European Commission

Rhine-Danube
Core Network Corridor Study

Final Report

December 2014

Table of Contents

Table of Figures

Table of Tables

Abbreviations

BAC	Baltic-Adriatic Corridor
Bn	Billion
BÖB	Bundesverband Öffentlicher Binnenhäfen e.V.
CED	Centralizare ElectroDinamice releu, RO / rail electrodynamic interlocking system
CEF	Connecting Europe Facility
CNC	Core Network Corridor
CNG	Compressed Natural Gas
Cp.	Compare
DG MOVE	European Commission – Directorate General for Mobility and Transport
EC	European Commission
ECMT (CEMT)	European Conference of Ministers of Transport
EFIP	European Federation of Inland Ports
ERTMS	European Rail Traffic Management System
ESPOO	Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991)
ESIF	European Strucutral and Investment Fund
ETCS	European Train Control System
EU	European Union
GDP	Gross Domestic Product
GSM-R	Global System for Mobile Communications - Rail
HNWL	Highest Navigable Water Level
IM	Infrastructure Manager
IU	Infrastructure User
IRU	International Road Union
IWT	Inland Waterway Transport
IWW	Inland Waterways
KPI	Key Performance Indicators
LNG	Liquified natural gas
LNWL	Low Navigable Water Level
LPG	Liquefied petroleum gas
LU	Loading Unit
LZB	Linienzugbeeinflussung /Rail signalling system
Mn	Million
MS	Member States of the European Union
MoU	Memorandum of Understanding
NSTR	Nomenclature uniforme des marchandises pour les Statistiques de Transport, Revisée
NUTS	Nomenclature of statistical territorial units (in EU)
OEMC	Orient-East Med Corridor
OMC	Open Method of Coordination Glossary (TENtec)
PP	Priority Project
PPP	Public Private Partnership
R-D Corridor	Rhine-Danube Corridor
RFC	Rail Freight Corridor
RRT	Rail/road terminal
PZB	Punktförmige Zugbeeinflussung/Rail signalling system
TEN-T	Trans-European Transport Network
TENtec IS	TENtec Information System
TEU	Twenty-foot Equivalent Unit

TMS	Multimodal Transport Market Study
UIC	International Union of Railways
UIRR	International Union of Road-Rail Combined Transport
UNECE	United Nations Economic Commission for Europe
WP	Work Package

Country Codes after ISO 3166:

AT	Austria
BG	Bulgaria
CZ	Czech Republic
DE	Germany
HU	Hungary
RO	Romania
SK	Slovakia
FR	France
HR	Croatia

1 Information on the study as such

1.1 Background

The **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 (later referred to in the document as TEN-T Guidelines) and the **Regulation (EU) No 1316/2013** of the European Parliament and the Council of 11 December 2013 establishing the Connecting Europe Facility, amending Regulation (EU) No 913/2010 and repealing Regulation (EC) No 680/2007 and (EC) No 67/2010 (later referred to in the document as CEF Regulation) define a multimodal core trans-European transport network, to be developed by 2030 and provide the setting up of nine TEN-T Core Network Corridors. The alignment of the corridors is determined in Annex 1 of the CEF Regulation. Annex II of the TEN-T Guidelines determines the urban nodes, ports, rail/road terminals and airports on the corridors.

The Core Network Corridors are an instrument to facilitate the implementation of the TEN-T core network and they are focussed on

- Modal integration (interoperable multimodal centres, ports, airports)
- Interoperability (e.g. different electrifications, different standards regarding train length, axle load)
- Coordinated development of infrastructure, in particular on cross-border sections and bottlenecks (e.g. physical, operational, administrative cross borders, navigability of rivers)
- Deployment of interoperable traffic management systems (RIS, ERTMS).

Art. 42.2 of the TEN-T Guidelines determine that the Core Network Corridors shall enable Member States to achieve a coordinated and synchronised approach with regard to investment in infrastructure, so as to manage capacities in the most efficient way. The Core Network Corridors shall support the comprehensive deployment of interoperable traffic management systems and, where appropriate, the use of innovation and new technologies.

In order to facilitate the coordinated implementation of Core Network Corridors European Coordinators were appointed in agreement with the Member States and after consulting the European Parliament and the Council. **Mrs. Karla Peijs has been appointed as the Coordinator for the Rhine – Danube Corridor**, whereby her remit shall be to

- Support the coordinated implementation of the Rhine-Danube Corridor
- Draw up the corridor work plan together with the Member States and monitor its implementation
- Consult with the Corridor Forum in relation to that plan and its implementation
- Report to the Member States and the Commission
- Draw up a report every year for the European Parliament, the Council, the Commission and the Member States
- Examine the demand for transport services, the possibilities of investment funding and financing.

Mrs. Karla Peijs is assisted in the performance of her task concerning the work plan and its implementation by a secretariat together with a consultant team and by the consultative forum – the Corridor Forum. With the agreement of the Member States concerned, the Coordinator may set up working groups on modal integration, interoperability and the coordinated infrastructure development on cross-border sections.

The following initiatives are incorporated into the TEN-T Core Network Corridors:

- Up to 2013 there have been 30 TEN-T funded Priority Projects. These were scattered geographically and included different political priorities (e.g. mainly conventional rail projects, high-speed rail projects, a few multimodal projects, one airport, Motorways of the Sea and Galileo). The work of former European Coordinators for certain Priority Projects forms the basis for the new Corridors, wherever possible.
- Of the 9 Rail Freight Corridors provisioned by Regulation (EU) No 913/2010 two RFC are of particular interest for the Rhine-Danube Corridor, namely the RFC No 9, ("Czech-Slovak Corridor") and the one formerly designated as No 7 ("Orient/East-Med Corridor") have already been established, and gone operational in 2013. Like all Rail Freight Corridors the RFC 7 has been integrated into the Core Network Corridors by aligning its name and primary route to the respective Core Network Corridor, in this case, overlapping with the Rhine-Danube Corridor exists to a large extend in Hungary and Western part of Romania. Following the alignment, new members need to join the RFC's Governance Structure. The accession shall take place gradually until 2020 at the latest in order to allow ample time to harmonise the applied rules and processes already implemented among RFC participant members. RFCs will continue to evolve in the context of Regulation (EU) No 913/2010 – which means, for instance, that they are not bound solely to the CNC infrastructure in their routing –, but they will be able to profit from the new instrument and thereby be boosted considerably.
- ERTMS Corridors have also been integrated into the new policy.
- Other types of corridors can be incorporated into this structure such as "green corridors" or "pan-European corridors" or even later developments.

Until 22.12.2014 the European Coordinator will draft the **Corridor Work plan**, which will indicate the development of the corridor, and receives approval of the concerned Member States. This is a step that will allow the focusing of attention on the most important actions to be undertaken along the Rhine-Danube corridor, which will also most probably remain priorities for a long(er) period of time.

During a set of meetings, the so-called Corridor Fora, the progress reports are discussed with a gradually increasing number of relevant stakeholders.

1.2 Scope of Work

The TEN-T corridor approach is a key feature of the future TEN-T policy implementation. The Core Network Corridor studies are preparing the foundation for the revised corridor approach in the year 2014.

DG MOVE B.1 has launched a call for tenders for elaborating of nine corridor studies in summer 2013. Each study relates to a single Core Network Corridor.

The main tasks of the study, to be achieved by the Consultant are generally:

a) identifying relevant stakeholders for the Corridor Fora,
b) gathering and review of existing studies and materials, and updating the data on infrastructure parameters in the TENtec IS,
c) elaboration of a Transport Market Study
d) preparation of the elements of the work plan as foreseen in the new regulation,
e) support to DG MOVE in preparing the meetings of the Corridor Fora.

The main objective of the Corridor Study is the preparation of the elements of the study work plan. The study work plan shall analyse the needs for the development of the corridor in the Member States concerned including the projects for the extension, renewal or redeployment of transport infrastructure for each of the transport modes involved in the Core Network Corridor and the options for funding and financing. It has to be developed within one year of the entry into force of the TEN-T regulation. The concept and the structure of the work plan in the study include as the first step the evaluation of the characteristics of the corridor by comparing the transport infrastructure requirements from the TEN-T Guidelines with the actual situation of the infrastructure on the Corridor. The determination of bottlenecks and missing links, in particular as regards cross border sections will be completed. The next step includes the identification of the objectives of the Corridor; they may be organised into various groups such as infrastructural objectives (e.g. implementation of ETCS), organisational objectives (e.g. customs procedures) and Guideline implementation objectives (e.g. harmonisation, liberalisation). This is followed by the identification of set of measures and possible source of financing. In parallel the multimodal market study will be elaborated, analysing the current situation for passengers and freight transport in the corridor in multimodal terms, traffic volumes and modal split. Intermediate results were discussed with the Member States and the stakeholders in the second and third meeting of the Corridor Forum.

Interaction with the Rail Freight Corridors, PLATINA II Coordination Action and the EU Danube Region Strategy has been established and form a major platform of exchange of information and data.

PLATINA II is pro-actively supporting the integration of the IWT into the Core Network Corridor studies/work plans, by providing information on 'why', 'what' and 'how' to collect IWT related data and information for the Core Network Corridor studies. The input has been distributed at the different preparatory meetings in 2014 through a series of Information Packages. In particular Work Package 4 of the PLATINA II project focusses on the inland waterway infrastructure and the integration of Inland Waterway Transport (IWT) into multimodal transport corridors.

The Final report with its Study work plan forms the main basis for the elaboration of the Corridor Work Plan by the Coordinator.

This Final Report provides the updated draft final version of the Study work plan with the corridor alignment, characteristics of modes in particular for rail and inland waterways and the inland ports, the critical issues and bottlenecks on the corridor and the programme of measures together with the list of projects with financial indications to resolve the bottlenencks on the corridor. The Final Report includes all comments received from Member States and stakeholders to the previous Progress Reports. Further recommendations were elaborated for the final report considering the following aspects:

- Assessment of bottlenecks- not yet covered by projects - regarding negative impact on the operation;
- Derivation of additional projects closing the remaining critical issues;
- Evaluation of these additional projects regarding efforts / impacts and timelines.

This report is the result of four Progress Reports and organised interactions between DG MOVE, the consultants, the Coordinator, the representatives of the Member States on the corridor and infrastructure managers.

The 1st meeting of the Corridor Forum was held in Brussels on 01.04.2014 with the representatives of the Member States (mainly Ministry of Transport / Infrastructure) and focussed on:

- Discussion of the alignment of the R-D Corridor
- Characteristics of the Corridor (incl. first description of bottlenecks / critical issues)
- Clarification of the participating stakeholders of the 2nd Corridor Forum
- Request for support of gathering of technical data for the update of TENtec IS, being a basis for establishing the Transport Market Study
- Request for delivery of relevant documents and studies on corridor infrastructure (incl. bottlenecks), corridor traffic and specific topics regarding intermodality, interoperability and organizational issues at border crossing points

Based on this meeting, the participating representatives provided feedback on the discussion paper and established valuable contact for gathering of data and studies.

The 2nd meeting of the Corridor Forum was held on 17.06.2014 with the representatives of the Member States and the Infrastructure Managers for rail, Inland waterways and ports (Inland waterways and maritime transport):

- Discussion of the final alignment of the R-D Corridor
- Characteristics of the Corridor (incl. description of bottlenecks / critical issues)
- Clarification of the participating stakeholders of the remaining Corridor Fora
- Request for support of gathering of technical data for the update of TENtec IS, being a basis for establishing the Transport Market Study
- Request for delivery of relevant documents and studies on corridor infrastructure (incl. bottlenecks), corridor traffic and specific topics regarding intermodality, interoperability and organizational issues at border crossing points

The 3rd meeting to the Corridor Forum was held on 2.10.2014 with the representatives of the Member States and the Infrastructure Managers for all modes, ports and airports:

- Presentation and discussion of the draft elements of the studywork plan
- Characteristics of the Corridor (incl. description of bottlenecks / critical issues)
- Presentation of the Transport Market Study
- Discussion of the draft Implementation Plan

The 4th meeting of the Corridor Forum was held in Brussels on 18.11.2014 with the Member States concerned and the Infrastructure Managers of rail, inland waterways, ports, roads and airports to address and clarify particular topics on the work plan regarding

- Characteristics of the corridor modes and bottlenecks/missing links/critical issues
- Specific objectives of the R-D Corridor
- List of measures
- Implementation plan
- List of projects per mode

The current final version of the report considers all project information provided and coordinated with the Member States. It provides a profound analysis of the projects regarding scope of measures, maturity / status of work as well as costs and funding. Furthermore it has been checked if these projects are compliant with the identified critical issues. These results were finally checked and confirmed by the Member States for the Final Report.

All comments from the last meeting of the Corridor Forum, the Working group meeting on ports and IWW and from bilateral discussions were incorporated into the Final Report.

1.3 Responsibilities and organisation of work

Work-sharing and assignment of responsibilities were necessary pre-conditions for efficient and successful project handling. In case of the Rhine-Danube corridor, the corridor team made use of the partners' knowledge and experience in two aspects:

1. Modal skills were the basis for attributing general responsibility as follows:
   - Rail + Rail-Road terminals: HaCon (HC), supported by subcontractor KombiConsult (KC)
   - Road + Ports + Airports: iC consulenten (IC), supported by UPB and subcontractors
   - Inland waterways: viadonau (Via)
2. Country specific skills were used to complete this basic assignment as follows:
   - Czech Republic and Slovakia: subcontractor Prodex
   - Hungary (particularly for road issues): local experts from Hungary provided by Panteia (PAN)
   - Romania: University POLITEHNICA of Bucuresti (UPB)

Table 1 provides an overview on the overall allocation of responsibilities.

Table 1: Allocation of partners' responsibilities per mode and country

	Rail	IWW	Road	Ports (Seaports, inland ports)	Terminals (Rail-road)	Airports	Alternative fuels infra-structure
Austria	HC	Via	IC	IC[2]	KC[3]	IC	Rail: HC IWW: Via Road: IC
Bulgaria	---	Via	---	IC[2]	---	---	
Croatia	---	Via	---	IC	KC[3]	---	
Czech Rep.	Prodex[3]	---	Prodex[4]	---	KC[3]	IC	
Germany	HC	Via	IC[1]	IC[2]	KC[3]	IC	
France	HC	---	IC[1]	---	KC[3]	IC	
Hungary	HC[1]	Via	PAN[4]	IC[1] [2]	KC[3]	IC	
Romania	UPB	Via	UPB[4]	UPB[4]	KC[3]	UPB[4]	
Slovakia	Prodex[3]	Via	Prodex[4]	IC	KC[3]	Prodex[4]	
Serbia	---	Via	---	IC	---	---	

1) Support by PAN, if required
2) Support by Via, if required
3) Input to be delivered to HC
4) Input to be delivered to IC

Under the responsibility of the respective task and work package leaders, especially the following issues were assigned according to Table 1

1. Completion of the TENtec data base,
2. Data collection and analysing with respect to corridor characteristics,
3. Review of studies,
4. Elaboration of corridor characteristics,
5. Programmes of measures within the corridor related Member States,
6. Identification of main objectives,
7. Contributions to the implementation plan.

1.4 Core Structure of this Study

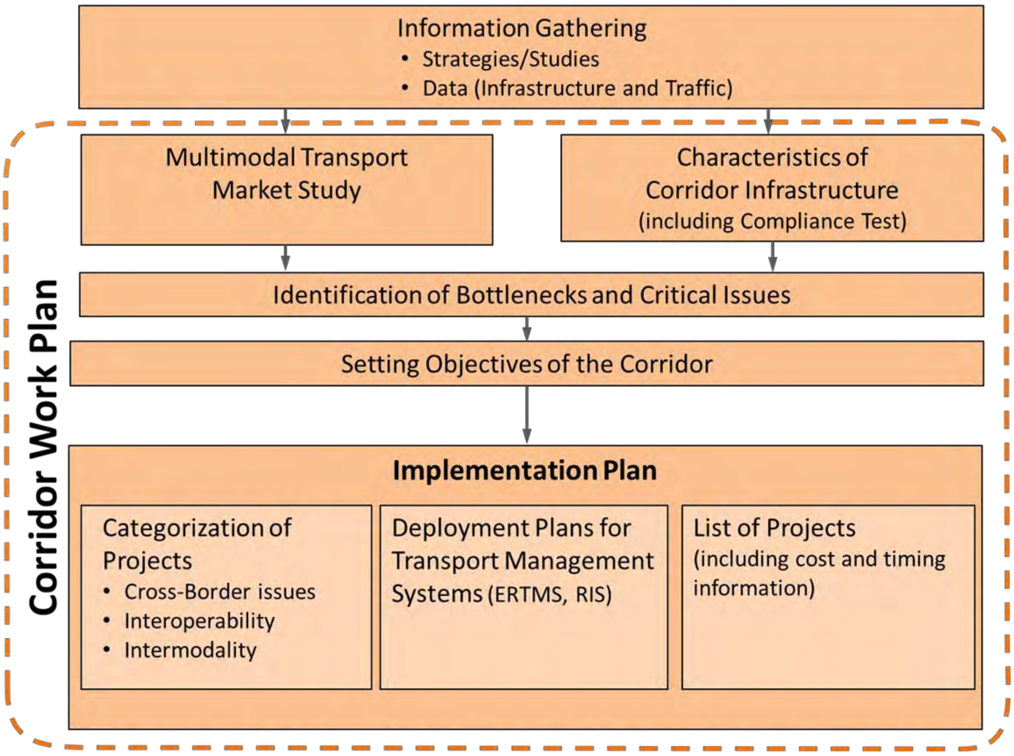
The elaboration of the Study on the Rhine-Danube Corridor follows the requirements for the Corridor Work Plan, that are set out in the Regulation 1315/2013 as mentioned above in Section 1.1. Thus, a number of correlating tasks is to be dealt with, that are set out in the flow chart of works for the Corridor study below (Figure 1)

The starting point of the study is the identification of stakeholders, public and private, related to the corridor. This includes the Commission, the Member States, the infrastructure managers, local and regional authorities, transport users and the civil society.

The identified stakeholders play a paramount role in the study for several reasons: the validation of study outcomes, the insight and expertise on non-available information and their views and expectations for the future of the corridor. Besides these, the study intends, by definition, to bring together these stakeholders so as to create a common basis of analysis (not one-sided information but harmonised), discuss barriers and solutions, liaise stakeholders and create future opportunities for the development of the corridor activities.

Thus, it is clear that the presence of stakeholders will set the basis for trustworthy results for this study and, consequently a realistic, win-win oriented Work plan. The consortium used several tools and methods in order to gather information on the corridor, define the current market status (supply and demand, barriers and opportunities), as well as the way it could develop in the future (threats and opportunities).

Figure 1: Work flow in the Corridor study



Source: Consortium

Given the different existing information systems and definitions, the data were checked constantly for compliance between systems. The results from the corridor analysis, amended by the stakeholder information provide a clear view of the current situation and what is necessary to improve the corridor performance (network, infrastructure and services).

The next step was therefore to set the objectives, i.e. clear statement of tangible (short and long-term) goals for the corridor and the extent that these are expected to impact on the corridor performance. Again, the views of all stakeholders are important, not only for setting realistic objectives representing all corridor actors, but also for engaging their commitment –though their involvement in the process- to the goals for the corridor. The objectives are expected to be strongly connected to the concept of interoperability and intermodality for seamless transport in the corridor, maximising its performance and efficiency, increasing competitiveness and abating the negative externalities.

As a next step, the completed, ongoing and future measures on the corridor were collected. Based on what is already there and what is planned, as well as what is necessary to achieve the corridor objectives, the set of measures are updated (programme of measures). These measures are translated into an implementation plan of ongoing and planned projects, which shall resolve the critical issues on the transport performance on the corridor. For the latter, in order to establish the financial feasibility of the planned projects, possible financing sources were identified together with a tentative time plan for realisation up to 2030.

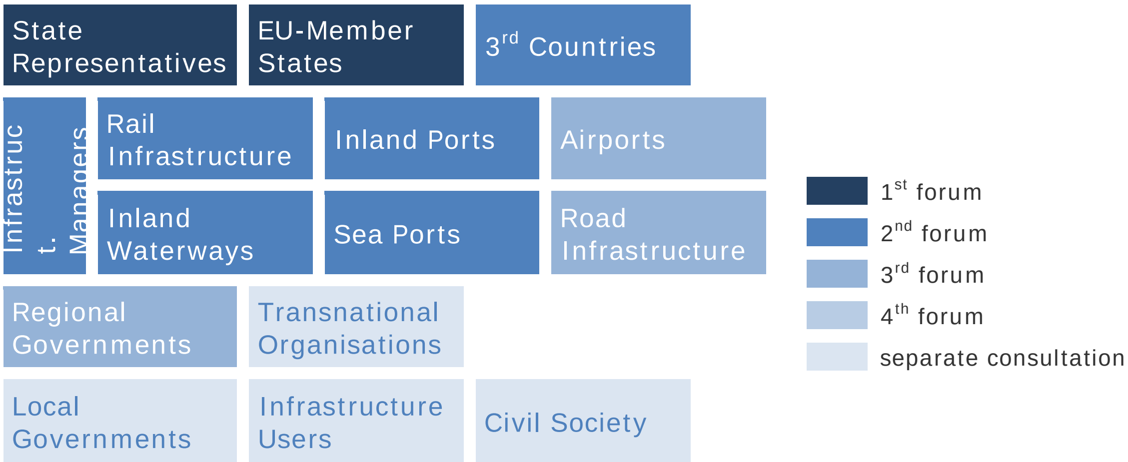
The present study constitutes the first part of a more extensive and long-term process under the major Union objective of planning, developing and operating the trans-European transport network aiming at providing a general overview of the Rhine-Danube Network corridor, with a view to establish the basis for the European Coordinator to draw up the Corridor's Work Plan. Accordingly, the study's scope was limited to the identification and description of the Corridor's characteristics, the identification of critical issues hindering its efficient and seamless operation, as well as the recording of all on-going and planned infrastructure projects known to present. At this stage, no in-depth analysis was carried out with regard to any of the issues addressed by the study. The latter would be part of the objectives and tasks of the follow-up studies, planned for the upcoming period 2015-2017.

2 Identification of stakeholders

The new TEN-T Guidelines aim to meet not only with the requirements of transport but also with societal development of the next decades. This opens up new challenges – both in terms of innovative technological solutions and governance approaches, involving a wide range of players. Article 50 of the TEN-T Guidelines sets the frame for engagement with public and private stakeholders and names the entities which relate to projects of common interest.

As a consequence, the elaboration process of the Work Plan for the Core Network Corridor peruses an inclusive stakeholder approach, which seeks to involve stakeholders gradually via several Corridor Fora. The Corridor Forum is a consultative body, adding specific geographic or thematic inputs to the corridor study which is provided as a basis of discussion. This way the work plan is the result of a broad consultation process, ensuring acceptance and implementation of measures.

Figure 2: Participants at Corridor Fora



Source: viadonau

At the First Corridor Forum in April 2014 representatives of the EU-Member States discussed the first outline of the Corridor. Stakeholders which could contribute to the elaboration of the work plan during the Second Corridor Forum in June 2014 have been identified with the help of Member States. Administrative bodies and organisations responsible for establishing, maintaining and operating rail infrastructure, inland waterways and ports took part in the meeting. As the Rhine-Danube corridor also relates to non-EU countries, representatives of Serbia, Bosnia and Herzegovina, Moldova and Ukraine were invited to take account of the developments in the neighbouring countries. The Danube Commission was invited as an important international intergovernmental organization, set up by the Convention regarding the regime of navigation on the Danube. The International Sava River Basin Commission was invited due to its crucial role as regards to the development of the Sava. At the Third Forum in October 2014 and the Fourth Forum in November 2014 infrastructure managers of road infrastructure, airports, relevant transnational organisations and regional representatives were welcomed to participate. Relevant additional transnational organisations, local governments, infrastructure users and representatives of civil society are involved in the process of the Work Plan elaboration by separate consultations, even beyond the elaboration phase. Personal visits are planned by the Corridor Coordinator Karla Peijs.

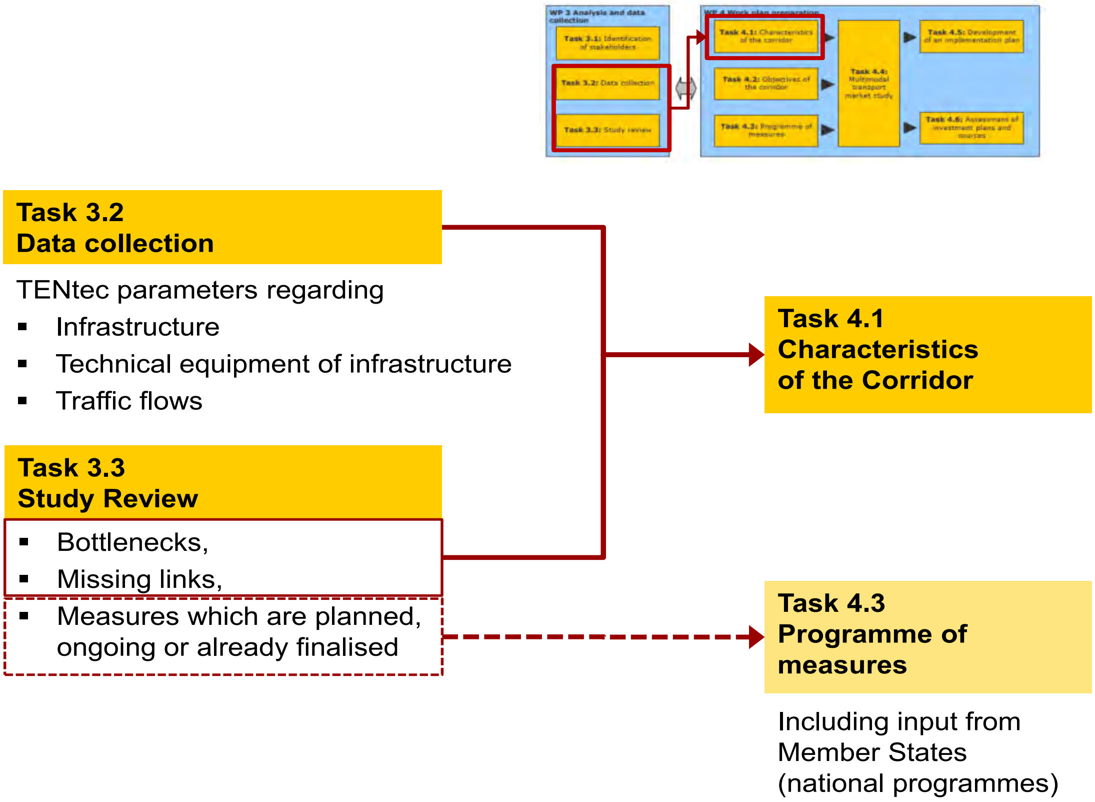
Annex I contains a complete list of stakeholders identified to be relevant to the Corridors' Development.

3 Review of studies

The primary goal of the work package "review of studies" (also including other relevant data sources) is to provide a complete picture of the corridor as a basis for the implementation plan. For this purpose the gathering of information is set on three pillars (see Figure 3):

- Collection of technical data of infrastructure attributes, technical equipment and traffic flows;
- Review of relevant studies in order to obtain information on bottlenecks (e.g. regarding capacity utilisation and operational problems) and missing links;
- Compilation of alleviation measures and programmes from traffic/transport master plans.

Figure 3: Components of information gathering



Source: HaCon

3.1 Data collection

Gathering, processing and analysing of technical data (covering infrastructure, technical equipment and operation) is a main pillar for compiling the characteristics of the corridor and for the subsequent work packages.

For this purpose, the TENtec information system shall be used. "*TENtec is the information system of the European Commission to coordinate and support the TEN-T Policy. It stores and manages technical and financial data for the analysis, management and political decision making of the TEN-T programme.*"[1]

[1] *http://ec.europa.eu/transport/themes/infrastructure/tentec/*

Within TENtec, data are captured and stored by subject (transport mode, transhipment facility etc.) and country. The respective parameters are described in the TENtec "Glossary"[2]. For the purpose of this study, a subset of totally 68 parameters has been labelled as mandatory by the EC:

- Rail: 24 parameters, (6 core parameters)
- Road: 14 parameters, (4 core parameters)
- Airports: 3 parameters, (2 core parameters
- Ports: 10 parameters, (2-3 core parameters)
- Inland waterways: 13 parameters, (5-6 core parameters)
- Rail-road terminals: 3 parameters, (2 core parameters)
- Alternative fuels: 1 parameter(included as core parameter above)
- **Total: 68 parameters**

A compilation of the most important TENtec parameters is provided in context with the corridor characteristics (see chapter 4.3).

The requested data has been gathered and uploaded to the TENtec date base for all sections of the corridor according to the agreed allocation of partners' responsibilities per mode and country (see Table 1). These data sets were used as an important input to describe the characteristics of the corridor and to identify compliance of these characteristics with the requirements of the regulation. Some of the most important data sources, which were uses for this data compilation, are:

- Rail: Network statements (Germany: STREDAX database of DB Netz AG), RFC implementation plans, EUROSTAT statistics;
- Road: Data delivered from the Ministries, National Road Infrastructure Managers, National Master plans, Highway websites;
- Airports: Airport websites, EUROSTAT statistics;
- Ports: Port websites, direct contact to Port Authorities;
- Inland Waterways: UNECE: Blue Book, Binnenschiffahrts-Verlag GmbH: WESKA, Wasser- und Schifffahrtsverwaltung des Bundes, Donauschifffahrtspolizeiverordnung, Wasserstraßenverkehrsverodnung, River Information Services (ELWIS, Doris), Kilometeranzeiger der Donaukommission;
- Rail-road terminals: KombiConsult terminal data base, AGORA data base, direct contact to terminals.

3.2 Study review

Next to the TENtec data base, study review is the second main pillar for drawing a complete picture of the corridor´s characteristics and the programme of measures. The study review is mainly intended to provide information on

- Bottlenecks,
- Critical issues
- Measures which are planned, ongoing or already finalised in order to improve the situation on the corridor and comply with the TEN-T standards.

A first set of relevant studies was issued by the EC within the Tender Specifications and verified during the Kick-Off-Meeting. Finally, this "priority list" consisted of more than 100 studies, covering all modes and the following sources:

[2] *EUROPEAN COMMISSION, DIRECTORATE-GENERAL FOR MOBILITY AND TRANSPORT: Open Method of Coordination - Geographical Information System; Glossary: Technical and Financial Data; DRAFT Update - Corridor Studies; 06/02/2014*

- Annual reports of the EU Coordinators Karla Peijs (PP18), Péter Balász (PP17) and Gilles Savary (PP22)
- Priority Projects 2010 - A Detailed Analysis
- Annual Progress Report on implementation of Priority Projects, 2012
- CEF: Pre-identified projects
- Main Line for Europe
- CETC-ROUTE 65 initiative
- PP17: Railway axis Paris-Strasbourg-Stuttgart-Wien-Bratislava, with all related single projects
- PP18: Waterway axis Rhine/Meuse-Main-Danube, with all related single projects
- PP21: Motorways of the Sea, with all related single projects
- PP22: Railway axis Athina–Sofia–Budapest–Wien–Praha–Nürnberg/Dresden, with all related single projects
- ERTMS studies
- Other EU projects,
- Other Priority Projects, such as PP 7
- REGIO funding: ISPA, ERDF, Cohesion Fund

In a second stage, this priority list has been enriched by additional studies, e.g.

- European projects (e.g. CREAM, COSMOS, ACROSSEE, FLAVIA),
- UNECE TEM and TER Master Plan (2006-2010)
- National traffic development and transport master plans,
- Other infrastructure funding schemes (e.g. for rail-road terminals and rail sidings),
- National studies (e.g. feasibility studies of infrastructure projects)

The results of the study review have been laid down in an Excel data base; this provides the opportunity to filter and extract information according to dedicated criteria, such as

- General information about the study (title, year of information status),
- Modes included,
- Location the described bottleneck/missing link/measure refers to,
- Description of bottlenecks by details about the time horizon (current/future bottleneck), passenger and/or freight traffic affected and the type of the bottleneck (infrastructure / operational / administrative),
- Improvement measures with information about the scope of work (study / infrastructure / vehicles / operation), the measure type according TENtec Glossary (rehabilitation / upgrading / new construction), the maturity according TENtec Glossary (completed / under construction / under study / planned), the year of start / finalisation and the associated costs / investments / expenditures.

The Excel file was attached as annex to the second progress report. By the deadline of this report, this data base includes information from more than 250 studies. Amongst them, a limited number of "core studies" has been identified for each mode/node type, which provides particularly important information. These core studies are briefly presented in chapters 3.2.2 - 3.2.7.

3.2.1 Traffic and transport master plans

Regarding the medium and long term planning of the Member States on transport modes the following list of National Master Plans have been taken into consideration (Table 2):

Table 2: Identified Master plans per country *

	National Transport Master Plans	Issued by	Status	Related investment documents	Related Transport Flow Models	Corridor relevant modes considered
DE	Bundesverkehrs-wegeplan 2003 (Federal Transport Infrastructure Program)	German Ministry of Transport and Infrastructure (BMVI)	Next issue will be 2015	▪ Verkehrsinvestitionsbericht (VIB) 2012 (Transport Investment Report 2012) ▪ Investitionsrahmen-plan (IRP) 2011-2015	▪ Prognose der deutschlandweiten Verkehrsverflechtung für 2025 (German Transport Forecast 2025; ITP/BVU 2007) ▪ Forecast for the Development of Freight and Passenger Transport 2030), 2014	▪ Road (Freight, PAX public/individual) ▪ Rail (Freight, PAX) ▪ IWT (Freight) ▪ Air (Freight, PAX)
CZ	Dopravní politika pro období 2014-2020 (The Transport Policy of the Czech Republic for 2014 – 2020 with the prospect of 2050) June 2013 Transport Sector Strategies, 2nd Phase, Summary document and Annexes	Czech Ministry of Transport	2014	▪ OPT Operational Programme Transport for period 2007-2013 ▪ Transport Sector Strategies, 2nd Phase: The Medium-Term Plan of Transport Infrastructure Development with a Long-Term Outlook, Final version, December 2013	▪ Traffic forecast medium and long term	▪ Road (Freight, PAX public/individual) ▪ Rail (Freight, PAX, HSR) ▪ IWT (Freight) ▪ Air (Freight, PAX)
AT	Gesamtverkehrs-plan 2012 (General Transport Infrastructure Strategy 2012)	Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT)	2013	▪ ASFINAG Rahmenplan 2014-2019 approved(Road Investment Framework), revised annually, draft Rahmenplan 2015 – 2020; ▪ ÖBB Rahmenplan 2014-2019 (Rail Investment Framework), approved, revised annually ▪ Zielnetz 2025 (Long-term rail infrastructure program) ▪ Bundesstraßengesetz (Long-term road infrastructure program) ▪ IVS Action Plan 2011 (Intelligent Traffic Management)	▪ Verkehrs-prognose Österreich VPÖ2025+; (Traffic Forecast Austria 2025), 2009	▪ Road (Freight, PAX public/individual) ▪ Rail (Freight, PAX) ▪ IWT (Freight) ▪ Air (Freight, PAX) ▪ ITS
SK	Strategic Development Plan of Transport Infrastructure of the SR by 2020, Phase I and Annexes , June 2014	Ministry of Transport, Construction and Regional development,	Approved June 2014	OPT Operational Programme Transport for period 2007-2013 and OP Integrated Infrastructure 2014 - 2020	▪ Forecast for the Development of Freight and Passenger Transport 2030), foreseen 2016	▪ Road, ▪ Rail, ▪ Aviation ▪ ITS ▪ IWT
HU	National Transport Infrastructure development Strategy (Aug 2014); National Transport Policy Concept (Nemzeti Közlekedési Stratégia – Nemzeti Közlekedési Koncepció) 2013/2014	Hungary – Ministry of National Development	Approved,	Operative Programme of Integrated Transport Development (Version 4.0, June 2014) (Integrált Közlekedésfejlesztési Operatív Program – IKOP 2014-2020), Annexes are pending		▪ Road ▪ Rail ▪ IWT ▪ Aviation ▪ Others

HR	Transport Development Strategy of the Republic of Croatia (2014-2030), draft, June 2014	Ministry of Maritime Affairs, Transport and Infrastructure	Final draft 2014	OPT for period 2007 – 2013, of year 2013; OPT Competitiveness and cohesion 2014-2020, draft, June 2014	▪ IWW transport ▪ Port	▪ IWT ▪ Ports
RO	Draft Romanian General Master Plan of Transport for short and long term, 2013, Sept. 2014 version	Ministry for Transport and Infrastructure	adoption expected in December 2014	Sectoral Operational Programme Transport for period 2007-2013 and draft of Operational Program Large Infrastructure 2014 – 2020, Sept. 2014 version	▪ Forecast freight and pax for 2020 and 2030	▪ Road ▪ Rail ▪ IWT ▪ Maritime port ▪ Aviation
BG	General Transport Master Plan 2010	Ministry of Transport, Information Technologies and Communications	2010, new draft expected in 2015	Operational Program "Transport" 2007-2013 Draft Operational Program "Transport and Transport Infrastructure" 2014-2020	• Transport model updated in 2013, forecast for 2020 and 2030	▪ Ports ▪ IWW

Source: iC consulenten

* No input has been received from France

The United Nations Economic Commission for Europe (UNECE) Trans-European Motorways (TEM) and Trans-European Railways (TER) Master Plans has also been taken into account in the studies review. The UNECE TEM and TER Projects are a sub-regional cooperation among Central, Eastern and South East European countries, whose scope was to develop a system of motorways and railways, linking the European Union's TEN-T Road and Railway Network with the road and rail systems of Eastern and South Eastern Europe non-EU Member States.

One of the main activities of this project was the elaboration of the "TEM and TER Master Plan", whose goals were the following:

- Evaluation and prioritization of infrastructure projects, together with their security of funding.
- A consistent and realistic short, medium and long term investment strategy on the road and rail Backbone Networks in the wider TEM and TER region.
- The identification of important issues such as alternative scenarios of growth, infrastructure bottlenecks, missing links and border crossing issues.

