



European
Commission

Rhine Danube



Work Plan of the
European Coordinator

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This report represents the opinion of the European Coordinator and does not prejudice the official position of the European Commission.

1. Towards the *Rhine-Danube* corridor work plan

1.1 Introduction

Regulation (EU) 1315/2013 setting out the new guidelines for the development of the Trans-European Transport Network (TEN-T) represents an important step forward in the integration of all European National Transport Systems leading to an optimisation of the Network that serves the population and supports the economic development of European regions.

The dual layer approach, Core Network and Comprehensive Network, is based on a careful analysis of existing and forecast traffic flows, both for passengers and for freight, in the medium-term until 2030 and in the longer-term until 2050.

The Eleven Core Network Corridors (CNC) (nine Multimodal and two horizontal corridors, the so-called Motorways of the Sea (MoS) and the ERTMS¹) will facilitate the implementation of the Core Network. The "Corridor Approach" will allow for a greater coordination of infrastructure development within the EU.

A crucial aspect when designing a Corridor was the necessity to create a network capable of joining local traffic flows with national and international flows and to ensure that the network would be sufficiently reliable and flexible to allow for growth of the regions and possible adaptation to changes of trend in the demand for transportation.

All transportation modes have a role to play and as such it is of utmost importance that the Work Plan integrates these modes in order to provide real alternatives to users, be they passengers, transporters, forwarders or producers. Users must have access to an efficient and sustainable means of transport from the starting point of their journey until the major nodes, where an alternative means or route may be taken.

The methodology used to set up this Corridor Approach included integration of the networks of different modes of transport, such as rail, inland waterway, road and aviation; connection through nodes, including major towns, production centres, ports or other centres based on the exchange of modes for a more capillary conjunction of local development with the International network.

The Rhine-Danube Core Network Corridor represents the backbone of the region from the Black Sea towards the very heart of the European Union, connecting the entry ports at the Black Sea, Constanta and the ports in the Danube Delta, to southern Germany and to the ports of the Rhine along one of its branches, while the other branch links the Ukrainian-Slovakian border to the same Rhine ports and central European regions.

All modes of transport are represented in this Corridor; however its distinctiveness stems mainly in the fact that it includes the major unspoiled river of the European Union, the Danube River, and links it to the other major river basin of the Rhine River.

International Transport Corridors always require a major coordinated effort to integrate infrastructure components derived from National and sometimes regional developments in rail, road or inland waterway legislation. In the case of this Corridor, also non-European Union legislation has to be taken into consideration since the

¹ ERTMS= European Railway Traffic Management System

Danube River crosses Serbia, Moldova and Ukraine and one of its main navigable tributaries; the Sava River defines the frontier between Croatia and Bosnia-Herzegovina.

As a river, unlike the roads and rail lines, it cannot be stopped at the border so its non-EU sections, in the above mentioned countries, have been incorporated into the corridor economy and are going to be treated as an integral part of the corridor.

While on one side there is a major environmental responsibility in using the river as an important artery of the transport system, there is also a great opportunity for the preservation of its natural habitat and the intelligent use of its water; whether that is drinkable water, water destined for irrigation purposes, energy creation or as a source of economic growth through the creation of logistics centres and the connection to the hinterland.

A balanced development of the transport logistics along the river Danube is a major aspect of the Rhine-Danube Corridor and integrates well with the other modes of transport along the same axis or along the other Czech-Slovak branch, as both branches represent major entry points to the European Union from the south east European countries.

1.2 Road Map to setting up the Corridor Work Plan

Following the publication of Regulation (EU) 1315/2013 (referred to as the TEN-T Guidelines) and Regulation (EU) 1316/2013 establishing the Connecting Europe Facility (CEF) on 20 December 2013 and the Nomination of the Coordinators in March 2014, work started on the drafting of a Study on each Corridor. This work was supported by a team of external Consultants who undertook a wide consultation with stakeholders and assisted in the drafting of the basis for the Corridor Work Plan.

Four consultation Fora have been held between April to November with the participation of representatives from the National Transport Ministries, from regions and from rail, inland waterways, road and ports Infrastructure bodies to discuss and present the findings concerning the Corridor infrastructures.

At the last Forum of the year, the Consultant presented the result of the "Study on TEN-T Core Network Corridor Rhine-Danube". This final report includes the analysis of the Corridor alignment, its infrastructures with a survey of the studies necessary to resolve the existing bottlenecks, including those studies that are on-going and those that are foreseen; a Transport Market Study has also been carried out to analyse the present trends and the expected variation of the traffic flows along the corridor on the time horizon of 2030.

The TEN-Tec maps, elaborated in accordance with data supplied by the Member States has been included as an Annex to the study. These maps provide a useful tool for the analysis of existing bottlenecks and the identification of more effective interventions.

The following sections include the main findings of this year's activities and the recommendations for Rhine-Danube Corridor Work Plan.

2. Characteristics of the *Rhine-Danube Corridor*

2.1 Corridor alignment

The Rhine-Danube Corridor is the main east-west link between continental European countries connecting France and Germany, Austria, Slovakia, Hungary, Croatia, Romania and Bulgaria all along the Main and Danube rivers to the Black Sea by improving (high speed) rail and inland waterway interconnections. It includes sections of Priority Projects 7, 17, 18 and 22. The parts in the Czech Republic and Slovakia are also covered by the Rail Freight corridor 9.²

Bulgaria and Croatia are only included in the corridor as regards Inland Waterways. This concerns ports and inland waterways of the Danube and Sava Rivers. Also, non-EU neighbouring countries are included in the analysis of the waterway corridor³. In detail this means the sections below are included in the analysis:

- Serbia: related to inland waterways (Danube, Sava) and two ports (Belgrade, Novi Sad)
- Bosnia and Herzegovina: related to inland waterways (Sava)
- Moldova: related to one port (Giurgiulesti)
- Ukraine: related to inland waterways (Danube).

The alignment of the corridor consists of the following main connections, as reported in the maps of the core and comprehensive network of the TEN-T Guidelines (Regulation 1315/2013) and according to Annex 1 of the CEF (Regulation 1316/2013):

