014-handbook-external-costs-transport.pdf>

⁴⁵ p. 78 in: Van Esse, Huib et al., External Costs of Transport in Europe – Update Study for 2008, Delft, September 2011, http://ecocalc-test.ecotransit.org/CE_Delft_4215_External_Costs_of_Transport_in_Europe_def.pdf

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Other effects of delays in rail transport are increased logistical cost⁴⁶ and the creation of a negative image of rail services. According to Consumer Markets Scoreboards 2012, rail service market ranks 27th out of 30 service markets in the perception of EU consumers⁴⁷. The results for 2013 are similar (26 out of 31)⁴⁸.

According to a 2007 study, rail was subsidised with 73 billion EUR p.a. in Europe⁴⁹. State subsidies for loss-making railways could be reduced with more competitive rail services, which would imply higher cost coverage from ticket sales.

⁴⁶ According to the World Bank Logistics Performance Index 2014, AT ranks 25 out of 163 with an index of 3.65, SI 41 with 3.38; 1st DE with 4.12
see: <http://lpi.worldbank.org/about>

⁴⁷ p. 59 in: European Commission (2013), Commission Staff Working Document - Impact Assessment - Accompanying the documents Proposal for a Regulation of the European Parliament and of the Council on the European Union Agency for Railways and repealing Regulation (EC) No 881/2004 - Proposal for a Directive of the European Parliament and of the Council on the interoperability of the rail system within the European Union (Recast) - Proposal for a Directive of the European Parliament and of the Council on railway safety (Recast) (SWD(2013) 8 final), Brussels, 30.1.2013, <http://eur-lex.europa.eu/legal-content/sl/TXT/?uri=CELEX:52013SC0008> .

⁴⁸ European Commission (2014), 10th Consumer Markets Scoreboard- Making markets work for consumers- 10th edition – June 2014, http://ec.europa.eu/consumers/consumer_evidence/consumer_scoreboards/10_edition/docs/consumer_market_brochure_141027_en.pdf, p. 11

⁴⁹ European Environment Agency (2007), Size, structure and distribution of transport subsidies in Europe, EEA Technical report No 3/2007, 19/03/2007, http://www.eea.europa.eu/publications/technical_report_2007_3 , p. 6.

4 Solutions and good practice

The transformation and alignment of national railway systems and the removal of technical obstacles cannot be expected in the short-term: investment needs are considerable, investment coordination and planning across borders often implies lengthy processes.

Corridors are the backbone and the point of departure for developing a Single European Railway Area and implementing technical interoperability. Existing examples of good practice in cross-border development of rail corridors show that these are long-term processes, which require significant political backing. But there is the even greater challenge to maintain and upgrade the dense European rail network besides the major corridors. Anna Gigantino, ERA, states that corridors as axes of transportation could be seen as good practice for international cooperation. However, a potential problem could be that new barriers could be created between corridors. Corridors are uni-dimensional, whereas the target of a Single European Railway Area is a bi-dimensional free space⁵⁰.

In line with the two main challenges, two strands of measures could lead to significant improvement of the status quo of cross-border rail transportation in the EU as such and in particular along the crucial north-south links where the case at hand is located and which supports the integration of the regions in South-East Europe into the EU:

- Dedicated investment in technical interoperability;
- Investment coordination.

4.1 Investment in technical interoperability

Concerning the implementation of technical interoperability, the South-Eastern Transport Axis (SETA) corridor study proposes measures such as the coordination of ERTMS implementation and a pool of multi-system locomotives; however, such pools already exist (see above). The Baltic-Adriatic Corridor Study emphasises that national governments and infrastructure managers are responsible for investing in the upgrading of line speed, axle load and the number of tracks and capacity. However, there is a need for coordination across the border when it comes to border sections⁵¹.