The original TEM and TER Master Plan was published in 2006, and included an extensive inventory of specific road and rail infrastructure projects for 21 countries. A revision of the Master Plan was carried out in 2009 and 2010, extending its coverage to 25 countries, and updating the project list and related figures. The exercise also revisited the bottlenecks, grouped under "capacity" and "condition" bottlenecks, missing links and border crossing issues.

Five countries belonging to the R-D corridor were included in the TEM and TER Master Plan study, namely, Austria, Czech Republic, Hungary, Slovakia and Romania. To this end, the study can provide certain information, albeit outdated, with regard to key bottlenecks and border crossing issues, technical data on current infrastructure and as well as information on planned infrastructure projects, including project costs and financing in the above countries.

The objectives of the **UNECE TEM and TER Master Plans** are:

For railways:

- To improve the quality and efficiency of transport operations,
- To assist the integration process of European transport infrastructure systems,
- To develop a coherent and efficient international railway and combined transport system in accordance with the UNECE Pan-European infrastructure agreements: European Agreement on Main International Railway Lines (AGC - May 1985) and European Agreement on Important International Combined Transport Lines and Related Installations (AGTC - Feb. 1991).

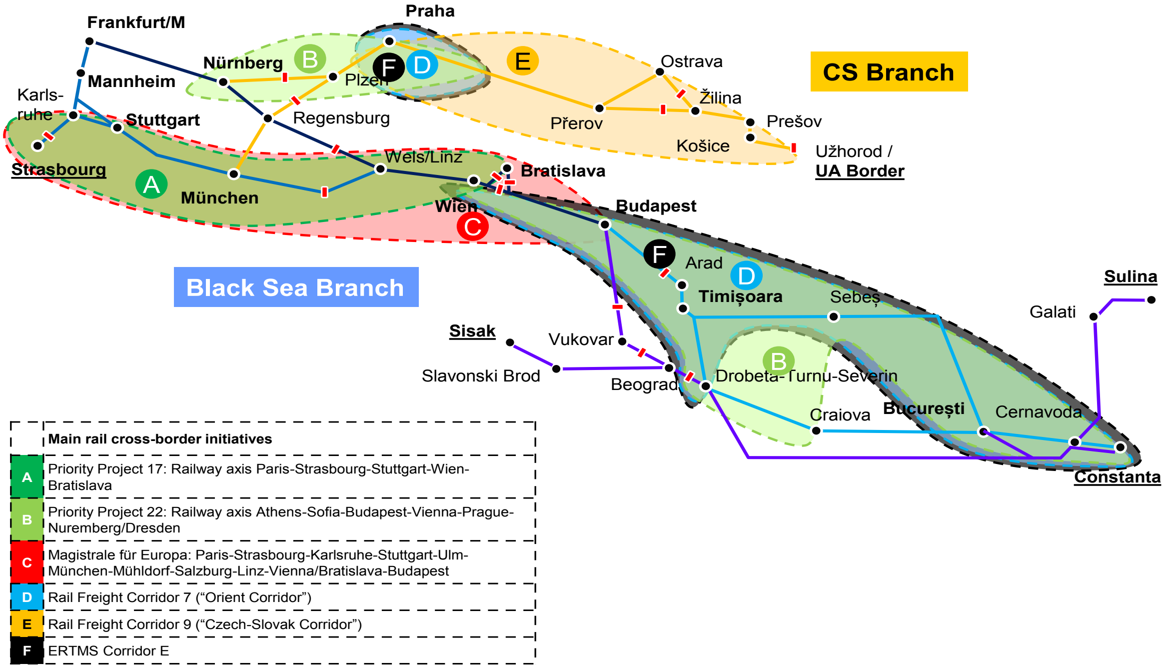
For roads:

- The facilitation of the international road traffic in Europe and among and through the countries participating in the project.
- The improvement of the efficiency of transport operations.
- The balance of gaps and imbalances existing in the transport infrastructure and more particularly in motorway network between Western, Eastern, Central and South-Eastern Europe.
- The assistance of the integration process of transport infrastructure systems of Europe thus promoting the overall development of the region.

3.2.2 Studies Rail

Reports from the following multi-national projects and initiatives (cp. Figure 4) have been used as an important information source to determine technical and operational characteristics of the corridor and to identify necessary or planned improvement measures. Together with the collected TENtec data that provide information on infrastructure attributes, technical equipment and traffic flows they form the basis for the elaboration of the work plan.

Figure 4: Main rail multi-national initiatives on the Rhine-Danube Corridor



Source: HaCon

- Priority Project 17: Railway axis Paris-Strasbourg-Stuttgart-Wien-Bratislava,
- Priority Project 22: Railway axis Athens-Sofia-Budapest-Wien-Praha-Nürnberg/ Dresden,
- Rail Freight Corridor 7 ("Orient East-Med Corridor"),
- Rail Freight Corridor 9 ("Czech-Slovak Corridor"),
- ERTMS Corridor E.

Furthermore the "Mainline for Europe" ("Magistrale für Europa") initiative Paris-Strasbourg-Karlsruhe-Stuttgart-Ulm-München-Mühldorf-Salzburg-Linz-Wien/Bratislava-Budapest" has been considered.

As Figure 4 shows, these six initiatives in total cover most of the Rhine-Danube Corridor geographically. The only main exception is the German section between Karlsruhe and the German/Austrian border via Frankfurt/Nürnberg. This gap has been closed by national studies.[3]

The Priority Projects 17 and 22 can be seen as the forerunners of the Rhine-Danube Corridor. They are documented by annual reports of the respective coordinators and contain numerous single projects, which are designed to achieve the requested infrastructure standards of the railway lines included. Principally dealing with passenger and freight traffic equally, they seem to put some more emphasis on passenger traffic, though. For this study they are of particular importance, since they contain information on

- The status of completion of the relevant Priority Project axes,
- Bottlenecks and main missing links,
- Need for further action on dedicated corridor sections.

A compilation of the most important results of the Priority Projects 17 and 22 is provided within the "Corridor Characteristics" (chapter 4.3.1).

The "Main Line for Europe" follows a similar approach. This initiative is promoted by 33 cities, regions and chambers of commerce and industry along the axis between Paris and Budapest. The association understands itself as a developer of concepts and as a bundler of interests towards decision makers. Within this corridor exercise, the consultants make use of continuously updated information on current developments (policy, economy, infrastructure, operation), which is provided on the initiative´s website.

The European Commission Rail Freight Corridor (RFC) initiative deals with freight transport on the corridor, expressed by Implementation Plans and Transport Market Studies. For the Rhine-Danube Corridor, the Rail Freight Corridors 7 and 9 are of particular importance. These reports contain detailed information for dedicated, single line sections on

- Infrastructure,
- Operation,
- Volumes,
- Bottlenecks,
- Cross-border operation.

The Rail Freight Corridor studies are of essential importance with respect to the corridor´s characteristics as well as for the Transport Market Study.

[3] *E.g. German Ministry of Transport: „Investitionsrahmenplan 2011 – 2015 für die Verkehrsinfrastruktur des Bundes (IRP), VDV: Investitionsbedarf für das Bundesschienenwegenetz aus Sicht der Nutzer; Sechste VDV-Maßnahmenliste*

The RFC studies have been supplemented by reports from EC funded research projects such as TREND, CREAM, COSMOS, ACROSSEE and FLAVIA. These projects deal with the analysis, implementation and optimisation of freight corridors, covering substantial parts of the Rhine-Danube Corridor. A particular focus is set on detailed analyses of cross-border rail operation, providing of best-practice compilations and action plans to overcome operational, technical, infrastructural and administrative impediments. They also contain information on traffic flows as well as infrastructural and technical data.

3.2.3 Studies Inland Waterways

More than 50 projects dealing with bottlenecks and missing links of the inland waterways of the Rhine-Danube Corridor have been collected from several sources of which the TEN-T projects and projects funded by the Structural and Cohesion Funds (2007-2014) as well as the project data sheets of the EU Danube Region Strategy, Priority Area 1a are the main ones. The projects dealt with upgrading the inland waterways, maintenance of the inland waterways, river information services, administrative barriers and others (e.g. lifting bridges).

The current status of inland waterway transport projects for upgrading the waterway infrastructure is well summarized in the Annual Activity Report for Priority Project 18 and 30 of the Coordinator Karla Peijs (Brussels, October 2013).

The EU Strategy for the Danube Region (EUSDR) is the most relevant strategic background for the Rhine-Danube Corridor. Priority Area 1a focuses on inland waterways and aims to improve mobility and multimodality. The Communication from the European Commission (2010), accompanied by a detailed EUSDR Action Plan and the Annual Implementation Reports describe the targets, actions and the progress made. The ambitious targets of Priority Area 1a are:

- Increase the cargo transport on the river by 20% by 2020.
- Solve obstacles to navigability and establish effective waterway infrastructure management by 2015.
- Develop efficient multimodal terminals at river ports, to connect inland waterways with rail and road transport by 2020.
- Implement harmonised River Information Services (RIS) and ensure the international exchange of RIS data preferably by 2015.
- Solve the shortage of qualified personnel and harmonize education standards by 2020.

One important asset of the EUSDR PA1a is an up-to-date project database[4]. It contains almost a hundred project datasheets in seven different categories. The most relevant to this study are the projects related to waterway infrastructure, waterway maintenance, ports and River Information Services.

The Plan of the major infrastructure works[5], as published by the Danube Commission in June 2014 also represents an important source of information as regards to bottlenecks and ongoing projects.

PLATINA[6] and its successor PLATINA II are European Coordination Actions supporting the implementation of NAIADES resp. NAIADES 2 "Towards quality inland waterway transport". Besides the Information Package on the State-of-Play of Inland Waterway Transport the PLATINA Inventory of Bottlenecks and Missing Links on the European Waterway Network are an important source for the study on the Rhine-Danube Corridor. It lists missing links as well as basic and strategic bottlenecks per country.

[4] *http://danube-navigation.eu/pages/projects*
[5] *Plan der großen Arbeiten, Donaukommission, Budapest, 2014*
[6] *http://www.naiades.info/*

The UNECE Blue Book is an inventory of main standards and parameters of the E-Waterway Network (International Waterways). It is the only source providing harmonized data on the inland waterway infrastructure. According to the Needs Assessment on Fairway Maintenance[7] the data does not reflect the situation on the Danube properly.

In relation to Waterway Maintenance the outputs of NEWADA duo are of great importance. The project is co-funded by the South-East Europe Transnational Cooperation Programme and unites waterway administrations from Austria, Slovakia, Hungary, Croatia, Serbia, Romania and Bulgaria in order to establish an integrated waterway management. To this effect they agreed on a common minimum Level of Service and assessed current and future maintenance activities. The results were published in a consolidated report containing the "Needs Assessment on Fairway Maintenance". The first draft of the EUSDR Fairway Rehabilitation and Maintenance Master Plan refines the outcomes and takes them to a political level.

River Information Services are regulated through Directive 2005/44/EC[8], which establishes a framework for the deployment and use of harmonised river information services (RIS) in the Community. The RIS Policy Review informs on the effort required to complete the implementation of the RIS Directive and on the opportunities of reaping the wider benefits of the investments already made. The related study was published by the European Commission in July 2014[9].

NEA elaborated a Study on Administrative and Regulatory Barriers in the field of Inland Waterway Transport in 2008. Based on this study a Monitoring Group was installed by PLATINA (SWP 1.2). The final monitoring report contains a list of 25 European barriers that occur frequently in different Member States and barriers which request measures on European or international level. Currently a Working Group of the EUSDR PA 1a is concerned with streamlining administrative processes.

An important source for the transport market study is the Market Observation, which is published by the Central Commission for the Navigation of the Rhine, including contributions by the Danube Commission. This observation tool uses indicators of various aspects and factors affecting the inland shipping market. Publications describe and analyse trends in relation to the structure of supply and demand, operating conditions, modal share, job market trends, etc. In addition the study on the "Innovative Danube Vessel"[10] and the "Verkehrsbericht 2012"[11] were important sources for the transport market study.

3.2.4 Studies Ports

Total number of port-related studies and projects collected until the end of November 2014 is 63. For most of the studies, the sources were port authorities themselves, which were contacted for information on studies and projects, either directly (in most cases) or via national and international port associations (e.g. European Federation of Inland Ports – EFIP, Bundesverband Öffentlicher Binnenhäfen e. V. – BÖB, etc.). The CEF Regulation 1316/2013 Annex I was also used as a source of information, as well as the database of the European Strategy for the Danube Region (a.k.a. the Danube Strategy).[12]

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[7] *Report of the "Network of Danube Waterway Administrations" – data & user orientation, available at http://www.newada-duo.eu/, Wien, 2014*
[8] *Directive 2005/44/EC of the European Parliament and of the Council of 7 September 2005 on harmonised river information services (RIS) on inland waterways in the Community, OJ L 255 p.152, 30.09.2005*
9 *http://ec.europa.eu/transport/modes/inland/studies/inland_waterways_en.htm*
10 *Report oft he „Innovative Danube Vessel" available at http://www.danube-navigation.eu/*
[11] *Generaldirektion Wasserstraßen und Schifffahrt, Außenstelle Süd*
[12] *http://www.danube-navigation.eu/pages/projects/ports*

The distribution of identified port-related studies per countries along the Corridor is as follows (excluding the French and German Rhine ports which are tackled in the Rhine-Alpine Corridor):

- Germany: 6 studies
- Austria: 10 studies
- Slovakia: 6 studies
- Hungary: 1 study
- Croatia: 4 studies
- Romania: 32 studies
- Bulgaria: 2 studies
- Multinational: 2 studies
- **Total: 63 studies**

All studies were validated by Member States and/or port administrators in respective ports.

Multinational studies used in the analysis process are: DaHar (Danube Inland Harbour Development) and INWAPO (Upgrading of Inland Waterway and Sea Ports)

3.2.5 Studies Rail/road terminals

In the framework of the "Agora" project, an EC-funded Marco Polo common learning action (2009-2010) with the aim for improvement of intermodal terminal management and operation as well as increasing terminal capacities by "soft" measures, a terminal database was implemented. This public database contains intermodal terminal sites throughout 22 European countries with information on their geographical position, associated modes of transport and operational modalities. The data are continuously maintained and therefore provide a broad basis for identifying the relevant terminals on the corridor.

Furthermore, the "Diomis" project was assigned by UIC and UIRR in 2006 to analyse the European rail infrastructure capacity and recommend measures for facilitating modal shift to rail as intended in the EC's White Paper on transport policy. Within this project, attention was directed to the situation in new EU Member States joined the Union in 2004 and 2007. Thus, Diomis reports for Bulgaria, Czech Republic, Hungary, Romania and Slovakia give a comprehensive description of intermodal rail-road transport for a large part of the Rhine-Danube corridor countries. Based on data of the years 2007 and 2008, scenarios for the development of combined transport in these countries were elaborated at time horizon 2020. For the study on the Rhine-Danube Corridor, the reports were used in the course of TENtec data gathering, e.g. regarding terminal sites, capacity and operators. Due to the economic crisis in the recent years, the results of the mentioned prognoses are only of limited usability for the corridor's Transport Market Study.

More current input for the Transport Market Study for German rail-road terminals can be obtained from a report released in 2012: "Entwicklungskonzept KV 2025 in Deutschland" (evolution concept for combined transport in Germany 2025) which was commissioned by the German Federal Ministry of Transport. Therein, detailed analyses on the level of aggregated terminal infrastructure areas, so-called "Standorträume", have been elaborated. By means of the forecasted traffic volumes in combined transport within these areas, the need for terminal capacity enlargement up to the year 2025 was deviated. These findings are also of relevance for the characterisation of the corridor by identification of (future) bottlenecks.

In general, for the subject of rail-road terminals there is the difficulty of less public available data. Intermodal terminals are often situated in business competition that leads to limited willingness of operators to provide business sensitive information such as traffic volumes. Thus, studies often show only aggregated data, a fact that hinders explicit statements about the characteristics of single terminals.

3.2.6 Studies Roads

The only Priority Project on motorways affecting the R-D Corridor is the Priority Project 7 (Motorway from Igoumenítsa /Patras to Budapest). The status of progress is reported in the Progress Report 2012 – Implementation of the TEN – T Priority Projects. On the one branch of the PP7 the studies on the sections between Drobeta Turnu Severin (RO) and Budapest (HU) are relevant for the R-D corridor. In particular studies and information were collected for the sections between Lugoj – Timișoara– Arad – Nădlac on the Romanian part of the Corridor and the section Makó– Nagylak – Csanádpalota on the Hungarian side of the Corridor. The other branch of PP7 in Romania runs from Arad in the direction of București and the port of Constanța.

The EU Strategy for the Danube Region is the most relevant strategic background for the Rhine-Danube Corridor. Priority Area 1b focuses on rail, road and air links and aims to improve mobility and multimodality. The EUSDR report of 2013 has been taken into consideration with the Annex 2 – projects approved by the Steering group and the Annex 3 – received projects. The roadmap for the implementation of actions has also been considered.

Important sources of information are the national Transport Master Plans of the Member States. The following master plans and strategic development plans were provided by the Member States Czech Republic, Slovak Republic, Hungary, Croatia, Bulgaria and Romania.

For the Czech Republic two documents were analysed in detail, the Transport Policy of the Czech Republic for 2014 – 2020 with the prospect of 2050, of June 2013, and the Transport Sector Strategies, 2nd Phase, summary document and the Annexes. Furthermore the National Reform Programme of the Czech Republic 2013 formed a source of information.

For the Slovak Republic the Strategic Development Plan of Transport Infrastructure of the SR by 2020. Phase I, June 2014, and the Operational Programme Integrated Infrastructure of October 2014 are available.

For Hungary the Transport Operational Programme of July 2009, National Transport Strategy – National Transport Policy Concept of 2013, the National Transport Infrastructure – Development Strategy 2014, and the Integrated Transport Development Operational Programme (ITOP) for 2014 – 2020, of June 2014 are available. The latter one was received in English in October 2014.

Croatia provided two strategic documents, the draft version of the Operational Programme Competitiveness and Cohesion, 2014 – 2020, June 2014 and the final draft of the Transport Development Strategy of the Republic of Croatia (2014 – 2030), June 2014, which were analysed with regard to the development of inland waterways on the Danube and the Sava and the related ports.

For Romania the preliminary General Master Plan of Transport for Romania of 2013 has been analysed, which shall form the basis for the development of the transport sector in Romania for the next 20 years and shall identify projects and policies that are meeting the Romanian transport needs best in the next 5 – 15 years. The Master plan provides the projects for the new Operational Programme period of 2014 to 2020. Also the draft version II of the Operational Programme Infrastructure, September 2014 was provided in Romanian language.

For Germany the actual Bundesverkehrswegeplan of 2003 together with the Investitionsbericht (investment report) for the years 2011 and 2012 and the

Investitionsrahmenplan (investment framework plan), (IRP) 2011 – 2015 are taken into consideration.

For Austria the actual Gesamtverkehrsplan 2012 of the BMVIT together with the Rahmenplan of ASFINAG for the period 2014 – 2019, the draft version of the Rahmenplan for the period 2015 – 2020 and the Rahmenplan for the ÖBB 2014 – 2019 were collected and reviewed.

These documents form the basic source of information on the description of the characteristics of the motorways in the Member States of the R-D Corridor. Studies on the traffic forecasts up to the year 2025 were received from Austria and Germany.

Further sources of information are the Operational Programmes Transport of the Member States Romania, Bulgaria, Croatia Hungary, Slovakia and Czech Republic. As the programming period ended in 2013 the new OPT´s for the programming period 2014 to 2020 are not yet approved and available only in draft version, therefore the OPT´s of the last period from 2007 to 2013 were taken into the evaluation.

National studies

Considering the list of pre-identified sections of the R-D Corridor in the CEF regulation the following core studies on national level for road projects were considered as important:

Cross Border Project Zlín - Žilina: Feasibility study "Express road R49/R6 Hulín - Púchov ", first studies of 2006, with the following sections A: Frystak - Lipa 1.etapa, B: Fryšták - Lípa 2.etapa, C: Luky - cross border CZ/SK, D: cross border CZ/SK-Púchov.

For Romania the following Feasibility studies were considered:

- Technical Assistance for the Preparation of Road Project Pipeline for the Cohesion Fund: Nădlac – Arad – Timișoara – Lugoj – Deva – Sibiu;
- Revising and updating the Feasibility Study for Timișoara Bypass and Motorway section Timișoarato Lugoj;
- Feasibility Study Bucuresti – Constanţa Motorway, Section Cernavoda – Constanţa.

Regarding Innovative Transport Systems a strategy paper on "ITS Action for the Roads, a framework for the coordinated evolution of existing and the accelerated introduction of new Intelligent Transport Systems in Germany over the period to 2020" was analysed. Another document of the German BMVI deals with the concept of secure parking for trucks in a modern demand oriented parking system.

From ASFINAG, the motorway operator of Austria, the "Verkehrssicherheitsprogramm 2020" (Traffic safety programme 2020) was analysed regarding measures on the introduction of secure parking facilities and telematics systems for traffic management.

Multinational studies

Regarding toll services in Europe the reports of the EU funded project on Regional European Electronic Toll Service form a source of information on toll systems:

In compliance with and in support of the existing EC legislation regarding the interoperability of electronic road toll system (Directive 2004/52/EC and the subsequent Decision 2009/750/EC) the proposed Project (REETS TEN) aims at deploying EETS compliant services in a cross-border regional project. The Project shall cover the electronically toll network of 7 Member States (Austria, Denmark, France, Germany, Italy, Poland and Spain) and Switzerland.

The EasyWay Projects phase I (2007-2009) and phase II (2010-2012) have been co-funded by the European Commission and are part of the EasyWay Global Programme 2007-2020. The core objective of EWI/II was to deploy Europe-wide ITS Core Services for the benefit of the road users. By doing so, the Programme supports the transport policy goals concerning road safety, environmental impact from transport and mobility. In both EW Project phases were settled clear targets, identifying the set of necessary ITS European Core Services to deploy Travelers Information Services, Traffic Management Services and Freight and Logistic Services; at the same time EasyWay I and II have represented an efficient and unique Platform that allows the European mobility stakeholders to achieve a coordinated and combined deployment of these pan-European services.

Another ITS project funded under the TEN-T Multi-Annual Programme is CROCODILE, which started in January 2013 and will be completed by December 2015. Following Member States of the R-D Corrdior are involved: Austria, Czech Republic, Germany, Hungary and Romania. The project sets up and operates a data exchange infrastructure for the information and data exchange between all involved public authorities and private users involved on safety related information services and truck parking information services. The project shall also foster cross-border ITS applications for travellers. Policy framework for the deployment of ITS across Europe is the action Plan of Dec 2008 and the directive 2010/40/EU.

As a first follow-up of the EasyWay initiative the European ITS platform (EIP) was launched in Nov. 2013, with a closing date of Feb. 2015. The EIP of road authorities and operators aim at enhancing the deployment of harmonised ITS services and the coordinated management of road transport in Europe.

As a further follow-up of the EasyWay initiative the European ITS Platform+ was launched in July 2014, end date is planned for December 2015. It will carry on the activities towards ITS operability and harmonised deployment in Europe, monitor the applications of the Easyway deployment Guidelines and provide user support.

A further study report of the EU funded project on the collection and analysis on the structure of the road haulage sector in the European Union, Task A of 3.2.2014 was taken briefly into consideration.

3.2.7 Studies Airports

Studies on the improvements of the connection of airports to the core network (core parameter) are mainly defined as rail or road project and included in the respective chapters on rail in the development plans. Information source are the strategic development plans and the national Master Plans with the relevant chapters on aviation and air transport.

3.3 Interactions with Platina II and RFC

In the course of the elaboration of the Corridor studies for all nine Corridors a valuable interaction took place with the PLATINA II as a European Coordination Action towards quality inland waterway transport. The following documents were distributed and taken into account for the corridor study:

- Information package on the State-of-Play of IWT, Vol 1.of D 4.3, March 2014, prepared for the first preparatory meeting of the Core Network Corridor Studies
- Information package on the Corridor objectives and prioritising projects in IWT and inland ports, Vol II of D 4.3, May 2014, prepared for the second preparatory meeting of the Core Network Corridor Studies
- Review of the second progress reports TEN-T Corridor Consortia, July 2014

- Review of the third progress reports TEN-T Corridor Consortia, October 2014
- Review of the Draft Final Corridor progress reports, SWP 5.4, 25. November 2014

Another important interaction took place with the Rail Freight Corridor 7. The Consultants of the Rhine-Danube corridor study and of the Orient East Med Corridor study were invited to the RFC Secretariate in Budapest for a meeting and received valuable information on the rail infrastructure parameter. Rail Freight Corridor 7 is established by cooperation of the transport ministries, infrastructure manager companies and allocation bodies of seven countries (Czech Republic, Slovakia, Austria, Hungary, Romania, Bulgaria and Greece) Close contact could be established with the secretariat of the RFC 7 and with MAV and GYSEV.

Also the RFC 9 (CS Corridor) was taken into the analysis. The CS Corridor has currently two members, the Czech Republic and Slovakia. An initiative has started to enlarge the CS Corridor to the Rhine Danube RFC. The consultant was invited to attend an informal meeting on the establishment of the Rhine Danube RFC.

3.4 Conclusions

Within the work package "study review", a comprehensive knowledge and data base has been set up in order to provide profound information about

- Characteristics of the corridor,
- Compliance of these characteristics with the requirements of Regulation 1315/2013,
- Measures which are planned, on-going or already finalised in order to improve the situation on the corridor and comply with the TEN-T standards.

Technical and infrastructure data were gathered from sources like EUROSTAT statistics, Network statements, RFC implementation plans, data delivered by the Ministries, highway/airport/port websites, UNECE Blue Book, River Information Services (ELWIS, DoRIS, etc), own data collections and interviews with infrastructure managers and operators.

Additional characteristics with particular focus on bottlenecks and missing links were derived from more than 250 studies, containing e.g. the Priority Projects 7, 17, 18 and 22, ERTMS implementation, the EU Strategy for the Danube Region, PLATINA and other multimodal and corridor related projects like CREAM, COSMOS, ACROSSEE or FLAVIA.

Furthermore, national and international traffic development and master plans have been taken into consideration.

All information derived from these analyses has been stored in Excel data bases. This provides the opportunity to quickly filter and extract information according to dedicated criteria.

In conclusion, the analysed studies, data bases and projects cover

- the entire Rhine-Danube corridor geographically – with a slight focus on the south-eastern part,
- all relevant topics, such as infrastructure bottlenecks, cross border sections, ERTMS or RIS, intermodality and interoperability, operational and administrative barriers, etc. and
- required data to describe the characteristics of the corridor and assess compliance with the requirements of Regulation 1315/2013.

Thus, the performed study review represents a sound basis for the next work steps, even though minor information gaps have been identified: some studies are not up-to-date or not yet available. In other cases, different sources provide inconsistent information on dedicated issues; this also shows the need to alleviate methodical problems by further research and harmonisation activities.

The main conclusions of the study review are described by transport mode:

3.4.1 Rail

The reports on Priority Projects 17 and 22 provide information on missing links and ongoing projects along the corridors. Infrastructure data, bottlenecks, line capacities, administrative barriers, cross-border operation are treated e.g. in the RFC implementation plans. These topics are also covered by other corridor projects like CREAM, COSMOS, ACROSSEE and FLAVIA.

Data gaps remain with respect to traffic volumes/flows, which are normally not available by official, public statistics. Of particular significance are volume figures in relation to the line capacity. In this respect, utilisation rates are generally available – at least in dedicated classes – from studies and from direct input by infrastructure managers (e.g. DB Netz AG). However, the calculation methods remain unknown. Most likely, the methods differ from country to country, which makes a corridor-wide analysis rather impossible (or leads to unsecured conclusions). Thus, a harmonisation of these calculation procedures is recommended. Also for the determination of the maximum possible train length a common procedure is recommended. According Regulation 1315/2013, 740 m train length should be implemented on the core rail freight network by 2030. However, based on the existing information it is almost impossible to measure the fulfilment of this requirement. Furthermore, the permitted train length must be defined in the same way in the different studies/countries in order to ensure a consistent analysis along the corridor. This is obviously not the case, shown on example of German rail network: Whereas DB Netz generally states a maximum length of 740 m for freight trains on the DB network, the RNE corridor information leaflets show a maximum length of only 600 m for all German sections of the Rhine-Danube corridor.

In coordination with DB Netz AG, the actual situation for Germany is as follows: The train length for the German corridor network is in general 740 m. Restrictions due to timetabling and the operational situation can partially influence the actually possible train length.

3.4.2 Inland Waterways

Infrastructure bottlenecks are described by several sources which cover the whole corridor. River Information Services was investigated by the RIS policy review, the related study was published by the European Commission in July 2014. Studies on Administrative Barriers are currently refined by the activities of EUSDR PA 1a Working Group. Results are expected by 2015.

Nearly all required parameters and corridor sections could be covered with data gathered by the consultants. Similar to the other modes, data gaps primarily refer to passenger and freight traffic flows.

One of the most significant parameters related to inland waterways is the available minimum draught. The information bases mainly on the UNECE Blue Book, which represents the best available international data. According to the Needs Assessment on Fairway Maintenance[13] this data does not reflect the situation on the Rhine-Danube Corridor properly, due to lacking monitoring and surveying equipment (e.g. gauging stations, surveying vessels…).

[13] *Report of the "Network of Danube Waterway Administrations" – data & user orientation, available at http://www.newada-duo.eu/, Wien, 2014*

For the parameter "navigation reliability", no official data was available for the Sava and for the waterways in Germany. The parameter also comprises the available draught and therefore has to be treated with caution.

3.4.3 Ports

It has to be considered that different methods are used to measure the cargo throughput of ports, while EUROSTAT offers no statistics for inland ports. Lack of standardized statistics revealed different methodologies of data collection by ports. In this view, some ports record their annual cargo flows in cargo tonnage (for the dry bulk, liquid bulk and general cargo) and, separately, in the number of twenty foot containers or twenty foot equivalent units (TEU) which is a standard measure for the throughput of containers in ports, while other ports measure only tonnage. The largest share of information needed for the assessment of the ports' characteristics was obtained in the direct contact with port managers.

Most ports comply with the requirements in terms of minimum draft whereas two ports need dredging interventions. 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). 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 addition, all ports reported having at least one freight terminal open to all operators in a non-discriminatory way with transparent charges. 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. Finally, most of the ports reported the existence of the shore-side electricity supply facilities for vessels.

3.4.4 Rail-/road terminals

Data have been gathered for all terminal locations associated to the terminal nodes on the Rhine-Danube Corridor. Missing information refers to the transhipment volume of the terminals. This is mostly due to strict confidentiality of such data. Some of these gaps might be filled by a completely working TENtec data base, which is continuously updated.

Concerning the "Programme of measures", the studies and particularly the traffic/transport master plans as well as the project data base of the EUSDR PA 1a provide a profound basis of information. Nevertheless, additional input from the Member States is required in order to obtain a complete and up to date status of the planned/ongoing projects and their main parameters (schedule, costs, funding, etc.). This procedure will be described in chapter 4.5.4.

3.4.5 Road

A similar situation appears with the gathering of traffic volumes/flows like for rails. Data on the toll charges for trucks are not available for all countries or could not be entered into the TENtec system (more than one value for a single cell).

Most of the national master plans and strategic development plans cover the development of the transport infrastructure up to the time horizon of 2020. Some of them provide traffic forecasts up to the 2030. While the new Member States of the EU were still involved in the finalisation of the new operational programmes for the period 2014 to 2020 only draft versions of these documents could be obtained for study review during the period of collecting information. On the other side for Germany the actual Bundesverkehrswegeplan (Federal transport infrastructure plan) is originated from 2003 and the next plan is foreseen in 2015. For Austria the Gesamtverkehrsplan of 2012 and the most actual and approved versions of the Rahmenplan for rail and road were considered.

All the master plans and strategic development plans deal also with the introduction and implementation of innovative transport systems and telematics solutions in order to provide a tool for traffic management and traffic safety.

3.4.6 Airports

No significant data problems occurred. However, this is also due to the very limited number of requested core parameters for airports. Projects regarding the improvement of the connection of the airports to the rail and road network are always considered under the list of respective rail or road projects. Nevertheless a summary of information on such projects is given in the chapter of programme of measures for airports. To cover the aspect of alternative clean fuels a survey was made on the availability of alternative fuels for ground operation and concepts for the future use of clean fuels could be identified for airports in Germany and Austria.

3.4.7 The Connecting Europe Facility

The analysis of the infrastructure and nodes on the Corridor took also into consideration the Regulation no 1316/2013 on establishing the Connecting Europe Facility, which defines in its Annex 1 Part 1 the pre-identified sections on the Corridor with including projects:

Table 3: CEF Pre-identified projects along the Rhine Danube corridor

Links/Nodes	Mode	Type of Projects
Rail connection Strasbourg – Kehl - Appenweier	Rail	Works interconnection Appenweier
Karlsruhe – Stuttgart - München	Rail	Studies and works ongoing
Ostrava/Přerov – Žilina – Košice - UA	Rail	Upgrading, multimodal platforms
Zlin - Žilina	Road	Cross-border road section
München - Praha	Rail	Studies and works
Nürnberg - Praha	Rail	Studies and works
München – Mühldorf – Freilassing - Salzburg	Rail	Studies and works ongoing
Salzburg - Wels	Rail	Studies
Nürnberg – Regensburg – Passau - Wels	Rail	Studies and works ongoing
Rail connection Wels - Wien	Rail	Completion expected by 2017
Wien – Bratislava/Wien – Budapest/Bratislava - Budapest	Rail	Studies high speed rail (including the alignment of the connection between the three cities)
Budapest - -Arad	Rail	Studies for high speed network between Budapest and Arad
Komárom - Komárno	IWW	Studies and works for cross-border bridge
Arad – Brašov – Bucuresti - Constanta	Rail	Upgrading of specific sections, studies high speed

Links/Nodes	Mode	Type of Projects
Main – Main-Donau-Canal	IWW	Studies and works on several sections and bottlenecks; inland waterway ports: multimodal interconnections with rail
Slavonski Brod	Port	Studies and works
Giurgiu, Galati	Port	Further development of multimodal platforms and connections with the hinterland: studies and works
Danube (Kehlheim – Constanta/Midia/Sulina)	IWW	Studies and works on several sections and bottlenecks ; inland waterway ports: multimodal interconnections
Sava	IWW	Studies and works on several sections and bottlenecks (including cross-border bridge)
Bucharest – Danube Canal	IWW	Studies and works
Constanta	Port, MoS	Port interconnections, MoS (including icebreaking services)
Craiova - Bucharest	Rail	Studies and works

Source: Regulation on the Connecting Europe Facility no. 1316/2013, Annex I

Additional projects assigned to other Core Network Corridors according to Regulation 1316/2013 Annex I in overlapping sections or parts of overlapping sections are:

Table 4: List of CEF Pre-identified projects along the Baltic-Adriatic corridor

	Links/Nodes	Mode	Type of Projects
1	Katowice – Ostrava – Brno – Wien & Katowice – Zilina – Bratislava - Wien	Rail	Works, in particular cross-border sections PL-CZ, CZ-AT, PL-SK and SK-AT, Brno-Přerov line; (further) development of multimodal platforms and airport-rail interconnections

Source: Regulation on the Connecting Europe Facility no. 1316/2013, Annex I

Table 5: List of CEF Pre-identified projects along the Orient / East-Med corridor

	Links/Nodes	Mode	Type of Projects
2	Praha	Rail	Upgrading, freight bypass; rail connection airport
5	Praha – Brno – Breclav	Rail	Upgrading, including rail node Brno and multi-modal platform
7	Bratislava – Hegyeshalom	Rail	Cross-border, upgrading
8	Mosonmagyaróvár – Rajka	Road	Cross border upgrading
9	Tata – Biatorbágy	Rail	Upgrading
10	Budapest – Arad – Timişoara – Calafat	Rail	Upgrading in HU nearly completed, ongoing in RO
12	Vidin – Craiova	Road	Cross-border upgrading

Source: Regulation on the Connecting Europe Facility no. 1316/2013, Annex I

Table 6: List of CEF Pre-identified projects along the Rhine – Alpine corridor

	Links/Nodes	Mode	Type of Projects
1	Frankfurt - Mannheim	Rail	Studies ongoing

Source: Regulation on the Connecting Europe Facility no. 1316/2013, Annex I

Annex 1 defines also Horizontal Priorities for innovative management and services in the area of innovative technologies:

Table 7: Horizontal Priorities

		Type of Projects
1	Innovative management & services	Telematic application systems for road, rail, inland waterways and vessels: ITS, ERTMS, RIS and VTMIS
2	Innovative management & services	Core network ports, motorways of the Sea (MoS) and airports, safe and secure infrastructure
3	Innovative management & services	New technologies and innovation in accordance with points (a) to (d) Art 33 of Regulation No 1315/2013

Source: Regulation on the Connecting Europe Facility no. 1316/2013, Annex I

These pre-identifed sections on the Rhine-Danube corridor shall be reflected then in the study work plan (see chapter 4.5) and the List of projects (see Annex 2 of this study report).

4 Elements of the Work Plan

This chapter is meant to be the basic source for the Work plan for the European Coordinator, providing for each mode and for the corridor the recent status of on-going projects (in the year 2014). It also contains the planned projects as obtained from the Member States, the Infrastructure Managers and Regional Authorities.

Partly but in a very small extent, the list contains additional project ideas to the planned projects (without cost and timing information), e.g. projects required as follow up of on-going projects, projects needed to remove the identified bottlenecks, projects to enhance freight transport services.

All projects listed aim towards the new construction or substantial upgrade of the technical infrastructure on the corridor. They may also tackle organizational and administrative problems still hampering the efficient flow of transport. However, projects which are related purely to maintenance or substitution of existing capacities are not primarily deemed as Corridor projects, with the exception of inland waterway works.