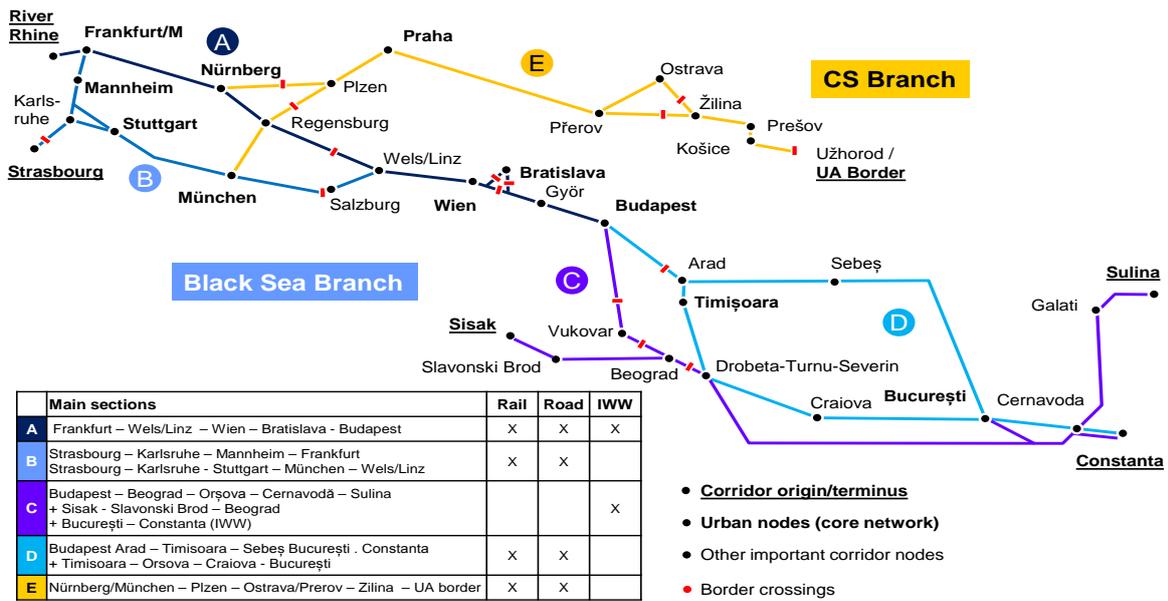
- Strasbourg – Stuttgart – München – Wels/Linz ;
- Strasbourg – Mannheim – Frankfurt – Würzburg – Nuremberg – Regensburg – Passau – Wels/Linz ;
- Munich/Nuremberg – Praha – Ostrava/Přerov – Žilina – Košice – UA border
- Wels/Linz – Wien – Bratislava – Budapest – Vukovar;
- Wien/Bratislava – Budapest – Arad – Brasov/Craiova – Bucuresti – Constanta – Sulina.

In figure 1 is reported the full alignment of the corridor split in five main sections to enhance the multimodal aspect of each section versus rail, road and inland waterways.

² See Annex 1 of the Regulation (EU) 1316/2013 establishing the Connecting Europe Facility (CEF).

³ The cooperation with third countries is described in Article 8 of the TEN-T Guidelines. Projects of common interest in order to connect the TEN-T network with networks of neighbouring countries may be supported, including financially, by the Union. The TEN-T Guidelines include maps of the indicative extension of the TEN-T to the neighbouring countries; IWW map is included for the Western Balkan countries.

Figure 1: Alignment of the Rhine-Danube Corridor (all modes)



Source: HaCon

The Corridor can be roughly split into two branches: the “Black Sea” branch and the Czech-Slovak “CS” branch in the north.

The Black Sea branch has two different routes in Germany and Romania. For Germany there is a northern route via Frankfurt/Nurnberg and a southern route via Stuttgart/Munich/Salzburg. In Romania, the Corridor routes via Sebes, as well as via Craiova. The section C of the Black Sea branch is exclusively dedicated to inland waterways (i.e. Danube and Sava).

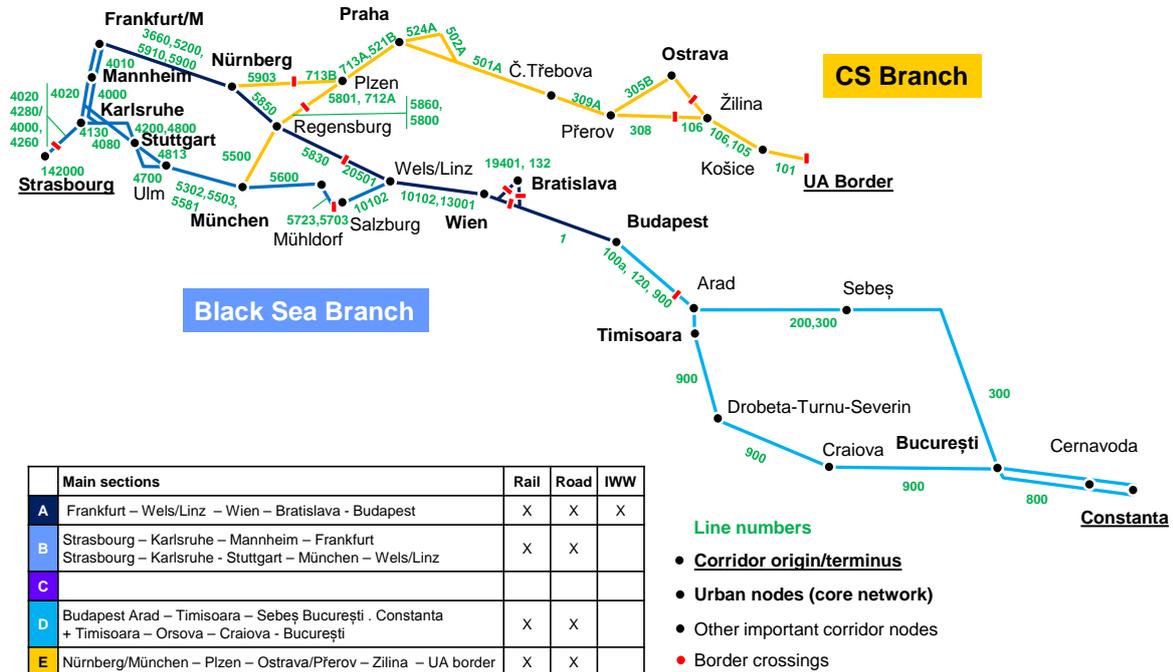
The alignment of inland waterways is clearly defined. It includes the Main River starting with the confluence with the Rhine, which is connected to the Danube by the Main-Danube Canal at Kelheim. The CEF Regulation includes a pre-identified project on Sava up to the port of Sisak, which is defined as a comprehensive port.

The CS Branch has two starting points (Munich and Nurnberg) and runs via Plzen and Prague towards Přerov in the Czech Republic. Beyond Přerov at Hranice na Morave the Corridor splits into the line via Ostrava, which is mainly dedicated for passenger traffic, and the direct line via Púchov and Žilina in Slovakia is mainly used by freight traffic.

Railways

The rail infrastructure of the Corridor is displayed below in Figure 2.

Figure 2: Rail alignment of the Rhine-Danube Corridor and assigned infrastructure



Source: HaCon

The figure shows the assignment of the infrastructure, represented by dedicated railway lines. Routing variants on the respective main sections are particularly available along the Rhine between Karlsruhe and Frankfurt (routing via Groß-Gerau – “Riedbahn” or via Darmstadt), between Karlsruhe and Stuttgart (“old” line and new (planned) high-speed line), between Praha and Kolin and between Linz and Wien (alte/neue Westbahn).