4.2 Investment coordination

A recent study by the European Commission's Directorate-General for Mobility and Transport (DG MOVE) proposes specific governance structures for cross-border projects including national authorities, local and regional authorities and the infrastructure managers. The best practice example mentioned in that study is the Joint Interstate Committee HU-SI for the re-opening of the line Murska Sobota-Hados⁵². A Committee was set up in 1995 by the Ministry of Transport (MPZ) of the Republic of Slovenia and the Ministry of Transport, Communication and Water Management (KHVM) of the Republic of Hungary with subcommittees for legal, financial, technical and technological issues. The respective incumbent state railways should implement the project whereas the Ministries of Finance were constantly involved. The line has been operational since 2001⁵³.

⁵⁰ Interview with Anna Gigantino, Head of Interoperability Unit, European Railway Agency, on 20.04.2016

⁵¹ European Commission website, Mobility and Transport, Baltic-Adriatic Core Network Corridor Study – Final Report, December 2014. https://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/bal-adr_en, p. 140

⁵² European Commission – Directorate General for Mobility and Transport - Directorate B – European Mobility Network - Unit B1 – Trans European Network, State of play of cross-border railway sections in Europe, February 2016.

⁵³ Total investment in HU: 40 mEUR, total investment in SI: 90 mEUR.

N.A. (2003), Audit report on railway construction Zalaövő–Bajánsenye–Hodoš–Murska Sobota, 2003, <http://docplayer.hu/10411470-Audit-report-on-railway-construction-zalalovo-bajansenye-hodos-murska-sobota.html>

Another example for the long-term nature of border crossing large-scale rail investment is the construction of the Brenner Base Tunnel (AT-IT). The investment volume is estimated at about EUR 10 billion. The development and planning process took about 15 years. Construction is carried out by the joint *societas europaea* (SE) - Austrian/Italian Galleria di Base del Brennero – Brenner Basistunnel BBT SE. The construction started in 2014 in Italy) and 2015 in Austria. The main steps in the process were a European Economic Interest Grouping (EEIG) founded in 1999, the establishment of the SE in 2004, a Memorandum of Understanding between the two Ministries of Transport in 2007 and the bilateral agreement on financing approved by the Interministerial Committee for Economic Planning CIPE⁵⁴ in 2010. Germany joined the initiative by co-signing the Memorandum of Understanding of 2007.

There are numerous examples across Europe where this process of investment coordination is still at an embryonic stage. In addition, the AT/SI case study is an illustration for the asynchronous processes in cross-border rail investment.

4.3 Summary

Summing up, the main option for easing the border obstacles caused by different national railway systems is the accelerated implementation of EU legislation on harmonised standards and harmonised homologation procedures (in particular TSI, ETCS) as well as the corridor approach.

The implementation of measures requires coordination between the countries along the rail corridors since the required measures are usually interconnected closely, be it the introduction of common standards or infrastructure upgrading measures on either side of the border.

Clear incentives are needed to overcome the sometimes low inclination of national railway infrastructure managers to invest in the upgrade of cross-border links. In this situation, EU initiatives and ERA as an EU authority play a key role in the implementation and enforcement of viable solutions.

⁵⁴ Comitato interministeriale per la programmazione economica - Interministerieller Ausschuss für Wirtschaftsplanung (CIPE)

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link to the CREAM project: <http://www.cream-project.eu/home/index.php> ;

link to the SPIDER PLUS project: <http://www.spiderplus-project.eu/the-project> ;