The elements of the Work plan consist of the

- Summary of the Work plan regarding the determination of the corridor alignment and the infrastructure, the main results of the analysis of the characteristics of the rail transport mode, the Inland waterway transport mode, the ports and rail / road terminals, the road transport mode and the airports on the Rhine-Danube corridor. The summary presents also the main finding from the Transport Market Study in a multimodal approach. Alongside with a brief presentation of the generic and more specific objectives of the corridor the summary presents the implementation plan with the main findings on projects for each mode of transport, which may resolve existing bottlenecks or critical issues thus hampering the free flow of passengers and goods on the corridor.
- Brief overview of the alignment and its infrastructure of the corridor.
- Description of the characteristics of the infrastructure based on the technical parameters for each mode of transport by verification of the compliance of the existing infrastructure with the parameters and the identification of critical issues hindering the efficient use of the infrastructure. The verification is made for all transport modes. Furthermore in a second step the analysis assessed the traffic flows per mode and the share of different transport nodes in the corridor considering passenger traffic and goods traffic in the transport market study.
- Review of the generic objectives of the corridor and identification of specific objectives for the rail and road transport mode, the inland waterway transport and the ports.
- The results of the analysis of critical issues and bottlenecks on the corridor are then compared to the list of projects for each mode. The list of projects per mode were collected from the Member States and the stakeholders and were discussed and reviewed, whether they eliminate existing bottlenecks and critical issues (those infrastructure section, which do not comply with the technical parameters) on cross border section or sections in a member state, whether they are ongoing projects or projects planned in the short, medium or long term. The list of projects was clustered also to mode specific criteria and to the mode specific objectives, where it seems to be useful.
- List of projects of each mode on the corridor and the nodes up to 2030 with indications on the location of the project, the promoter of the project; whether it covers a critical issue or not and whether the project correspond to the CEF pre-identified sections including projects.

The following principles have been applied in the elaboration of the Work Plan:

- A number of sections and nodes on the Rhine-Danube Corridor are overlapping with other corridor studies. In particular the overlapping of the rail and road infrastructure sections between Wien and Calafat/Craiova exists with the OEM corridor. However for the analysis and the implementation plan these sections are included in both studies. On the other side it has been agreed, that the IWW infrastructure of the Danube River and Inland ports on the Danube River are included exclusively in this corridor study.
- It has also been agreed that the ports on the river Rhine and Neckar are dealt in the Rhine-Alpine Corridor study; this refers to the ports of Strasbourg, Karlsruhe, Mannheim/Ludwighafen, Mainz and Stuttgart. For the TMS some of the ports were taken into consideration. Projects for these ports are included in the Rhine-Alpine Corridor study.
- Due to the specific characteristics of the Rhine-Danube Corridor it has also been agreed in the first Corridor Forum to invite neighbouring countries to the Corridor Fora.
- It has also been agreed during the Corridor Forum to include IWW ports of the comprehensive network into the Transport Market Study, having a major influence of the current and future transport flows along the corridor.
- Following point 14 of the CEF Regulation and the TEN-T guidelines the Work Plan includes on-going projects and planned projects on the creation of new infrastructure as well as substantial upgrading together with the rehabilitation of existing infrastructure to cope with the objective of completion of the core network by 2030. On the other side the Work Plan does not include projects aimed for the pure rehabilitation of infrastructure (rail and road), building rehabilitation and extension measures on airports (e.g. new runways).
- A close interaction took place with the PLATINA II action on several topics based on the feeback reports on the corridor reports in particular in the field of IWT. Furthermore a close interaction with the Rail Freight Corridor 7 took placewith respect to rail infrastructure parameters.

4.1 Summary of the Work Plan

The Summary presents the results of the elaboration of the Work Plan within the study on the Core Network Corridor Rhine-Danube.

It consists of a brief overview on:

- the corridor alignment and the infrastructure per mode;
- the identification of bottlenecks by comparing the existing infrastructure with the technical parameters as set in the regulation;
- the development of specific objectives from the generic objectives as defined in the Regulation;
- the plans of implementation of ongoing and planned projects on the short, medium and long term by the Member States together with the List of projects.

The last subject involves the analysis of the project information, received from the Member States. More in particular this includes:

- verification whether Member States remove and resolve identified bottlenecks first on cross border sections and infrastructure sections (which do not comply with the core technical parameters of each mode);
- collection of information on the timing and the costs of the planned projects;

- to clarify whether bottlenecks still remain, as they are not covered by the list of projects so far;
- the timing of the projects' implementation, as some projects indicates a completion date behind 2030. However the analysis showed that additional information is still required from the Member States and the stakeholders.

In addition to the examination of project information of Member States, the work plan provides a thorough analysis of the projects, looking at scope of measures, maturity / status of work as well as costs and funding. The results of these analyses were checked and confirmed by the Member States. Based on the final approved project list, further recommendations are given on:

- assessment of prioritized needs for action- not yet covered by projects - regarding negative impact on the operation;
- derivation of additional projects closing the remaining critical issues;
- evaluation of these additional projects regarding efforts / impacts on the functionality of the corridor and timelines.

4.1.1 Determination of the corridor alignment and infrastructure

The Rhine-Danube Corridor is described as:

"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."[14]

The Member States Bulgaria and Croatia are only included in the Inland Waterways corridor. This concerns ports and inland waterways of the rivers Danube and Sava. Also some neighbouring, third countries are included in the analysis of the waterway corridor[15]. 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 (River Sava);
- Moldova: related to one port (Giurgiulesti);
- Ukraine: related to inland waterways (Danube).

According to CEF Regulation 1316/2013, the alignment consists of the following five main parts:

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

[14] *See* Annex 1 of the CEF regulation 1316/2013. *Document of the European Commission (Directorate-General for Mobility and Transport) The core Network Corridors- Trans European transport Network 2013*

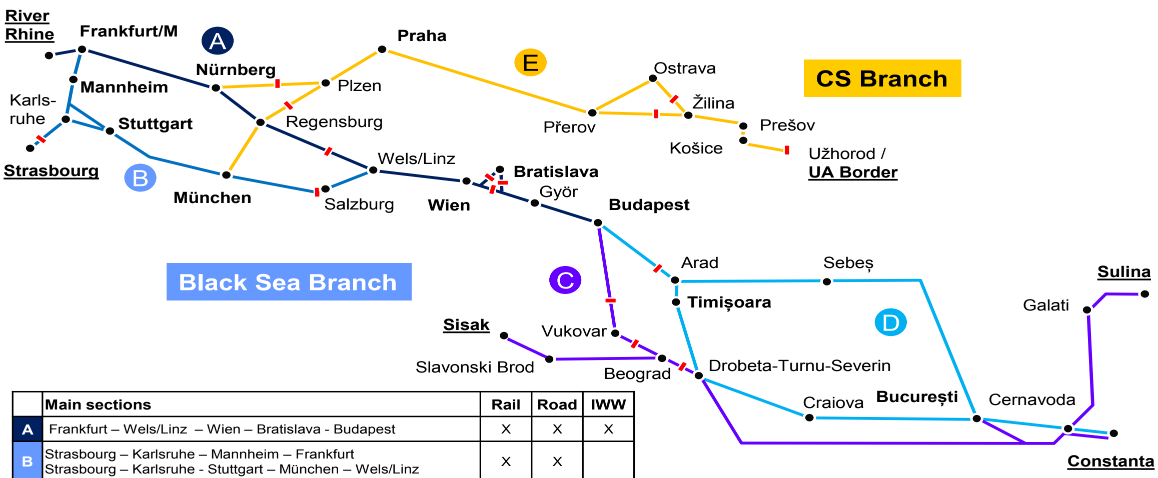
[15] *The cooperation with third countries is described in Article 8 of the TEN-T Guidelines. Projects of common interest in order to connect the TEN-T network with networks of neighbouring countries may be supported, including financially by the Union.*

The Annex of the CEF regulation is in line with the maps of the core and comprehensive network in the TEN-T Guidelines.

In the CEF Regulation 1316/2013, the alignment of inland waterways is clearly defined. It includes the river Main starting with the confluence with the Rhine, which is connected to the Danube by the Main-Danube Canal at Kelheim. The Regulation (EU) No 1316/2013) pre-identified the Sava project up to the port of Sisak, which is defined as a comprehensive port.

The corridor can be roughly split into two branches: the "Black Sea" branch" and the "CS" branch in the north (the latter following the terminology used in RFC 9).

Figure 5: Alignment of the Rhine-Danube Corridor (all modes)



	Main sections	Rail	Road	IWW
A	Frankfurt – Wels/Linz – Wien – Bratislava - Budapest	X	X	X
B	Strasbourg – Karlsruhe – Mannheim – Frankfurt Strasbourg – Karlsruhe - Stuttgart – München – Wels/Linz	X	X	
C	Budapest – Beograd – Orşova – Cernavodă – Sulina + Sisak - Slavonski Brod – Beograd + Bucureşti – Constanta (IWW)			X
D	Budapest Arad – Timisoara – Sebeş Bucureşti . Constanta + Timisoara – Orsova – Craiova - Bucureşti	X	X	
E	Nürnberg/München – Plzen – Ostrava/Prerov – Zilina – UA border	X	X	

Source: HaCon

The Black Sea branch has different routes in Germany and Romania. For Germany there is a northern route via Frankfurt/ Nürnberg and a southern route via Stuttgart/München/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 (Danube and Sava).

The CS Branch has two starting points (München and Nürnberg) and runs via Plzeň and Praha towards Přerov in the Czech Republic. Beyond Přerov at Hranice na Moravě 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 manly used by freight traffic.

4.1.2 Characteristics of the corridor

Given the corridor alignment (see previous section) and the related infrastructure, the characteristics of each transport mode were analysed and a compliance check was made on the infrastructure based on the parameters as specified in the Regulation. The main objective is the identification of sections, which are critical for efficient transport flows and have a negative impact on the functionality of the transport performance.

Rail characteristics

Of particular relevance for the rail characteristics are the standards set by Art 39 of the Regulation 1315/2013. Concerning rail, the "core parameters"[16] and standards are defined:

- *Electrification: Core network to be electrified by 2030 (including sidings where necessary)*
- *Track gauge: New lines to be built in UIC standard gauge (1435 mm), except in certain circumstances*
- *Line speed: Core freight lines 100 km/h by 2030 (NB: no speed requirement for passenger lines)*
- *Axle load: Core freight lines 22.5 t axle load by 2030*
- *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*

Beyond these core parameters, further TENtec parameters have been analysed and included in the following presentations, as far as relevant for the characteristics.

Although the data collection process has been concluded byJune, some minor data gaps still remain for some line sections in Romania, for which official data could not yet be delivered by the authorities. However, only minor shares of the required data sets are classified as "others/unknown" and therefore do not influence the overall results remarkably.

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

1. "Traction": more than 90 % of the corridor rail lines are electrified. Gaps of electrification are limited to some sections in Germany (München-Mühldorf-Salzburg line and cross-border sections with the Czech Republic) and Czech Republic;
2. "Track gauge": all corridor lines provide for standard gauge (1,435 mm);
3. "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);
4. "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. Note: In Hungary, 22.5 tonnes is possible with reduced line speed.
5. "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;
6. "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.

[16] *Apart from these six core parameters, other TENtec parameters were analysed and included in this report*

Inland Waterway characteristics

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

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)*

As large stretches of the inland waterways in the corridor coincide with state borders, the study does not distinguish between national and cross-border bottlenecks.

The Main and the Main-Danube Canal provide for stable *fairway conditions*. At the free-flowing sections of the Danube and the Sava River, however, the requirement of a *minimum draught* of 2.5 m is hardly met. Even on 240 days per year for downstream sections or for upstream sections 300 days per year. As defined by the AGN agreement[17] of rivers with fluctuating water levels.

Regular fairway maintenance is necessary and particularly important on free-flowing sections. It has the potential to improve infrastructure conditions substantially and on short term. The fairway maintenance cycle consist of monitoring (river bed, water levels), planning (prioritization, coordination), execution (realignment of the fairway, dredging works in accordance with environmental legislation) and information (to infrastructure users). Regarding ice fighting measures lacking equipment with ice breakers and unclear responsibilities at the Iron Gate have been identified as a bottleneck.

The *minimum height under bridges* of 5.25 m – as required by the TEN-T Regulation - is not met by five bridges along the Main and Danube (Auheim, Alte Mainbrücke Würzburg, Bogen, Luitpoldbrücke, Margit-híd). Even if those bridges do not reach a clearance of 5.25 m over the whole fairway width, some of them are arch bridges and show a suitable clearance in the middle of the fairway. At the Main-Danube Canal overage *locks* have to be reconstructed (Erlangen and Kriegenbrunn). Since June 2011 the lock of Gabčikovo has operated with only one of the two chambers, due to a complete reconstruction. Works will take another 18 months and should be completed by the middle of 2017. The risk of a complete blockage of the fairway (which occurred in October 2013 and again in July 2014) is an imminent threat in this period. The Iron Gate I and II locks have also been identified as bottleneck 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 as promoted by the Commission´s Guidance Document "Inland waterway transport and Natura 2000 – sustainable inland waterway development and management in the context of the EU Birds and Habitats Directives" as well as the "Joint Statement on Guiding Principles for the Development of Inland

[17] *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*

Navigation and Environmental Protection in the Danube River Basin", taking into account the EU 2020 Biodiversity Strategy and related instruments such as the 7th Environmental Plan). Several projects to upgrade inland waterway infrastructure of the Rhine-Danube Corridor are either under study, approved or on-going (see implementation plan chapter).

RIS services are available along the whole Corridor but to a different extent and quality and interoperability is not always ensured. RIS applications still focus very much on the safety of inland navigation while automatic information exchange with terminal operators, freight brokers and shippers is used primarily in pilot operations. 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.

Port characteristics

Port parameters analysed are as follows:

- *IWW connections*
- *Road and rail connections*
- *Intermodal facilities*

More detailed parameters are in the main text of port characteristics. The majority of the Corridor core ports comply with the requirement set in the 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 ports (Rhine and Neckar ports are tackled in the study on Rhine-Alpine Corridor) 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 where all ports have rail connection to the hinterland, where some railway lines are in poor condition and therefore rarely used, such as in the case of the Port of Komárom in Hungary. In this particular port the railway tracks do not reach the quay line so direct ship-to-rail (and vice-versa) transhipment is not possible. Similar situation with the low quality of road and rail connections were reported by the Port of Galati (RO). Port of Cernavodă (RO) has reported no availability of railway tracks along the quay line, thus preventing the direct ship-to-rail (and vice-versa) transhipment.

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. Additionally, all ports have at least one freight terminal open to all operators in a non-discriminatory way with transparent charges.

In terms of plans for alternative clean fuel facilities, only one port (Constanța) 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 to the external supply of electricity to vessels in ports, most of the ports reported the existence of shore-side electricity supply facilities for vessels, with the exception of the ports of Galati (RO) and Wien (AT), whereas the ports of Frankfurt (DE), Komárno (SK) and Bratislava (SK) have limited possibilities for shore-side electricity supply.

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, while certain bottlenecks and missing links in ports are not currently addressed and will have to be planned in the future period. Detailed account on gaps between identified bottlenecks and current and planned projects is given in the main characteristics chapter.

Rail/Road terminal characteristics

The TEN-T regulations highlight the role of rail/road terminals (RRT) and have already defined their locations along the Corridor in Annex II of the EU-Regulation 1315/2013.

The analysis of rail/road terminals also includes locations with trimodal facilities enabling container transhipment to/from rail/road and inland waterways[18]. Infrastructure, volume and operation will however focus on the rail/road aspect of these trimodal terminals:

- In France there are two core network terminals on the corridor, both located in the port of Strasbourg at the river Rhine. The two trimodal terminals focus on container transport and provide handling tracks to accommodate the full length of current international direct or shuttle trains of about 600 to 700 m.
- In Germany 15 rail/road terminals belong to the core network of the corridor. It has been identified that the market development requires an increase of the handling capacity in terminal areas. Rail accommodation per RRT node is not an issue.
- In Austria there are five core network terminals on the Rhine-Danube corridor: Linz Stadthafen, Wels Vbf, Wels RoLa, Wien Nordwest and Wien Freudenau Hafen. Although located close to the terminal Wels Vbf, we consider Wels RoLa as a separate terminal, which is providing RoLa services only and which has its own dedicated tracks and area. Another terminal in the Linz/Wels area with a trimodal upgrade programme is Ennshafen.
- In Hungary there are three core network terminals on the Rhine-Danube corridor, which are all located in Budapest: Budapest-Bilk, Budapest Mahart (MCC), and Budapest Törökbálint, whereof Budapest-Bilk is the largest terminal and the only intermodal facility to provide handling tracks capable for full length of current international direct or shuttle trains (600 – 700 m). Jointly with Budapest Mahart it is also the most advanced in terms of infrastructure, handling, information technology and process organisation.
- In Bulgaria the only core network terminal is the terminal Ruse Tovarna, which has two handling tracks of only about 100 m usable length. According to market investigations the terminal is currently not used, thus the handling volume is zero. As with most of the terminals in Bulgaria, this facility was established some thirty years ago, but not well maintained and used in a proper way. Thus, the technical and infrastructure conditions of the facility are not state-of-the-art either.
- In Romania, there are 26 intermodal public terminals owned by CFR Marfa, the state-owned rail freight operator, and operated by the forwarder Rofersped, from which 7 public terminals actually have little activity (called "open" terminals) and the other 19 have had no activities (in 2013). However, the terminals without activity are still available for upgrading and equipment modernizing, in case of economic recovery of Romania. Along the corridor, the most relevant terminals are: Bucuresti Sud, Craiova and Semenic – near Timisoara city, these have only

[18] Nodes representing inland ports and rail-road terminals often have more than one facility (e.g. 3 rail-road terminals in Stuttgart). For the purpose of coherence with other European legislation and the common professional use of words, the Consortium has specified rail/road terminals (RRT) as intermodal terminals facilitating intermodal transport as defined in EC-Directive 92/106, thus basically the transhipment of containers, swap bodies and semi-trailers between two modes of transport, in this case rail and road.

very small traffic operation. None of the terminals provides handling tracks for the full length of current international direct or shuttle trains of about 600 to 700 m.

In the Czech Republic there are eight core network terminals on the corridor. By far the most important of them is Praha Uhříněves. It is also the only Czech terminal with handling tracks for complete international direct or shuttle trains. Except of the lack of the rail track feature, overall, the technical equipment of all other terminals seems to be compliant. However, according to information from the Czech Ministry of Transport most of these terminals need to be modernised. For this reason a respective funding programme under OPTII has been prepared and is ready for implementation.

In Slovakia there are three core network terminals on the corridor, two located in Bratislava and one in Žilina. Another terminal in Žilina - Teplička is currently under construction. All three existing terminals are focusing on container transport and were built some 30 to 40 years ago primarily designed for handling 20-foot ISO containers. The main limiting factor of the container terminals in Slovakia is the insufficient usable length of the transhipment tracks.

Road characteristics

In total the road corridor has a length of 4.470km and covers the Member States France, Germany, Czech Republic, Slovakia, Austria, Hungary and Romania, whereby the smallest share of the length of road per MS has France and the largest share is located in Romania.

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 Regulation 1315/2013. 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 2013*
- *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 Zlín and Žilina on the Czech side from Zlín to the border R49 and on the Slovakian side the R6 from the border to Beluša.
- 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 R-D corridor: The M15 Expressway (14 km between Rajka/SK border – Hegyeshalom/M1) is only a half motorway and functions currently as an expressway with 2x1 traffic lanes.

Compliance with the main parameter on type of road (motorway, express way or ordinary road) has not been achieved on the following sections on national level:

- Slovakia: A larger number of sections on the D1 from Hričovské Podhradie up to the Border (UA) are under preparation or construction.
- Romania: Projects concerning the Nădlac – Arad and Timișoara – Lugoj – Deva – Sibiu sections are on-going or were contracted in 2012. Completion is expected by 2022. A revision of the study on the difficult and expensive section between Sibiu and Pitești was completed by 2012. In the Romanian General Master Plan of Transport – Sept. 2014 version, Sibiu- Pitești section is proposed to be tested in two versions: firstly as an express road and then, as a motorway, with completion date by 2022. 47% of total length of the A1 is in operation. On the relation between Arad and Calafat (A6) Romania is not planning to make major investments, only minor rehabilitation projects are envisaged. Preparatory study was planned in 2013. Only rehabilitation measures of the A6 road between București and Craiova are planned, meaning between Alexandria and Craiova.

Compliance with the main parameter on type of road (motorway, express way) has been achieved in Germany, Austria, to a large extend in the Czech Republic and in Hungary (except the cross border sections as mentioned above), but critical sections were identified due to capacity problems, heavy traffic by trucks, and therefore resulting in unfavourable (deteriorated) road and bridge conditions:

- Germany: Critical sections due to road conditions and heavy traffic are on the A5 between Appenweier and AS Baden-Baden and on several sections of the A8 from AS Karlsbad to the German/Austrian border. Similar situation appears on the A3 in Bavaria, where bridges have to be rehabilitated and reinforced together with extension lanes. Also an extensive program of extended capacity for parking areas alongside the motorways is planned between 2013 and 2023.
- Austria: Section-wise bottlenecks due to heavy traffic are existing on the A4 between Airport Vienna /Fischamend and on the A1 between Pöchlarn and Ybbs. The construction of a third lane is in realisation. No other infrastructure projects for the period 2013 – 2018 on the corridor are planned beside rehabilitation and maintenance measures due to heavy traffic. A programme for extended parking areas alongside the motorway is progressing, which will replace the existing parking areas due to security reasons.
- Czech Republic: The main route D1 between Praha and Brno requires modernisation measures. The section between Kroměříž and Zlín is under construction.
- In Hungary the following critical sections are identified and reported: More lanes on the M0 ring motorway around Budapest are to be built between interchanges M1/M0 and M7/M0 (2.8 km) in 2014-2016.

  The deteriorated asphalt pavement of the old/first carriageway on the Southern Section of M0 Ring Motorway between interchanges M1/M0 and M51/M0 (approximately 26 km) is to be replaced by concrete pavement (including the renewal of the bridge across the Danube). Due to the traffic volume close to capacity, the widening of M1 motorway section between Tatabánya and Budapest (approximately 44 km) is under preparation.

Regarding the secure parking facilities for trucks each member state is following 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 LNG and LPG are available in all Member States on different level.

Airports characteristics

There are in total 11 airports along the Rhine-Danube Corridor, which can be assigned to Core network nodes. The majority is in Germany (4), Romania and the Czech Republic (each 2). Other Member States have one per country.

Relevant TENT-T parameters based on the Regulation 1315/2013 Article 41, paragraph 3 for airports are:

- *Rail connection*
- *Alternative clean fuels*

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 with a high-speed rail network connection. The dedicated main airports along the R-D corridor are: Frankfurt, München, Stuttgart, Praha, Wien and Budapest.

The following airports are without rail connection in 2013:

Praha, Bratislava, Budapest, Timişoara. Thus, the Airport of Praha (Václav Havel International) and Budapest Airport (Ferenc Liszt International) are to be connected to heavy rail by 2050.

The airports in Frankfurt, Stuttgart, München and Wien have started to make provisions for the use of alternative clean fuels for ground services. Charging stations for e-cars are under implementation.

4.1.3 Transport Market Study

The multimodal transport market study describes the transport activities to explain and illustrate given bottlenecks on a corridor level. Based on the requirements of the Work Plan the transport market study has a strong focus on international or cross-border bottlenecks. As the time horizon of the Regulation for the CNC is up to 2030 it has to be considered that due to the unpredictable changes in the transport market up to 2030 future traffic most likely will also bring up new bottlenecks.

For this reason the TMS reviews and combines existing forecast, without making own ones, to forecast the demand and supply side of the transport market.

In the transport market study drivers for scenarios are presented, they mainly consist of socio economic data and are well described in national sources and the European data project ETISplus. For describing the demand and supply side of the TMS national forecasts are used. Additionally ETISplus data is used that 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.

Population on the corridor is really 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 R-D 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 into 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 mode 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.

The supply side analysis presents information on capacity and provides information on the degree of utilization at infrastructure level. At the end of the chapter the impact of the Implementation plan is combined with the demand and supply side:

- 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. Due to the high rail demand this additional capacity is expected to be put to use efficiently almost right away. A capacity plan to increase capacity gradually to deal with all future demand would be advisable. On other supply characteristics, the RFC 7 implementation plan indicates that the current waiting time for freight trains at the Hungarian borders with Romania (Curtici)-and with Slovakia (Štúrovo) is the highest with an approximate 2 hours average.
- IWT in theory has sufficient capacity according to fairway ECMT classifications. Locks on the sections also have sufficient capacity for the near future and lock projects are identified in the implementation plan. However 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 at times 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 Main-Danube Canal sections in Germany are also no issue. Naturally occurring issues will remain in the future. The operation of larger ships and convoy arrangements may increase the capacity of the Danube fleet. However due to the free flow sections 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 and future capacity is anticipated to be sufficient.
- 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.

The strengths, weaknesses, opportunities and threats for individual transport modes and multimodal transport are treated in the TMS chapter of the report as well as modal shift to comply with EU White paper goals.

4.1.4 Objectives of the corridor

Starting points for the definition of the objectives of the corridor are the Articles 4 and 10 of the Regulation 1315/2013 which contain provisions on general objectives of the TEN-T network and general priorities. 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, which is efficient and sustainable and increases the benefits of its users.

The requirements for the core network are consistent with those for the comprehensive network but need to be accomplished by 31. December 2030. For inland ports infrastructure, in addition to the infrastructure requirements stated in Article 15, the availability of alternative clean fuels is requested on the core network. Article 39 of the TEN-T regulation sets the requirements for the infrastructure of the core network.

Based on the defined general and specific objectives of Articles 4 and 10 of the TEN-T regulation corresponding Key Performance Indicators (KPIs) are developed. Important input documents are: the SUPERGREEN project[19] and the TEN-T planning methodology project[20] (October 2010). These are matched with the defined specific objectives, where relevant. The definition of KPIs follows the differentiation between general and operational objectives. Specific Objectives (SO), are defined as:

<u>Specific objectives related to cohesion:</u>

SO 1 Upgrading of infrastructure quality level to comply with standards set out in the Regulation 1315/2013 (particular focus on core parameter for rail and road modes).

<u>Specific objectives related to efficiency:</u>

SO 2 Removal of infrastructure bottlenecks and "filling in" missing links by complying with the core parameters of the modes

SO 3 Interoperability of national transport networks by complying with the relevant core parameters

SO 4 Optimal integration and improved interconnection of transport modes intermodality (ensuring/improving "last mile" connections to ports, airports and RRTs)

SO 5 Efficient use of infrastructure (new and existing)

<u>Specific objectives related to sustainability:</u>

SO 6 Contributing to the sustainability objectives of the European Union: low-carbon and clean transport (reducing emissions and noise), the EU Biodiversity Strategy and the related intruments where applicable (conserving biodiversity and ecosystem services)

SO 7 Reduction of external costs of transport (safety, accidents)

The KPIs defined below help measure the degree of success towards the set objectives:

KPI_1 Degree of compliance to regulation standards: based on the transport infrastructure requirements stipulated in the TEN-T Regulation

KPI_2 Distance and travel time savings of new or improved sections

KPI_3Connection of ports and terminals to the rail and road network as well as to IWT

[19] *SUPERGREEN Deliverable D2.2 – Definition of Benchmark Indicators and Methodology (September 2010).*
[20] *Trans-European Transport Network planning methodology (October 2010).*

KPI_4 Use of common traffic management systems e.g. availability of ERTMS, ITS, RIS (Number of available key services)

KPI_5 Availability of multimodal platforms (freight)

- Number of RRTs
- Maritime: number of ports connected to existing rail network
- Inland Waterway: number of inland waterway ports connected to existing rail network /maritime ports
- Airports: number of airports connected to existing rail network

KPI_6 Freight and passenger volumes / performance: specific KPI for ports are defined below

KPI_7 Infrastructure capacity utilization rate by solving capacity bottlenecks through percentage of improved sections on rail or road in length, removal of links with high utilisation rate.

KPI_8 Availability of alternative clean fuels infrastructure

KPI_9 Freight security – availability of secured parking along road network

The quality of service in inland waterway transport on the Rhine-Danube Corridor largely depends on the reliability, the waiting times at border crossings, availability of locks and the readiness of information. Therefore additional KPI's are proposed of IWT:

- Reliability: % of days per year with draught over 2.5m
- Waiting time at border crossings: average hours of idle time at border crossings
- Operational availability of lock chambers: No. of days per year with partial / complete closure of locks

Ports have a need for other KPI's such as waterborne traffic measured in tons/year, intermodal connectivity measured in regular services, storage capacity measured in tons or TEU and passenger boarding time measured in average daily values.

4.1.5 Implementation plan

The projects on infrastructure improvements to remove the critical issues and bottlenecks on the corridor are collected and analysed for rail, inland waterways, ports, road/rail terminals, roads and airports. Projects are categorised according to their main contribution to the corridor objectives.

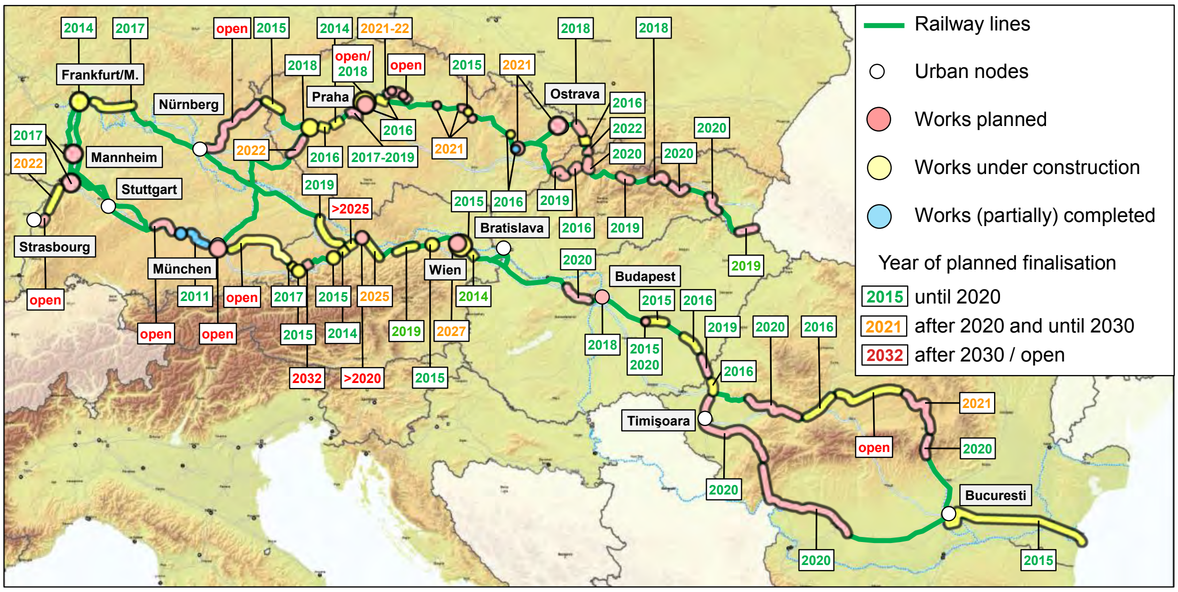
Rail

By end of November 2014, the overall project list for the corridor contains 134 rail projects (incl. ERTMS). One third (absolute number: 46) of these projects are located in Czech Republic, the other corridor countries provide between 10 (Slovakia) and 25 (Austria) projects. Five further projects are not allotted to a dedicated country, but to multi-national activities, mostly covering pan-European consulting like supporting ERTMS implementation etc. No dedicated project list was available for France (no response towards enquiry).

The scope of projects varies considerably, between studies for a single issue with limited scope and large infrastructure projects covering all kinds of implementation. In some cases, several implementation stages have been indicated as separate projects (and therefore counted separately), whereas in other cases these construction stages were aggregated to one entire (large-scale) project.

The vast majority of the projects deal with infrastructure works: in 91 out of 134 cases (68%). In addition, most of the "Study" projects are related to infrastructure issues as well. Within this total "infrastructure works" cluster, most of the projects (80 projects = 88%) are allotted to upgrade measures (cp. Figure 6)

Figure 6: Overview on rail infrastructure projects (upgrade/rehabilitation)



Source: HaCon based on Annex II – List of projects

A further relevant project cluster is the implementation of ERTMS along the corridor.

The current ERTMS implementation status has been determined as an update of the status quo making use of the project lists provided by the Member States. In summary it can be stated that the Black Sea Branch shows the following picture: For France no information on concrete ERTMS projects is available. In Germany GSM-R has been implemented on all sections of the corridor as a precondition for the implementation of ETCS level 2. The implementation of ETCS will be done subsequently in the course of line upgrades and new construction projects.

On the Eastern part of the Black Sea Branch, dedicated ERTMS projects have been set up for most of those sections, which are not yet equipped. In 2014, the section Salzburg-Attnang will be finalised, other sections in Hungary and Romania in 2015/2016. For Hungary the implementation of GSM-R on the entire core network is foreseen until end of 2015. However, the majority of ERTMS projects is still in the planning phase; their finalisation is expected for 2020 or later. For some of the corridor sections no year of completion has been defined up to now; partially, the implementation of ERTMS is coupled to the regular displacement of LZB. Nearly all ERTMS projects refer to the implementation of level 2.

On the CS Branch, nearly the entire alignment in the Czech Republic and in Slovakia is covered with projects for ERTMS implementation (level 2). Most of these activities are currently in the planning phase; however, first sections are expected to be completed in 2014 and 2015. As far as binding deadlines are known, the implementation works shall be finalised until 2022. For Germany, the CS branch shows the same picture as the Black Sea Branch: between München or Nürnberg and the CZ border no concrete short-/mid-term ETCS implementation measures are foreseen (whereas GSM-R has been implemented already).

Most of the rail projects (incl. ERTMS) cover a timeframe until 2022. Until 2030, 113 projects (84%) will be finalised according to the current timelines. The conclusion of further 21 projects (16%) is expected after 2030 or not yet indicated by a specific finalisation year.

For the further development of ERTMS implementation the breakthrough programme of the European Commission is of particular importance. It is designed to generate through-going cross-border ERTMS sections and to push bilateral cross-border cooperation between ministries, rail infrastructure managers and safety authorities.

Besides ERTMS implementation measures the listed projects generally deal with the fulfilment of the corridor objectives that are mainly derived from the standards defined by regulation 1315/2013 and additionally correspond to the criteria "line capacity", "inclinations" and "single track sections".

The corridor objective "Core freight lines 100 km/h by 2030" is tackled by projects, but not everything is covered. At least one through-going 100 km/h route for freight trains on the entire corridor will be available by 2021.

Measures that deal with the corridor objective "Core freight lines to allow for 740 m trains by 2030" are not explicitly mentioned in the project descriptions. It can be assumed that major upgrade projects also include the expansion of the usable sidings lengths and/or the built-up of additional sidings capable for 740 m trains. Such measures cover great parts of the Czech, the Slovak and the Romanian network as well as all relevant sections in Austria between Passau and Linz, Salzburg and Wels and around the Wien node. It is important to mention that all statements related to the current train length and to respective projects can only be understood as an indication, as a common corridor-wide methodology for determining the maximum train length is not in place.

Dedicated measures for the achievement of the corridor objective "Core freight lines 22.5 t axle load by 2030" are not explicitly mentioned. However it is assumed that such measures are included in the identified modernisation projects on the section Ceska Kubice - Plzeň and on the Romanian rail network. No dedicated measures to resolve insufficient axle load are known for the sections Strasbourg - FR/DE border, Garching a.d. Alz – Freilassing and most sections in Hungary.

In relation to the corridor objective "Core network to be electrified by 2030" it is intended to electrify almost all remaining diesel lines of the corridor. The only exception is the section Regensburg – Schwandorf – Furth i.W. – DE/CZ border. For further related upgrading projects on the German network (Nürnberg-Schirnding and München-Freilassing line) a reliable year of finalisation has not been stated yet.

With respect to the corridor objective "Removal of line capacity bottlenecks" it can be assumed that most of the identified infrastructure upgrade and new construction measures will contribute to capacity increase in the Rhine-Danube corridor. However, it is obvious that the gain in line capacity will be at least partially consumed by additional volumes. Therefore, pure infrastructure measures will not be sufficient to cope with the (explicitly demanded) traffic increase. Additionally, substantial efforts have to be invested for other measures like traffic management systems or operational/infrastructural separation of freight and passenger traffic in order to manage the envisaged volumes with a high level of service/operation quality.

The corridor objective "Removal of operational restrictions caused by strong inclines" can only achieved by large-scale infrastructure measures. Almost all corridor parts with strong inclines will remain in the future and will thus cause operational restrictions especially for freight trains.

Dedicated measures related to the corridor objective "Removal of single track sections" are mainly allotted to the lines München – Freilassing in Germany (realisation time open) and Arad – Craiova in Romania. Furthermore, studies are ongoing for the Wien-Bratislava line. In contrast, the single track border sections Germany/Czech Republic and Slovakia/Ukraine are not subject of dedicated projects. The affected sections need to be assessed and monitored in the future development process of the corridor.

Prioritised need for action can be deduced in two ways:

- Projects which solve problems related to the core parameters of the regulation which have not a specified deadline until 2030. These projects need to be accelerated or provided with a reliable finalisation date until 2030.
- Problems related to the core parameters of the regulation, which are not covered by any project as documented in ANNEX II – List of projects. These corridor parts need to be further tackled in a coordination process between the European Coordinator, the Member States involved and the related rail infrastructure manager(s) to ensure a complete implementation of the core network corridor until the aimed at finalisation year 2030.

A detailed overview on the considered sections is included in the main parts of this study.

Inland waterways

Almost 50 projects along the Rhine-Danube Corridor relate to inland waterways, 12 of them are under implementation and still on-going. The figure below shows the time frame for planned and mature projects, organized by inland waterway specific objectives and activity areas.

The projects are grouped into four specific objectives on the time line from 2015 up to 2030, navigation status; compliance with requirements of TEN-T Regulation; River Information Services (RIS)s strengthening the competitive advantages of IWT.

The corridor objective to "maintain and preserve a good navigation status" is to be realized on short to medium term. This relates not only to the fairway parameters, but also to the availability of locks throughout the year.

Bulgaria and Croatia plan projects to improve fairway maintenance and rehabilitation. Nevertheless additional equipment (gauging stations, equipment for surveying, dredging and marking) is needed in several countries. Project activities at the Slovak, Hungarian, Croatian, Serbian, Romanian, Bosnian and Ukrainian sections have been found missing. The activities identified by the Fairway Rehabilitation and Maintenance Master Plan (EUSDR PA 1a) for the Danube and the Sava need to be realized in a harmonized way.