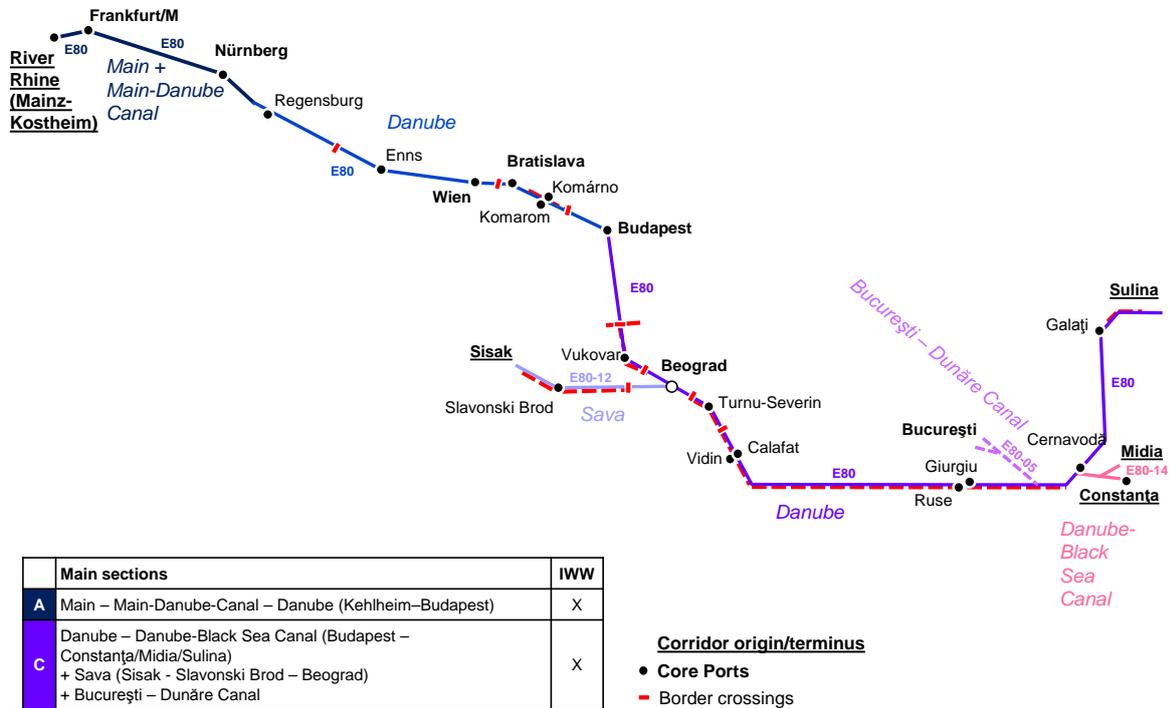
The Black Sea rail branch covers six countries (France, Germany, Slovakia, Austria, Hungary and Romania). Its total distance between Strasbourg and Constanta is about 2,300 km, depending on the routing in Germany and Romania. The major part is allotted to Romania (37%), followed by Germany (28%), Hungary (18%) and Austria (16%). Slovakia and France have only very small sections of the Black Sea branch.

The CS branch is about half as long as the Black Sea branch. The total average length is 1,150 km, dedicated to only three countries (Germany, Czech Republic and Slovakia). More than 50% of the CS branch distance (about 600 km) is located in the Czech Republic.

Inland Waterways

The inland waterways alignment is displayed below in Figure 3.

Figure 3: IWW alignment of the Rhine-Danube Corridor and assigned infrastructure



Source: viadonau

The Rhine-Danube Corridor is clearly defined when it comes to inland waterways. It includes the Main starting at the confluence with the Rhine (at Mainz-Kostheim), which is connected to the Danube by the Main-Danube Canal between Bamberg and Kehlheim. The TEN-T Guidelines (p. 160) include the Sava in the Corridor up to the comprehensive port of Sisak.

The navigable Danube crosses Germany, Austria, Slovakia, Hungary, Croatia and the Republic of Serbia, forms the border between Romania and Bulgaria, and passes Moldova and Ukraine eventually flowing into the Black Sea at Sulina. The Sulina Canal is one of the three channels in the Danube Delta. Also the Danube-Black Sea Canal between Cernavoda and Constanta and the branch to Midia are part of the Core Network Corridor.

The Sava River included in the Core Network Corridor starts at Sisak in Croatia, constitutes the border between Croatia and Bosnia and Herzegovina before reaching Serbia and flowing into the Danube at Belgrade.

In addition to the existing inland waterways also the planned Danube–Bucuresti Canal with its two branches is part of the Rhine-Danube Corridor.

The following neighbouring countries are considered in relation to inland waterways:

- Serbia: Danube, Sava
- Bosnia and Herzegovina: Sava
- Moldova: port of Giurgiulesti
- Ukraine: Danube.

In contrast to other transport routes, in many cases inland waterways are identical with state borders. Therefore the distances of corridor sections assigned to the member states cannot be summed up in order to evaluate the length of the whole inland waterway. The inland waterway of the Rhine-Danube corridor between Mainz-Kostheim and Constanta, comprising the Main (Mainz-Kostheim – Bamberg), the Main-Danube Canal, the Danube

(Kehlheim-Cernavoda) and the Danube-Black Sea Canal (Cernavoda-Constanta), has a length of 2,735 river km⁴. The considered inland waterway corridor sections (including Sava and the Danube between Cernavoda and Sulina) sum up to 4,198 river km. The river kilometre 0 of the Danube is at the mouth to the Black Sea at Sulina.

Locks are mainly an issue at the Canals and the Upper Danube which – due to its high slope, is used for hydropower. The only locks at the Lower Danube are those at the Iron Gate I and II power plants. Altogether 48 single chamber locks are situated on the Rhine-Danube Corridor, of which 28 are allocated to the Main, 16 to the Main-Danube Canal and 4 to the Upper Danube. The 24 double chamber locks are located at the Lower Main (6), at the Danube (14) and at the Danube-Black Sea Canal (2), respectively the Poarta Alba-Midia Navodari Canal (2).

Ports

The ports alignment is displayed below in Figure 4:

Figure 4: Overview of ports



The Corridor include 19 core ports, all are inland waterway ports except Constanta and Galati that are both inland waterway and maritime ports.

In terms of road connection, all ports have road connection but of varying quality in terms of number of lanes and capacities. Similar situation is seen in case of railway connection where all ports have rail connection to the hinterland, whereas some railway tracks are in poor condition and/or rarely used due to current modal split or due to their deteriorated state (e.g. Port of Komárom in Hungary).

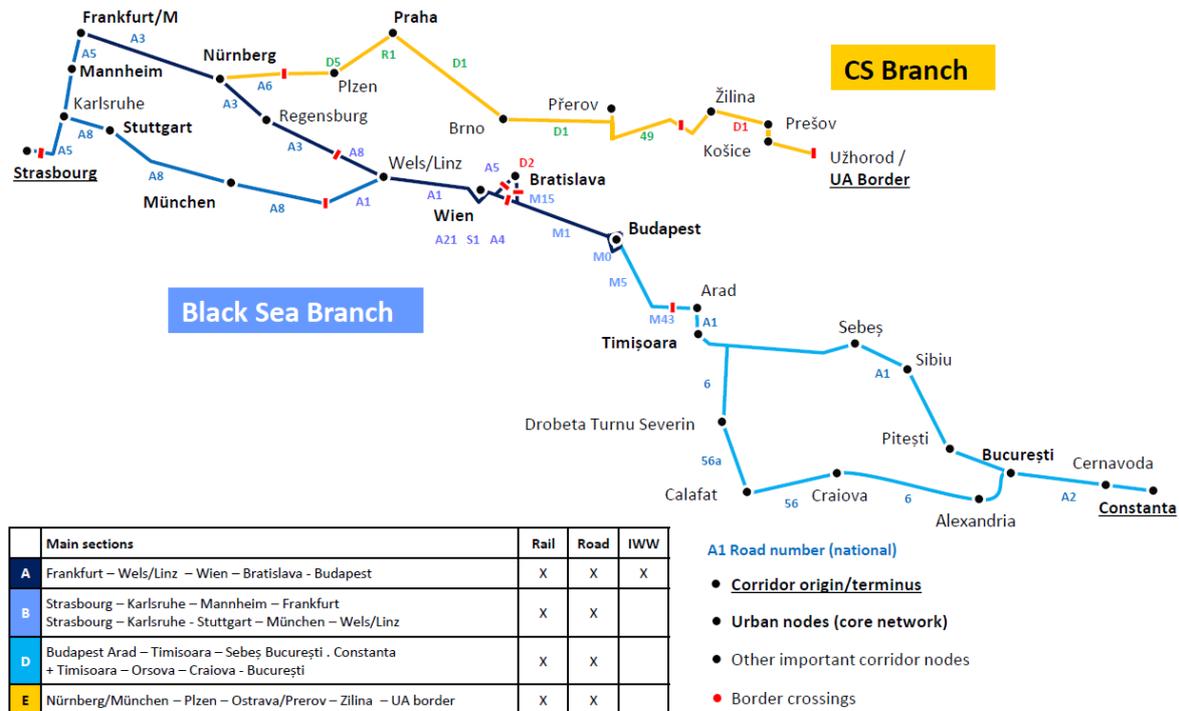
Ports play an important role in the development of the Transport system and as intermodal logistics platforms for the connection of regions that are not directly crossed by the corridor.