link to the LivingRAIL project: <http://www.livingrail.eu/>

SETA Corridor

<http://www.seta-project.eu/index.php/about-seta/facts-a-figures>

TEN-T

http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/bal-adr_en.htm

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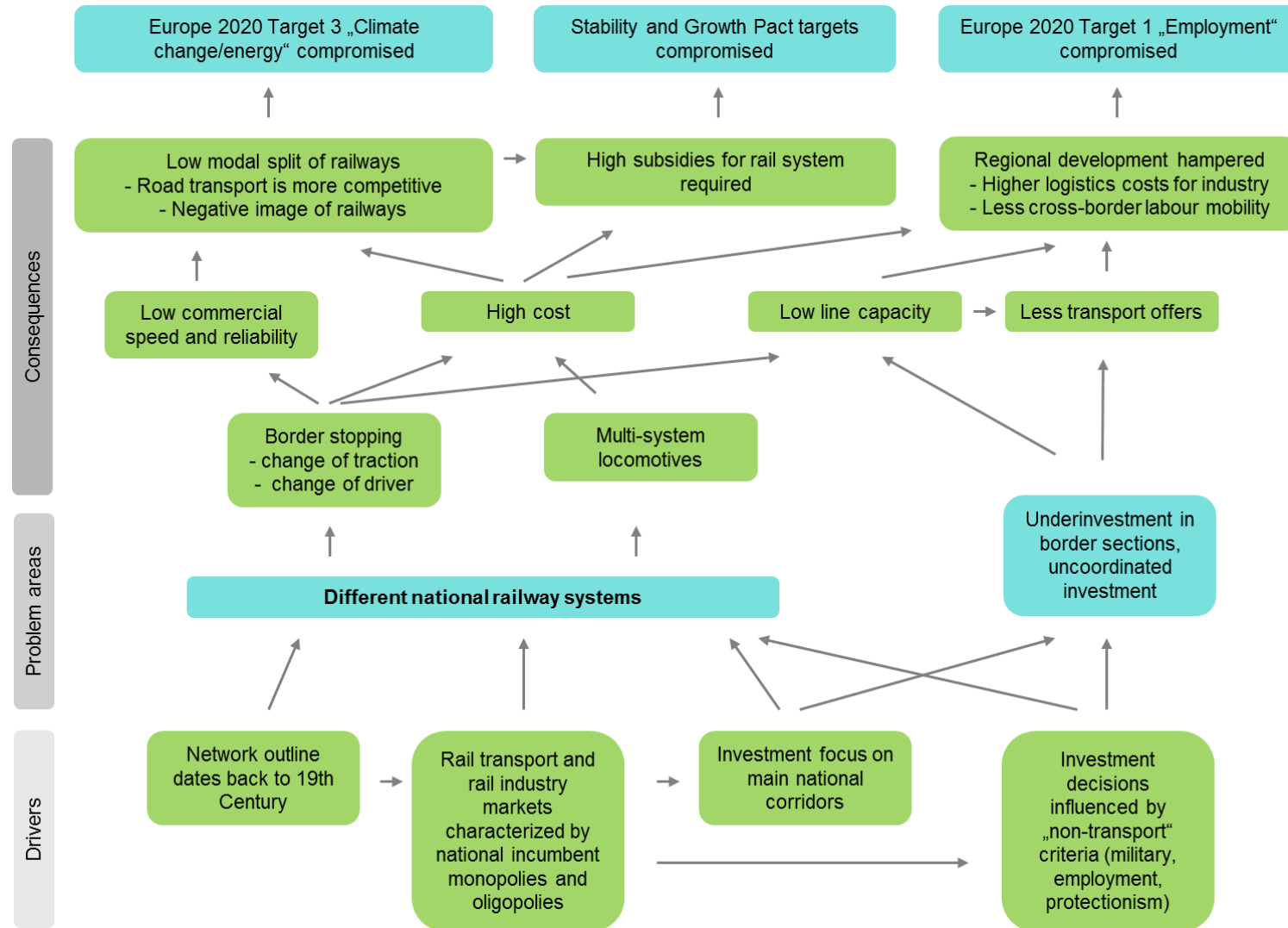
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09.08.2016 (telephone interview)	Winfried Ritt	Joint Technical Secretariat Central Europe Programme	Project Manager
15.09.2016 (interview)	Thomas Spiegel	Federal Ministry for Transport, Innovation and Technology, AT	Section II Infrastructure Planning and Financing, Coordination, Department Infra 2 Infrastructure Planning (Head)
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Austrian Federal Railways (ÖBB Infrastructure), Slovenian Railways (SZ), RailNetEurope (RNE) were contacted; however, interviews could not be held.

Annex

Figure 3. Problem tree



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