The reconstruction of locks at the Main and the Main-Danube Canal are envisaged. Bottlenecks in the operation of Gabčikovo and the Iron Gate locks are approached by projects but further initiatives will be needed to contribute to a good navigation status.

Regarding the corridor objective to "comply with the requirements of class IV[21] respectively– where appropriate in order to meet market demands - to a higher classification[22]" the largest number of projects has been identified. In practice, this means that for Austria, Slovakia, Hungary, Croatia, Serbia, Romania, Bulgaria, Moldova, the Ukraine and Bosnia and Herzegovina the AGN standards shall apply. Sections in Germany have to comply with the requirements according to ECMT all year round. Unless exemptions are granted by the European Commission in duly justified cases, reaching the parameters of class IV by 2030 is the minimum requirement as

[21] *as required by Article 15 of the TEN-T Regulation (Transport infrastructure requirements)*
[22] *as defined by Article 16 of the TEN-T Regulation (Priorities for inland waterway infrastructure development)*

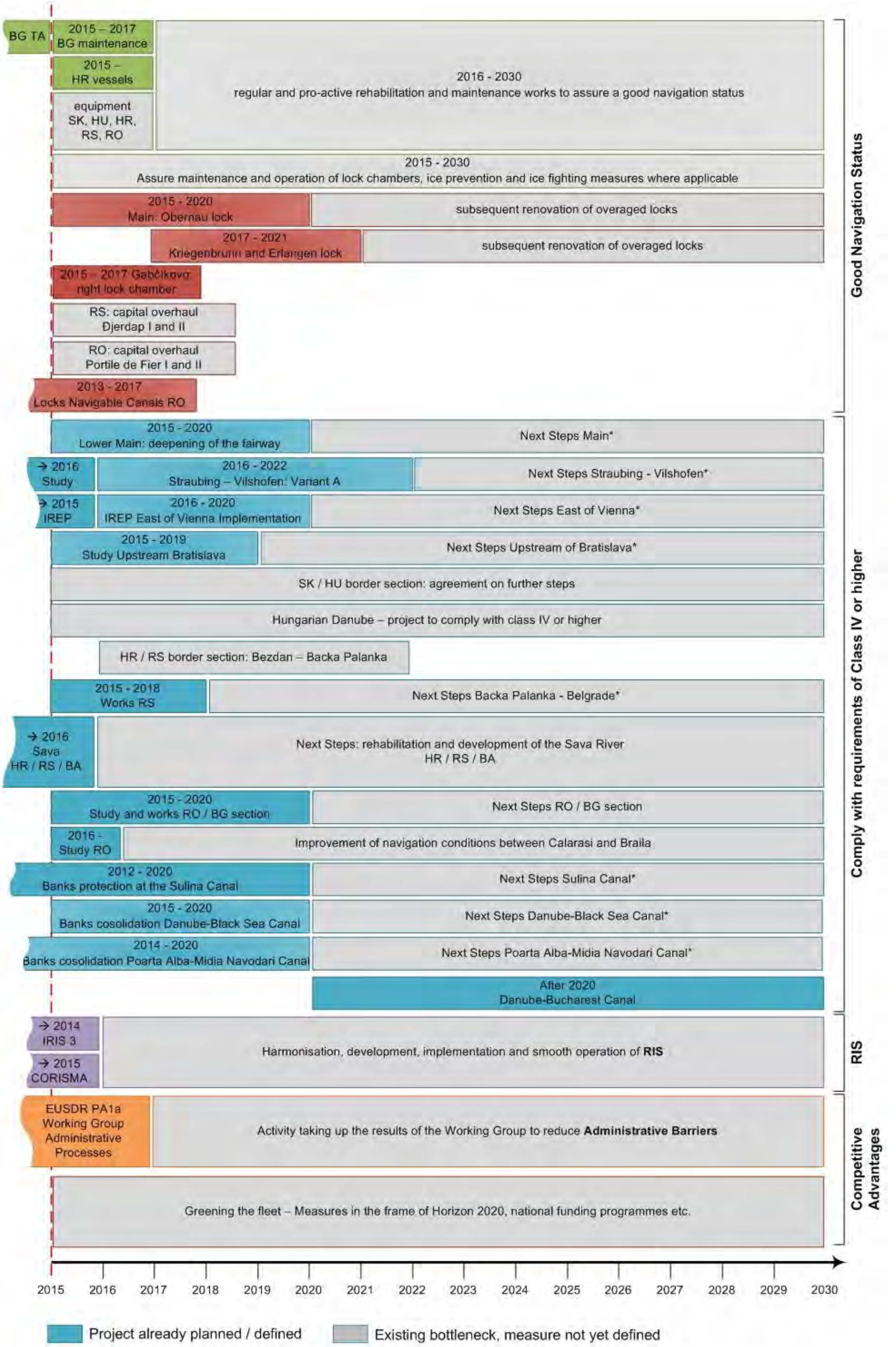
set out in the TEN-T Regulation, Article 15. Priority shall be given to achieving higher standards according to the class of the respective section in order to meet market demands in case of modernizing waterways (Article 16).

Some of the identified projects are considered as advanced; some may only start after finishing preparatory works carried out by means of an integrated approach. Project initiatives related to river engineering and training works could not yet be identified at the Hungarian Danube stretch.

Measures to meet the corridor objective to"enhance and operate River Information Services" shall take into account the results of the TEN-T studies "Implementation of River Information Services in Europe" and "RIS enabled Corridor Management". It is recommended to deal with outstanding challenges in a joint initiative, possibly even across the boundaries of the Rhine-Danube Corridor.

Investments in innovative vessels and new technologies as well as the simplification and harmonisation of administrative processes shall aim to support the corridor objective to "strengthen the competitive advantages of inland waterway transport". The recommendations of EUDRS PA1a Working Group shall be taken into account.

Substantial risks to the corridor development consist in a lack of staff and budget of waterway administrations in several countries resulting in failing to reach a good navigation status on short term. High national co-financing rates for third countries are seen as an important obstacle to the implementation of cross-border projects.



The overview figure contains the most relevant measures to tackle identified bottlenecks between 2015 and 2030.

* next steps required if the parameters of the TEN-T regulation respectively the AGN agreement (where applicable) are not yet met.

Source: viadonau

Ports

The port implementation plan consists of five different categories of activities:

- modernization and capacity extensions of port infrastructure,
- connecting inland port infrastructure to rail freight and road transport infrastructure,
- alternative clean fuel supply facilities,
- depth maintenance in port areas and port approaches,
- missing and additional (suggested) projects

As regards to port capacity issues there are 19 projects (studies and works) directly related with capacity extensions. The most notable capacity extensions projects, in terms of scope and costs, are projects in the ports of Wien (AT), Constanta (RO), Nürnberg (DE), Regensburg (DE), Galați (RO), Vukovar (HR) and Bratislava (SK).

Additionally, many ports planned undertaking infrastructure modernization projects mostly related to reconstruction and upgrade of quay walls. These types of works are notable in the ports of Bratislava (SK), Budapest (HU), Drobeta Turnu Severin (RO), Giurgiu (RO), Galați (RO), Cernavoda (RO) and Regensburg (DE) where the quay wall in the west basin dates from 1910/1911.

Planned projects related to road and rail infrastructure are 4 in Constanta (RO) and 3 in ports of Giurgiu (RO), Regensburg (DE) and Vukovar (HR). It must be noted that all these projects are related to the rail and road infrastructure in the port areas, whereas the planned internal road and rail infrastructure is connected to the outside network of roads and railways. Rail and road infrastructure projects outside port areas are not in jurisdiction of port administrations.

What is missing in terms of rail connections is the project related with the rehabilitation of the railway connection in the Port of Komárom (HU) with its hinterland and therefore it is highly recommended to take up this project. Moreover, the Port of Galati (RO) reported existing road and rail connections to its hinterland but of exceptionally low quality so these aspects should be taken into consideration.

The only core port on the Corridor which reported concrete projects on providing LNG supply facilities in the next 5 years period is the Port of Constanta. However, as the project titled LNG Master Plan for Rhine-Main-Danube (2012-EU 18067-S) is currently on-going it is expected that after the final results of this project (end of 2015) more ports will be able to plan their activities in this field in more details

It is also recommended that the ports are encouraged to provide shore-side facilities for electricity supply to vessels (pursuing Article 4(4) of the Directive 2014/94/EU), as well as to consider electrification of internal railway tracks in ports.

Whereas two ports (Vidin and Cernavoda) reported depth issues which create bottlenecks especially in case of low water, there is no identified project dealing with the issue of draft in the port of Cernavoda (RO). In this view, it is highly recommended to consider a project dealing with this particular issue. Additionally, it is recommended to consider the financial support for dredging equipment acquisition in ports, in Member States where waterway administrations are not in charge of maintaining minimum depths in port approaches, off port berths and in port basins.

In a nutshell, the missing port-related projects on the Rhine-Danube Corridor are linked to the following issues:

- insufficient depth in the port of Cernavoda (RO) of only 1.5 meters;
- rehabilitation of the railway link in the port of Komárom (HU);

- lack of the quayside railway tracks in the port of Cernavoda (RO);
- high quality hinterland connection in the port of Galați (RO),
- e-Maritime facilitation in seaport of Constanta (RO)

Moreover, the following is a list of the so called "conditional" bottlenecks that would justify new projects dealing with feasibility study and cost-benefit analysis (CBA) on provision of shore-side power supply, in terms of Article 4(4) of the Directive 2014/94/EU:

- Lack of shore-side power supply in the port of Vienna (AT);
- Lack of shore-side power supply in the port of Galati (RO);
- Limited shore-side power supply in the port of Bratislava (SK);
- Limited shore-side power supply in the port of Komárno (SK);
- Limited shore-side power supply in the port of Frankfurt (DE)

In addition, the Consultant proposes four additional horizontal projects which are not related to individual ports only but to the entire port system along the Corridor:

__F__easibility Study on __A__dministrative Facilitation of __I__nland Waterways __T__ransport (FAIT)

__GR__eening of __IN__land __PORT__s (GRINPORT)

Public __Fin__ancing and __Ch__arging Practices of Inland __Port__s in EU (FINCHPORT)

Feasibility Study and Cost-Benefit Analysis of __E__lectrification of __P__orts __I__nternal __R__ailways (EPIR)

Rail/Road Terminals

Terminals are the connecting points of freight. The main KPI, which most of the projects reflect upon, is the capacity of the (rail/road) terminal. Against this background the following measures/projects on rail/road terminals are identified:

- France (Strasbourg terminals): No projects have been provided to the consultants; they are included in the Rhine-Alpine Corridor study.
- Germany: New construction/expansion measures for the terminals Nürnberg-Hafen, Regensburg-Ost, Kornwestheim (Stuttgart) and München-Riem have been concluded.
- Austria: Linz (improvement of the terminal located in the port of Linz), Wien Freudenau Hafen (improvement of the present RRT, acquisition of land for extending the trimodal terminal and building a trimodal terminal), Wien Inzerdorf (building of a totally new RRT to be used also for hub traffic) and Wels (extension of the existing RRT terminal).
- Hungary: No dedicated projects for rail/road terminals are known.
- Romania: The following plans in core network terminal nodes have been identified: (1) Rail Road Terminal "Timișoara – Remetea Mare", promoted by the local authorities, with studies carried between 2011 and 07.2014, with an estimated cost of 18 mn Euro; (2) Rail Road Terminal "Craiova", promoted by the local authorities, with studies which will be carried between 2015 and 2016, with an estimated cost of 10 mn Euro. Both projects are without financing at this moment.
- Bulgaria: There is a project in preparation under the Operational Programme on Transport 2007-2013 to build a new terminal as Intermodal Terminal Ruse. The tender procedure shall take place in 2015 with an indicative period of implementation of two years.

- Czech Republic: The Ministry of Transport stated that currently no rail/road terminal projects are underway. However, as stated before, a funding programme for the modernisation of existing terminals is under preparation.
- Slovakia: The Transport Operational Programme for the years 2007 to 2013 includes the construction of a new public intermodal transport terminal in Žilina – Teplička. Another public intermodal transport terminal is planned to be built in Bratislava. However, the implementation of this project is currently stopped; resumption of works will be decided not before 2017.

Road

A total of 72 road infrastructure projects along the entire length of the R-D corridor are identified in the study that will address current and future bottlenecks and shall be included in the general R-D corridor Implementation Plan. According to the results of the analysis, 37% of the projects are planned to be completed in the near future, by the year 2016, 29% of the projects will be completed on a mid-term horizon, between the years 2016-2020, and more than 20 % on a long-term horizon up to 2035. In addition, the analysis identifies a number of projects that address current bottlenecks, for which it is unknown when they would be completed (14%).

Regarding ITS, a brief overview is given on ongoing projects of implementing Innovative traffic management systems in Germany and Austria. Other Member States have also planned to introduce ITS on their motorway network in the coming years.

Missing links on *national sections* (not fulfilling the technical core parameter) are presented in detail in the implementation plan.

Removal of infrastructure bottlenecks and "filling" missing links at cross border sections – compliance to technical parameter

Czech – Slovakian border, Expressway R49 – R6 Hulín (CZ) – Púchov (SK):

The cross-border road project indicated on the list of pre-identified projects for CEF is the cross border section Zlín – Žilina: A feasibility study on the express road R49/R6 Hulín – Púchov of September 2006 was made, which refers to the design of the upgrading and new alignment of the sections from the border Hranice – Púchov. This section is under study SEA-EIA for 4 individual sections, which shall be completed by 2015.

In the Czech Republic on the express road R49 there are two constructions (Fryšták – Lípa 1st and 2nd phase) that implementation should start in 2017-2018. As regards to section Lípa – CZ/SK border significant delay could be expected due to a negative EIA decision issued by the Czech Ministry of the Environment in November 2013. In case of this project the elaboration of a new route study reassessing originally proposed width parameters is in process. The expectation is to finalize this study till the end of this year 2014.

Slovakian – Hungarian border:

The M15 (Mosonmagyaróvár-HU/SK border) relates to the OEM and the R-D corridor: The M15 Expressway (14 km between Rajka/SK border – Hegyeshalom/M1) is planned to be upgraded to a full motorway. Project HU/SK Border-Mosonmagyaróvár is identified in the CEF list of the Orient/East Med corridor. Construction may start in first half of 2017.

A new bridge across the Danube at Komárom/Komárno is under preparation as a constituting part of the Inland Waterways and link to the OEM Corridor. Therefore the project is classified under IWW projects. Construction period is planned for 01/2016 – 12/2018. All steps are to be coordinated between Slovakia and Hungary.

Hungarian – Romanian border:

M43 motorway section from Makó – Csanádpalota - Nădlac (Romanian border) being under construction is to be completed by July 2015 (Part of Priority Project 7). The section should be completed during the 2007 – 2013 programming period. Finalization of M43 Expressway Makó – Csanádpalota (Border HU/RO), opening scheduled in September 2014.

The border section between Romania and Bulgaria is dealt in the study of the OEM corridor.

Airports

Airports are generally compliant with road connections. A rail connection is not always present at the moment. Additionally there are multiple upgrades planned for the existing rail connection. The following connection upgrades are expected:

- Frankfurt, has rail connections, yet upgrades are under study for a new high speed rail connection between 2015 and 2021.
- Stuttgart, a connection between the airport and the national rail system is planned. The connection is related to the construction of the Stuttgart central station which shall be completed by 2021.Further more by the end of 2017 Stuttgart Airport will become the final station for tram connection; in 2014 the first regular hydrogen public bus service has started. Stuttgart Airport so far is connected to the S-Bahn.
- München airport has two plans to improve the existing rail connection.
- Praha, there is a missing connection of 5km existing. A feasibility study on this is now ongoing. Furthermore and upgrade of the existing Metro connection will be completed in phases between the years 2014 and 2018.
- Wien, extension of rail station for international trains to 400 m; a project on a rail line to Wien central station for heavy trains. Expected completion date is 2014 and 2015 respectively. Wien Airport has also plans to improve the railway services towards the east and north.
- Bratislava, had a project on rail connection to Wien, but it has not matured. Further research on the connections of the Bratislava airport will be conducted during the next project phase.
- For Budapest airport plans for the construction of rail connectionsare under development.
- Bucharest airport is undergoing road and rail connection projects.
- According to the Nürnberg Airport a direct connection to the highway A3 is planned.
- With regard to the Ostrava airport the process of implementation of rail connection project has already started.

Four airports currently have plans or facilities for alternative fuels. These are the airports of Frankfurt, Stuttgart, München and Wien.

4.2 Determination of the corridor alignment and infrastructure

The outline of the Rhine-Danube Corridor is provided in Annex 1 of the CEF regulation 1316/2013. It is described as "*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.*"[23]

Bulgaria and Croatia are only considered in terms of ports and inland waterways of the Danube and Sava rivers.

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 following neighbouring countries shall be considered in the elaboration of the study as follows:

(1) Serbia: related to inland waterways (Danube, Sava) and two ports (Belgrade, Novi Sad);

(2) Bosnia and Herzegovina: related to inland waterways (River Sava);

(3) Moldova: related to one port (Giurgiulesti);

(4) Ukraine: related to inland waterways (Danube).

4.2.1 Overview on the general alignment of the corridor

According to CEF Regulation 1316/2013, the alignment consists of the following five main parts:

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

The Annex of the CEF regulation is in line with the maps of the core and comprehensive network in the TEN-T Guidelines.

In the CEF Regulation 1316/2013, the alignment concerning inland waterways is clearly defined. It includes the river Main starting with the confluence with the Rhine, which is connected to the Danube by the Main-Danube Canal at Kehlheim. The Regulation (EU) No 1316/2013) pre-identified the Sava project up to the port of Sisak, which is defined as a comprehensive port.

4.2.2 Structuring the corridor into main branches/sections,

The corridor can be roughly divided into two branches: the "Black Sea" branch" and the "CS" branch (the latter following the terminology used in RFC 9) and further detailed into five main sections, whereof sections A to D refer to the Black Sea Branch; section E is congruent with the CS Branch.

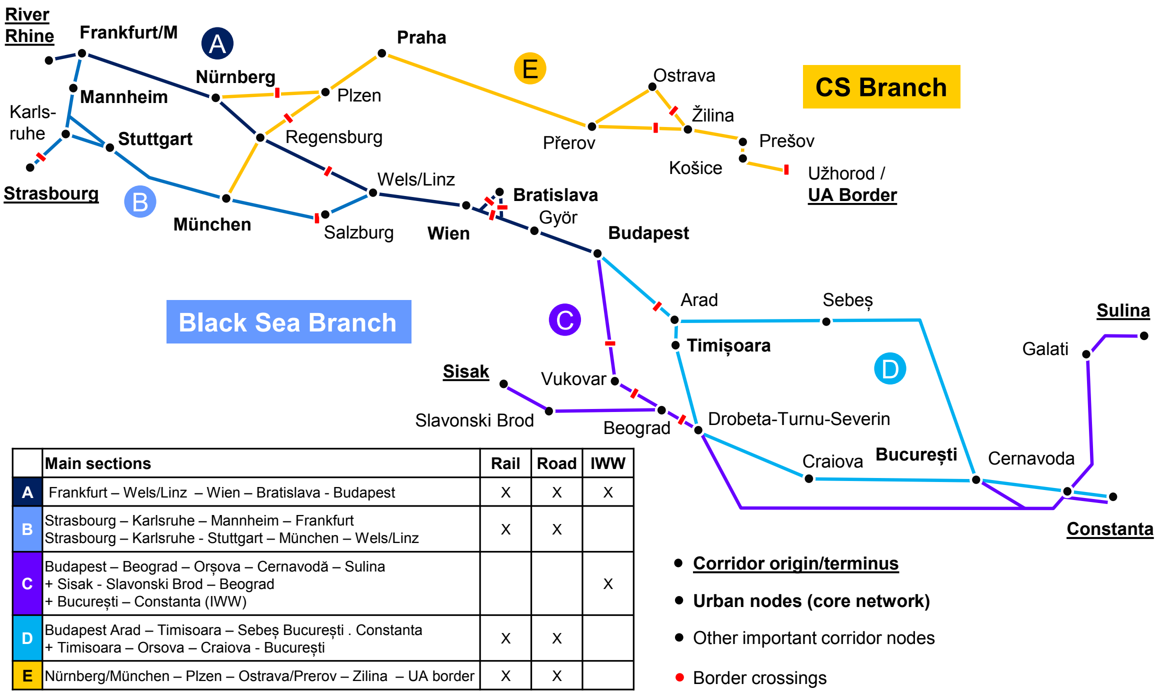
[23] *Document of the European Commission (Directorate-General for Mobility and Transport) The core Network Corridors- Trans European transport Network 2013*

The RFC Rhine – Danube (future RFC 9) is in the initial phase of development and shall be operational latest by November 2020. According to Regulation 913/2010, the part of the CS Branch from Praha to UA border is equivalent with the initially defined RFC 9 that has already been operational as of 10 November 2013.

The Black Sea branch shows layout variants in Germany (northern route via Frankfurt/Nürnberg and southern route via Stuttgart/München/Salzburg) and in Romania (via Sebes and via Craiova). The section C of the Black Sea branch is dedicated to inland waterways exclusively following the Danube and considering the Sava as well.

The CS Branch has two starting points (München /Nürnberg) and runs via Plzeň and Praha towards Přerov in the Czech Republic. Beyond Přerov at Hranice na Morave the corridor splits into two variants: the line via Ostrava is mainly dedicated for passenger traffic whereas the direct line via Púchov and Žilina in Slovakia is manly used by freight traffic (Figure 7).

Figure 7: Alignment of the Rhine-Danube Corridor (all modes)



	Main sections	Rail	Road	IWW
A	Frankfurt – Wels/Linz – Wien – Bratislava - Budapest	X	X	X
B	Strasbourg – Karlsruhe – Mannheim – Frankfurt Strasbourg – Karlsruhe - Stuttgart – München – Wels/Linz	X	X	
C	Budapest – Beograd – Orşova – Cernavodă – Sulina + Sisak - Slavonski Brod – Beograd + Bucureşti – Constanta (IWW)			X
D	Budapest Arad – Timisoara – Sebeş Bucureşti . Constanta + Timisoara – Orsova – Craiova - Bucureşti	X	X	
E	Nürnberg/München – Plzen – Ostrava/Prerov – Zilina – UA border	X	X	

Source: HaCon

The next step of work consisted in assigning exact infrastructure to the corridor alignment. The results are different layers for rail, road and inland waterway, which show not only the general corridor layout, but also contain different routings via dedicated rail lines, roads or inland waterways, represented by associated identifiers (rail line number, road number, inland waterway appellation (see chapter 4.3).

Based on the Regulation 1315/2013 and the agreements of the first Corridor Forum, urban and traffic/logistics nodes belonging to the corridor have been identified. These locations represent agglomerations of population and economy (urban nodes) on one side and consolidation points for passenger and freight traffic (airports, ports, terminals) on the other side.

The result is compiled in Table 8, distinguished per country and node type. Totally 69 nodes have been identified.

Table 8: Nodes belonging to the corridor

	Urban nodes including their ports and airports		**Airports** to be connected to TEN-T rail and road by 2050		**Maritime ports** to be connected to TEN-T rail and road by 2030		**Inland core network ports**		**Rail-road terminals**		**Σ**
FR	**Strasbourg**	**1**		**-**		**-**		**-**	**Strasbourg**	**1**	**2**
DE	**Mannheim Frankfurt Nürnberg Stuttgart München**	**5**	**Frankfurt Nürnberg**** **Stuttgart München**	**4**		**-**	**Frankfurt Nürnberg Regensburg**	**3**	**Karlsruhe Mannheim/ Ludwigsh. Stuttgart Frankfurt Nürnberg München**	**6**	**18**
CZ	**Ostrava Praha**	**2**	**Ostrava**** **Praha**	**2**		**-**		**-**	**Praha Ostrava Plzeň Přerov Pardubice**	**5**	**9**
SK	**Bratislava**	**1**	**Bratislava****	**1**		**-**	**Bratislava Komárno**	**2**	**Bratislava Zilina**	**2**	**6**
AT	**Wien**	**1**	**Wien**	**1**		**-**	**Enns Wien**	**2**	**Wien Wels**	**2**	**6**
HU	**Budapest**	**1**	**Budapest**	**1**		**-**	**Budapest Komárno**	**2**	**Budapest**	**1**	**5**
HR		**-**		**-**		**-**	**Slavonski Brod Vukovar**	**2**		**-**	**2**
RS		**-**		**-**		**-**	Novi Sad* Beograd*	2		-	**2**
RO	**Timișoara București**	**2**	**Timișoara**** **București****	**2**	**Constanta Galati**	**2**	**Dobreta-Turnu-Severin Calafat Cernavoda Galati Giurgiu Constanta**	**6**	**București Timișoara Craiova**	**3**	**15**
BG		**-**		**-**		**-**	**Ruse Vidin**	**2**	**Ruse**	**1**	**3**
MD		-		-		-	Giurgiulesti*	1		-	**1**
UA		-		-		-		-		-	**-**
Σ		**13**		**11**		**2**		**22**		**21**	**69**

** Inland ports belonging to neighbouring countries*
*** 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.*

Source: HaCon based on Annex 2 of Regulation 1315/2013

In the first meetings of the Corridor forum the decision was made to invite only those ports of the neighbouring countries, which are listed in the table above.

According to Art 41/3 of Regulation 1315/2013 core network airports are divided into those that "shall be connected with the railway and road transport infrastructure of the trans-European transport network by 31 December 2050" (Frankfurt, Stuttgart, München, Praha, Wien and Budapest) and those that do not fall under this definition (Nürnberg, Ostrava, Bratislava, Timișoara and București).

Next to 13 urban nodes, most of the core network nodes are represented by inland ports (19+3 additional ports) and rail-road terminals (21). Looking at the corridor related countries most of the nodes are assigned to Germany (18) and Romania (15).

4.2.3 Corridor sections belonging to several corridors

A number of sections are shared with other corridors. Whereas the basic infrastructure data and underlying studies will solely be collected by one consortium, all the corridor studies concerned should reflect the developments from the specific corridor perspective.

The following sections belong to several corridors. *Italicised* sections fall also under the responsibility of the Rhine-Danube Corridor study and will be considered here:

Rhine-Alpine Corridor:

- Rhine area between Strasbourg and the river Main estuary

Scan-Med Corridor

- Würzburg – Nürnberg; – Augsburg – München; München – Schwandorf

Orient/East-Med Corridor

- Terminals in the Czech Republic
- *Port of Vidin*
- *Sections between Praha and CZ/SK border (rail, road) and the terminal in Zilina*
- *Sections between Wien and Craiova including all sections (rail, road) within Hungary*

Baltic-Adriatic Corridor

- Terminal in Ostrava (CZ)
- Road and rail between Ostrava and Přerov

Corridor sections belonging to the other corridors are also dealt in the studies of the other corridors; this is in particular relevant for the Orient-East Med Corridor, where a major overlapping on the rail and road infrastructure between Wien and Calafat/Craiova exists.

4.3 Description of the characteristics of the corridor

The detailed corridor characteristics as presented in this chapter mainly refer to the identification of missing links and bottlenecks in terms of the Regulation 1315/2013:

'bottleneck' means a physical, technical or functional barrier which leads to a system break affecting the continuity of long-distance or cross-border flows and which can be surmounted by creating new infrastructure or substantially upgrading existing infrastructure that could bring significant improvements which will solve the bottleneck constraints;

Thus, the corridor characteristics provide necessary input to the required programme of measures and their implementation plan. In order to elaborate a complete picture of the corridor, the corridor characteristics are based on two main pillars of information (cp. Figure 3, page 20):

- The collected TENtec data provide information on infrastructure attributes, technical equipment and traffic flows;
- The review of relevant studies provides information on bottlenecks (e.g. regarding capacity utilisation and operational problems) and missing links.

The results presented in the following paragraphs are aggregations of the information from the above data compilations, designed to provide a quick and complete overview on the main characteristics and critical issues of the corridor.

Detailed data files are provided as annexes to the second progress report.

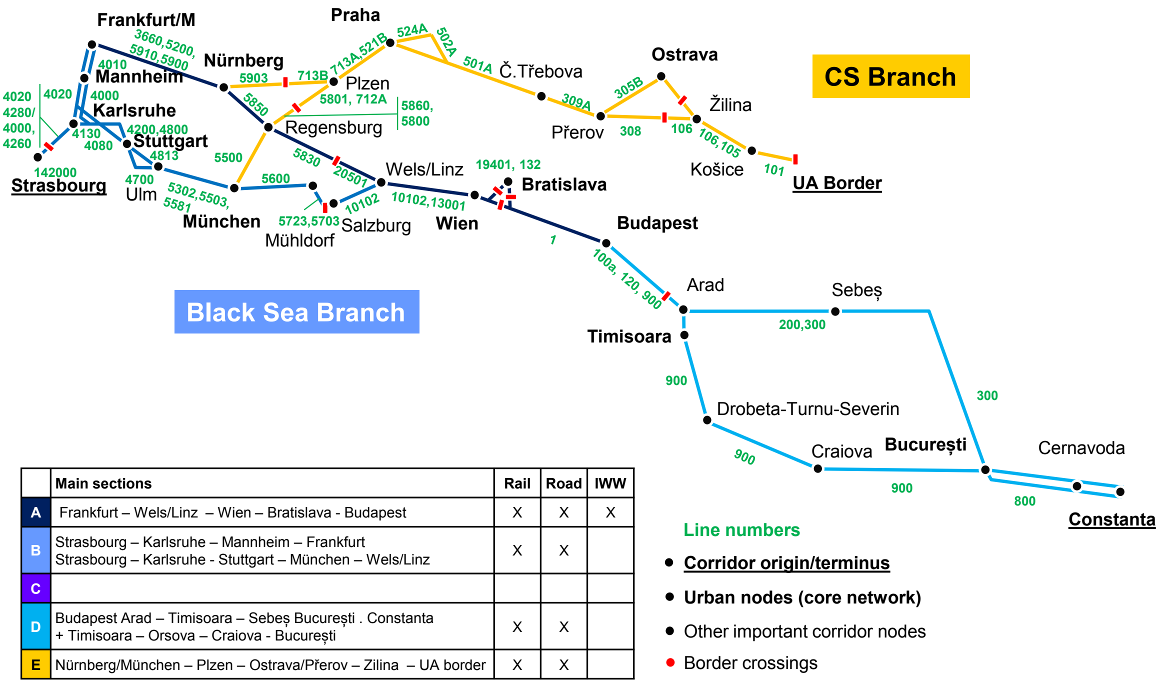
4.3.1 Characteristics Rail

The rail infrastructure of the corridor is displayed in Figure 8.

The figure also 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 Kolín 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 some 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 shares of the Black Sea branch.

Figure 8: Rail alignment of the Rhine-Danube Corridor and assigned infrastructure



	Main sections	Rail	Road	IWW
A	Frankfurt – Wels/Linz – Wien – Bratislava - Budapest	X	X	X
B	Strasbourg – Karlsruhe – Mannheim – Frankfurt Strasbourg – Karlsruhe - Stuttgart – München – Wels/Linz	X	X	
C				
D	Budapest Arad – Timisoara – Sebeș București . Constanta + Timisoara – Orsova – Craiova - București	X	X	
E	Nürnberg/München – Plzen – Ostrava/Přerov – Zilina – UA border	X	X	

Source: HaCon

The CS branch is about half as long compared to 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.

Of particular relevance for the rail characteristics are the standards set by Regulation 1315/2013. Concerning rail, the following "core parameters" and standards are defined:

- *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.*

Beyond these core parameters, further TENtec parameters have been analysed and included in the following presentations, as far as relevant for the characteristics.

Several TENtec parameters refer to passenger and freight traffic flows and might provide indications regarding infrastructure congestions. However, as these data are only fragmentarily available and furthermore also inconsistent (see chapter 3.4), pure traffic flow data have not been used in the following analyses. Instead, relevant studies as well as information from infrastructure managers have been exploited to provide information on line capacity utilisation.

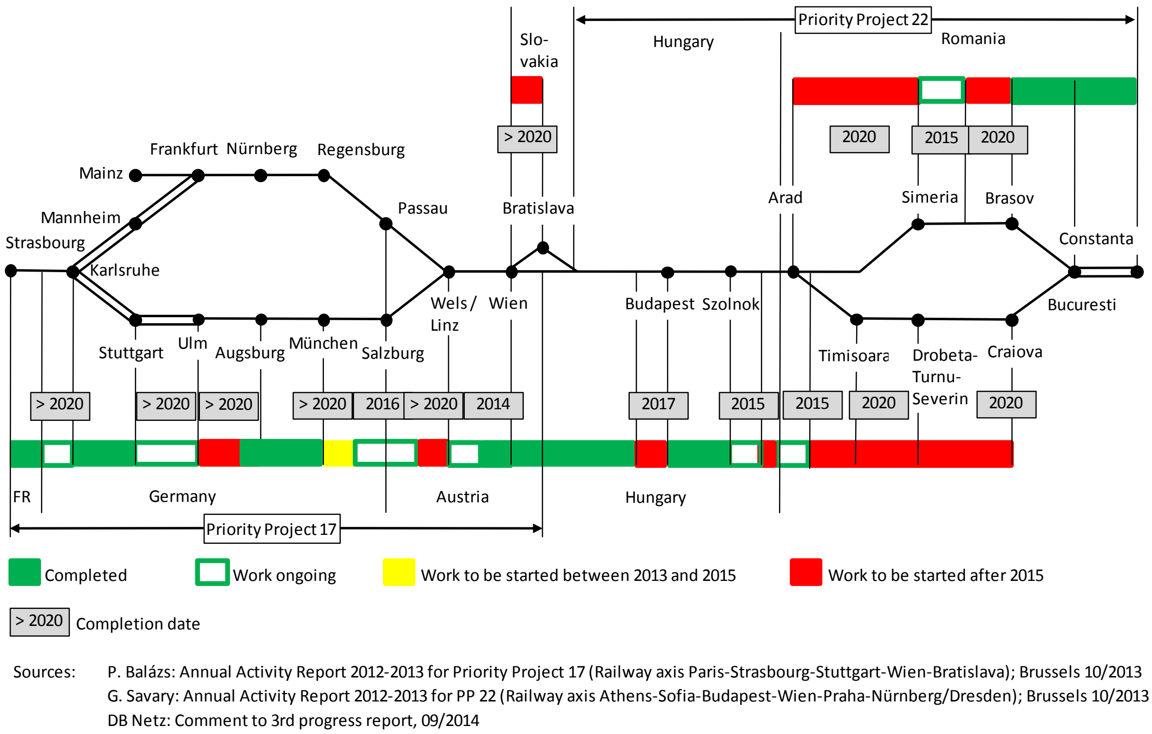
Former TEN-T Priority Projects 17 and 22 as basis for the Rhine-Danube corridor

Considerable parts of the Rhine-Danube corridor have already been matter of several (former) Priority Projects and their implementation plans. With respect to rail, this concerns the Priority Projects 17 and 22. Figure 9 and Figure 10 provide an overview on the implementation status, as far as the Rhine-Danube corridor alignment is concerned.

Considerable parts of the "Black Sea Branch" in Germany, Austria, Hungary and Romania are already completed or are planned to be finalised within the next years. "*Sections with one or two electrified tracks capable of a speed of at least 100 km/h are considered complete from an infrastructure standpoint. The installation of ERTMS is also mandatory on a number of sections of the PP 22 under the terms of the European Deployment Plan of 22 July 2009*."[24] However, other parts are delayed or unsecure regarding their finalisation (see paragraph "Problematic Areas" below).

[24] *Gilles Savary: Annual Activity Report 2012-2013 for Priority Project 22 Railway axis Athens–Sofia–Budapest–Wien-Praha–Nürnberg/Dresden; Brussels, October 2013*

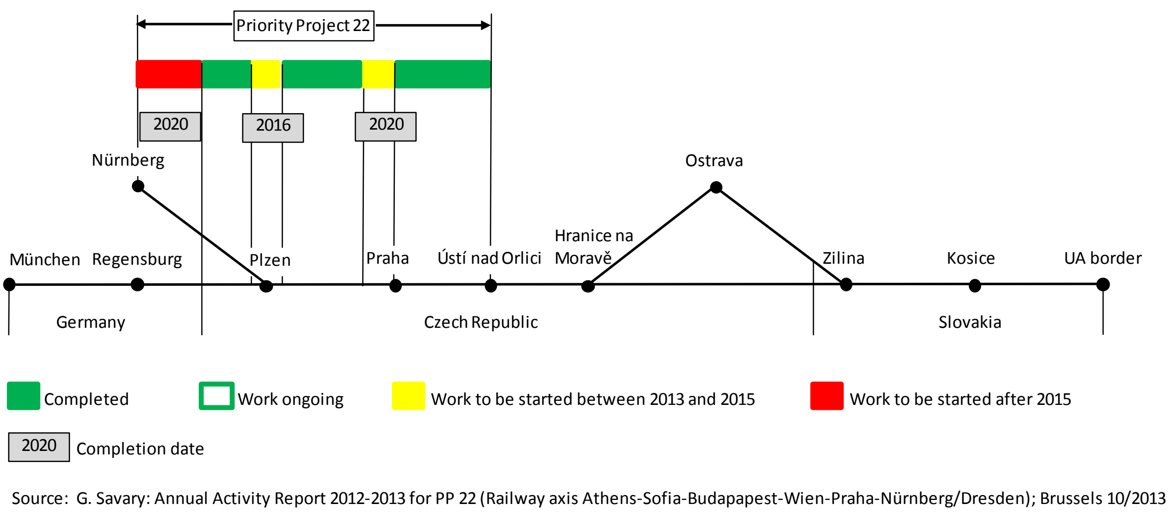
Figure 9: Implementation status of Priority Projects 17 and 22 as basis for Rhine-Danube Corridor "Black Sea" branch (status: 10/2013)



Source: HaCon based on PP Activity Reports

What concerns the "CS Branch", the coverage by the Priority Projects is particularly lower and is limited to the line sections between Nürnberg and Česká Třebová (via Plzeň and Praha), where the lines to Přerov and Wien diverge (cp. Figure 10). The PP 22 report does not provide information related to the line sections between München and Plzeň (via Regensburg) and all eastern parts beyond Česká Třebová.