⁴ Generally the distance is measured in river kilometres, which measure distances along rivers. They do hardly correspond to “real” kilometres, as the river often meanders.

Roads

The road alignment is displayed below in Figure 5 where are also displayed the urban and other nodes, the origin and terminus of sections and the border crossing.

Figure 5: Road alignment of the Rhine-Danube Corridor and assigned infrastructure



The road corridor has a total length of 4.470km for both branches, the one across Czech Republic and Slovakia and the one along the river Danube. It crosses France, Germany, Czech Republic, Slovakia, Austria, Hungary and Romania.

The road infrastructures follow in the northern branch from Frankfurt to Nuremberg and Regensburg the BAB 3 and in the southern part from Karlsruhe via Stuttgart, Munich the BAB 8.

Along the Danube basin, the road corridor starts in Strasbourg (FR) with the motorway A35 and follows the motorway N4 to the crossing of the Rhine – at Kehl (DE) entering into the motorway A5 at Appenweier up to Frankfurt. The road alignment of the corridor shows some similarity to the rail alignment, particularly with respect to line variation between Karlsruhe and Frankfurt.

In Austria the motorways A8 (from Suben to Haid) and A1 (Salzburg – Vienna) passing by Vienna on the A21 and the express way S1 south of Vienna and the A4 from Wien towards the Hungarian border form the road corridor along the river Danube. A connection from the A4 east of Bruckneudorf to the D2 at Jarovce (SK) is the motorway A6. In Hungary the M1 from the Austrian/Hungarian border to Budapest, the short section of M15 between the Slovakian/Hungarian border and the M1, the M0 around Budapest and the M5 to Szeged and from there the M43 form the main route towards Romania. In Romania the main branch is from Arad via Sebeș to Pitești and București and the second branch via Craiova to București. The route continues then from București to Constanța. The route from Drobeta Turnu Severin towards Craiova is indicated on the maps of the TEN-T Regulation via Calafat and its port (belonging to the core network, whereas the direct route from Drobeta Turnu Severin via Filiasi to Craiova is indicated as

comprehensive network). However this is an overlapping section with the Orient-East Med Corridor (OEM). The total average distance of the Black Sea branch is about 2,300 km, thus almost exactly the same value as rail.

Hungary, Czech Republic and Slovakia have realised an ambitious construction programme on their motorway network in the last years. Also Romania has carried out a number of road projects on sections of the main corridor route between Nadlac – Bucuresti – Constanta (Northern parts). On this, there are operational motorway sections: Arad – Timisoara; Pitesti – Bucuresti – Cernavoda- Constanta; Saliste -Sibiu by-pass (Selimbar); Constanta Ring road; Deva (Soimus)- Orastie-Sebes-Sebes by-pass-Cunta; Balint –Dumbrava; Lugoj-Balint (A6).

As the schematic figure shows the main difference to the rail corridor is the missing part of the CS branch via Munich and Regensburg as well as from Regensburg to Plzen. For this reason, the average road length of the CS branch is about 100 km shorter compared to rail. The road alignment differs from the rail alignment mainly in the Czech Republic, since there is a road connection to Brno. From Brno a connection to Přeřov and Ostrava is recommended, thus following the modification of the RFC 9 between Přeřov to Ostrava. The section between Hulin and Ostrava is part of the Baltic-Adriatic Corridor (BAC). The road corridor continues then south of Přeřov from Zlin to Zilina, Prešov, Košice to the Ukraine border.

Airports

The airports alignment is displayed below in Figure 6:

Figure 6: Airports to be connected with TEN-T network by 2050



Source: iC consulenten

There are a total of eleven airports along the Rhine Danube Corridor that can be assigned to Core Network nodes, with a majority in Germany (4), Romania and the Czech Republic (2 each) and one per other Member State.

Based on the TEN-T Guidelines Art. 41, para. 3, there are dedicated main airports, defined in the part II of Annex II that shall be connected with the TEN-T rail network by 2050, wherever possible into the high-speed rail network. These dedicated main airports along the Rhine-Danube corridor are: Frankfurt, München, Stuttgart, Praha, Wien and Budapest.

The following airports are not included in the above obligation and therefore do not have the obligation to be connected to rail by 2050: Nürnberg, Bratislava, București and Timișoara. Ostrava airport connection although not required, is nearly completed.

Rail/Road terminals

The rail/road terminals alignment is displayed below in Figure 7, which shows the assignment of the listed nodes to the corridor infrastructure and provides an impression on the spatial distribution of traffic/logistic core areas on the corridor.

Figure 7: Overview on core network urban and traffic/logistic nodes on the alignment of the Rhine-Danube Corridor



Source: European Commission;
<http://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/site/en/maps.html>
 Modified by HaCon

The TEN-T Guidelines highlight the role of rail/road terminals (RRT) and have already defined their locations along the Corridor in Annex II of the Regulation.

Particularly nodes representing inland ports and rail-road terminals often have more than one facility (e.g. three rail-road terminals in Stuttgart).

2.2 Compliance with the technical infrastructure parameters of the TEN-T guidelines

In Annex II is reported the comprehensive list of projects that has been identified during the study on the corridor, some are ongoing and other are foreseen in order to achieve the compliance of infrastructure to the requirements as reported in the Regulation 1315/2013.

Rail

TEN-T Guidelines set the following "core parameters" for rail:

- *Electrification: Core network to be electrified by 2030 (including sidings where necessary)*
- *Axle load: Core freight lines 22.5 t axle load by 2030*
- *Line speed: Core freight lines 100 km/h by 2030 (NB: no speed requirement for passenger lines)*
- *Train length: Core freight lines to allow for 740 m trains by 2030*
- *ERTMS / signalling system: Core network to be equipped with ERTMS by 2030*

- *Track gauge: New lines to be built in UIC standard gauge (1435 mm), except in certain circumstances.*

To illustrate the rate of compliance of the current corridor characteristics with the requirements of the Regulation, the following points should be noted:

- "Traction": more than 90 % of the corridor rail lines are electrified. Gaps of electrification are limited to some sections in Germany (Munich-Mühldorf-Salzburg line, however electric traction is possible via Rosenheim and cross-border sections with the Czech Republic) and Czech Republic;
- "Axle load": 67% of the corridor lines allow for 22.5 tonnes axle load. Line sections not fulfilling the requested standards are mostly located in Hungary and Romania.
- "Maximum operating speed": more than 90 % of the corridor rail lines provide for operating speeds of 100 km/h and more. Line sections with insufficient operating speed are located on the "CS" branch and on the Eastern part on the "Black Sea" branch (Romania; Hungary: local speed drops in Budapest node);
- "Maximum train length": 47% of the corridor lines allow for 740 m train length. Corridor lines which do not fulfil the 740 m criterion are located on the CS branch, in Austria, Romania and on one small section in Hungary. Due to methodical problems in the determination of the permitted train length, the significance of this result is limited, though;
- "ERTMS in operation (YES/NO parameter)": Currently, regular ERTMS operation is rare in the Rhine-Danube corridor; it is restricted to some line sections in Austria and Hungary. Further sections in Romania and Czech Republic are in testing operation.
- "Track gauge": all corridor lines provide for standard gauge (1,435 mm);

In order to reach our final target to achieve an interoperable and competitive railway network, three conditions need to be fulfilled along the corridors: sufficient infrastructure quality, harmonisation of national rules throughout Europe and introduction of ERTMS. To speed up this process and to show tangible results in the railway sector, we need to accomplish quick wins through implementing short-term and less costly projects. Implementation of interoperability actions, such as the 740m train length standard, harmonisation of operation and authorisation rules would have a direct impact on productiveness.

According to the Work Plan of the European ERTMS Coordinator a detailed way how to accelerate ERTMS equipment along the Core Network Corridors is described. In cooperation with the railway sector, a so called Breakthrough programme for ERTMS has been established that consists of a limited number of objectives to be reached by 2016. One of those objectives is the review of the currently valid European Deployment Plan (EDP) and to identify a strategy for ERTMS equipment by 2030, as laid down in the TEN-T Guidelines.

Inland waterways

Article 15 and 39 of the TEN-T Guidelines describe among other things, the transport infrastructure requirements for inland waterways allocated to the core network. Particularly the compliance with ECMT waterway class IV requirements, valid for 365 days per year, was verified along the following parameters:

- *Length of vessels and barges: from 80-85m*
- *Maximum beam: from 9.50m*
- *Minimum draught: from 2.50m*
- *Tonnage: from 1000 – 1500t*
- *Minimum height under bridges: from 5.25/7.00 m (2 layer resp. 3 layer container transport)*

Regarding inland waterway infrastructure the Danube-Bucharest Canal is the only missing link and was already identified in the CEF regulation.

The Main and the Main-Danube Canal provide for stable *fairway conditions*. However, at many sections of the Danube and the Sava Rivers, the requirement of a *minimum draught* of 2.5 m is frequently not met, even not for 240 days per year for downstream sections or for upstream sections 300 days per year, as referred to by the AGN agreement⁵ of rivers with fluctuating water levels.

Regular fairway maintenance and rehabilitation is necessary and particularly important on free-flowing sections. It has the potential to improve infrastructure conditions substantially on the short and medium term.

Works on overage locks is also necessary, in particular, the Iron Gate I and II locks have also been identified as bottlenecks and need a capital overhaul.

River engineering projects should be approached from a holistic point of view and shall take various interests such as transport economy, ecology, and flood protection into account (integrated approach).

RIS services are available along the whole Corridor but to a different extent and quality and interoperability is not always ensured. The most relevant projects on corridor level are IRIS Europe 3 and RIS enabled Corridor Management.

Administrative processes and paperwork are sometimes seen as a significant competitive disadvantage for inland waterway transport on the Rhine-Danube Corridor.

Ports

Port parameters analysed are as follows:

- IWW connections
- Road and rail connections
- Intermodal facilities

The majority of the Corridor core ports comply with the requirement set in the new TEN-T Regulation: there are only two ports, Vidin (BG) and Cernavoda (RO), where the minimum depth is not met, and therefore requiring dredging activities.

All core ports⁶ have a road connection but of varying quality in terms of number of lanes and capacities. The situation is similar in view of railway connection, as all ports have rail connection to the hinterland.

⁵ As of November 2014, the following countries of the Rhine-Danube Corridor acceded to AGN: Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Moldova, Romania, Serbia, Slovakia, Ukraine

⁶ Rhine ports are tackled in the study on Rhine-Alpine Corridor

The level of intermodal facilities in ports is varying and, generally, declines in the “down the river” direction, with a noticeable need for additional provision of such facilities in determined ports.

In terms of plans for alternative clean fuel facilities, only one port (Constanta) reported its project plans on providing facilities for alternative clean fuels (i.e. LNG), while some of the remaining core ports on the Corridor are taking part in the LNG Master Plan on the Rhine-Main-Danube axis, already financed by TEN-T.

As regards the external supply of electricity to vessels in ports, most of the ports reported the existence of shore-side electricity supply facilities for vessels.

In most of the cases, port administrations and their parent territorial entities (state, region or municipality – depending on the port governance system applied in each Member State) have properly planned tackling the bottlenecks in ports.

Road

About 78% of the total length of roads is classified as motorways (express ways) and 22% are ordinary roads.

Of particular relevance for the road characteristics are the standards set by the TEN-T Guidelines. Concerning road, the following core parameters and standards are defined:

- Type of road, whether the road is an ordinary road, express road or motorway: Roads have to be either express roads or a motorway by 2030;
- Parking area along the road: Sufficient parking areas at least every 100km, per 2030;
- Availability of alternative clean fuels, by 2030;
- Use of tolling system/ITS and their interoperability with other systems.

The following cross-border sections form a part of the missing links of the Rhine-Danube Corridor, which do not comply with the technical standards:

- Czech – Slovakian border: between Zlin and Zilina: on the Czech side from Zlin to the border R49 and on the Slovakian side the R6 from the border to Belusa;
- Hungarian-Romanian border: M43 motorway section (2x2 traffic lanes + emergency lanes) from Makó to Csanádpalota city (Romanian border) being under construction is to be completed by July 2015 (Part of Priority Project 7);
- Hungarian-Slovakian border: M15 (Mosonmagyaróvár-HU/SK border) relates to the OEM Corridor with impact to the Rhine-Danube corridor: The M15 Expressway (14 km between Rajka/SLK border – Hegyeshalom/M1) is only a half motorway and functions currently as an expressway with 2x1 traffic lanes.

Regarding the secure parking facilities for trucks each Member State follows the minimum requirement of the parameter (every 100km); however the need for sufficient parking space is increasing.

Regarding the toll system, the Member States have implemented a variety of toll charging systems, which makes it difficult to find a way of implementing a toll charging system on the entire road corridor. Currently the EU co-funded project Regional European Electronic toll system (REETS) is analysing the situation in detail.

The availability of alternative clean fuels along the road corridor is given; possibilities for liquefied natural gas (LNG) and liquefied petroleum gas (LPG) are available in all Member States at different levels.

Airports

The following core parameters and standards are defined for airports:

- Connection to rail network, and road network; certain airports have to be connected to heavy rail by 2050;
- Capacity to make available alternative clean fuels by 2030.

Based on the Regulation 1315/2013 Article 41, para 3, there are dedicated main airports, defined in the part II of Annex II that shall be connected with the trans-European rail network by 2050, wherever possible into the high-speed rail network. These dedicated main airports along the R-D corridor are: Frankfurt, München, Stuttgart, Praha, Wien and Budapest.

Airports assigned to the core network, which do not fall under the obligation of Regulation 1315/2013, Article 41(3); accordingly they do not have to be connected to the TEN-T rail and road network by 2050 are the remaining airports of the list, namely: Nürnberg, Ostrava, Bratislava, București and Timișoara.