Figure 10: Implementation status of Priority Project 22 as basis for Rhine-Danube Corridor "CS" branch (status: 10/2013)



Source: HaCon based on PP Activity Reports

Problematic areas as documented in the PP reports are displayed in Figure 11 in most cases they primarily indicate delays compared to the initial timing. According to the Activity Reports of the Priority Projects this refers to the following sections:

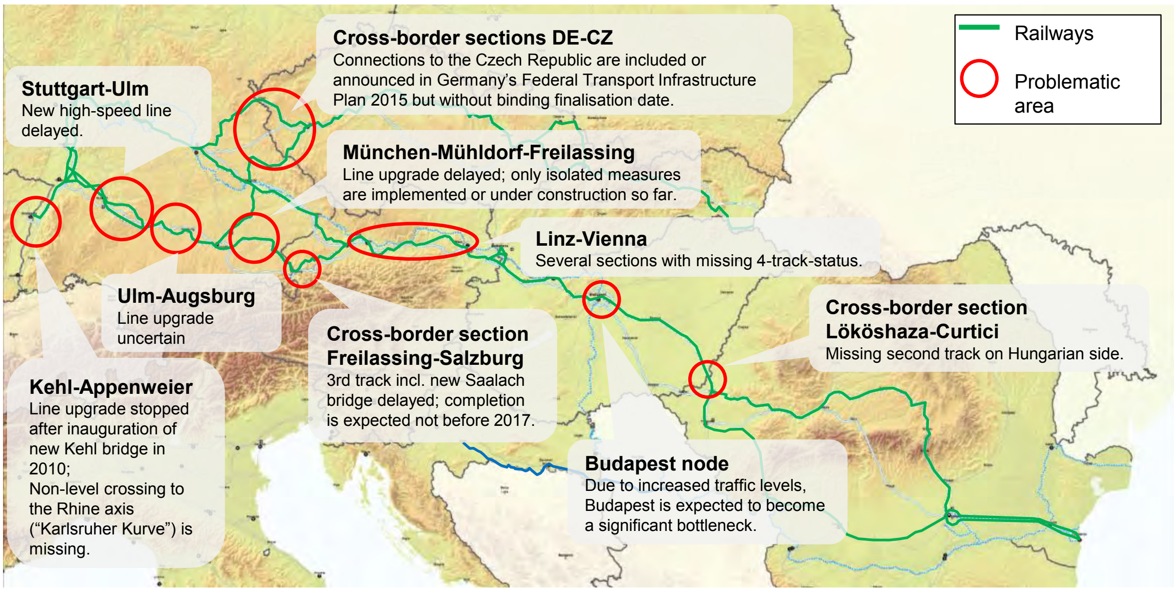
- Kehl-Appenweier:
  - Line upgrading (continuation of new) stopped after the inauguration of the new Kehl bridge in 2010. Further planning steps are not yet defined by DB Netz AG.
  - Non-level crossing to the Rhine axis ("Karlsruher Kurve") is missing.
- Cross-border sections Germany-Czech Republic:
  - Connections to the Czech Republic have not been considered a priority by the German national transport ministry (BMVI). For this reason, the complementation progress of the "CS Branch" is partially faster on the Czech side (cp. Figure 10). The section Marktredwitz – DE/CZ border is part of the current German transport master plan, but without a binding finalisation date.
  - On the line Praha - Beroun - Plzeň some sections (as a part of former PP 22) have already been upgraded. Some parts on Czech side however still lag behind (especially Plzeň junction and the section Praha – Černošice - Beroun - Dvůr Králové) that constitute bottlenecks and obstacles on the connection between Praha and German border.
  - For Germany it has to be considered that currently a new Federal Transport Infrastructure Plan 2015-2030 ("Bundesverkehrswegeplan") is in preparation whereby the connections to Czech Republic will be reassessed. Results are not expected before the end of 2015.
- Stuttgart-Ulm (including new Stuttgart main station): New high-speed line is delayed (cost increase); according current expectations the project will be completed by 2021.
- Ulm-Augsburg: The section between Augsburg and Dinkelscherben has been completed. The remaining parts of the project shall start after the completion of the high-speed line Wendlingen – Ulm. It will be evaluated for the new Bundesverkehrswegeplan.
- München-Mühldorf-Freilassing: Line upgrade is delayed because of political priority setting and the limitations to the transport budget. In the 1990ies, priority was given to financing projects along the Rhine Alpine corridor (upgrading Karlsruhe – Basel, Mainz, Mannheim and Emmerich – Oberhausen) and the Scandinavian-Mediterranean corridor (upgrading Berlin – Halle/Leipzig, Halle/Leipzig – Erfurt, Erfurt – Nürnberg and Nürnberg – Ingolstadt – München). Other important infrastructure projects between former Eastern and Western Germany were prioritised as well.
- As yet no financial backing or legal approval for upgrading the entire line section is foreseen in Germany's Federal Transport Infrastructure Plan, at first only isolated measures are implemented or under construction so far. The planning process for further measures along this line started in October 2012; results are expected for summer 2016.
- Cross-border section Freilassing-Salzburg: Due to problems with the procurement, the start of the connection Freiburg – Salzburg is delayed. Consequently, the new bridge over the river Saalach, which should have been ready by 2012, is delayed, too, and will not be finished before 2017. According to a court decision, the work for the third track between Freilassing and Salzburg cannot be assigned. The planned construction start in spring 2014 will be further

delayed. Due to these circumstances, the planned operational start for the entire section between Freilassing and Salzburg is now expected for 2017.

- Linz-Wien: Several sections with missing 4-track-status.
- Budapest node: Due to increased traffic levels, Budapest is expected to become a significant bottleneck.
- Cross-border section Lököshaza (Hungary) / Curtici (Romania): Missing second track on Hungarian side limits the full benefits of the major works in progress between Arad and Curtici. However, MÁV stated that in their "opinion the missing second track on Hungarian side does not jeopardize the full benefits of the major works in progress between Arad and Curtici as the present traffic can pass seamlessly the one track section. The forecasted increase of volume of traffic will be handled by the planned implementation of the second track between Békéscsaba - Lőkösháza state border."[25]

In addition, the Czech MoT emphasised the need to modernize the 15 km long section Chocen - Usti nad Orlic.

Figure 11: Problematic areas as identified in the Priority Projects 17 and 22 (status: 10/2013)



Source: HaCon based on PP Activity Reports

4.3.1.1 Corridor overview

Areas with high line capacity utilisation

Corridor line sections with high or even critical capacity utilisation tend to show decreasing service quality, due to their sensitivity to train delays, which in case of occurrence are likely to be transmitted to other trains. Often such delays cannot be reduced on short term, since operational flexibility on the line is not available. Furthermore, line congestions make it difficult or even impossible to acquire additional rail traffic on the corridor.

For the analysis of the Rhine-Danube Corridor, no dedicated capacity calculations have been performed by the consultants. Instead, the relevant studies (e.g. RFC implementation plans, statements from Infrastructure Managers) have been exploited to the overall corridor picture shown in Figure 12.

[25] *Source: Email of Mr János Andó from 15 August 2014*

Figure 12: Areas with high rail capacity utilisation on the Rhine-Danube Corridor

Source: HaCon based on study review

The analysis shows that the line sections concerned can be distributed to two utilisation clusters:

- Line sections with "critical" capacity utilisation, expressed by an utilisation rate of more than 90% or by a respective classification in the analysed studies;
- Line sections with "high" capacity utilisation, expressed by an utilisation rate between 50 and 90% or by a respective classification in the analysed studies.

Based on the available data on utilisation rates, only a qualitative evaluation can be made. For this reason, the values in Figure 12 do not allow deduction of exact and absolute capacity reserves on the lines (e.g. train paths per year). The overview therefore shall only give an impression of the corridor parts where capacity problems are to be expected, if no countermeasures are taken.

Considering these aspects, the corridor shows three countries with particularly high utilised railway lines:

- Germany with long line sections between Karlsruhe and Frankfurt, between Hanau and Nürnberg (including the urban nodes within these sections). Furthermore the node of Regensburg is affected (crossing point between the "Seaport Branch" and the "CS Branch") [26] as well as the short section between Freilassing and the German/Austrian border. All these critical utilisation rates are due to high traffic volumes.
- Additionally, the line between München and Freilassing is concerned, particularly on the section Markt Schwaben-Mühldorf. On this section single track comes together with a mix of freight and regional traffic (see also Figure 15: Areas with insufficient line equipment on the Rhine-Danube Corridor).
- Czech Republic, where high traffic volumes lead to high capacity exploitation on the section Furth i.W. – Domažlice, in the Praha area and on almost the entire corridor alignment east of Praha, particularly on the sections Poricany – Pardubice and Chocen-Usti nad Orlici – Česká Třebová junction as well as within Ostrava node.

[26] *Source: DB Netz AG: "Kapazitätsmanagement und Netzentwicklung: Erfahrungen mit Kompromissen zum Fahrplan 2018"; Presentation by Dr. Michael Beck; Berlin 15.08.2013; Additional information by DB Netz 26.11.2014*

- Romania showing high utilisation rates on the lines around București (high traffic volume) and between Arad and Craiova (single track sections). Furthermore, the entire line between Curtici and Sighișoara currently provides only reduced capacity due to construction/modernisation works.

Furthermore, single corridor sections and nodes with high capacity utilisation have been identified:

- Wien-Nickelsdorf: mixed traffic of passenger and freight trains;
- Bratislava node: most related corridor sections are only single track (Parndorf-Bratislava Petržalka, Bratislava Petržalka -Rajka;
- Budapest node: level crossing of transit and shunting yard traffic just at the Budapest southern Danube bridge (that is the only main rail link between the Eastern and Western part of Hungary apart from some secondary lines crossing the river Danube).

In contrast, major parts of the corridor related railway lines in Austria, Slovakia and Hungary currently show sufficient capacity reserves.

Areas with a critical line layout

Areas with a critical line layout may lead to insufficient rail traffic quality (e.g. in case of low line speed) and/or allow for only low utilisation of the train capacities. Figure 13 provides an overview on the

- core parameter "line speed" along the corridor with reference to the requirements of Regulation 1315/2013 (100 km/h max line speed have to be implemented on core freight lines by 2013) and
- corridor parts with strong inclines. These line sections show long distance inclines of notably more than 12.5‰ (regular maximum value on main lines with passenger and freight traffic e.g. in Germany), which were reported as leading to restricted continuity of long-distance (freight) flows, because the permitted weight of the trains has to be reduced and/or an additional pushing loco is needed.

Figure 13: Areas with critical line layout – Line speed and strong inclines

Source: HaCon based on study review and TENtec data analysis

Figure 13 provides the following main results:

- Line sections with particular low line speeds are mainly allotted to
  - the Czech Republic (border crossings to Germany, Ostrava region, section between Hranice na Morave and Púchov (SK));
  - Slovakia (border crossing to Ukraine and Czech Republic (see above) and Bratislava node
  - Romania (Curtici – Arad).

Apart from that, rather small line sections within the node of Wien are concerned.

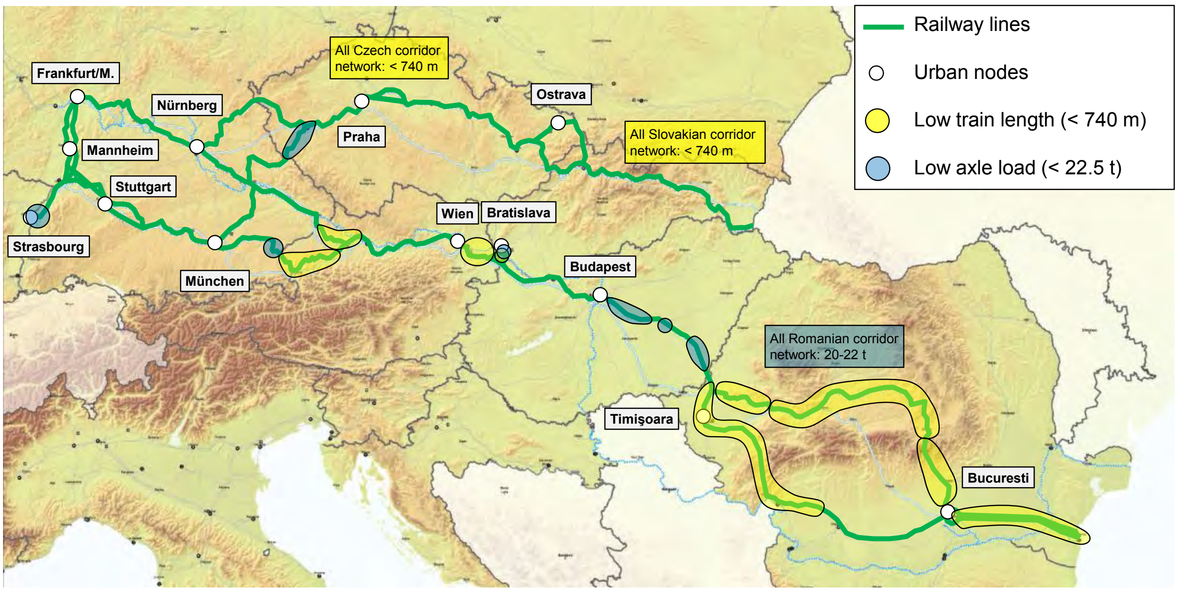
- Strong inclines with severe consequences for rail (freight) operation are located in
  - Germany ("Spessart" east of Frankfurt, "Geislinger Steige" between Stuttgart and Ulm, but also the new high-speed line between Stuttgart and Ulm);
  - Czech Republic (Ostrava region, section between Hranice na Morave and Púchov (SK);
  - Slovakia (section Liptovský Mikuláš - Štrba - Spišská Nová Ves, border crossing to Czech Republic and Ukraine (see above));
  - Romania (line sections Timișoara – Filiași and Brașov –Brazii).

Two further core parameters according Regulation 1315/2013 are considered in Figure 14:

- Axle load (Core freight lines 22.5 t axle load by 2030);
- Train length (Core freight lines to allow for 740 m trains by 2030.

The limited significance and comparability of the permitted train length values has been pointed out in chapter 3.4. Nevertheless, this parameter has also been included in the presentation of results for reasons of completeness.

Figure 14: Areas with critical line layout – Train length and axle load



Source: HaCon based on study review and TENtec data analysis

Considering these methodical restrictions, the criterion of 740 m train length is fulfilled in France and Germany (statement of DB Netz AG) completely, in Hungary for the most part (except line section Rajka – Hegyeshalom – Győr). In Austria, the "Neue Westbahn" permits 740 m, all other line sections 650 m. In Romania, most of the corridor rail lines show values between 600 m and 720 m; only the sections between the Hungarian border and Curtici and Filiaşi – Bucuresti allow 740 m. In the Czech Republic and in Slovakia no 740 m freight trains are currently permitted on the corridor lines due to technical and administrative limits. Both, administrative measures and in some cases further investments are needed.

Line sections permitting axle loads lower than 22.5 tonnes are located on the following parts of the corridor:

- France (Strasbourg – Border FR/DE: 20 tonnes);
- Germany (Garching – Freilassing: 20 tonnes);
- Czech Republic (Furth i.W. – Plzeň: 20 tonnes);
- Hungary (Budapest-Ferencváros – Cegled, Szolnok-Szajol, Gyoma-Lököshaza; Raijka – Hegyeshalom: all 21 tonnes). However, 22.5 tonnes is possible with reduced speed limitations.
- Romania (all rail lines belonging to the corridor: 20-22 tonnes).

Areas with insufficient rail line equipment

Figure 15 provides an overview on corridor areas with

- missing electrification (another core parameter according Regulation 1315/2013) and with
- single track sections.

As shown in this figure, almost the entire corridor is currently already electrified. Gaps remain mainly in Germany (between München and Salzburg and on the border-crossing sections to Czech Republic) as well as in the Czech Republic (German border Furth i.W. – Plzeň).

Single track sections show a particular congruence with the not electrified lines in Germany and the Czech Republic. This is no coincidence, as these two parameters often go hand in hand.

Further corridor parts, which have not yet been upgraded to double track level, are located in

- Slovakia (border-crossing sections between Bratislava and Austria/Hungary and towards Ukraine),
- Hungary (line section towards the Romanian border: Békescsaba - Lőkösháza),
- Romania (between Arad and Filiași).

Figure 15: Areas with insufficient line equipment on the Rhine-Danube Corridor

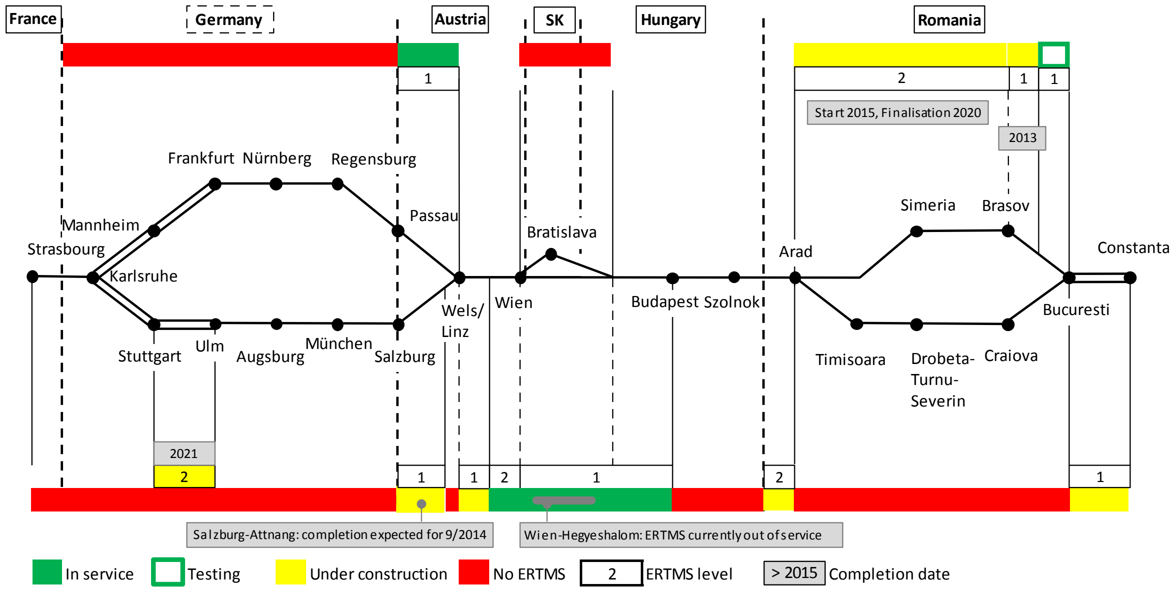
Source: HaCon based on study review and TENtec data analysis

Areas with ERTMS equipment

The current status of another core parameter – the trackside implementation of ERTMS - is visualised in Figure 16 ("Black Sea" branch) and Figure 17 ("CS" branch). With status of November 2014, regular operation of ERTMS was limited to some line sections in Austria and Hungary. The Austrian section Wels-Passau has been put in operation in 2014, whereas between Wien and Hegyeshalom the existing ETCS (level 1) system is not used at the moment.

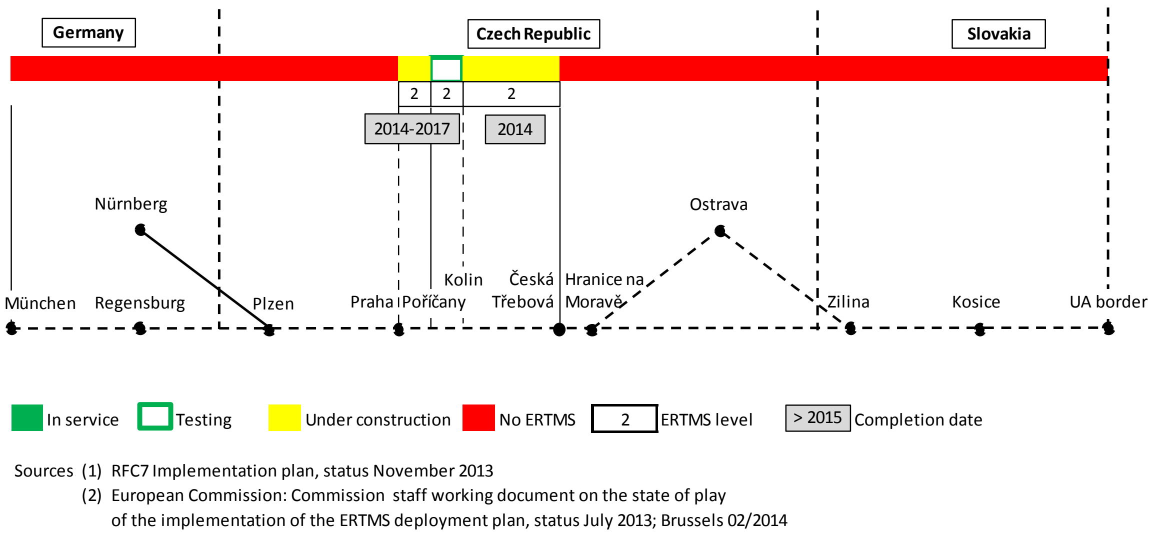
Further corridor parts in Romania and the Czech Republic are currently in a testing phase. By November 2014 no ERTMS has been implemented on the corridor sections in France, Germany and Slovakia. However, in France and Germany GSM-R as one of the core components of ERTMS has been already installed on the entire corridor network.

Figure 16: Status of ERTMS trackside implementation on the Rhine-Danube Corridor - "Black Sea" branch (status: 11/2014)



Source: HaCon based on European Commission: "Commission staff working document on the state of play of the implementation of the ERTMS deployment plan, status July 2013"; Brussels 02/2014 and comments of ÖBB-Infrastruktur AG on second progress report, status: July 2014; DB Netz: comments to draft final report, status November 2014

Figure 17: Status of ERTMS trackside implementation on the Rhine-Danube Corridor - "CS" branch (status: 11/2014)



Source: HaCon based on European Commission: "Commission staff working document on the state of play of the implementation of the ERTMS deployment plan, status July 2013"; Brussels 02/2014

Further steps for equipment of the corridor with ERTMS refer mostly to Romania (finalisation of the "northern" branch via Simeria/Brasov is foreseen until 2020) as well as to Austria and Czech Republic. In Germany, ERTMS will be provided on existing lines within infrastructure upgrade projects and on all new lines. The latter also refers to the new high-speed line Wendlingen-Ulm, which shall be taken into operation by 2021.

4.3.1.2 Summary: Compatibility of rail parameters with the requirements of the Regulation

Table 9 provides an overview on the characteristics of the corridor lines with regard to the six core rail parameters as stated in Regulation 1315/2013. For each of these parameters, classes have been defined, taking up the requirements of the Regulation and the standards provided by the TENtec Glossary. If the latter were missing, other useful clusters have been introduced. Standards fulfilling the requirements of the Regulation are highlighted in green.

For each standard, the percentage values denote the total rail length in each country, where the respective threshold values are fulfilled. Thus, figures inside the "green area" of the table indicate compliance with the Regulation, figures outside the "green area" stand for gaps of the standards.

Although the data collection process has been concluded by now, some minor data gaps still remain for some line sections in Romania, for which official data could not be delivered yet by the authorities. However, only minor shares of the required data sets are classified as "others/unknown" and therefore do not influence the overall results remarkably.

The figures in Table 9 illustrate the accordance grade of the current corridor characteristics with the requirements of the Regulation:

- "Traction" (TENtec parameter 6): More than 90 % of the corridor rail lines are electrified. Gaps of electrification are limited to some sections in Germany (München-Mühldorf-Salzburg line and cross-border sections with the Czech Republic) and Czech Republic;
- "Track gauge" (TENtec parameter 7): All corridor lines provide for standard gauge (1,435 mm);
- "Maximum operating speed" (TENtec parameter 11): More than 90 % of the corridor rail lines provide for operating speeds of 100 Km/h and more. Line sections with insufficient operating speeds are located on the "CS" branch and on the eastern part on the "Black Sea" branch (Romania; Hungary: local speed drops in Budapest node).
- "Axle load" (TENtec parameter 13): 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. Note: In Hungary 22.5 tonnes is possible with speed limitations.
- "Maximum train length" (TENtec parameter 15): 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 the methodical problems described above, the significance of this result is limited, though.
- "ERTMS in operation (YES/NO)" (TENtec parameter 23): Currently, ERTMS is only an exceptional characteristic of the Rhine-Danube corridor; it is restricted to some line sections in Austria and Hungary.

A detailed list of the line sections, which do not fulfil the requirements of the Regulation, is provided as Annex IV to this report.

Table 9: Country specific fulfilment of rail "core parameters" according Regulation 1315/2013

	TEN-T RHIN-DAN						Status:	21.10.2014		
	RAILWAYS		All entries: %-age of all sections fulfilling the respective standard							
No.	TENtec Technical Parameters	Standards [1]	FR	DE	AT	CZ	SK	HU	RO	Total
1	Length of all sections (km)		7,7	1.835,1	508,5	884,9	473,8	412,2	1.584,8	5.706,9
6	Traction	Electrified	100%	79%	100%	91%	100%	100%	95%	91%
		Diesel	0%	21%	0%	9%	0%	0%	0%	8%
		Others/Unknown	0%	0%	0%	0%	0%	0%	5%	1%
7	Track gauge (mm)	1000 mm	0%	0%	0%	0%	0%	0%	0%	0%
		1435 mm	100%	100%	100%	100%	100%	100%	95%	99%
		1520 mm	0%	0%	0%	0%	0%	0%	0%	0%
		1524 mm	0%	0%	0%	0%	0%	0%	0%	0%
		1600 mm	0%	0%	0%	0%	0%	0%	0%	0%
		1602 mm	0%	0%	0%	0%	0%	0%	0%	0%
		1668 mm	0%	0%	0%	0%	0%	0%	0%	0%
		Others/Unknown	0%	0%	0%	0%	0%	0%	5%	1%
11	Max operating speed (km/h)	> 250 km/h [2]	0%	7%	0%	0%	0%	0%	0%	2%
		201 - 250 km/h [2]	0%	7%	34%	0%	0%	0%	0%	5%
		161 - 200 km/h [2]	0%	9%	25%	0%	0%	0%	0%	5%
		121 - 160 km/h [2]	0%	55%	36%	64%	0%	17%	17%	37%
		100 - 120 km/h [2]	100%	22%	6%	22%	88%	81%	76%	45%
		< 100 km/h	0%	0%	0%	14%	12%	1%	2%	4%
		Others/Unknown	0%	0%	0%	0%	0%	0%	5%	1%
13	Max axle load (t)	> 22.5 t	0%	0%	0%	0%	0%	0%	0%	0%
		22.5 t	0%	97%	100%	92%	100%	60%	0%	67%
		22 t	0%	0%	0%	0%	0%	0%	23%	6%
		21 t	0%	0%	0%	0%	0%	40%	0%	3%
		20 t	100%	3%	0%	8%	0%	0%	72%	22%
		18 t	0%	0%	0%	0%	0%	0%	0%	0%
		16 t	0%	0%	0%	0%	0%	0%	0%	0%
		Others/Unknown	0%	0%	0%	0%	0%	0%	5%	1%
15	Maximum train length (m)	> 740 m	100%	0%	0%	0%	0%	97%	19%	12%
		740 m	0%	100%	34%	0%	0%	0%	0%	35%
		700 - 739 m	0%	0%	0%	44%	8%	0%	50%	21%
		600 - 699 m	0%	0%	66%	48%	92%	3%	26%	28%
		500 - 599 m	0%	0%	0%	9%	0%	0%	0%	1%
		< 500 m	0%	0%	0%	0%	0%	0%	0%	0%
		Others/Unknown	0%	0%	0%	0%	0%	0%	5%	1%
23	ERTMS in operation	YES	0,0	0,0	39%	0,0	0,0	43%	0,0	7%
		NO	100%	100%	61%	100%	100%	57%	95%	93%
		Others/Unknown	0%	0%	0%	0%	0%	0%	5%	1%
	* Glossary: Technical and Financial Data, Draft Update - Corridor Studies, 06.02.2014									

Threshold values according to Regulation 1315/2013

[1] according OMC Glossary or useful classes

[2] relevant only for freight lines

Source: HaCon based on TENtec data gathering tables

Compilation of further rail parameters by country

Apart from the "core parameters", several other parameters contribute significantly to the overall rail picture of the Rhine-Danube Corridor. Table 10 shows eight further TENtec parameters and their assignment to defined standards.

Table 10: Country specific TENtec parameters (except "core parameters")

	TEN-T RHIN-DAN								Status:	21.10.2014
	RAILWAYS		All entries: %-age of all sections fulfilling the respective standard							
No.	TENtec Technical Parameters	Standards [1)]	FR	DE	AT	CZ	SK	HU	RO	Total
1	Length of all sections (km)		7,7	1.835,1	508,5	884,9	473,8	412,2	1.584,8	5.706,9
2	Type	Conventional	100%	86%	66%	100%	100%	100%	95%	92%
		High speed	0%	14%	34%	0%	0%	0%	0%	8%
		Others/Unknown	0%	0%	0%	0%	0%	0%	5%	1%
4	Activity	Freight	0%	0%	0%	0%	0%	0%	0%	0%
		Passenger	0%	0%	0%	0%	0%	0%	0%	0%
		Freight & Passenger	100%	100%	100%	100%	100%	100%	95%	99%
		Others/Unknown	0%	0%	0%	0%	0%	0%	5%	1%
5	Number of tracks	Single	0%	11%	5%	21%	4%	12%	22%	15%
		Double	100%	88%	94%	72%	96%	88%	73%	83%
		More than double	0%	1%	1%	7%	0%	0%	0%	1%
		Others/Unknown	0%	0%	0%	0%	0%	0%	5%	1%
8	Load gauge (UIC type)	A Gauge	0%	1%	100%	0%	0%	0%	0%	9%
		B Gauge	100%	8%	0%	15%	79%	100%	0%	19%
		C Gauge	0%	56%	0%	71%	21%	0%	95%	57%
		Others/Unknown	0%	35%	0%	14%	0%	0%	5%	15%
12	Max inclination (‰)	> 15 ‰	0%	12%	3%	12%	50%	0%	26%	17%
		12.51 - 15 ‰	0%	22%	5%	16%	0%	0%	0%	10%
		=< 12.5 ‰	100%	66%	92%	72%	50%	100%	69%	71%
		Others/Unknown	0%	0%	0%	0%	0%	0%	5%	1%
14	Rail voltage (Volt)	AC 25 kV, 50 Hz	100%	0%	0%	20%	7%	99%	95%	37%
		AC 15 kV, 16 2/3 Hz	0%	79%	100%	0%	0%	1%	0%	35%
		DC 3 kV	0%	0%	0%	71%	93%	0%	0%	19%
		DC 1.5 kV	0%	0%	0%	0%	0%	0%	0%	0%
		DC 0.75 kV	0%	0%	0%	0%	0%	0%	0%	0%
		DC 0.66 kV	0%	0%	0%	0%	0%	0%	0%	0%
		DC 0.63 kV	0%	0%	0%	0%	0%	0%	0%	0%
		Diesel	0%	21%	0%	9%	0%	0%	0%	8%
		Others/Unknown	0%	0%	0%	0%	0%	0%	5%	1%
25	Control & command system	ETCS	0%	0%	39%	0%	0%	43%	0%	7%
		PZB	0%	77%	37%	0%	0%	0%	0%	28%
		CED	0%	0%	0%	0%	0%	0%	95%	26%
		LZB	0%	20%	24%	0%	0%	0%	0%	9%
		semi automatic	0%	0%	0%	1%	0%	0%	0%	0%
		LS	0%	0%	0%	99%	80%	0%	0%	22%
		EVM	0%	0%	0%	0%	0%	57%	0%	4%
		without	0%	0%	0%	0%	20%	0%	0%	2%
		KVB	100%	0%	0%	0%	0%	0%	0%	0%
		Others/Unknown	0%	3%	0%	0%	0%	0%	5%	2%
27	Voice system radio (GSM-R)	YES	100%	100%	100%	40%	7%	1%	0%	48%
		NO	0%	0%	0%	60%	93%	99%	95%	51%
		Others/Unknown	0%	0%	0%	0%	0%	0%	5%	1%
	* Glossary: Technical and Financial Data, Draft Update - Corridor Studies, 06.02.2014									

1) according OMC Glossary or useful classes

Source: HaCon based on TENtec data gathering tables

- In order to provide a consistent overview and in line with regulation 1315/2013 (Article 11, 2a), the threshold value between "conventional" rail lines and "high-speed" has been set to 200 km/h for all corridor sections. In this sense, the vast majority of the corridor consists of "conventional" rail lines. Only several new rail lines in Germany (Karlsruhe-Mannheim, Stuttgart-Ulm) and Augsburg-München (Linz-Wien") have been categorised as high-speed.
- The same applies for the "Activity" cluster. All corridor parts are designed for both passenger and freight traffic. Even the new high-speed line Stuttgart-Ulm has been categorised as "Freight & Passenger" in accordance with DB Netz AG, as a considerable number of freight trains has been included in the cost-benefit calculation. Some small sections within Wien node are used by freight trains exclusively even though from a formal perspective these sections are also categorised as "Freight & Passenger".
- More than 80% of the corridor is designed as at least double tracked. Nevertheless, all corridor countries (except France) show also some single track sections (see Table 10).
- The load gauge[27] categories provide a rather mixed picture. Nearly 60% of the corridor is classified as GC. However, a nameable share of the corridor sections could not assigned clearly to the standards. This particularly refers to Germany, where numerous line sections were stated as "on demand" in the STREDAX database of DB Netz AG.
- Line sections with strong inclination have been shown in Figure 13 (page 73). As a general rule, inclinations not exceeding 12.5‰ can be regarded as non-problematic for operation. In contrast, 18% of the total corridor length shows an incline of more than 15‰. Some of these sections have been pointed out above as impediments for long-distance freight traffic.
- Regarding electrification, three rail voltage system are represented on the corridor:
  - AC 25 kV, 50 Hz in France, parts of Czech Republic (Plzeň - Beroun), parts of Slovakia (Bratislava node), Hungary and Romania;
  - AC 15 kV 16 2/3 Hz in Germany and Austria,
  - DC 3 kV at main parts of Czech Republic (Beroun – SK border) and Slovakia (CS branch).
- The parameter "Control & command system" has been assigned to the respective signalling systems. In this respect, eight signalling systems are in use on the corridor (incl. ETCS). Most widespread are PZB/LZB (Germany, Austria), CED (Romania) and LS (Czech Republic, Slovakia).
- GSM-R has currently been installed in France, Germany, Austria and partially also in the Czech Republic and Slovakia. On the other side, 50% of the total corridor length has not yet been equipped with GSM-R.

4.3.1.3 Rail interoperability on the corridor

Seamless rail traffic along the corridor strongly depends on the compatibility of the infrastructural, technical and operational parameters. For this purpose, the relevant parameters - based on the TENtec data gathering tables - have been visualised by "country charts". These charts show the change of the parameters in each country, including the respective cross-border sections according Regulation 2013/15:

[27] *A loading gauge defines the maximum height and width for railway vehicles and their loads to ensure safe passage through bridges, tunnels and other structures*

'Cross-border section' means the section which ensures the continuity of a project of common interest between the nearest urban nodes on both sides of the border of two Member States or between a Member State and a neighbouring country.

Annex “TENtec_Data_Rail_Country-charts” to this Report contains a compilation of all rail country charts of the Rhine-Danube Corridor. As an example, Figure 18 shows the country charts for Czech Republic with the technical and infrastructural parameters of the TENtec data gathering tables. The volume flows (passengers, tonnes, trains) have been excluded from this presentation, since they are only fragmentarily available and have no direct impact on the interoperability on the corridor. The resulting capacity utilisation on the rail lines has already been shown in Figure 12 (page 72).

The figures in the country charts have to be understood as the most unfavourable value in each section displayed. This means that possibly short unfavourable values determine the overall figure for the total section. This particularly applies for all parameters, which show numerous changes on short distances (e.g. maximum speed, load gauge, incline). For this reason, a compilation of all parameter changes is included as annex to the second progress report. For Germany, this annex also includes the sectioning of the STREDAX data base of DB Netz AG, which is much more detailed than the TENtec sectioning.