Regarding the availability of alternative clean fuels for airport ground services (e-mobility, hydrogen, CNG (compressed natural gas), LPG); some airports have introduced charging or fuelling stations recently. Hydrogen facilities for charging and charging stations for e-cars are already being introduced at Stuttgart and Munich Airport as low-emission fuels; a charging station for e-cars and a LPG fuelling station for the operation of 37 natural gas-powered vehicles were introduced in Vienna. Similar actions are deemed to be implemented at airports committed to become ecologically friendly in their operation (e.g. Budapest airport by 2020)

Stuttgart Airport is currently running a research project called eFleet. The goal of the project is to operate a representative mix of e-vehicles such as e-buses for passenger transport, e-luggage and push back trucks for ground operation.

Rail/Road Terminals

A 'freight terminal' means a structure equipped for transshipment between at least two transport modes or between two different rail systems, and for temporary storage of freight, such as ports, inland ports, airports and rail-road terminals.

The TENtec Glossary defines rail/road terminals (RRT) as part of multimodal platforms (MMP). MMPs are created through assembling a number of existing TENtec sections / nodes. Thus multimodal platforms are a specific term for the use of TENtec.

For establishing MMPs, interconnecting points are needed. They are made of seaports, inland ports and airports, as well as rail/road terminals (RRT). The Glossary further expresses that a RRT is a terminal which transfers goods between rail and road only. That could be virtually any piece of installation for handling freight. The TENtec information system itself calls for "Rail-Road intermodal terminals", thus focuses on a particular type of freight transport.

The analysis of rail/road terminals includes locations with trimodal facilities enabling container transshipment to/from rail/road and inland waterways. Infrastructure, volume and operation will however focus on the rail/road aspect of these trimodal terminals. By doing so, the scope of work has been extended considerably and the separation from private installations needs to be assured.

Following this definition, the rail-road nodes of the Rhine-Danube Core Network include 41 single terminals only considering facilities directly located in the respective city. This number of terminals considers that single terminal nodes along the corridor can be subject to multiple facilities operating individually or as a unit.

27 of the identified 41 terminals stand for pure rail-road facilities, while 14 of them represent trimodal terminals. Most (15) of the terminals are located on the German sections of the corridor, followed by Czech Republic (8), Romania (5) and Austria (5).

Next to these core network terminals further intermodal facilities are important for the access to the corridor.

3. Results of the transport market study

The transport market study (TMS) has been carried out in 2014 and presents drivers for scenarios, which mainly consist of socio-economic data and are well described in national sources and the European data project ETISplus. National forecasts are used to describe the demand and supply side of the TMS. Additionally ETISplus data is used, which contains detailed information on transport demand and infrastructure characteristics. Rail data is also present in the international rail studies of Rail Freight Corridors 7 & 9 and Priority Project 22. The source of information for Inland Waterways Transport is medium and long term perspectives for IWT. Regional data of roads, ports and airports are presented in detail in the appropriate section of the TMS.

The TMS's main conclusions are presented below:

Population on the corridor is centred on the corridor urban nodes. In the future this geographical pattern is not expected to change. Population decline is forecasted in Germany, Hungary, Romania and Slovakia. This will not affect the strongly urbanised areas. Modest population growth is expected in Austria, Strasbourg area and the Czech Republic. In terms of economics, the existing GDP difference/gap between roughly the eastern and western part of the corridor will not be shifted by 2030 by forecasts. The forecasted economic growth rates of the countries on the corridor are not too different from each other. Economic growth is roughly between 1 and 2% per year in terms of GDP in current prices.

The existing transport pattern indicates that road is the most used cross-border transport mode for passenger and freight. In total 68.4 million international passenger demand trips were made in 2010 within the corridor study area. Between Austria and Germany 17.2 million trips were observed, representing 25% of the total trips. The second highest flow is the bidirectional traffic between Austria and Slovakia: 12.2 million trips, 18% of the total.

The most represented mode is road, covering 83% of the total trips, followed by rail with 13% and air with 4%. For the individual modes the bidirectional traffic flow between Austria and Germany is again the most important traffic flow, except for rail. For rail the most import flow is between Austria and Hungary. For road the bidirectional traffic flow between Austria and Slovakia is the second highest. The single French region on the corridor has a high number of road traffic. For rail the highest intensity is the flow between Austria and Germany, and for air the flow between Germany and Hungary.

International Freight demand transport is concentrated on the western part of the corridor. The transport in between the areas of Austria, Germany, Czech Republic and Slovakia accounts for 82% percent of the total corridor transport. Between the Czech Republic and Slovakia more than 18 million tonnes are transported. Austria – Germany accounts for 14 million tonnes.

The transport volume for road within the RD corridor is twice as big as for rail, and four times as big as for inland waterway. Or in percentages: 58% for road, 28% rail and 14%

IWT. The Czech Republic has the highest rail and highest road volume of the corridor countries. The enlargement of the corridor catchment area and comprehensive ports in the TMS as agreed in the second corridor forum makes the modal split more favourable towards IWT. The relevant IWT countries of Bulgaria, Croatia, Serbia and Ukraine rank lowest in terms of volume. Romania ranks highest, not in the least due to the expanded third countries, especially Serbia has a high volume of import and export to Romania, mostly due to the port of Constanta.

For rail, the connection between the Czech Republic and Slovakia transport more than 9 million tons. The Czech-Slovak connection therefore accounts for about 34% of the volume. The total international rail volume of Bulgaria with respect to the corridor is 1 million tonnes.

The conclusion on the demand side is that road transport will be dominant in the future market in the baseline scenario. Currently road is dominant and the position is expected to strengthen practically corridor wide in the baseline situation. This is the case for international and national traffic, passenger and freight. In a number of cases the growth rates are higher for alternative modes of transport, but the net volume growth is generally highest for road. Passengers are forecasted to have more individual wealth, more car ownership and in a limited number of countries face deteriorating public transport. In the baseline freight scenarios a continued trend is generally assumed, which is beneficial for road because if a mode shift has not taken place in the past years, no future mode shift is forecasted in some models. Still in scenarios of higher road costs and improved alternatives, road is still expected to remain dominant. This leads to the conclusion that there is a need to strengthen the rail and inland waterway transport modes on the corridor to take over future transport volumes through the improvement of the rail and the inland waterway network and not to stop there to support modal shift. International traffic, import, exports and transit is expected to grow in all forecasts. This helps to create a larger playing field for intermodal operations. The traffic of the Eastern part of the corridor will grow at a higher rate. However the Member States of Austria, Czech Republic, Germany and entry/exit node France (Strasbourg) on the corridor are expected to maintain the high transport demand by 2025.

As for the supply side, information on capacity and the utilization at infrastructure level has been analysed:

- Road currently has short distance capacity issues around corridor nodes, which influence the long distance travel as well. Germany has the most urban areas and also the most utilised road infrastructure. In the expected implementation plan Germany has the highest number of capacity upgrades projects. Slovakia also has a high number of capacity projects in the implementation plan. Other supply characteristics presented in the TMS are border waiting time and infrastructure charges.
- Rail is faced with capacity issues on short and long distance areas. This does include cross border sections but not particularly. Future supply is foreseen in the implementation plan for rail, but this additional capacity is expected to be consumed by the existing and future demand. On other supply characteristics, the RFC 7 implementation plan indicates that the current waiting time at the Romanian and Slovakian border is the highest with an approximate 2 hours average.
- IWT would have sufficient capacity if the parameters according to fairway ECMT classifications would be observed. However, this is not the case. Existing locks on the sections have sufficient capacity for the near future but some are in a bad state of maintenance and have therefore become a bottleneck. Lock projects are identified in the implementation plan. Furthermore, the Danube fleet is operating under low water conditions and therefore the barges cannot use their full loading capacity. All free-flowing sections on the corridor are often problematic in terms of fairway depth, depending on the time of season. Icing periods, which rarely occur

between January and February, limit the capacity as well. The operation of larger ships and convoy arrangements may increase the capacity of the Danube fleet. However due to the low water conditions it has currently multiple fairway bottlenecks. To improve the IWW supply in the future all bottlenecks are to be relieved and all fairway maintenance needs to be coordinated until 2030 and beyond.

- Core and comprehensive ports are evaluated. For a number of ports, intermodal connections in particular with rail have to be improved.
- Air passenger traffic is the overall highest growing transport mode in the reviewed forecasts of the TMS. The current air volume is low however, both for freight and passengers. Capacity expansions at the largest air nodes of Germany, Austria and the Czech Republic are considered as needed and are ongoing. Hungary also has a large air node, but capacity is not needed immediately.

The German part of the corridor (South of Germany) has the busiest infrastructure. Expected infrastructure investments will help increase supply, yet the infrastructure in this part of Germany is still expected to be used intensively in the future.

4. Critical issues on the *Rhine-Danube* Corridor

The Study on the Rhine-Danube corridor has led to identify prominent critical issues along the corridor; most urgent issues are relevant to cross-border connections, bottlenecks, implementation of intermodality and compliance with interoperability standards.

The modal split: In 2010 this was 58% for road, 28% for rail and 14% for IWT, for international freight. The baseline indication is that road would increase modal share at the cost of rail and IWT. The supply side analysis presents capacity data, border waiting times and infrastructure charges and the Supply side is the one that influences the modal split.

Rail is presently heavily utilised and consequently any modal shift from road to rail is hampered by lack of sufficient capacity. More than one third of rail projects in the implementation plan are about infrastructure works. In the German Bundesverkehrswegeplan of 2003 it is stated that the future projects are sufficient to handle the future capacity but that the capacity on the railway network is not significantly improved. About 10% of the Corridor international rail freight volume is related to Germany. Roughly 40% of the rail project costs are assigned to Germany in the current draft implementation plan. The Czech Republic has a larger share of Corridor freight (around 26%) and also the largest number of rail projects (but not the highest budget). Austria has a relative high rail share of 23% and capacity issues in the country; the share of projects is proportionate. Almost the whole section of Prerov-Kosice between the Czech and Slovak Republics is the only long rail stretch with under-use of capacity. The starting and ending points are an exception as there is a high use of capacity. Volumes are high between the Czech and Slovak Republics and the high predicted growth rates can be facilitated on this stretch. There are a limited number of rolling stock capacity projects in the implementation plan and no gaps are identified. In total it is expected that most added capacity for railways is consumed, either by the existing demand or by future demand, such that the corridor returns to the status quo.

The Budapest node, due to large increase of traffic, is expected to become a significant bottleneck. Lack of second track between Hungary and Romania may become an important bottleneck although for the time being the existing traffic is handled properly.

Imbalance of flows in IWT in the Rhine-Danube corridor has to be addressed by improving multimodality and by a pro-active industrial and land use planning policy. The critical issues for inland waterway and railways need to be addressed if the modal split

goals of the European White Paper on transport are to be met on the Rhine Danube corridor. Rehabilitation of the infrastructure, implementation of the infrastructure projects, proper maintenance are of key importance.

The capacity of Inland Waterways is determined by the existing bottlenecks and missing links along the Rhine-Danube Corridor.

Inland waterways capacity criticality relates to three main areas: locks, fairways and the fleet. The lock capacity is sufficient for the present traffic; however a number of locks need maintenance and modernisation of systems. The width of fairways is generally sufficient for accommodating multiple ships, but the depth to enable the efficient transport of goods is often not sufficient. In low water conditions for example a vessel on the Danube can sometimes only be loaded by 50%. Therefore projects to enhance navigability, including rehabilitation, infrastructure projects and maintenance, are of crucial importance.

The current implementation plans do not give sufficient assurance that all navigability problems will be solved for all areas until 2030 and that the requirements as regards to draught in the TEN-T Regulation (2.5 m draught throughout the entire year) will be met.

Corridor oriented strategies play an important role to support the coordination of measures to tackle these bottlenecks in an harmonised manner in order to ensure compliance with the standards laid down by the TEN-T Regulation. They have led to the adoption of the Master Plan for rehabilitation and maintenance of good navigability drafted under the auspices of the Danube Strategy and officially adopted by the Ministers of the Riparian States in December 2014⁷.

Finally it should be observed that the fleet capacity is sufficient on the Rhine-Danube corridor, in view of the current unsatisfactory state of the fairway.

In the implementation plan for ports 20 projects (studies and works) are directly related with capacity extensions. The largest port Constanta also has the most projects. The maritime port of Galati has a number of capacity projects. Other large projects take place in the port of Vienna (AT) Nuremberg (DE), Regensburg (DE), Giurgiu (RO), Vukovar (HR) and Bratislava (SK). In fact, there are no missing projects for capacity identified by the consultants, meaning that there is sufficient supply expected when all projects are implemented in the planned time period.

From the supply side the airports of the corridor are in need of additional runways or of passenger terminals. Expansion of rail connections increases the catchment area of an airport to actually enable the high forecasted growth of air travel.

Road has congestion around most of the nodes of the corridor. These are primarily urban nodes. Germany has the most urbanised areas and also the most utilised road infrastructure. In the expected implementation plan Germany has the highest number of capacity upgrade projects. Slovakia has works concentrated to the east of Zilina to solve the most congested area. Bratislava is also identified as a congested node in the supply section. Loss of capacity here would be detrimental for the modal split of road. Under-use of capacity is identified for long stretches of road, but congestion is around urban nodes so a long-distance trip without congestion is nearly impossible.

Administrative processes and paperwork are seen as a significant competitive disadvantage for inland waterway transport on the Rhine-Danube Corridor. Besides differences between national rules, it has to be taken into account the fact that not all Danube riparian states are an EU Member State and not all EU states are in the Schengen area. Therefore, for instance, border checks for passengers and crews are necessary, as well as required customs clearance procedures for imports and exports.

⁷ Signatures are still pending for Hungary and Serbia

A first analysis of administrative forms in use demonstrated that more than 15 forms are to be filled in for a single transport. On many occasions multiple data entry of the same data is required. The administrative bottlenecks – as mentioned by inland waterway operators – that cause the biggest time losses and highest operational costs can be summarised into three main areas: administrative bottlenecks related to customs, ports, border police and navigation surveillance.

5. Objectives of the *Rhine-Danube Corridor*

The general objectives of the Core Network corridors are set by the TEN-T Guidelines, which provides that “The trans-European transport network shall strengthen the social, economic and territorial cohesion of the Union and contribute to the creation of a single European transport area”:

- Territorial and structural cohesion: to ensure accessibility and connectivity of all regions of the European Union;
- Efficiency between different networks: by the removal of bottlenecks, the increase in capacity of over-utilised sections and the bridging of missing links within Member States' territories and between them must be a priority;
- Transport sustainability: all transport modes must be developed in view of addressing concerns regarding environmental sustainability and economic efficiency;
- Increase in the benefits for the users: the European transport network must answer to the mobility and transport needs of its users.