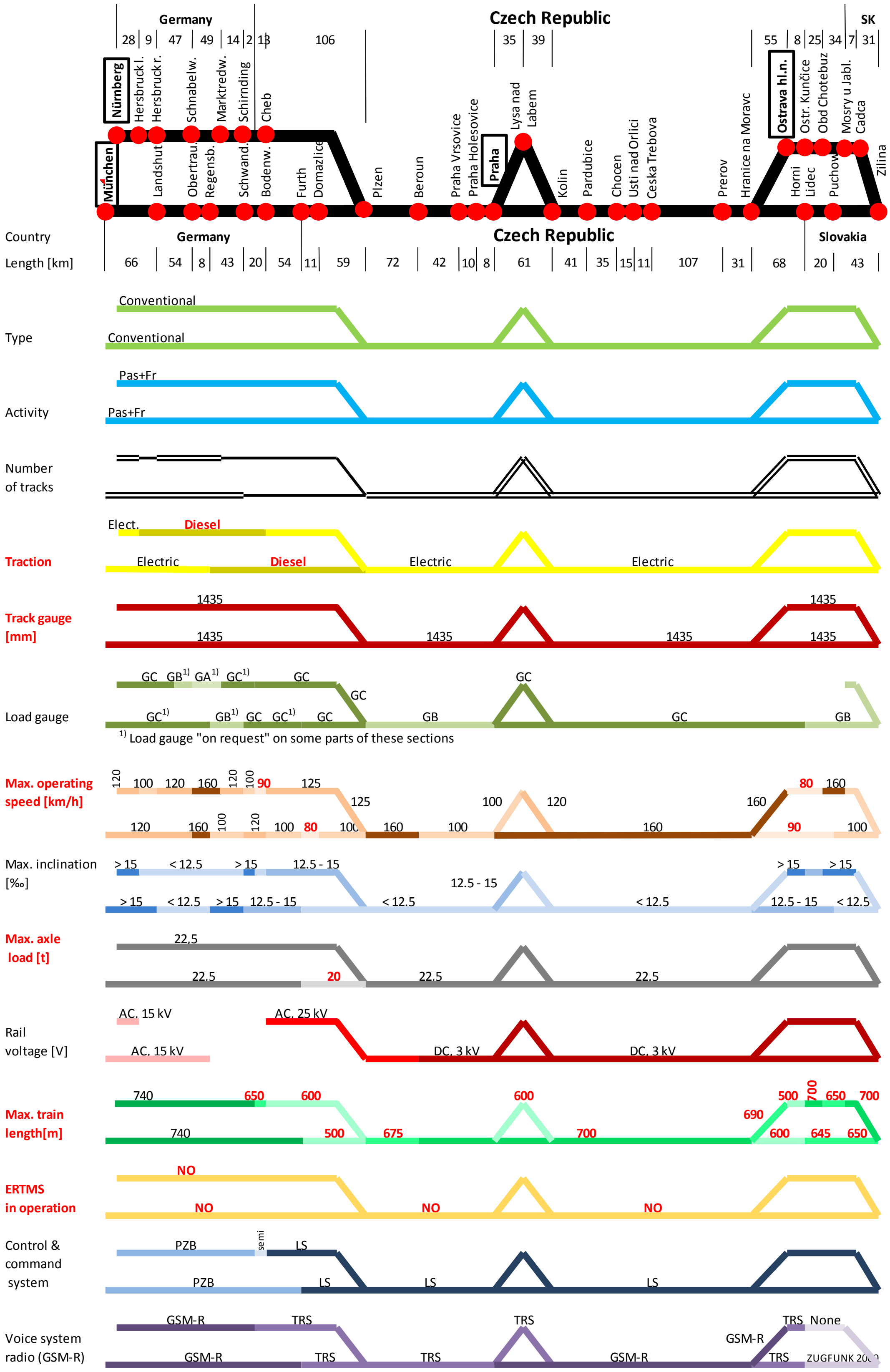
Characteristics missing the requirements of the Regulation are highlighted in red and bold within the country charts.

The main results from these country charts are the following:

- The corridor is totally equipped with standard gauge (1,435 mm). However, at the connection to Ukraine (end of the CS branch), the gauge changes to 1,520 mm.
- The railway companies are using three different electric voltage systems on the corridor:
    - AC 25 kV, 50 Hz in France, parts of Czech Republic (Plzeň - Beroun), parts of Slovakia (Bratislava node), Hungary and Romania;
    - AC 15 kV 16 2/3 Hz in Germany and Austria,
    - DC 3 kV at main parts of Czech Republic (Beroun – SK border) and Slovakia (CS branch).
- The corridor is not completely electrified (cp. Figure 15, page 76).
- Common signalling systems are currently used in Germany/Austria (PZB/LZB), in the Czech Republic/Slovakia (LS) and Austria/Hungary (ETCS, but not in operation).
- Assuming that the existing electrification gaps will be closed, a locomotive to operate the complete corridor would have to be compatible with
    - On the “Black Sea” branch
        - Two electric power systems,
        - Seven signalling systems,
        - Two ERTMS levels.
    - On the “CS” branch
        - Three electric power systems,
        - Three signalling systems.
- The maximum configuration for a freight train is limited by
    - On the “Black Sea” branch
        - Load gauge GA (Germany, Austria, Hungary); numerous German sections are “on demand”

  - Axle load = 20 t (France, Germany, Romania),
  - Train length = 600 m (Romania).
- On the “CS” branch
  - Load gauge GA (Germany); numerous German sections are “on demand”
  - Axle load = 20 t (Czech Republic),
  - Train length = 500 m (Czech Republic).

Figure 18: Country chart with technical TENtec parameters (Example: Czech Republic)



Source: HaCon based on TENtec data gathering tables

Of particular interest are the parameter changes at cross-border sections which are also part of each country chart. The Rhine-Danube Corridor contains nine country/country rail connections with totally 12 cross-border sections in terms of Regulation 1316/2013, Article 2 (*"...the section which ensures the continuity of a project of common interest between the nearest urban nodes on both sides of the border..."*).

It has to be considered that some parameters do not have direct impact on the rail interoperability along the corridor (e.g. number of tracks, max. speed, inclination). For this reason, Table 11 provides a compilation of the cross-border sections and assigns the change of those TENtec parameters, which are relevant for cross-border interoperability.

Table 11: Change of TENtec rail parameters on cross-border sections

Coun-tries	**Cross-border section**	**Change of parameters with impact on interoperability**							
		Traction	Track gauge	Load gauge	Axle load	Rail voltage	Train length	ERTMS	Control system
FR-DE	Strasbourg-Stuttgart			X	X	X			X
FR-DE	Strasbourg-Mannheim			X	X	X			X
DE-AT	Nürnberg-Wien			X			X		
DE-AT	München-Wien	X		X	X		X		
AT-SK	Wien-Bratislava			X		X	X	X	X
SK-HU	Bratislava-Budapest				X		X	X	X
AT-HU	Wien-Budapest			X		X	X		
HU-RO	Budapest-Timişoara			X	X		X		X
DE-CZ	Nürnberg-Praha	X		X		X	X		X
DE-CZ	München-Praha	X		X	X	X	X		X
CZ-SK	Praha-Žilina[a]			X			X		
CZ-SK	Ostrava-Žilina[a]						X		
SK-UA	Chop		X						

a) No urban node on Slovakian CS branch; Zilina selected instead.

Source: HaCon based on TENtec data gathering tables

The most import findings of the cross-border analysis are the following:

- There is no cross-border section without any change of relevant parameters.
- On most cross-border sections, there is a change of 4-5 parameters. More parameter changes have to be stated especially between Germany and the Czech Republic; in contrast, the sections between Nürnberg and Wien, between Wien and Budapest as well as between Czech Republic and Slovakia show rather few changes of the relevant parameters.
- Parameters referring to the capacity of freight trains (load gauge, axle load, train length) change more often than pure technical parameters (traction, track gauge, voltage, ERTMS, control system).

4.3.2 Characteristics Inland Waterways

4.3.2.1 Corridor inland waterway infrastructure

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 guidelines for the development of the trans-European transport network (Regulation (EU) No 1315/2013, p. 160) include the Sava into the corridor up to the comprehensive port of Sisak. Despite being part of the corridors name, the Rhine is not part of the Rhine-Danube Corridor. The characteristics of this important inland waterway axis are described in the study on the Rhine-Alpine Corridor.

The navigable Danube crosses Germany, Austria, Slovakia, Hungary, Croatia and the Republic of Serbia, forms the border between Romania and Bulgaria, and passes Moldavia and Ukraine eventually flowing into the Black Sea at Sulina. The Sulina channel 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 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.

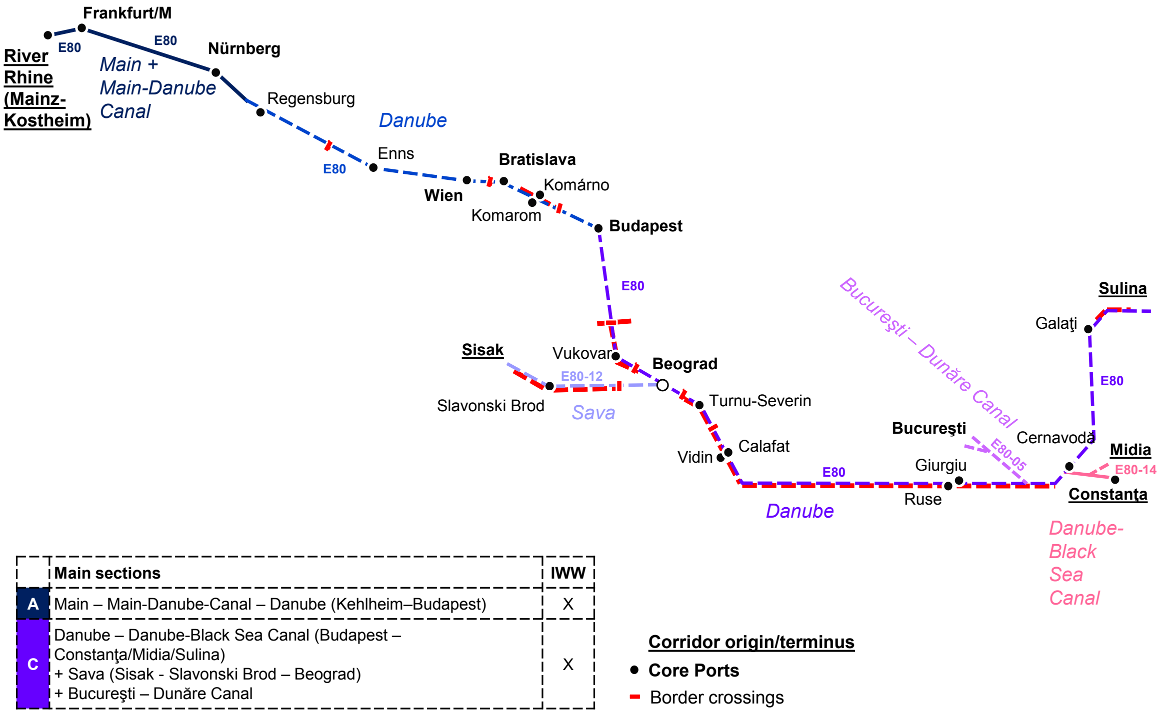
The following neighbouring countries are considered in relation to inland waterways:

- 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 of 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 km. The whole inland waterway network of the Rhine-Danube Corridor including also the Sava up to Sisak, the Poarta Albă - Midia Năvodari Canal and the Danube until Sulina has a length of 3,655.59 rkm.The inland waterway corridor sections in TENtec sum up to 4,198 river km, as the border section between Romania and Bulgaria is counted twice.

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. The river kilometre 0 of the Danube is at the mouth to the Black Sea at Sulina.

Figure 19: IWW alignment of the Rhine-Danube Corridor and assigned infrastructure



Source: viadonau

The characteristics of Inland Waterways are described by the existing bottlenecks and missing links along the Rhine-Danube Corridor as well as by already started or initiated measures to tackle these bottlenecks. Measures included in the report were selected due to their importance for future development projects on the Corridor.

Whereas interregional strategies lead the way and international agreements set common standards (e.g. European Agreement on Main Inland Waterways of International Importance - AGN and the Classification of Inland Waterways - ECMT). Several important projects are related to the EU Strategy for the Danube Region and therefore are listed in the related online project database.

The characteristics of inland waterways are structured along the thematic key aspects - Waterway Infrastructure, Waterway Rehabilitation and Maintenance, River Information Services and Administrative Barriers.

4.3.2.2 Characteristics of waterway infrastructure

The inland waterways of the Rhine-Danube Corridor show a large variety in nautical, hydrological and hydromorphological characteristics. While on impounded sections the conditions of the waterway are rather stable and a good navigable status is considered as secured, **free-flowing sections bear particular challenges**. A significant portion of the navigable waterways consists of free-flowing sections; the Sava is not regulated by barrages at all. Particularly in free-flowing sections, the transport of sediments (bed load and suspended matter) leads to continuous change in the morphology of the riverbed, either in the form of sedimentation or erosion. In order to secure internationally harmonised fairway parameters (predominantly fairway depths and widths), continuous fairway rehabilitation and maintenance efforts and integrated river engineering measures are necessary.

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 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)

As there are no time related limitations, the parameters have to be met all year round.

ECMT classes range from I to VII, waterways with a class IV or higher are considered as waterways of international importance (E waterways). The European Agreement on Main Inland Waterways of International importance (AGN) specifies the waterway classes further, stating that on waterways with fluctuating water levels the recommended draught should correspond to the draught reached or exceeded for 240 days on average per year, on upstream sections of natural rivers characterized by frequently fluctuating water levels due to strong direct dependence on weather conditions, on 300 days. The Upper Danube starts at Gönyű (rkm 1,790) in Hungary. The recommendations on minimum requirements for standard fairway parameters by the Danube Commission specify parameters in relation to the dimensions of the fairway, in contrary to the AGN or ECMT classifications, which focus on the possible vessels used on the fairway. The minimum requirements are taking morphological and regional characteristics of different Danube sections into account.

In order to circumvent a high number of exceptions in relation to the provision of draughts (as foreseen by Article 15 of the TEN-T Guidelines), it is proposed to apply the standards of AGN in Austria, Slovakia, Croatia, Serbia, Romania, Bulgaria, Moldova, the Ukraine, Bosnia and Herzegovina (these countries set the AGN into force), when deciding on new projects with support from the Connecting Europe Facility, ESIF or IPA II.

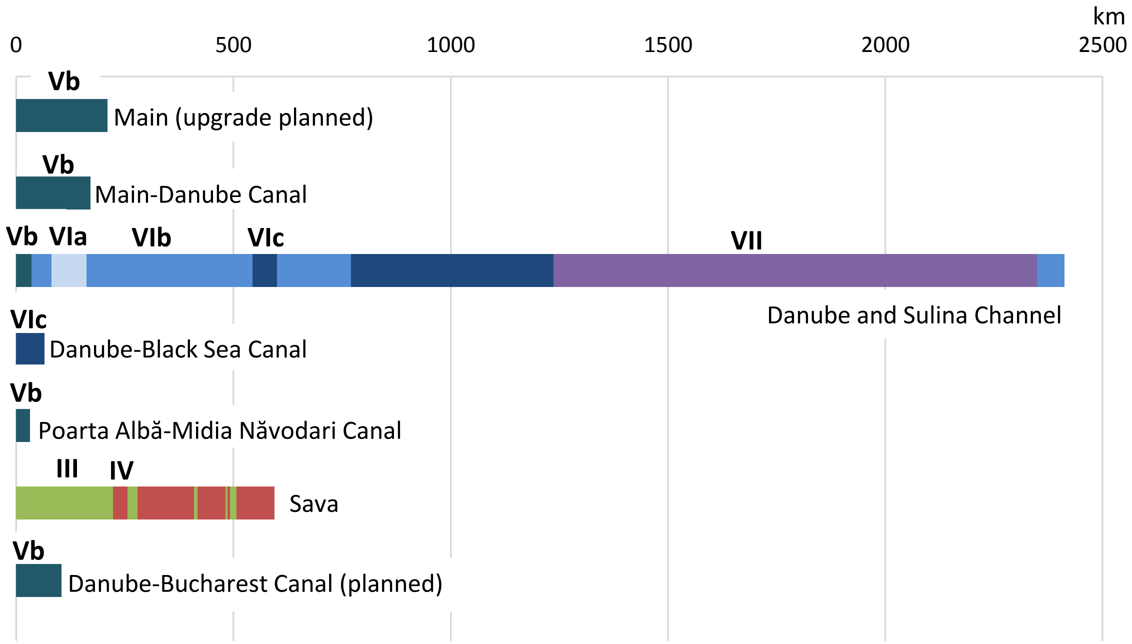
Apart from the Sava all waterways of the Rhine-Danube Corridor are classified at least as class V waterways, with increasing ranks towards the Black Sea.

Figure 20 shows the waterway classes at the Rhine-Danube Corridor. The objective of the Corridor for Austria, Slovakia, Hungary, Croatia, Serbia, Romania, Bulgaria, Moldova, the Ukraine, and Bosnia and Herzegovina (these countries are contracting parties to AGN) is at least to comply with the AGN standards. Unless exemptions are granted by the European Commission in duly justified cases, sections in Germany have to comply with Class IV throughout the year as defined by Article 15 and 16 of the TEN-T Regulation.

The Sava River only partly complies with class IV (53% or 316.50 km), while 47% of its navigable length shows class III (277.10 km)[28], which is planned to be upgraded.

[28] *Classification according to Decision – 14/12 on adoption of Amendments to the Decision 19/08 on Adoption of Classification of the Sava River Waterway (ISRBC, November 2012)*

Figure 20: Classification of waterways on the Rhine-Danube Corridor



Source: viadonau

In addition to the inland waterways included in the Rhine-Danube Corridor the Váh, Drava and Tisa are important tributaries to the Danube reaching class IV. The Rhine is an important connection to the corridor, with the most dominant and mature market and with a share of almost 70% in total transport performance (in tonne-kilometres) in EU. The characteristic of the Rhine are issue to the study on the Rhine-Alpine Corridor.

The parameters according to AGN for each section of the Corridor are shown on the following table. Draught values should be ensured or exceeded throughout the whole year on the artificial canals, for 240 days per year on rivers with fluctuating water levels resp. on 300 days per year for upstream sections with frequently fluctuating water levels. Unless exemptions are granted by the European Commission in duly justified cases, sections in Germany needs to fulfil the minimum requirements of the TEN-T Regulation, i.e. 2.5m of draught as well as 5.25m minimum height under bridges as defined by ECMTall year round.

Table 12: Minimum requirements and higher standards in case of modernizing waterways in order to meet market demands

Class	Sections	Length of vessel/convoy	Beam of vessel/convoy	Draught of vessel/convoy	Bridge clearance
III	47% of the Sava	Upgrade to class IV			
IV	Minimum requirement to be reached on all sections (in Germany all year round, on upstream sections of free flowing rivers with frequently fluctuating water levels on 300 days and on downstream	85	9.5	2.50 – 2.80	5.25 or 7.00

	sections on 240 days per year with fluctuating water levels) unless exemptions are granted by the European Commission in duly justified cases. 53% of the Sava				
Va		95 - 110	11.4	2.50 – 4.50	5.25 or 7.00 or 9.10
Vb	Main, Main-Danube Canal, Danube- București Canal, Kehlheim-Schwabelweis, Poarta Albă-Midia Năvodari Canal	172 - 185			
VIa	Straubing-Vilshofen	95 - 110	22.8		7.00 or 9.10
VIb	Schwabelweis-Straubing, Vilshofen-Bratislava, Border SK/HU-Lagymános, Sulina branch	185 - 195			7.00 or 9.10
VIc	Bratislava-Border SK/HU, Lagymános-Belgrad, Danube-Black Sea Canal	270 - 280 195 - 200	22.8 33-34.2		9.10
VII	Belgrad-Sulina branch	275 - 285	33-34.2		9.10

Source: viadonau

The Main and the Main-Danube Canal provide for stable fairway conditions. According to experts of waterway administrations, the TEN-T Guidelines´ requirement of a **minimum draught** of 2.5 m is not met at large parts of the Danube throughout the year. Especially when it comes to free-flowing sections of the Danube this requirement is hardly met, even the provision of 2.5 m fairway depths on 240 days on average per year is challenging for some sections of the Danube.

Measures to improve the fairway conditions do not only have a positive impact on the energy consumption but also improve the emissions to air. This is because (1) more water depth/draughts allow for larger ships (lower emissions per tkm) or (2) more water depth reduces low water resistance of vessels (less fuel consumption/ emissions under same conditions). The reduction potential of fuel as well as the emissions is up to -68% (depending on specific circumstances).[29]

Vertical bridge clearance is indicated in relation to the highest navigable water level (HNWL), whereby the passage height corresponds to the distance in metres between the lowest point of the bridge over the entire fairway width and the highest navigable water level. The TEN-T regulation obligates the Member States to ensure a bridge clearance of 5.25 m, exeptions may be granted in duly justified cases. Arch bridges, like the Alte Mainbrücke in Würzburg and the Margit-híd in Budapest, etc. have a low bridge clearance at the limits of the fairway but are no obstacle to navigation due to the higher clearance in the middle of the fairway. Only bridges which have a clearance below 5.25 m and are an obstacle to navigation should be considered for rebuilding.

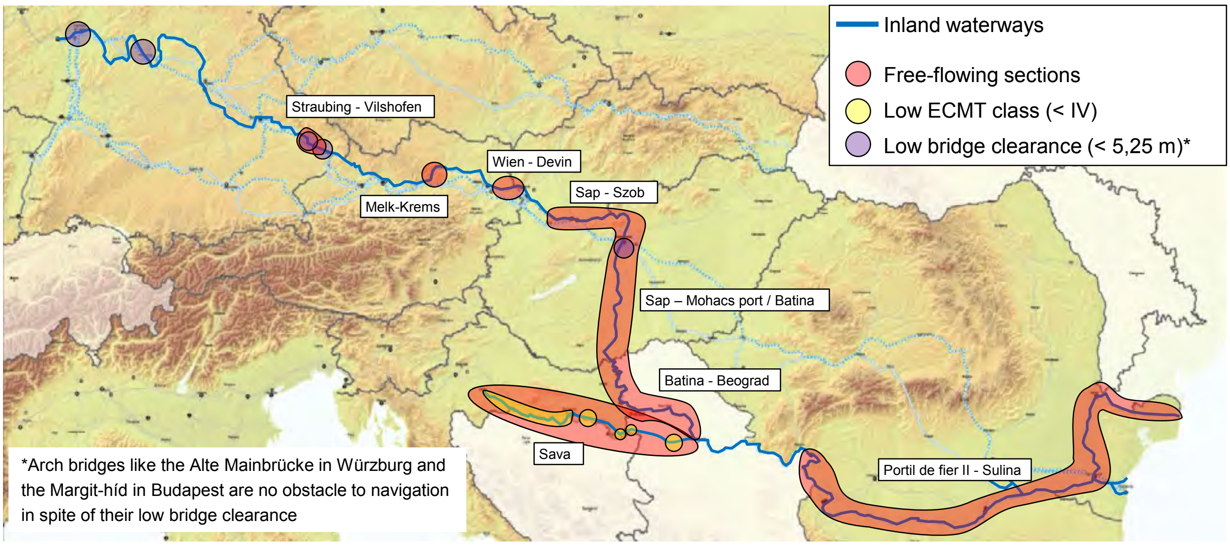
[29] *Commission Staff Working Document: "Greening the fleet: reducing pollutant emissions in inland waterway transport", Brussels, 10.9.2013, SWD(2013) 324 final*

The ECMT classification as well as the AGN agreement specifies the bridge clearance according to the waterway classes. On basis of the TEN-T Regulation, there is **no legal obligation to increase the height of existing bridges, which are already higher than 5.25m**. New bridges however should be built in accordance with ECMT / AGN.

The required **minimum height** of 5.25m in relation to the highest navigable water level is not reached by the rail and road bridge in Auheim (4.85m, Main-km 59.55) and the road bridge Alte Mainbrücke Würzburg (4.45m, Main-km 252.32) at the Main. The rail bridge at Schwabelweis (5.95m, Danube-km 2,376.82), the rail bridge Bogen (5m, Danube-km 2,311.27), the rail bridge Steinbach in Passau (6.3m, Danube-km 2,230.28), the Luitpoldbürcke in Passau (5.15m, Danube km 2,225.75) and the Margit-híd in Budapest (4.98m, Danube-km 1,648.7) do not comply with the required clearance of seven meters for vessels transporting three layers of containers but are no obstacle to navigation (see explanation above). The old bridge in Bratislava which is about to be replaced, the Željeznički most Bogojevo – Erdut (8.59m, Danube-km 1,366.44) and the Drumski most Smederevo-Kovin (8.44m, Danube-km 1,112.10) do not reach the required height of 9.10m and impede the transport of 4 layers of containers.

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

Figure 21: Inland waterways with unfavourable infrastructure conditions



Source: viadonau based on TENtec data gathering

The following table shows the parameters specifying the inland waterway infrastructure of the Rhine-Danube Corridor per country according to the information included in the TENtec database.

The analysed data accordingly has to be treated with caution. At this point it is important to mention that cross-border sections should be shown separately as the concerned countries share the responsibility over those sections. 42% of the navigable Danube constitutes a border between two countries. At present the TENtec database only allows the exclusive allocation of a section to one country.

The information on the minimum draught is mainly based on the UNECE Blue Book, which represents the best available international data. According to the Needs

Assessment on Fairway Maintenance[30] this data does not reflect the situation on the Rhine-Danube Corridor properly, due to lacking monitoring and surveying equipment (e.g. gauging stations, surveying vessels…).

Table 13: TENtec IWW parameters - Fulfilment of Regulation requirements by country

	TEN-T RHIN-DAN													08.05.2014
	INLAND WATERWAYS	All entries: %-age of sections fulfilling the respective srandard												
No.	TENtec Technical Parameters	Standards 1)	FR	DE	AT	CZ	SK	HU	HR	RS	BG	RO	MD	UA
1	Section (km)													
2	CEMT class	I to III		0%	0%		0%	0%	40%	0%	0%	0%		
		IV		0%	0%		0%	0%	40%	50%	0%	0%		
		V a		0%	0%		0%	0%	0%	0%	0%	13%		
		V b		63%	0%		0%	0%	0%	0%	0%	0%		
		VI a		38%	0%		0%	0%	0%	0%	0%	0%		
		VI b		0%	100%		67%	50%	0%	0%	0%	0%		
		VI c		0%	0%		33%	50%	20%	50%	0%	13%		
		VII		0%	0%		0%	0%	0%	0%	100%	75%		
3	Nr of single locks			48	0		0	0	0	0	0	0		
4	Nr of double locks			8	9		1	0	0	0	0	6		
5	Chamber lock width (m)			11,98	24		34	-	-	-	-	12,5		
6	Chamber lock length (m)			190	227		275	-	-	-	-	145		
7	Minimum width (m)²	narrowest part (m)		11,45	23		22,8	35	9	9,5	35	11,5		
8	Min draught (m)	< 2,5 m		13%	0%		67%	100%	60%	50%	0%	0%		
		2,5 m - 3 m		88%	100%		33%	0%	40%	50%	100%	25%		
		> 3 m		0%	0%		0%	0%	0%	0%	0%	75%		
		shallowest part (m)		2,3	3		2	1,7	1,6	2	2,5	2,5		
9	min height under bridge (m)	< 5,25		50%	0%		0%	50%	0%	0%	0%	0%		
		≥ 5,25		50%	100%		100%	50%	100%	100%	100%	100%		
		lowest bridge (m)		4,45	7,67		7,59	4,98	6,16	6,95	13,91	10		
10	Navigation reliability (%)			no data	95,68%		87%	65%	100%[3]	65%	64%	72%		
17	Intelligent transport systems (RIS)	YES		100%	100%		100%	100%	100%	100%	100%	100%		
		NO		0%	0%		0%	0%	0%	0%	0%	0%		

Source: viadonau based on TENtec data gathering

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 at the Rhine-Danube Corridor, of which 28 are allocated at the Main, 16 at the Main-Danube Canal and 4 at 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).

From time to time lock revisions are necessary. For the duration of construction works single chambers lock are closed completely, at double chamber locks one of the two lock chambers has to be closed. As the (partial) obstructions lead to delays in transport, the construction periods should be hold as short as possible.

Several locks in Germany were constructed about 80 years ago. A declared development goal is the successive overhauling respectively the reconstruction of locks. Plans for the lock at the Main-Danube Canal were made, the locks in Erlangen and Kriegenbrunn will be reconstructed. A new "Bundesverkehrswegeplan" will be elaborated until 2015, at the moment shortcomings in the transport network are analysed bur are not yet available to the general public.

A major project in implementation is the revision of the locks in Kachlet. Construction works started in March 2012 and will be finished by the End of 2017. The northern chamber was closed until 07 May 2014 and was closed again on 09 May 2014, until further notice only one lock will be available.

Currently only one of the two chambers is used at the Gabčíkovo lock. Due to reconstruction works the right chamber was closed from June 2011 to March 2013. The left chamber is under reconstruction since September 2013. In October 2013 a

[30] Report of the "Network of Danube Waterway Administrations" – data & user orientation, available at http://www.newada-duo.eu/, Wien, 2014

complete closure of the fairway was necessary for a whole week. The transport sector was informed only eight days in advance, which prohibited them to take appropriate preventive measures.[31] A complete closure for several days was necessary again in the end of July 2014. After finishing the reconstruction of the left chamber and successful performance tests, the right chamber will be shut down for a complete reconstruction. Construction works are estimated to take about 18 months.

The Master Plan for IWW Transport in Serbia (2006) named the Iron Gates as critical locations. Iron Gate I have been in operation for about 40 years and Iron Gate II for about 25 years. According to the report, the present condition of the navigation locks cause breakdowns which might result in a complete stoppage of inland navigation traffic. The lock chambers on the right bank (Ðjerdap I and II) are maintained by Serbia while those on the left bank (Portile de Fier I and II) are maintained by Romania.[32] Information on further plans on reconstruction of the lock chambers was requested in a letter to the lock operator.

In addition the locks on the Danube-Black Sea Canal (namely Cernavoda and Agigea) and the Poarta Alba-Midia Navodari Canal (namely Ovidiu and Navodari) exceeded their initially indicated life-span by far. A renewal of the locks was investigated by a feasibility study.[33]

In deviation from the OMC Glossary, available figures on the navigation reliability on the Danube are expressed by the percentage of days per year, on which the fairway meets the requirements defined for a deep fairway channel[34]. The project partners of NEWADA duo[35] agreed on a Common minimum level of service regarding the depth and width of the fairway in the project partner states (all Danube riparian states excluding Germany, Moldova and Ukraine). The indicated percentage refers to this Level of Service.

The navigation reliability varies between 64% in Bulgaria and 100% in Croatia. This parameter does not account for official closures of the waterway due to extreme weather events such as high water, ice, wind or fog.

Only recently, in June 2014, industry companies represented by Pro Danube International and Pro Danube Austria requested more concrete actions from the governments of the Danube States to develop the Danube waterway into a sustainable, environmental friendly core transport axis with positive impacts on regional development[36]. The need for urgent actions in six fields was presented at the Annual Forum of the EU Strategy for the Danube Region in Wien to a wide audience and addressing Commissioner Johannes Hahn and Corridor Coordinator Karla Peijs directly.

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[31] Notice-to Skippers 139/00/2013 and 145/00/2013 available under http://nts-pilot.slovris.sk

[32] EUSDR Project Data Sheet PA1A071 - Capital repairs (rehabilitation) of Navigation Locks at HEPS Đerdap I and HEPS Đerdap II

[33] EUSDR Project Data Sheet PA1A034 - Rehabilitation of locks on the Danube-Black Sea Canal and the Poarta Alba-Midia Navodari Canal

[34] Fairway depth of 2.5 m at Low Navigable Water Level (ENR), i.e. on 94% (343 days) of the year, calculated on the basis of the discharge observed over a period of 30 years with the exception of ice periods. Fairway width (range of values accounts for different curve radii):

- *40 to 80 m in Austria*
- *60 to 100 m in Slovakia and Slovakian-Hungarian border section*
- *80 to 120 m in Hungary*
- *80 m in Croatia, Serbia, Romania and Bulgaria (including border sections) – no range for curve radii as there is usually no passing of vessels/convoys in bends on these sections*

[35] the Danube´s waterway administrations of Austria, Slovakia, Hungary, Croatia, Serbia, Bulgaria and Romania

[36] http://www.prodanubeaustria.at/fileadmin/pdf/2014-06-14_Danube_Industry_Declaration_PDI-PDA.PDF on 29.10.2014

Request for urgent actions by industry companies:

- Establish an effective waterway infrastructure management
- Execute the pre-identified TEN-T bottleneck infrastructure projects
- Develop the Danube Ports into effective centers of intermodal logistics and industrial growth
- Facilitate the modernisation of the Danube Fleet
- Abolish all unnecessary administrative barriers for waterway transportation
- Optimize financial support schemes of the European Union to stimulate investment in the sector

4.3.2.3 Fairway rehabilitation and maintenance

Waterway maintenance is an important and **continuously necessary** activity, which constitutes one of the key competencies of most waterway administrations. Maintenance measures (especiallyrealignment of the fairway, dredging works in accordance with environmental legislation) have the potential to improve the condition of infrastructure substantially and on short term.

River engineering works may help to reduce the maintenance efforts at long sight and are needed if maintenance is not sufficient to mitigate severe impacts on both, navigation and environment (e.g. collapse of banks, rapid depth erosions).

Maintenance measures are predominantly **important on free-flowing sections** of rivers, with frequent morphological changes. The Main and the Main-Danube Canal are maintained by the Generaldirektion Wasserstraßen und Schifffahrt -Außenstelle Süd. At the Danube and its navigable tributaries numerous bodies are responsible for waterway maintenance. The Network of Waterway Administrations (NEWADA and NEWADA duo) is engaged in harmonizing methodologies and therefore make the efforts more effective.

Within the EU co-financed project a report on optimised surveying and maintenance activities by participating waterway administration was drafted. A catalogue of critical locations will be amended in the Fairway Rehabilitation and Maintenance Master Plan by the Danube Region Strategy – Priority Area 1a. Those critical locations are of top priority for maintenance measures.

The following figure (Figure 22: Critical locations East of) is an extract of the Austrian catalogue of critical locations. It shows 6 fords and 5 lateral sedimentations, which have a high maintenance priority. The amount of dredged material strongly depends on the development of discharge during the year (low and high water periods). After the flooding in summer 2013 until April 2014 about 830,000 m³ gravel and sediments were dredged from the Austrian Danube.[37]

[37] *Figures including maintenance measures conducted by viadonau; excluding measures by Verbund HydroPower AG or private and public ports.*

Figure 22: Critical locations East of Wien

Source: viadonau

As the critical locations change from week to week and from year to year a typical "fairway maintenance cycle" consist of monitoring (river bed, water levels), planning (prioritisation, coordination), execution (realignment of the fairway, dredging works in accordance with environmental legislation) and information (to infrastructure users).

Maintenance measures are also necessary inside ports and on canals. The same equipment and vessels may be used at all locations.

In line with the "**fairway maintenance cycle**" a needs assessment was performed and is currently refined along with the elaboration process of the joint Fairway Rehabilitation and Maintenance Master Plan, which brings the results of NEWADA duo to the level of political decision makers.

The **Fairway Rehabilitation and Maintenance Master Plan** for the Danube and its navigable tributaries shows that equipment for fairway maintenance is lacking in several countries. Need areas which particularly demand attention are the equipment for the execution of dredging works to assure minimum fairway parameters (depth / width) as well as equipment to mark the fairway and survey the riverbed regularly. Up-to-date sounding and dredging equipment, automatic gauging stations, marking vessels and marking signs are needed in several countries. In order to conduct monitoring works efficiently along the Rhine-Danube Corridor a common reference system and a network of strategically well placed gauging stations in combination with regular riverbed surveys at least complying with the minimum level of service would be needed. Information should be collected in a joint database, analysed and passed on to skippers. The Master Plan was designed to provide a basis for coordinated actions on a transnational level. Waterway management authorities calculated investment costs of 85 million EUR in order to bridge the gap between the current status quo in fairway maintenance and the agreed common minimum levels of service. In terms of regional distribution, the majority of investments will be needed on the Lower Danube (particularly Romania and Bulgaria). On 3rd December 2014 the Ministers of Austria, Bulgaria, Croatia, Germany, Moldova, Romania, Slovakia, Ukraine and Bosnia and Herzegovina signed the Conclusions on the Fairway and Rehabilitation Maintenance Master Plan. Serbia indicated it will join its signature to the conclusions at a later stage. Hungary did not yet sign the Conclusions but expressed a message of support and left open the perspective of joining the conclusions later. It also finds broad support by the operators of Danube waterway transport services.[38]

Waterway Maintenance activities on the Danube are based upon the **Belgrade Convention** which stipulates that "the Danube riparian States undertake to maintain their sections of the Danube in a navigable condition for river-going and, on the

[38] *Inforegio-Newsroom: Joint-statement by Violeta Bulc, Commissioner for Mobility and Transport and Corina Crețu, Commissioner for Regional Policy on the Danube Ministerial Meeting on 3 December. 04/12/2014 (http://ec.europa.eu/regional_policy/newsroom/detail.cfm?LAN=en&id=1823&lang=en)*

appropriate sections, for sea-going vessels, to carry out the works necessary for the maintenance and improvement, of navigation conditions and not to obstruct or hinder navigation on the navigable channels of the Danube" (Art. 3). In addition the TEN-T regulation demands for a good navigation status of rivers, canals and lakes, while respecting the applicable environmental law. In 2012/2013 nine out of 11 Danube riparian states agreed on a declaration which reasserts existing obligations to maintain the fairway to a good standard and undertakes measures to tackle problems like low water or ice (Luxembourg Declaration). Neither Hungary nor the Ukraine signed the declaration; these countries are consequently not bound to its implementation.

However Waterway Maintenance mainly consists and **depends on national efforts**. Neither maintenance equipment nor maintenance itself was eligible for EU-funding during the last funding periods. During the 2nd Corridor Forum in June 2014, the European Commission clarified that "*operational and maintenance costs are not eligible under the Cohesion funds. However complex vessels can be discussed in the negotiation of the Operational Programmes for 2014-2020. A coordinated approach for the Rhine-Danube Corridor may be discussed*".

Only recently (May 2014) technical assistance for the preparation of a project to modernise and optimise the rehabilitation activities on the common Bulgarian-Romanian section of the Danube River was granted by the Technical Assistance Facility of the EUSDR.

During the NAIADES II Implementation Meeting on 11.4.2014 in Brussels, the European Commission announced that it intends to conclude an administrative agreement with the Danube Commission in order to define its role regarding waterway maintenance and therefore supporting the implementation of the Declaration on effective waterway maintenance (Luxembourg, June 2012)

In winter also **ice fighting measures** have to be taken in order keep inland waterway transport operable, to protect locks and to prevent ice jams or floods. The responsible organisations have to be equipped to take adequate measures and to keep hindrances to inland waterway transport as short as possible.

In 2012 ice events at Iron Gate lead to a complete blockage of navigation for almost four weeks. Proper measures could have shortened this interruption significantly. Enquiries by industry representatives revealed unclear responsibilities in ice-prevention and ice-fighting as well as violations of the convention signed between the state of Serbia and Romania in 1998 as regards to the equipment with ice breakers.[39]

In June 2014 in Ruse, the Transport Minister of Bulgaria, Mr Papazov, the Transport Secretary of State of Romania, Mr Matache, on behalf of Minister Sova and the Rhine-Danube TEN-T European Coordinator, Mrs Peijs, signed the joint Statement for ensuring the conditions for navigation on the Romanian-Bulgarian common sector of the Danube river.

According to this Joint Statement they committed to take immediate action in case of emergency situation and to prepare for a medium and long term plan for the maintenance and improvement of the fairway.

4.3.2.4 Studies and works related to infrastructure investments

According to the TEN-T Guidelines Waterway Infrastructure includes the fairway itself as well as locks and bridges. The execution of related projects is important for assuring the availability of the transport infrastructure throughout the year. Recent project examples related to bridges and locks are the lifting of the rail bridge at

[39] *http://www.prodanube.eu/*

Deggendorf, the ongoing modernization of the Bratislava Old Bridge or the renewal of the Kachlet lock.

As the riverbed in free-flowing sections is subject to constant changes, projects aiming to stabilize the conditions and therefore ensuring the required fairway conditions are extremely complex and therefore projects of long durations. Major decisions cannot be based on freight transport developments only, but need to take **other functions of the waterway and spin-offs**[40] of waterway transport to industrial and economic development of the waterway into account as well. Other functions for example are:

- Tourism and recreation
- Ecology, landscape and wildlife
- Hydroelectricity
- Floof Protection
- Living

Spin-offs could be:

- Development of ports, industrial sites
- Locational advantages for existing companies
- Impulses to regional development

Projects should be approached from a holistic point of view, in particular feasibility studies, cost benefit analysis and impact assessments shall take the various interests into account. About 40% of the rivers in the Rhine-Danube Corridor are located alongside Natura 2000 sites[41]. Following the **integrated approach** promoted by the Commission´s Guidance Document "Inland waterway transport and Natura 2000 – sustainable inland waterway development and management in the context of the EU Birds and Habitats Directives" as well as the "Joint Statement on Guiding Principles for the Development of Inland Navigation and Environmental Protection in the Danube River Basin" is key to the successful execution of integration river engineering projects. The EU 2020 Biodiversity Strategy and related instruments such as the 7th Environmental Action Plan are important inputs during the execution of the integrated approach.

The consideration of the requirements from all different sectors (inland navigation, environmental protection with special emphasis on biodiversity, flood protection etc.) right from the start is of crucial importance, but also requires additional time in the planning and execution.

Shallow water resistance[42]

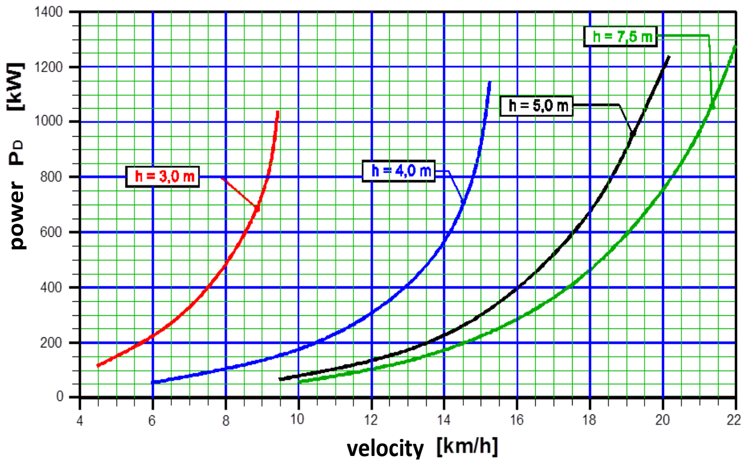
For inland vessels shallow water hydrodynamic is important. The figure below shows the differences in fuel consumption for different water depths for a typical European self-propelled vessel (110 m long, draught 2.50m, 1,800 t carrying capacity), power 1000 KW, all other circumstances being equal.

[40] *See PLATINA II Information Package on the Corridor objectives and prioritising projects in IWT and inland ports, Volume 2*

[41] *Inland waterway transport and Natura 2000 – sustainable inland waterway development and management in the context of the EU Birds and Habitats Directives, European Commission, 2012*

[42] *Platina Report Report - Technical support for an impact assessment on greening the inland fleet, 31.01.2013*

Figure 23: Water depth in relation to fuel consumption



The table below shows how the water depth affects the ship's speed and emissions. If the water depth rises from e.g. 3 to 4 m, emissions will drop to 62%; a further rise of water depth to 5 m will bring about a drop of 50%

Table 14: Water depth in relation to speed and emissions

Water depth [m]	Speed through water [km/h]	Specific fuel consumption at 0.22 kg/kWh [g/tkm]	Specific CO2-emission [g/tkm]	Index [%]
3.0	9.4	13.0	41.0	100
4.0	15.2	8.0	25.3	62
5.0	19.3	6.3	19.9	49
7.5	21.1	5.8	18.2	44

Furthermore, if an increased draught is added to higher water depths, fuel consumption and emissions will further decrease. The operation performance remains unchanged at 1000kW.

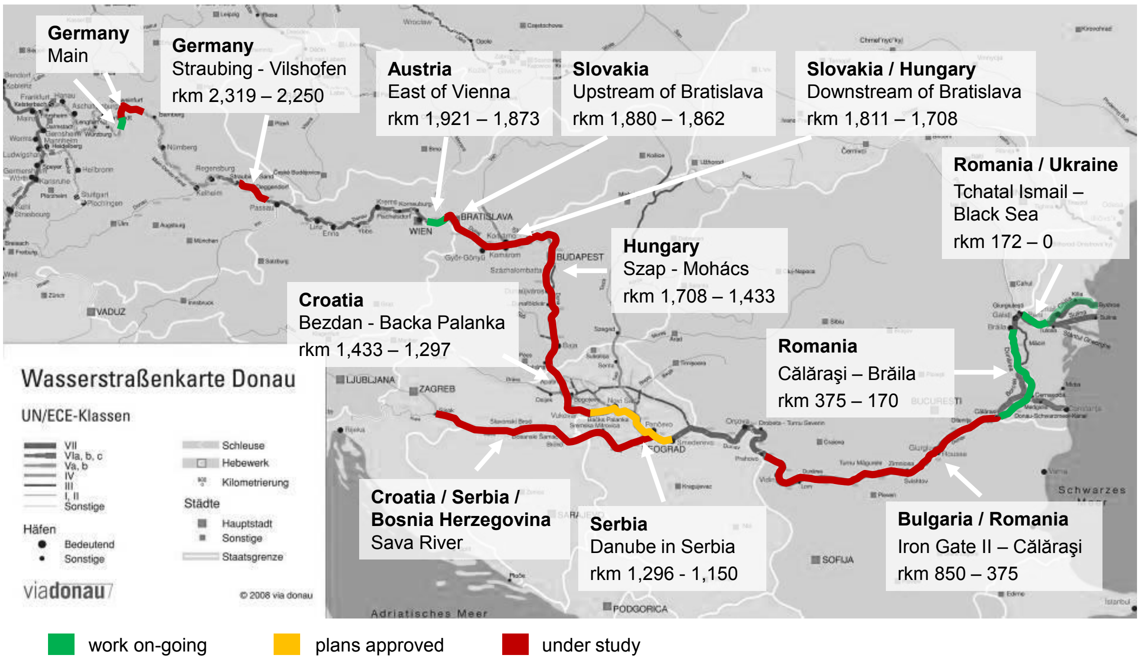
Table 15: Draught in relation to fuel consumption and emissions

Waterdepth [m]	draught [m]	Load [t]	Speed through water [km/h]	Specific fuel consumption at be=0.22 kg/kWh [g/tkm]	Specific CO2-emission [g/tkm]	Index [%]
3.0	2.5	1800	9.2	13.0	41.0	100
4.0	3.0	2400	13.1	7.0	22.0	54
5.0	3.5 (max.)	3000	14.3	5.1	16.2	40
7.5	3.5 (max.)	3000	17.4	4.2	13.2	32

If the water depth rises from e.g. 3 to 4 m, emissions will drop to 54%; a further rise to 5m brings about a drop to 40%, at 7.5m even 32% turn out.

Infrastructure upgrading in terms of increased water depths often determine the maximum draught and hence the maximum deadweight of the whole (national or even international) trip. These infrastructural circumstances therefore influence emissions along the complete transport route. Accordingly, the measure might be considered as reasonable especially on the condition that there is an adequate transport volume on the waterway.

Figure 24: Overview of infrastructure projects related to IWW fairways



Source: viadonau based on review of studies

Development of the Main[43] *(Germany)*

The upgrade of the Main to class Vb increases the fairway depth from 2.5m to 2.9m as well as the fairway width from 36m to 40m. Planning, Approval and Construction phases are conducted subsequently for different sections. The upgrade is on-going, currently the section between Dettelbach and Gerlachshausen is under construction, between Wipfeld and Ottendorf official approval of the plans is pending and between Ottendorf and Limbach detailed technical designs are being elaborated. It is planned to complete the upgrade in 2016. The realization of Works at the Lower Main (from Seligenstadt to Mainz) is planned between 2016 and 2019.

Straubing-Vilshofen[44] *(Germany, rkm 2,319 – 2,250)*

In March 2013 the "Variant-independent investigation on the development of Danube waterway between Straubing and Vilshofen", co-financed by TEN-T, has been completed. In a first step urgent flood prevention measures and selected activities part of Variant A will be realized in the section between Straubing and Deggendorf. The project proposal for the elaboration of technical designs and public participation as part of the approval process for this section was recommended under the 2013 TEN-T Multi-Annual Call. Variant A consists of an optimized current state through adding new

[43] Wasserstraßen-Neubauamt Aschaffenburg (www.wna-aschaffenburg.wsv.de)
[44] Project fiche 2007-DE-18050-S, Part of Priority Project 18; Variantenunabhängige Untersuchungen zum Ausbau der Donau zwischen Straubing und Vilshofen (www.donauausbau.wsv.de)

and renewing existing regulation structures (groyns and longitudinal structures). The overall project will be evaluated by the Bundesverkehrswegeplan 2015.[45]

East of Wien [46] (Austria, rkm 1,921 – 1,873)

The present implementation step of the "Integrated River Engineering Project East of Wien" started in 2007 and is expected to be finished in December 2015. An important part is the pilot project Bad Deutsch-Altenburg which tests river-engineering measures aimed at a sustainable protection of both the National Park and inland navigation. The construction of this pilot project is expected to be completed in 2014, in 2015 the post-monitoring of the pilot project, the start of the construction of the priority measures as well as the planning of the subsequent implementation steps is planned. The results of the pilot will be taken up by the next steps of implementation measures in the frame of the "Integrated River Engineering Project East of Vienna".

Complex solution upstream of Bratislava[47] (Austria and Slovakia, rkm 1,880 – 1,862)

The objective of this project in definition phase is to assure required fairway parameters on the 8km Austrian-Slovakian border stretch starting at the confluence of Danube and Morava rivers (rkm 1,880.26) and the 11km Slovakian stretch until Bratislava (rkm 1,862.00). The project is being discussed in the Slovak–Austrian Commission on Transboundary Waters and depends on the agreement of the national authorities. According to information from the Slovak Ministry of Transport, the pre-project and project preparation may be financed by the Cohesion Fund, depending on the agreement of the European Commission with the results of the feasibility study.

Slovakian-Hungarian border stretch[48] (Slovakia and Hungary, rkm 1,811 – 1,708)

The Slovakian-Hungarian border stretch from rkm 1,811.00 to rkm 1,708.20 is in the need of ensuring the required fairway parameters.

Szap to Mohács port / Batina[49] (Hungary, rkm 1,708 – 1,433)

EU-co-funded feasibility studies and several variants for technical design are available since November 2011. The project is on stand-by, as the National Environmental Authority did not approve the study conclusions.

Bezdan to Backa Palanka (Croatia and Serbia, rkm 1,433 - 1,297)

The project "upstream of Apatin"[50]_was limited to the Croatian Danube rkm 1,433 to rkm 1,382. A new cross-border initiative between Serbia and Croatia deals with critical sectors between Bezdan and Backa Palanka by means of river training an dredging works.

Danube in Serbia[51] (Serbia, rkm 1,296 – 1,150)

The current project is focused on the stretch of the Danube River between Bačka Palanka and Belgrade (rkm 1,295.5 to rkm 1,150). The joint stretch with Croatia is not targeted. The activities focus on Technical designs for six selected critical locations - focused on the stretch between Bačka Palanka and Belgrade. - are ready. The

[45] Feedback after the 1st Corridor Forum by Georg Henkelmann (Bundesministerium für Verkehr und digitale Infrastruktur) on 29 April 2014
[46] Project fiche 2007-AT-18020-P, Part of Priority Project 18; EUSDR Project Data Sheet PA1A031 - Integrated River Engineering Project on the Danube East of Vienna
[47] EUSDR Project Data Sheet PA1A075 - Complex solution for Danube stretch upstream of Bratislava
[48] EUSDR Project Data Sheet PA1A076 - Complex solution for Danube stretch downstream of Bratislava
[49] Karla Peijs: Annual Activity Report 2012-2013 for Priority Project 18 & 30
[50] EUSDR Project Data Sheet PA1A038 - Rehabilitation of the riverbed and the right bank of the Danube river from km 1382 to km 1433
[51] EUSDR Project Data Sheet PA1A021 - Preparation of Necessary Documentation for River Training and Dredging Works on selected locations along the Danube River in Serbia; Input by Ivan Mitrovic (Plovput) at the 5th Follow – up Joint Statement Meeting in Zagreb on 4 - 5th February 2014

dredging permit for all sectors was acquired in June 2013. The approval of the Environmental Impact Assessment for the beginning of works was approved in February 2014, the Feasibility Study and Conceptual designs were approved by the State Revision Commission in March 2014. Main designs for 3 sectors with structures are being prepared at the moment and will be finalized in June 2014. Tendering of works will start in September 2014, so works and environmental monitoring will start in 2015.

Portil de fier II – Călăraşi[52] (Romania and Bulgaria, rkm 846 – 375)

Around 21 critical locations were defined for the Romanian-Bulgarian border section (rkm 845.50 – 375.00). It would be necessary to conduct various river engineering works in order to ensure minimum navigation depths throughout the year. In 2011 a number of vessels were blocked due to the low waters levels. Currently an Action Plan for common projects and activities was presented by the "Inter-ministerial Committee for Sustainable Development of Inland Waterways Transport on the Romanian – Bulgarian common sector of the Danube". A new study will be tendered in autumn 2014 in parallel to the one for the Călăraşi-Brăila section in order to generate scientific evidence.

Călăraşi-Brăila[53] (Romania, rkm 375 – 170)

Ten critical locations for navigation have been identified, where minimum depths are reduced to 1.40m during dry season. As a consequence, vessels are forced take a bypass route via the Bala–Borcea branch, which extends the navigation distance to around 110 km, for about 140 – 160 days per year. A feasibility study for the project was completed in 2006. In April 2009 the contract for the execution of the works at three out of the ten critical locations was signed, namely for Bala Branch, Epurasu Island and Caleia Branch. The project was delayed several times for various reasons; in August 2011 the contractor had been notified to resume the works.

At the moment the Călăraşi-Brăila project is delayed for a proposal of a new design. The project is restructured in order to achieve the improvement of navigation conditions and also to ensure the sturgeon migration. A new study will be tendered in autumn 2014, which will generate additional scientific evidence as a basis for decision-making.

Ukrainian-Romanian border stretch[54] (Romania and Ukraine, rkm 172 – 0)

The Kilia and Bystroe arms have been included in the analysis. Dredging works should ensure the required fairway conditions at the Kilia and Bystroe arms of the Danube. The ESPOO procedure between Romania and Ukraine is on-going. There is maritime transport currently possible, but target fairway depth according to Danube Commission Recommendations is not yet reached.

Rehabilitation and Development of the Sava River Waterway[55]
(Croatia, Bosnia and Herzegovina and Serbia)

The short term Action Plan from October 2008 described dredging and training works, river bend improvements and marking system enhancements starting in 2009 until

[52] *EUSDR Project Data Sheet PA1A027 - Improving navigation conditions on the Romanian–Bulgarian common section of the Danube (rkm 845.5–375); Input by Christina Cuc (Ministry of Transport of Romania) at the 5th Follow – up Joint Statement Meeting in Zagreb on 4 - 5th February 2014*
[53] *EUSDR Project Data Sheet PA1A026 - Improving navigation conditions on the Danube between Călăraşi and Brăila (rkm 375–175); Input by Catalina Dumbrava (River Administration of the Lower Danube) at the 5th Follow – up Joint Statement Meeting in Zagreb on 4 - 5th February 2014*
[54] *EUSDR Project Data Sheet PA1A105 - Construction of the Deep-Water Fairway Danube – Black Sea in the Ukrainian Part of the Danube Delta*
[55] *Feasibility Study and Project Documentation for the Rehabilitation and Development of Transport and Navigation on the Sava River Waterway; EUSDR Project Data Sheet PA1A040 - Reconstruction and Improvement of the Sava River in Croatia*

2018. In January 2014 the preliminary design and the feasibility study have been completed. Environmental Impact Assessment was partly completed and the detailed design was still ongoing. The project is split into two parts, one from Sisak to Brčko and one from Brčko to Belgrade. The one between Sisak and Brčko has been suspended for some time. The one from Brčko to Belgrade has been cancelled.

Danube-Bucuresti Canal[56] (Romania)

The canal will connect Bucuresti with the Danube by using the lower courses of the Argeş and Dâmboviţa rivers. Summing up to a length of 104 km, the Argeş river accounts for 73 km while the Dâmboviţa river is 31km long. The new waterway will feature two ports in București (Decembrie and Glina) as well as the Olteniţa Port at the junction of the Argeş and the Danube. Around 60% of the works were completed, when the project was stopped in 1991. In 2009 a feasibility study was elaborated, the technical-economical documentation was approved in 2012. Approval by a governmental decision is pending. The project is scheduled to start after 2020.

4.3.2.5 River Information Services (RIS)

River Information Services are regulated through Directive 2005/44/EC[57], this Directive establishes a framework for the deployment and use of harmonised river information services (RIS) in the Community in order to support inland waterway transport with a view to enhancing safety, efficiency and environmental friendliness and to facilitating interfaces with other transport modes. The concept of River Information Services (RIS) stands for the most substantial change in the sector for the last decades and aims at the harmonised implementation of information services in order to support traffic and transport management in inland navigation, including interfaces to other transport modes. The implementation of RIS will not only improve safety and efficiency in inland waterway traffic but enhance the efficiency of transport operations in general.

The Directive 2005/44/EC applies to 13 EU Member States. Serbia, Bosnia and Herzegovina and the Ukraine are not formally concerned; however they are undertaking significant steps in RIS deployment. Since the 1980s, much has been achieved by the administrations and the private sector.

Deployment of River Information Services in the Rhine-Danube Corridor

The deployment of River Information Services started with EU co-financed research projects (INDRIS, COMPRIS) in 1999 and was facilitated by several national projects, of which several were EU co-financed[58]. In the programming period 2007-2013, projects have been focusing on the deployment of enabling infrastructure and on the provision of River Information Services. For the Rhine-Danube Corridor, the following EU co-financed projects at several programs (TEN-T, Structural and Cohesion Funds, Instrument for Pre-Accession, etc.) are relevant[59]:

- Implementation of River Information Services in Europe - IRIS Europe II and IRIS Europe 3 (01/2009-12/2014)
- Full deployment of Inland AIS transponders (06/2008-12/2012)
- RIS enabled Corridor Management (01/2013-12/2015)

[56] EUSDR Project Data Sheet PA1A002 - Systematization of Argeş and Dâmboviţa Rivers for navigation and other uses – "Danube–Bucharest Canal"
57 Directive 2005/44/EC of the European Parliament and of the Council of 7 September 2005 on harmonised river information services (RIS) on inland waterways in the Community, OJ L 255 p.152, 30.09.2005
[58] River Information Services Policy Brochure, Transport Research Knowledge Centre, 2010
[59] Information based up the draft report on the Evaluation of RIS Implementation for the period 2006-2011, Main Report, Intermediate results as of 1.2.2014, prepared by a DG MOVE financed study executed by Panteia

- Implementation of River Information Services in Bulgaria (Phase 1 completed 01/2014, Phase 2 until 05/2015, Phase 3 until 2020)
- Vessel traffic management and information system on the Danube, the Danube Black sea canals and Poarta Alba-Midia Navodari in Romania (until 12/2013)
- Full implementation Service of RIS on the Sava waterway (until 12/2014)
- Implementation of River Information Services in Serbia (until 12/2012)

RIS Services are available along the whole Corridor but to a differing extent and quality, interoperability is not always assured. Additional steps are needed to make services more efficient and to make them available for the entire inland waterway network. RIS applications in the Rhine-Danube corridor still focus very much on the safety of inland navigation while automatic information exchange with terminal operators, freight brokers and shippers is used primarily in pilot operations.

Available services at the Rhine-Danube Corridor

- Electronic Navigational Charts are provided for the entire Rhine-Danube Corridor, however in varying quality and up-to-dateness.
- Authorities in all EU Member States in the corridor provide Notices to Skippers, also in varying quality and up-to-dateness.
- With the completion of the German Inland AIS infrastructure in the end of 2014, such infrastructures will support traffic management in the entire corridor.
- At dangerous spots in Romania there are VTS/RIS centres to improve the safety, increase the efficiency and the safeguard the environment.

Equipment of vessels and use of services

- A majority of the vessels is equipped with Inland AIS transponders. Authorities from six countries in the corridor have conduced equipment programmes for Inland AIS transponders.
- Information provided at the Inland ECDIS Expert Group leads to the conclusion that approximately 50% of the vessels are using Electronic Navigational Charts often in combination with the Notices to Skippers.
- The use of Electronic Reporting is in the starting phase in this corridor.

Within the EU-financed study "Evaluation of RIS Implementation for the period 2006-2011", Panteia surveyed the national authorities on the status of River Information Services in the end of 2011 and identified the technical availability of the key RIS technologies in the Rhine-Danube corridor, which is listed below.

Table 16: Technical availability of the key RIS technologies in the Rhine-Danube corridor [60]

		Germany	*Austria*	*Slovakia*	*Hungary*	*Croatia*	*Serbia*	*Romania*	*Bulgaria*
Notices to Skippers	Fairway & Traffic Messages (FTM)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Water Related Messages (WRM)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

[60] *Source: "Evaluation of RIS Implementation for the period 2006-2011, Main Report", Panteia; July 2014*

		Germany	Austria	Slovakia	Hungary	Croatia	Serbia	Romania	Bulgaria
	Ice Message (ICEM)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Weather Related Messages (WERM)	No	No	Yes	No	Yes	Yes	No	Yes
	Method of diffusion	Online portal or e-mail subscription	Online portal or e-mail subscription	Online portal or e-mail subscription	Online portal or e-mail subscription	Online portal or e-mail subscription	Online portal or e-mail subscription	Online portal	Online portal or e-mail subscription
Automatic Identification System (AIS)	AIS infrastructure	Only ship-ship communication available;	Yes, obliged	Yes	Yes, obliged	Base stations are available	Yes, 15 base stations are available	Yes, 4 AIS base stations are available	Yes, 8AIS base stations are available
	On-board equipment	Yes,> 90 % of the fleet meaning more than 1450 ships	Yes, 100 % coverage meaning 21 ships	Yes, > 70 % as 45 mobile and 15 portable AIS transponders were installed	Yes, 100 % coverage meaning 106 ships	Only governmental vessels [61]	More than 100 ships equipped	Yes, 100 % meaning 262 ships	Yes, 49 ships equipped
	Exchange	No	Possible	Possible	Possible	Possible	Possible	No	No
Electronic Reporting	ERINOT, ERIRSP	Yes	Yes	Yes (pilot)	Yes	Yes	Yes	No	No
	BERMAN and PAXLISTS	No	No	No	Yes	No	Yes	No	No
	Exchange	No	Yes	Yes (pilot)	Yes	Yes	Yes	No	No
Electronic Navigationa	Coverage (regarding the Danube)	100%	100%	100%	100%	100%	100%	100%	100%

[61]*There was equipment programme few years ago where Ministry trough low budget support equipped all domestic vessels which navigate on international waters of Danube river. In 2013. it was planned to equip the rest of private fleet, but according Croatian legislation the private companies could not get financial support if they have not settled all they debts to the state. Other vessels will be equipped trough national low budget support in next period/years. Croatian shipping companies will be covered fully considering of AIS equipment*

		Germany	Austria	Slovakia	Hungary	Croatia	Serbia	Romania	Bulgaria
	Provision free of charge	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Technical availability of the key RIS technologies in the Rhine-Danube corridor[62]

Better prediction of available water depth[63]

If reliable prognoses of river fairway depths are available, higher amounts of cargo can be transported because larger ships can be used and/or draught can be expanded. On the river Rhine, such a forecast system is already operating satisfactorily and a reduction of 5% fuel consumption and emissions is expected on the basis of such prognoses. On the Danube though, the suitability of the systems for defining the possible draught is limited because the systems have large tolerances and wide variations. A reliable forecast model could there result in significant energy savings – about 20 to 30%.

[62] Source: "Evaluation of RIS Implementation for the period 2006-2011, Main Report", Panteia; July 2014
[63] Platina Report Report - Technical support for an impact assessment on greening the inland fleet, 31.01.2013

4.3.2.6 Administrative Barriers

Administrative processes and paperwork are sometimes seen as a significant competitive disadvantage for inland waterway transport on the Rhine-Danube Corridor. A thorough analysis of administrative barriers encountered in European inland waterway transportation was carried out in the framework of a screening study (Study on Administrative and Regulatory Barriers in the field of Inland Waterway Transport, NEA et al., 2008) and the PLATINA project (Annual monitoring report, 2010). This analysis resulted in a priority list of administrative barriers. These were for instance focused on financing problems, social security, insurance problems, long duration of ship inspections and the existing international ADNR regulations.

More recently, within the framework of the EU Strategy for the Danube Region, a new working group on administrative processes was started by Priority Area 1a (on Inland Waterways) in cooperation with PA11 (Security). The background for this initiative is provided by 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. Especially on the external EU-borders (e.g. Mohács / Bezdan), administrative procedures for freight transport on water were found to take long and consequently cause additional costs for operators. 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, border police and navigation surveillance.

Ascertainment and coordination within the EUDRS Working Group is on-going. First results are expected for spring 2015.

4.3.2.7 Sustainable freight transport, new technologies and innovation

Article 32 and 33 oblige Member States to support sustainable freight transport services, new technologies and innovation. They provide the legal basis for initiatives regarding fleet modernisation, new technological solutions, steaming, etc.

The recently published study on the "Innovative Danube Vessel" gives recommendations for the modernisation of the fleet, considering requirements of the transport market in the Danube region, specific fairway and navigation conditions of the Danube River, the state of the art in inland vessel technology as well as innovative technical solutions derived from published research projects.

The study proposes implementation steps to set-up and executes a project to design, construct and test the operation of proposed vessel solutions.

Within the LNG Masterplan project pilot deployments will be carried out, covering parts of the entire LNG supply chain (LNG terminals and bunkering stations, LNG propelled vessels and LNG inland carriers, LNG/CNG fuelling stations for trucks).

Funding programmes for fleet modernisation exist in Germany as well as in Austria and are under preparation in other countries on the Rhine-Danube Corridor. Information on different funding schemes is published in the European funding database[64]. In line with the NAIADES II Communication, it is recommended that all countries of the Rhine-Danube Corridor set up appropriate co-financing schemes for facilitating innovation, Cohesion Countries may even benefit from co-financing from ESIF.

[64] *www.naiades.info/funding*

4.3.3 Characteristics Ports

Characteristics of ports along the Corridor are recorded mainly on the basis of technical parameters, study reviews and a questionnaire based survey of all core ports on the Corridor (excluding the Rhine ports which are tackled in the study related to the Rhine-Alpine Core Corridor), conducted by the consultant. The characteristics of ports are described by the existing or foreseen bottlenecks, missing links and improvement measures in ports along the Rhine-Danube Corridor as well as by already started or planned measures to tackle these bottlenecks, if any. Measures included in the report were selected due to their importance for future development projects on the Corridor.

Figure 25: Overview on ports

Source: iC consulenten, based on EC Regulation 1315/2013

4.3.3.1 Compliance of the corridor ports

Compliance of the Corridor ports with the standards or regulations is analysed in continuation, parameter by parameter.

<u>Parameter 1 - Maritime chamber lock (dimensions)</u>

This parameter specifies the dimensions of chambers of ship lock which allows vessels to enter a port from the seaside. Since only two EU ports on the Corridor are capable of handling sea-going vessels on a regular basis (Constantza and Galati) and the rest of the port are pure inland ports, hence this parameter was not applicable for any of the ports on the Corridor as not even the two seaports (Constantza and Galati) have maritime chambers.

<u>Parameter 2 – Maximum draught (natural or dredged)</u>

This parameter refers to the maximum draft of a vessel that can enter a port. This parameter is more relevant for sea ports as the minimum draught in inland ports is conditioned by the UNECE/CEMT class of inland waterway on which a port is located. Nevertheless, the Consortium gathered the data for this parameter for most of the ports where information was available. Data analysis of all 19 core ports (excluding the Rhine ports which are tackled in the study related to the Rhine-Alpine corridor) demonstrated that most of the ports comply with the standards defined in the Regulation 1315/2013 in terms of minimum draft, while the port of Cernavoda (RO) with the minimum draft of just 1.5 meters and determined terminals in the port of Vidin (BG) with the minimum draft of 2.4 m (terminal "Vidin Nort" has a *maximum* depth of 2.5 m) will need additional attention in the future planning. Nevertheless, the minimum draft in ports is of no relevance if the same minimum draft, according to the UNECE/CEMT standards, is not available in the waterway where the port is located.

Parameter 3 – Passenger traffic flow (pax per year)

This parameter refers to the number of passengers embarked and disembarked at a given port in a year for which the data is collected. It must be noted that EUROSTAT does not offer any statistical records for passengers in inland ports.

EC regulations do not provide any requirements in terms of passenger flows in inland ports, whereas for maritime ports a condition exists in the EC Regulation 1315/2013, Article 20(2a), where it says that a maritime port shall meet the following criteria (if it does not meet the others in the same Article): the total annual passenger traffic volume exceeds 0.1% of the total annual passenger traffic volume of all maritime ports of the Union. The reference amount for this total volume is the latest available three-year average, based on the statistics published by Eurostat.

Relevant analysis for passenger flows is given in Table 17

Table 17: Compliance of maritime ports with criteria pursuant to EC Reg. 1315/2013, Article 20(2a)

Year	2010	2011	2012	Average	0,1% of average	Constantza 2013	Compliance Y/N
Passenger volume EU-28 (*1000)	424.588	421.373	398.110	414.690	414	54	N

Source: iC consulenten, based on EUROSTAT and study data

However, although the seaport of Constantza does not meet the criteria stipulated in EC Reg. 1315/2013, Article 20(2a), it does meet the criteria in terms of cargo volume, analyzed in Parameter 4.

Parameter 4 – Freight traffic flow (tons per year)

This straightforward parameter refers to the volume of cargoes (loaded/unloaded/transhipped) at a given port in year for which the data is collected. Like in case of passenger traffic flows EUROSTAT does not offer any statistical records for cargo volumes in inland ports, except for the seaport of Constantza. However, the source of data for the seaport of Constantza was the port authority itself, having the most accurate data which is, anyway, transmitted to EUROSTAT.

The threshold of minimum 500.000 tons of annual freight transhipment (Art. 14(2) of 1315/2013) is reached in 10 core ports (excluding Rhine ports), while 9 core ports registered their freight transhipment volumes below the given threshold. Ports (of those with available data) with cargo flows below the threshold pursuant to Article 14(2) of EC Regulation 1315/2013 are: Nürnberg (DE), Komárno (SK), Komárom (HU), Calafat (RO), Drobeta Turnu Severin (RO), Giurgiu (RO), Cernavoda (RO), Slavonski Brod (HR) and Vukovar (HR). However, as the statistical data were not available at EUROSTAT and as such data had to be obtained directly from the ports only for the last available year of statistical records, meaning that no three-year average could be assessed, this incompliance with the regulated threshold should be taken with certain reserve.

In case of seaports, Article 20(2b) of EC Regulation 1315/2013 foresees, among others, the following condition: "The total annual cargo volume – either for bulk or non-bulk cargo handling – exceeds 0.1% of the corresponding total annual cargo volume handled in all maritime ports of the Union. The reference amount for this total volume is the latest available three-year average, based on statistics published by EUROSTAT". In this view, the latest available average for all maritime ports of the Union (2010-2012) amounts to 3,724,186.000 tons, thus making the 0.1% reference an amount of 3,724.186 tons. Total cargo volume handled in 2013 in the seaport of Constantza was 55,138.057 tons, thus exceeding the threshold by far (Table 18)

Table 18: Compliance of maritime ports with criteria pursuant to EC Reg. 1315/2013, Article 20(2b)

Year	2010	2011	2012	Average	0,1% of average	Constantza 2013	Compliance Y/N
Cargo volume EU-28 (*1000 t)	3,699.940	3,770.121	3,732.497	3,724.186	3.724	55.138	Y

Source: iC consulenten, based on EUROSTAT and study data

In the specific case of the Port of Galati, which is a IWW/Maritime port located on the Danube, deeper inland, if the threshold for inland port is applied then this port complies with the conditions of Article 14(2) of EC Regulation 1315/2013 as it handled 3.511.317 tons in 2013. However, if the "maritime ports condition", provisioned in Article 20(2b) of EC Regulation 1315/2013 is applied, then the threshold is not met.

For those ports that do not comply with the aforementioned threshold it is not known if the cause for non-compliance was of market nature or due to capacity or operational deficiencies, with the exception of the port of Galati in which the cause for non-compliance was of market nature, as reported by the port administration.

<u>Parameter 5 – Connection with rail and Parameter 6 – Rail connection (number of tracks)</u>

The first parameter in this group refers to the existing or non-existing railway connection connecting a port with its hinterland and the second parameter refers to the number of tracks connecting a port with the railway network in its hinterland, in both directions. In Consortium's opinion, these two parameters are complementary and could easily be merged together.

All of the 19 analysed ports have rail connection to the hinterland, with the different number of rail tracks. However, the Hungarian port of Komárom has a railway connection which is heavily deteriorated and is rarely used due to its condition. In this particular port the railway tracks do not reach the quay line so direct ship-to-rail (and vice-versa) transshipment is not possible. The port of Cernavoda (RO) has reported no railway tracks along the quay line. Port of Galati has an interesting and peculiar situation as it provides the interoperability between two rail networks (European 1435 mm and former CSI rail system 1524 mm) at the east EU border. However, the port of Galati reported low quality of railway connections to the rail section of the Rhine-Danube Corridor.

<u>Parameter 7 – Transhipment facilities for intermodal transport</u>

This parameter is aimed to reveal the possession and operation of transhipment facilities for intermodal transport, that is, Ro-Ro ramps, rail ramps, container handling equipment (RTGs, straddle carriers, reach stackers, etc.) or trailer handling equipment (low bed semi-trailers, hauling tractors, etc.) and direct ship-to-railway (and vice-versa) transshipment in a port.

Ports of Slavonski Brod (HR), Komarom (HU), Galati (RO), Calafat (RO), Drobeta Turnu Severin (RO) and Cernavoda (RO) are the core ports that do not have the transhipment facilities for intermodal transport, while Galati (RO) has limited and ineffective intermodal facilities but this port has reported a planned project modernization of the existing infrastructure to solve the reported bottleneck. However, the port of Slavonski Brod (HR) has planned a project on construction of multimodal platform (Ro-La terminal and container terminal, as reported by the Port Authority of Slavonski Brod) for which a building permit exists.

Parameter 8 – Road connection (number of lanes)

This parameter refers to the number of road lanes connecting a port with the road network in its hinterland, in both directions.

All ports with available data have road connections with different number of lanes and of unknown quality at this stage. In a port survey of all ports on the corridor, conducted by the consultant, most of the ports reported high quality road connection with the hinterland except the Romanian core ports of Galati and Calafat which clearly reported low quality of the road connections to their hinterland. In addition, the distance to the nearest highway from the port of Calafat is 206 km and from the port of Galati is 126 km. Remaining ports reported the existence of high quality road infrastructure but the distance to the nearest highway varies from, for example, only 1 km in case of the ports Nürnberg (DE) or Enns (AT), to 50 km in case of the port of Vukovar (HR) or even 233 km in the case of port of Drobeta Turnu Severin (RO).

Parameter 9 – Waterway connection (CEMT class)

This parameter describes the existence of waterway connection of a given port and its class according to UNECE/CEMT classification of waterways. The class of a waterway is defined in the "European Agreement on Main Inland Waterways of International Importance (AGN)" by the UNECE (1996) and the resolution No. 92/2 on new classification of inland waterways by CEMT (1992). CEMT classes range from I to VII, waterways with a class IV or higher are considered as waterways of international importance (E waterways).

Analysis of the various waterway sections where ports are located is given in the chapters of this Progress Report referring to inland waterways.

Parameter 10 – Type of port

This parameter describes the port in terms of vessels that can be handled at a given port, that is, inland waterway port, sea (maritime) port or a combination of these two types, IWW/Maritime. Out of 19 core port ports (excluding the Rhine and Neckar ports) analysed in this report, only two ports, Galati (RO) and Constanta (RO) are IWW/Maritime ports as per classification, while all other ports are inland ports.

Supply of alternative fuels

Provision of alternative fuels has been tackled in EC Regulation 1315/2013, Article 3(w), where **L**iquefied **N**atural **G**as (LNG) is considered the most interesting option for IWT. A strong signal given by the European Commission through the adopted clean fuel strategy in favour of the deployment of LNG is expected to trigger policies that will have lasting favourable conditions for LNG uptake at various levels in Member States[65].

Apart from the evident benefit for the environment, by introducing the supply of LNG fuel from LNG terminals or refuelling stations in the portfolio of their services, ports can develop additional business lines. In this view, one of the ambitions of the

[65] *Source: PANTEIA, et.al. Contribution to Impact Assessment of measures for reducing emissions of inland navigation, 2013*

European Commission is to accelerate the construction of LNG bunkering stations[66]. On 15 April, the European Parliament gave its final approval to the Directive on the employment of alternative fuels infrastructure which contains new rules to ensure the build-up of infrastructure for alternative fuels across Europe and the development of common technological specifications, including shore-side electricity facilities and LNG refuelling points.

The agreed text[67] of the Directive contains, inter alia, the following provisions on LNG fuel supply:

- A core network of LNG refuelling points at maritime and inland ports should be available at least by the end of 2025 and 2030 respectively.
- LNG refuelling points include, inter alia, LNG terminals, tanks, mobile containers, bunker vessels and barges.