The core objectives of the Rhine-Danube Core Network Corridor aim to ensure reliability of the infrastructure addressing bottlenecks and cross-border missing links as well as supporting intermodal operations and interoperability. These core objectives, together with a proposed performance measurement framework, establish a sound basis for defining the implementation measures.

More specifically the Rhine-Danube Corridor aims to fulfil the following objectives:

- Fully develop its multimodal and intermodal potential:
 - Ensuring interconnection of transport modes at the nodes, real-time information in the transport chain, communication to the users at the stations, freight transshipment etc.;
 - Improving last mile connection;
 - IWW: minimum standards of CEMT class IV; ensure year-round navigability; continuous bridge clearance
 - Railways: ERTMS-equipped infrastructure, interoperability of national networks, full electrification, safety, multimodal nodes connected to rail, etc.;
 - Airports: at least one terminal accessible to all operators
 - Ensure traffic management systems (ERTMS, ITS for road, River Information Services (RIS), SES/SESAR) and new technologies deployments

- Improve standardisation and interoperability along the corridor, between the Member States and with the neighbouring countries, through:
 - Quality of infrastructure and the transport system:
 - Interoperability / compliance with TEN-T standards
 - Adequate capacity of transport
 - Reduction of congestion
 - Interconnection of airports and ports to rail and road
 - Impacts on urban areas
 - Ensure safe and secure infrastructure
 - Transport sustainability
 - Reduction of emissions through shift to more sustainable modes
 - Availability of clean fuels

6. Recommendations and outlook by the European Coordinator

Rhine-Danube corridor develops from east to west along two main streams of traffic converging towards the central part of the European Union and therefore towards the other main corridors.

The more northern branch starting at the Slovak-Ukrainian border is bimodal in its strict definition, although it runs in parallel with the Orient-East Med corridor and its component of inland waterway on the Elbe River in Czech Republic. This stream also runs in parallel with the Rhine-Alpine corridor and its Rhine River between France and Germany.

The more southern branch, from the access ports on the Black Sea in Romania crossing all the Balkan States and reaching once more the central part of the European Union is multimodal with a strong inland waterway component developed through the Danube River, its tributary Sava, the canal Main-Danube and the river Danube until the Rhine river.

On both branches it is necessary to upgrade to same level of performance of different sections of rail, road and inland waterway connection, as well as integration of ports and airports. Not much has to be done from scratch: one example is the canal linking the Danube River to the outskirts of Bucharest.

Keeping in sight the realisation of the whole corridor components by 2030 with the technical and operational characteristics as described in the TEN-T Guidelines, there is no difference between the level of criticality of each of the identified necessary interventions. Just because all of these interventions are necessary to reach the final goal, their criticality is high.

However there are few parameters that shall determine which interventions have a higher priority compared to others.

From the operative point of view, intermodality, interoperability, cross-border and bottlenecks are the parameters that impose a label of priority to technical intervention.

In addition and sometimes above these parameters there are other considerations that set an even higher priority, among which one can recognise maturity of the project, delivery of higher benefits, in terms of economic growth, environmental performance, local population benefit and European added value.

The weight of each of these parameters has to be valued through a comprehensive assessment of the impact of each measure in terms of job creation, return of investments and environmental benefits.

Starting from the statement that a chain is as strong as its weakest link, the same can be said for the corridor, each bottleneck determines the capacity of the whole corridor if all chains/parts of the corridor are equally stressed .

Navigability is probably the major critical issue for the whole corridor as it's achievement encompasses a European perspective with a local development while alleviating the strain put on rail lines and reducing the impact of an ever growing road transport demand.

While preserving the living habitat and the biodiversity of this important natural resource of water, the use of the inland waterway corridor, Rhine-Main-Rhine/Main Canal-Danube for freight transport, promises to unleash unspoiled transport capacity capable of supplying alternative hinterland connections for the sea ports, as well a series of logistics interchange inland ports all along the Danube River with associated benefits for the riparian communities as well as for the interconnections with other regions.

Navigability on the river Danube has been so far provided through measures that mostly have been undertaken by each riparian State more or less in coordination with the neighbouring countries, certainly not at the level of service continuity as requested by the Regulation 1315/2013 requirements. It is now time that this effort shall be faced in its entirety and the opportunity is now offered by the publication of the Master Plan for rehabilitation and maintenance published in October under the auspices of the EU Strategy for the Danube River.

As sometimes the interpretation of obligations and of possible compensatory measures, that are integral part of the European Environmental Legislation, is not so easily done, the setting up of common Teams of Experts in environment and in transport economy will be evaluated for those projects where the protection of the living habitat appears critical.

On the rail part of the corridor, bottlenecks have been identified in various sections of the corridor. Both lines from Nuremberg to Prague and from Munich to Prague are subject to evaluations concerning line-upgrades in the frame of the German Bundesverkehrswegeplan 2015. The line upgrade between Munich and Salzburg has been delayed due to political priority setting and are subject to evaluations concerning line-upgrades in the frame of the German Bundesverkehrswegeplan 2015. The Stuttgart-Ulm line, including the new Stuttgart station has been delayed due to intensive protests of citizens while works already had started. The Budapest node, due to large increase of traffic, is expected to become a significant bottleneck.

Lack of second track between Hungary and Romania may become an important bottleneck although for the time being the existing traffic is handled properly.

Line capacity utilisation is very high and sometimes critical in many sections, such as along the Rhine valley and until Nuremberg, in Czech Republic, in Slovakia and at nodes like Prague, Bratislava, Ostrava and Budapest.

If all these bottlenecks are certainly important and need to be addressed without delays, it will be of utmost importance to identify those that are mature for an early implementation, while preparing the path for the others through appropriate studies and impact assessments.

On the basis of the Breakthrough program for ERTMS, the deployment is at an advanced stage in Austria, Hungary and Slovakia, they plan to finalise their corridor sections before 2017. On most of the Czech corridor sections, deployment of ERTMS is planned to be finished by 2018, in some cases it will be realised even later (2020). These countries should focus and find solutions for their cross-border sections before the implementation. Romania has partly performed the works that will be completed by 2020. Germany shall deploy its entry points by 2020 providing connection to Austria, to Czech Republic and to France.

Detailed ways how to accelerate ERTMS equipment along the core network corridors will be described in a separate Work Plan by the European ERTMS Coordinator. In his report, the ERTMS Coordinator will present a so called Breakthrough programme, which has been established in close cooperation with the railway sector and consist of a limited number of objectives to be reached by 2016, including a review of the current European Deployment Plan and the identification of a strategy for ERTMS equipment by 2030, as laid down in Regulation (EU) 1315/2013.

Maturity along with the use of innovation for the traction, like the use of LNG-LPG or of electrical engines has to be regarded as important drivers in the selection of projects.

The use of an early evaluation of the environmental impact, both on the biodiversity and on the impact of the climate change, is recommendable when starting any infrastructural project; a good example is represented by the Joint Statement on Guiding Principles on the Development of Inland Navigation and Environment Protection in the Danube River Basin.

Further analysis of the transport market study will be performed in 2015. As well the consultation exercise will be extended to all the societal interest groups for a wider understanding of the undertaking and of the benefits that will derive from the implementation of the core corridor.



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Useful links with background information:

see: http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/corridor-studies_en.htm

- Corridor Study
- List of projects
- TENtec maps



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