Article 39 (2b) of the EC Regulation 1315/2013 requires availability of the alternative clean fuels for both inland waterway and maritime transport infrastructure. In this view, of those ports with available data, only ports of Ruse (BG), Galati (RO), Constanta (RO), Komárno (SK), Karlsruhe (DE) and Strasbourg (FR) have reported plans to provide such facilities until 2030. However, no concrete projects were identified or reported by respective ports, except for the LNG Master Plan for Rhine-Main-Danube (2012-EU-18067-S) which will reveal its results in 2015.

Shore-side electricity facilities

Directive 2014/94/EU on the deployment of alternative fuels contains the following provision related to the shore-side electricity supply in ports:

"Member States shall ensure that the need for shore-side electricity supply for inland waterway vessels and sea-going ships in maritime and inland ports is assessed in their national policy frameworks. Such shore-side electricity supply shall be installed as a priority in ports of the TEN-T Core Network, and in other ports, by 31 December 2025, unless there is no demand and the costs are disproportionate to the benefits, including environmental benefits."

Out of 19 core ports on the Corridor, only 2 ports – Galati (RO) and Wien (AT) do not provide shore-side electricity supply, while the Slovakian ports of Komárno and Bratislava and the German port of Frankfurt have only limited possibilities for shore-side electricity supply to vessels.

Shore-side electricity supply is very well received by river cruise ships, due to high consumption of electric energy for their daily needs when berthed in ports. Certain ports have informed the European Federation of Inland Ports (EFIP) about the low utilization of shore-side electric power facilities for cargo vessels, mostly due to the low benefits in terms of cost saving and due to the fact that cargo vessels do not spend much time in ports. However, as the time a vessel spends in a port is very "stretchable" variable (especially in the ports not having vertical quay walls and the latest transhipment technology) and as the reduction of pollutant emissions from berthed vessels is an important issue (Art. 47(1e)), the Consultant recommends futher activities in view of assessment of the needs for such facilities in terms of Article 4(4) of the Directive 2014/94/EU (feasibility studies and CBA for provision of such facilities), as well as facilitation and support for justified projects related to provision of shore-side electricity supply in both inland and sea ports.

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[66] Source: PANTEIA/NEA, PLATINA II, SWP4.1: Information Package on the Corridor objectives and prioritising projects in IWT and inland ports, Vol. 2

[67] http://www.europarl.europa.eu/meetdocs/2009_2014/documents/tran/dv/alternativefuelsagreedtext_/alternativefuelsagreedtext_en.pdf

Non-discriminatory freight terminals in ports

All 19 core ports analysed in this Study (Danube, Main-Danube Canal and Main ports were analysed in this Study, while the remaining inland ports of the Rhine-Danube corridor, that is, the Rhine and Neckar ports, are analysed in the Rhine-Alpine Corridor Study) reported having at least one freight terminal open to all operators in a non-discriminatory way, applying transparent charges, according to Art. 15(2) of the Regulation 1315/2013.

Table 19: Compliance with the transport infrastructure requirements for inland ports and seaports

Criteria	Minimum draft	Road connection	Rail connection	Alternative clean fuel up to 2030	Shore-side power supply	Min 1 common user terminal	Intermodal facilities	Waste reception facilities	VTMIS, SafeSeaNet, e-Maritime
Regulation 1315/2013	15(3a)	15(1)	15(1)	39(2b)	14(3)	15(2)	28	22(2)	22(3)
Port									
Frankfurt A/M (DE)	√	√	√	×	√ (-)	√	√	n/a	n/a
Nürnberg (DE)	√	√	√	×	√	√	√	n/a	n/a
Regensburg (DE)	√	√	√	×	√	√	√	n/a	n/a
Enns (AT)	√	√	√	×	√	√	√	n/a	n/a
Wien (AT)	√	√	√	×	×	√	√	n/a	n/a
Bratislava (SK)	√	√	√	×	√ (-)	√	√	n/a	n/a
Komárno (SK)	√	√	√	∏	√ (-)	√	√	n/a	n/a
Komárom (HU)	√	√	√ (-)	×	√	√	×	n/a	n/a
Budapest (HU)	√	√	√	×	√	√	√	n/a	n/a
Vukovar (HR)	√	√	√	×	√	√	√	n/a	n/a
Slavonski Brod (HR)	√	√	√	×	√	√	∏	n/a	n/a
Drobeta TS (RO)	√	√	√	×	√	√	×	n/a	n/a
Calafat (RO)	√	√	√	×	√	√	×	n/a	n/a
Giurgiu (RO)	√	√	√	×	√	√	√	n/a	n/a
Galati (RO)	√	√	√	∏	×	√	√ (-)	n/a	n/a
Cernavoda (RO)	×	√	√	×	√	√	×	n/a	n/a
Constanta (RO)	√	√	√	∏	√	√	√	√	√ (-)
Vidin (BG)	×	√	√	×	√	√	√	n/a	n/a
Ruse (BG)	√	√	√	∏	√	√	√	n/a	n/a

Source: iC consulenten, based on information provided from port authorities

Legend:√ - full compliance, √ (-) – limited compliance, ∏ - planned, ×- incompliance, n/a – not applicable,

4.3.3.2 Identified bottlenecks and missing links in ports

Based on the above analysis, the most obvious bottlenecks in the Corridor's core ports, which are currently not planned and/or on-going, are the following:

Infrastructure bottlenecks and missing links

- insufficient depth in determined terminals of the port of Vidin (BG) of 2.4 meters;
- insufficient depth in the port of Cernavoda (RO) of only 1.5 meters;
- lack of the quayside railway tracks in the port of Cernavoda (RO);
- deteriorated railway link in the port of Komarom (HU);
- low quality road and rail hinterland connection and ineffective multimodal facilities in the port of Galati (RO);
- provision of e-Maritime services in the seaport of Constanta (RO).

Conditional infrastructure bottlenecks

Article 4(4) of the Directive 2014/94/EU contains the following provision: "Member States shall ensure that the need for shore-side electricity supply for inland waterway vessels and sea-going ships in maritime and inland ports is assessed in their national policy frameworks. Such shore-side electricity supply shall be installed as a priority in ports of the TEN-T Core Network, and in other ports, by 31 December 2025, *unless there is no demand and the costs are disproportionate to the benefits, including environmental benefits*."
In this view, the following "conditional" bottlenecks have been identified:

- Lack of shore-side power supply in the port of Wien (AT);
- Lack of shore-side power supply in the port of Galati (RO);
- Limited shore-side power supply in the port of Bratislava (SK);
- Limited shore-side power supply in the port of Komárno (SK);
- Limited shore-side power supply in the port of Frankfurt (DE)

Administrative and operational bottlenecks

- harmonisation and simplification of the reporting formalities for inland vessels (mirroring the FAL Convention[68] and "single window" concept in maritime transport).

Remaining bottlenecks, in terms of forecasted or existing capacity constraints or missing links are taken into account in the on-going or planned projects identified by the consultant and reported by the Member States and port administrations.

Gap analysis

Based on the assessment of the technical parameters of ports, as well as on the contents of the identified studies and projects related to ports, the consultant is of the opinion that the following additional group of measures should be considered in certain ports:

- dredging in port approaches and port basins,
- improvement of the road and rail hinterland connection quality,
- electrification of the railway network within ports,
- provision of quayside railway tracks,
- facilitation of intermodal operations in ports (infrastructure and administrative),

[68] *Convention on Facilitation of Maritime Traffic (FAL Convention) - The Convention was adopted by the International Conference on Facilitation of Maritime Travel and Transport on 9 April 1965. The purpose of the FAL Convention is to facilitate maritime transport by reducing paper work, simplifying formalities, documentary requirements and procedures associated with the arrival, stay and departure of ships engaged on international voyages.*

- e-Maritime facilitation and procedures in seaports,
- feasibility studies and cost-benefit analyses for ports having no or limited shore-side power supply facilities,
- administrative standardization for vessel/cargo documents in ports.

4.3.4 Characteristics Rail/Road Terminals

Figure 26 shows the assignment of the listed nodes to the corridor infrastructure and provides and impression on the spatial distribution of traffic/logistic core areas on the corridor.

Figure 26: Overview on core network urban and traffic/logistic nodes

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

For the further selection procedure it has to be considered that particularly nodes representing inland ports and rail-road terminals often have more than one facility (e.g. 3 rail-road terminals in Stuttgart). With respect to rail-road terminals, a compilation of single locations associated to the agreed terminal nodes has been elaborated. This list has been gathered by checking databases, such as AGORA intermodal terminal database[69], by exploiting information provided by terminal and transport operators as well as by professional experience.

The TEN-T regulations highlight the role of rail/road terminals (RRT) and have already defined their locations along the Corridor in Annex II of the EU-Regulation 1315/2013.

A precise definition of rail/road terminals is however missing in EU-Regulation 1315/2013. Article 3 defines 'logistic platform' as an area which is directly linked to the transport infrastructure of the trans-European transport network including at least one freight terminal, and which enables logistics activities to be carried out. A 'freight terminal' means a structure equipped for transhipment 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

[69] *http://www.intermodal-terminals.eu/database*

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.

For the purpose of coherence with other European legislation and the common professional use of words, the contractors have specified rail/road terminals (RRT) as intermodal terminals facilitating intermodal transport as defined in EC-Directive 92/106, thus basically the transhipment of containers, swap bodies and semi-trailers between two modes of transport, in this case rail and road. This means that the analysis of rail/road terminals will also include locations with trimodal facilities enabling container transhipment 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[70] needs to be assured.

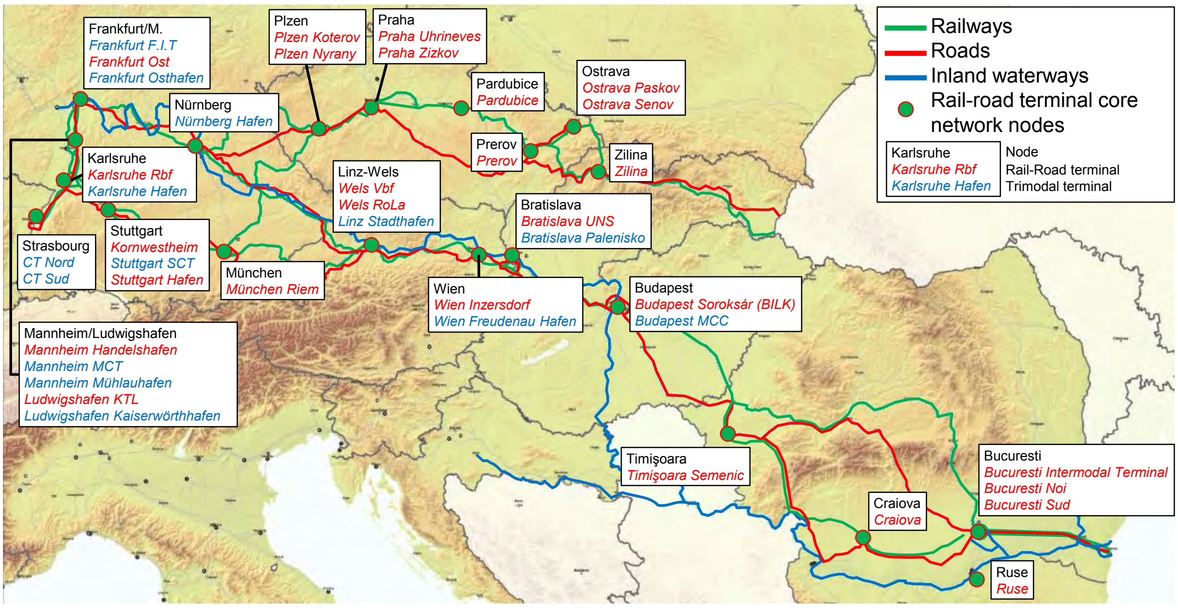
Following this definition, the rail-road nodes of the Rhine-Danube Core Network include 41 single terminals only considering facilities directly located in the respective city (see Figure 27). This number of terminals considers that single terminal nodes along the corridor can be subject to multiple 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 the Czech Republic (8), Romania (5) and Austria (5).

Next to these core network terminals according TEN-T Regulations further intermodal facilities are important for the access to the corridor. One of these terminals is Česká Třebová that supplements the Praha terminals.

[70] *Definitions in Articles 22 (1) b, 25 (1) of Regulation 1315/2013 stipulate that installations looked at in the framework of the regulation are somewhat public infrastructure since Member States are obliged to ensure that the „terminal is open to all operators in a non-discriminatory way and applies transparent, relevant and fair charges".*

Figure 27: Terminals with rail/road transhipment in the core network nodes



FR		DE		AT		CZ		SK		HU		RO		BG		TOTAL	
Road-Rail	Tri-modal	Road-Rail	Tri-modal	Road-Rail	Tri-modal	Road-Rail	Tri-modal	Road-Rail	Tri-modal	Road-Rail	Tri-modal	Road-Rail	Tri-modal	Road-Rail	Tri-modal	**Road-Rail**	**Tri-mod.**
-	2	7	8	3	2	8	-	2	1	1	1	5	-	1	-	**27**	**14**
2		15		5		8		3		2		5		1		**41**	

Source: HaCon based on KombiConsult analysis

The quantitative analysis to be performed in the framework of this study refers to the parameters laid down in the TENtec Glossary and thus covers the number of rail tracks and road lanes used for accessing the rail/road terminals as well as the handling volumes. Table 20 provides a listing of the rail/road terminal on the corridor with the described characteristic figures.

While the infrastructural data could be obtained from public sources or maps, unified data on capacity and traffic flow is only rarely available from public sources and often in the property of the operating companies concerned and commercially sensitive. Annual traffic flows are not commonly published or do not lead to conclusive comparison between the assessed terminals. Furthermore, a consistent measurement of capacity is absent; different measurements in tonnes, loading units and TEU lead to further difficulties to establish a comprehensive overview.

The volume data in Table 20 refers to the most recent year available and was transformed into the requested unit "tonnes per year" from the normally used dimensions [TEU] or [LU]. All terminals along the Rhine-Danube corridor are connected to rail and road by at least one rail track or one road lane so that this fundamental criterion is met.

Table 20: Overview on rail/road terminals with their TENtec characteristics

Country / Terminal	freight traffic (t)	rail connections	road connections
FR			
Strasbourg CT Nord		1	2
Strasbourg CT Sud		1	2
DE			
Frankfurt/Main FIT	30.000	1	2
Frankfurt/Main-Ost	1.000.000	4	2
Frankfurt/Main-Osthafen	330.000	1	4
Karlsruhe Rbf	900.000	1	2
Karlsruhe Hafen	0	2	2
Kornwestheim	1.875.000	2	2
Ludwigshafen Kaiserwörthhafen	0	1	2
Ludwigshafen KTL	5.087.000	2	4
Mannheim Handelshafen	750.000	1	2
Mannheim MCT		1	2
Mannheim-Mühlauhafen	913.000	1	4
München (Riem)	4.500.000	2	4
Nürnberg-Hafen TriCon	3.000.000	1	2
Stuttgart Container Terminal SCT		1	2
Stuttgart-Hafen	600.000	2	4
AT			
Linz Stadthafen	1.962.000	2	4
Wels RoLa	895.000	4	2
Wels Vbf	1.333.000	4	2
Wien Freudenau Hafen	4.820.000	3	4
Wien Nordwest/Inzersdorf	422.000	2	2
HU			
Budapest (Soroksár)	1.457.000	2	2
Budapest Mahart Container Center	610.000	1	4
BG			
Ruse Tovarna	0	1	2
CZ			
Ostrava-Paskov		1	2
Ostrava-Šenov		1	2
Pardubice	0	2	2
Plzeň-Koterov		1	2
Plzeň-Nýřany		1	2
Praha (Uhříněves)	5.248.000	2	2
Praha (Žižkov)		2	2
Přerov		2	2
SK			
Bratislava Palenisko	268.000	1	2
Bratislava ÚNS	155.000	2	2
Žilina	732.000	2	4
RO			
București Intermodal Terminal	100.000	1	2
București Noi	0	1	2
București Sud		2	2
Craiova	0	2	2
Timișoara Semenic	0	1	2
Gesamtergebnis	**36.987.000**	**68**	**100**

Remarks for column "freight traffic": Values refer to rail/road handlings only; "0" = no rail/road handling performed (zero t); No entry = no data available

Source: KombiConsult analysis 2014

Next to these basic figures, the current situation of rail/road terminals on the corridor is as follows:

- In France there are two core network terminals on the corridor, Strasbourg CT Nord and Sud, both located in the port of Strasbourg at the river Rhine. One is operated by the port of Strasbourg itself, the other one by the Contargo group. The two trimodal terminals focus on container transport and provide handling tracks to accommodate the full length of current international direct or shuttle trains of about 600 to 700 m.
- In Germany, the "German Development Concept for Combined Transport until 2025"[71] forecasted substantial growth of the intermodal market. This also refers to terminal areas located on the Rhine-Danube Corridor. Table 21 provides a compilation of these terminal areas and their main performance figures for 2008/2025[72].

Even if we consider that some improvements have been realised since 2008 (Kornwestheim, Ludwigshafen, München-Riem: each 3rd module in operation, Nürnberg Hafen: 2nd module in operation, expansion of Regensburg), it is evident that the market development requires an increase of the handling capacity in several terminal areas; however, it is up to the private sector to decide on specific terminal and improvement measures.

Table 21: Handling capacity, volume and enlargement need 2008/2025 for rail/road terminal areas in Germany

Location Area	2008		2025	2008-2025
	Existing Handling Capacity [LU/a]	Existing Handling Volume [LU/a]	Requested Handling Capacity [LU/a]	Capacity Expansion Need [LU/a]
Frankfurt	199,000	113,000	266,000	67,000
Karlsruhe	247,000	109,000	215,000	-
Mannheim/ Ludwigshafen	499,500	403,000	1,220,000	720,500
München	240,000	271,000	737,000	497,000
Nürnberg	235,000	189,000	506,000	271,000
Stuttgart	165,000	144,000	443,000	278,000
Total	**1,585,500**	**1,229,000**	**3,387,000**	**1,833,500**

Source: HaCon/KombiConsult analysis based on CT Development Concept 2025

- In Austria there are four core network terminals on the Rhine-Danube corridor: Linz Stadthafen, Wels Vbf, Wien Nordwest and Wien Freudenau Hafen. Although located close to the terminal Wels Vbf, we consider Wels RoLa as a separate terminal, which is providing RoLa services only and which has its own dedicated tracks and area.

  The Linz Stadthafen terminal is owned and operated by Linz AG, the local supplier for Energy, Telecommunications, Public Transport, and Community Services. The terminals in Wels and Wien Nordwest are operated by Terminal Service Austria (TSA), a rather new established division of the owner of these terminals ÖBB-

[71] *Entwicklungskonzept KV 2025 in Deutschland als Entscheidungshilfe für die Bewilligungsbehörden, Aktenzeichen Z14/SEV/288.3/1154/UI32;UI32/3141.4/1, Abschlussbericht, Hannover, Frankfurt am Main, November 2012*

[72] *It must be considered that the congruence of these terminal areas with the core network nodes is unknown and thus cannot be secured.*

Infrastruktur AG. The terminal in Wien Freudenau is operated by WienCont; the transhipment capacity has recently been increased by an additional gantry crane.

The terminals in Wels and Wien have strongly developed as turntables between Western European countries (mainly Germany and the Netherlands) on the one side and other domestic destinations as well as South Eastern European countries on the other side. Another terminal in the Linz/Wels area with a trimodal upgrade programme is Ennshafen.

- In Hungary there are three core network terminals on the network of the Rhine-Danube corridor, which are all located in Budapest: Budapest-Bilk, Budapest Mahart (MCC), and Budapest Törökbalint, whereof Budapest-Bilk is the largest terminal and the only intermodal facility to provide handling tracks capable for full length of current international direct or shuttle trains (600 – 700 m). Jointly with Budapest Mahart it is also the most advanced in terms of infrastructure, handling, information technology and process organisation.
- In Bulgaria the only core network terminal on the network is the terminal Ruse Tovarna, which has two handling tracks of only about 100 m usable length. According to market investigations the terminal is currently not used, thus the handling volume is zero. As most of the terminals in Bulgaria this facility was established some thirty years ago, but not well maintained and used in a proper way. Thus, the technical and infrastructure conditions of the facility are not state-of-the-art either.
- The Romania, there are 26 intermodal public terminals owned by CFR Marfa, the state-owned rail freight operator, and operated by the forwarder Rofersped, from which 7 public terminals actually have little activity (called "open" terminals) and the other 19 have had no activities (in 2013). However, the terminals without activity are still available for upgrading and equipment modernizing, in case of economic recovery of Romania. Along the corridor, the most relevant terminals are: Bucuresti Sud, Craiova and Semenic – near Timisoara city, these have only very small traffic operation. None of the terminals provides handling tracks for the full length of current international direct or shuttle trains of about 600 to 700 m.
- In the Czech Republic there are eight core network terminals on the corridor, which are located in Ostrava (Ostrava-Paskov, Ostrava-Senov), Plzeň (Plzeň-Koterov PCP, Plzeň-Nyrany), Praha (Praha Uhříněves, Praha Zizkov), and Přerov. Praha has also its importance as a "turntable" or "hub terminal" for flows towards Slovakia and Poland. The by far most important terminal is Praha Uhříněves. It is also the only Czech terminal with handling tracks for complete international direct or shuttle trains. Except of the lack of this feature, overall, the technical equipment of all other listed terminals seems to be appropriate. However, according information from Czech Ministry of Transport most of these terminals need to be modernised. For this reason a respective funding programme under OPTII has been prepared and is ready for implementation.
- In Slovakia there are three core network terminals on the corridor, two located in Bratislava and one in Žilina. Another terminal in Žilina - Teplička is currently under construction. The terminals Bratislava ÙNS and Žilina are operated by Rail Cargo Operator - CSKD s.r.o., the terminal Bratislava Palenisko is operated by SPaP a.s. All three existing terminals are focusing on container transport and were built some 30 to 40 years ago primarily designed for handling 20-foot ISO containers. The main limiting factor of the container terminals in Slovakia is the insufficient usable length of the transhipment tracks.

4.3.5 Characteristics Road

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

In Austria the motorways A8 (from Suben to Haid) and A1 (Salzburg – Wien) passing by Wien on the A21 and the express way S1 south of Wien 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 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 Sebes to Pitesti and București or via Craiova to București. The route continues then from Bucureștito Constanta. 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 Filiași to Craiova is indicated as comprehensive network). However this is an overlapping section with the Orient-East Med Corridor (OEM).

The length of the motorways/express ways in the Member States is as follows:

Table 22: Length of motorways/express ways in the Member States

FR:	N4	6km	completed
	A35	3km	completed
DE:	A5	212 km	completed
	A3	461km	completed
	A6	107km	completed
	A8	342km	completed
	A99	40km	completed
AT:	A1	270km	completed
	A8	61km	completed
	A6	22km	completed
	A21	38km	completed
	S1	16km	completed
	A4	58km	completed
	A25	20km	completed
CZ:	D1	335km	completed
		18km	under construction
	D5	151km	completed
SK:	D1	167km	completed
		196km	under construction/in planning
	R6	26km	in planning
HU:	M0	79km	completed
		29km	in planning
	M1	167km	completed
	M5	169km	completed
	M43	35km	completed to Mako
		58km	to RO Border completed 2014
	M15	14km	completed
RO:	A1	282km	completed
		105km	under construction

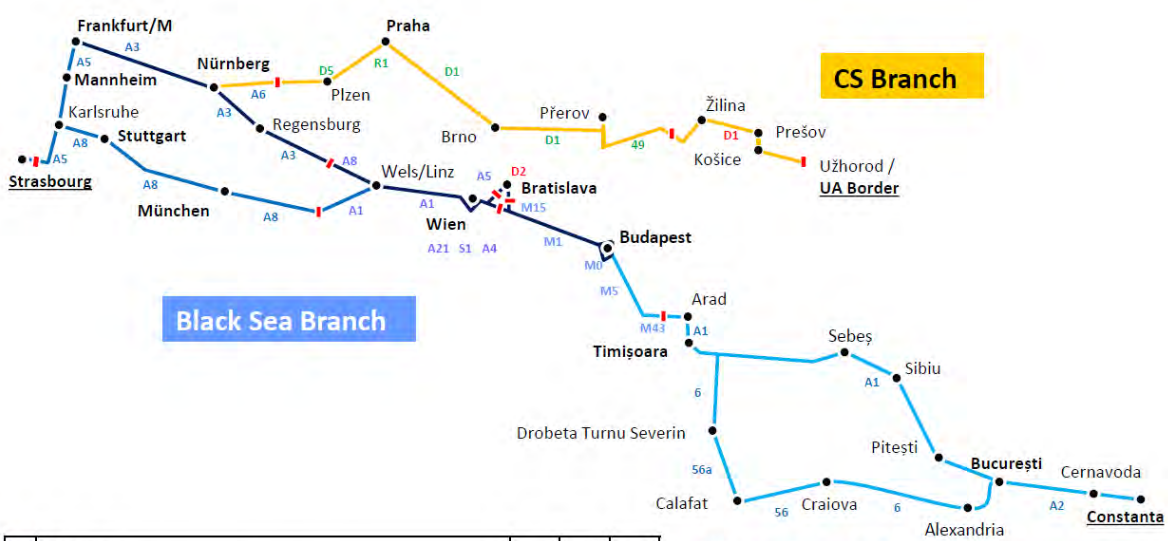
	204km	are open
A2	225km	completed
A6	11km	in operation
	239km	are open

Source: Wikipedia, iC Consulenten

Hungary, the 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 – Timișoara; Pitești– București – Cernavoda- Constanta; Saliste -Sibiu by-pass (Selimbar); Constanta Ring road; Deva (Soimus)- Orăștie - Sebeș- Sebeș by-pass- Cunța; Balinț–Dumbrava; Lugoj- Balinț (A6).

As the following schematic figure shows the main difference of the road alignment to the rail alignment in the corridor is the missing part of the CS branch via München and Regensburg as well as from Regensburg to Plzeň. 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 Přerov and Ostrava is recommended, thus following the modification of the RFC 9 between Přerov to Ostrava. However the section between Hulin and Ostrava is part of the Baltic-Adriatic Corridor (BAC). The road corridor continues then south of Přerov from Zlín to Žilina, Prešov, Košice to the Ukraine border. The total average distance of the Black Sea branch is about 2,300 km, thus almost exactly the same value as rail.

Figure 28: Road alignment of the Rhine-Danube Corridor and assigned infrastructure



	Main sections	Rail	Road	IWW
A	Frankfurt – Wels/Linz – Wien – Bratislava - Budapest	X	X	X
B	Strasbourg – Karlsruhe – Mannheim – Frankfurt Strasbourg – Karlsruhe - Stuttgart – München – Wels/Linz	X	X	
D	Budapest Arad – Timisoara – Sebeș București . Constanta + Timisoara – Orsova – Craiova - București	X	X	
E	Nürnberg/München – Plzen – Ostrava/Prerov – Zilina – UA border	X	X	

Source: iC consulenten/HaCon

In total the road corridor has a length of 4,470km and covers the Member States France, Germany, Czech Republic, Slovakia, Austria, Hungary and Romania, whereby the share of the length of road per MS is as follows:

- FR: below 1%
- DE: about 27%
- CZ: about 11%
- SK: about 9%
- AT: about 11%
- HU: about 10%
- RO: about 33%

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

In the discussion with the German BMVI the correct road alignment between Straßburg and the motorway A5 as expressed in the TENtec IS has been discussed and clarified in such a way that the road connection from Straßburg runs via the Rhine bridge to Kehl and then to the A5 at Appenweier, thus following the E52 and not the alignment as indicated in the TENtec system via Illkirch-Graffenstaden to Offenburg being only the local road L98. This issue has to be clarified with the TENtec office.

Of particular relevance for the road characteristics are the standards set by the Regulation 1315/2013. 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 2013*
- 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

With regard to the availability of safe parking and resting areas the Art. 39 of the Regulation define the requirement of rest areas on mmotorways approximately every 100km in line with the need of the society and the market. Germany with its high density of commercial traffic intends to provide sufficient rest areas with services and fuel stations every 50 – 60km and safe and secure parking areas every 15-20km on the motorways. Also Austria intends to construct more secure parking areas for the commercial traffic.

Information on the availability of clean fuels could be obtained from specific web-sites; such services are currently mainly located within urban nodes in most countries and only to a limited range along the RD road network. Howeve first trends show the increasing possibility of implementing such services of alternative clean fuels along the road network to a larger extent until 2030.

4.3.5.1 Capacity Utilisation

The Consultant analysed the current utilisation of the RD road infrastructure capacity based on data available in TENtec. This was at certain extend hampered by the missing data for technical characteristics of the roads and/or for the observed traffic.

For the sake of completeness most important missing data was collected, and summarized from and in cooperation with relevant national companies and competent authorities. For example the major German source is the Federal Highway Research Institute or 'Bundesanstalt für Straßenwesen' (BASt), the Austrian one is ASFINAG (short for 'Autobahnen- und Schnellstraßen-Finanzierungs-Aktiengesellschaft' which is for 'Autobahn and Gighway Financing stock corporation') and the French source is the Direction Régionale de l'Environnement, de l'Aménagement et du Logement' (DREAL) or 'the Regional Directorate for Environment, Development and Housing'. Due to different systems to express the average traffic data in the Member States, the consultant has applied the following approach in presenting the traffic data.

Very large variations were observed regarding the input infrastructure capacity (Parameters 9 and 10 total hour capacity forward/backward): from the unrealistic value of 26,000 to 900 cars per hour per line. Due to this and in order to make different national data comparable the Consultant assumed average daily capacity for the different infrastructure types, as follows (vehicles/day both directions):

- Rural two lane roads[73] 20,000 vehicles/day
- Rural two lane roads with separator[74] 30,000 vehicles/day
- Motorways with 2 lanes per direction[75] 70,000 vehicles/day
- Motorways with 3 lanes per direction[76] up to 100,000 vehicles/day

The above average values were further adjusted relevant to reflect specific characteristics influencing the capacity, such as high gradient or high share of heavy freight traffic.

The annual average daily traffic was estimated based on data for freight traffic flow (trucks per year, parameter 12) and passenger traffic flow (cars per year, parameter 15).

There is a huge spread in the distribution of passenger traffic flow per day per section, between 2,020 (Romania) and more than 100,000 in France and Germany. The average weighted daily number of passengers is about 32,500 cars.

Road sections that carry out high number of passengers (cars per day) are located in Germany and France (cars per day):

- Strasbourg (J. A35/A350) <--> Strasbourg (J. A35/A351) with 149,000 (FR)
- Kreuz Stuttgart <-> Wendlingen with 109,000 (DE)
- Kreuz Walldorf <-> Dreieck Karlsruhe with 105,000 (DE)
- Kreuz München-Nord <-> Kreuz München Ost with 101,000 (DE).

The freight traffic varies from around 400 trucks per day in Romania to 18,000 trucks per day in Germany and Hungary. The average weighted daily number of trucks is about 6,700 trucks per day.

The most freight traffic intensive sections are (trucks per day):

- Kreuz Walldorf <-> Karlsruhe 18,200 (DE)
- Budapest (J. M0/M6) <--> Budapest (J. M0/M5) 17,300 (HU)
- Kreuz München-Nord <--> Kreuz München-Ost 17,000 (DE)
- Budapest (J. M0/M7) <--> Budapest (J. M0/M6) 16,400 (HU)
- Nürnberg Nord <-> Kreuz Nürnberg 16,200 (DE)
- Dreieck Karlsruhe <-> Appenweier 16,100 (DE)
- Brno <--> Brno (jih) 16,000 (CZ).

The share of heavy goods traffic ranges from 8% in Czech Republic to more than 50 % in Hungary. The average weighted share of heavy goods traffic is about 21 %. Almost all border sections (for which data are available) show relatively high values regarding the share of heavy traffic. Furthermore especially in Romania share of heavy traffic of many sections exceeds 30 %.

[73] *Assumed to correspond to the German standard RQ 10,5*
[74] *Assumed as RQ 20*
[75] *Assumed as RQ 29,50*
[76] *Assumed as RQ 29,50*

Following sections with a high share of heavy traffic are listed:

- Čunovo/Rajka <--> Hegyeshalom more than 50 % (HU)
- Jarovce/Kittsee (border SK/A) <--> Čunovo /Rajka (border SK/HU) 45 % (SK)
- Grenzuebergang Waidhaus/Rozvadov <--> Sulkov 35 % (CZ)
- Simeria <--> Sebeș 41% (RO)
- Sibiu <--> Veştem 39% (RO)
- Sebeș <--> Veştem 38% (RO)
- Sulkov <--> Ejpovice 37 % (CZ)
- Timişoara <--> Lugoj 37% (RO)
- Kreuz Oberpfälzer Wald <--> DE/CZ Waidhaus 36 % (DE)
- Deva <--> Simeria 33% (RO)
- Cenad <--> Arad 32% (RO)
- Passau-Mitte <--> DE/AT Suben 31% (DE)
- Lugoj <--> Deva 31% (RO)
- Wels <--> Grenzuebergang Suben 28% (AT)
- Kreuz Altdorf <--> Kreuz Oberpfälzer Wald 28% (DE)
- Mosonmagyaróvár <--> Győr 28 % (HU)
- Makó<--> Nagylak / Nădlac 27 % (HU).

The overall average capacity utilisation ratio calculated for the corridor sections for which data is available is about 55%. In practice, the actual ratio should be higher due to other vehicles not considered on the calculations (buses and motorcycles as a minimum).

The utilisation ratio varies between 3% (rural road in Romania) and a capacity overload from 80% plus on several sections in France, Germany, Austria, Czech Republic, Romania and Hungary.

Below capacity utilisation is explained in more detail for all individual countries.

In France sections of the R-D Corridor are clustered around Strasbourg, next to the German border. The average capacity utilisation is more than 100 % along the section Strasbourg (J. A35/A350) to Strasbourg (J. A35/A351).

In Germany capacity utilisation is extremely high especially around bigger cities and important connections to the South and East:

- Dreieck Karlsruhe <--> Appenweier
- Dreieck München-Allach <--> Dreieck München-Feldmoching
- Dreieck München-Feldmoching <--> Kreuz München-Nord
- Kreuz Heidelberg <--> Kreuz Walldorf
- Kreuz München-Nord <--> Kreuz München-Ost
- Kreuz München-Ost <--> Kreuz München-Süd
- Kreuz Nürnberg <--> Kreuz Altdorf
- Kreuz Stuttgart <--> Wendlingen
- Kreuz Walldorf <--> Dreieck Karlsruhe
- Nürnberg-Nord <--> Kreuz Nürnberg
- Würzburg-Heidingsfeld <--> Kreuz Biebelried.

Furthermore freight traffic is concentrated around almost all large cities. Share of heavy traffic ranges between 20-30% at almost all border sections as for example following:

- Kreuz Oberpfälzer Wald <--> DE/CZ Waidhaus 36 %
- Passau-Mitte <--> DE/AT Suben 31%
- Kreuz Altdorf <--> Kreuz Oberpfälzer Wald 28%
- Kreuz Deggendorf <--> Passau-Mitte 23%.

In Austria the weighted average capacity utilisation is about 63% mainly due to the high utilisation (over 90%) along:

- Haid (J. A1/A25) <--> Linz
- Voesendorf <--> Schwechat
- Schwechat <--> Bruckneudorf.

In addition section Haid (J. A1/A25) to Linz with more than 13,000 trucks and 77,600 cars per day shows one of the highest volume of traffic in Austria. Furthermore a high share of heavy goods traffic was analysed for section Wels <--> Grenzuebergang Suben right to the German border.

In Czech Republic the weighted average capacity utilisation is some 70% mainly due to high utilisation (over 80%) along the sections adjacent to Praha and Brno, as follows:

- Praha Třebonice - Praha Slivenec
- Praha Řepy - Praha Březiněves
- Praha Slivenec - Praha Vestec - Praha Jesenice
- Brno - Brno (jih)
- Brno-Ostopovice – Brno.

In addition road sections carrying out a high number of passengers are located around cities Praha and Brno as well.

The following sections show the highest share of heavy goods traffic in Czech Republic.

- Sulkov <--> Ejpovice 37%
- Grenzuebergang Waidhaus/Rozvadov <--> Sulkov 35 %

In comparison the lowest share of heavy traffic is 8% from Kroměříž to Střelná at the Slovakian border.

In Romania the weighted average capacity utilisation is comparatively low with about 31%, except for Alexandria <--> Bucureşti (J. 100A/6) with more than 109% probably due to the fact that it is a rural road with one line per direction.

Furthermore share of heavy traffic is between 30-40% on the following sections:

- Simeria <--> Sebeș
- Sibiu <--> Veştem
- Sebeș <--> Veştem
- Timişoara <--> Lugoj
- Deva <--> Simeria
- Cenad <--> Arad
- Lugoj <--> Deva.

In Slovakia the weighted average capacity utilisation is comparatively low with about 35%, except along Dubná Skala <->Turany<->Hubova and Višňové <--> Dubná Skala with more than 70% probably due to the fact that there are only rural or rural two lane roads.

The highest share of heavy traffic shows section Jarovce/Kittsee (border SK/A) <--> Čunovo/Rajka (border SK/HU) with around 45 %.

The weighted average capacity utilisation in Hungary is around 37 % and only sections around Budapest are higher than 50%. In addition most freight traffic intensive sections are around Budapest as well:

- Budapest (J. M0/M6) - Budapest (J. M0/M5) and Budapest (J. M0/M6) - Budapest (J. M0/M5) with over 200,000 tons and 16,500 – 17,000 trucks per day,

- Budapest (J. M0/M1) - Budapest (J. M0/M7) with 175,000 tons and 13.000 trucks a day
- Tatabánya - Budapest (J. M0/M1) with some 150,000 tons and almost 11,000 trucks/day, followed by
- Győr - Tatabánya (HU) with some 135,000 tons.

The above findings are confirmed by the Hungarian Operation Program Transport 2007-2013 that states "the southern section of Motorway M0 is of key importance in the international road network of Hungary, and it regional and local role is also important. The traffic on the motorway is outstanding; its current capacity cannot satisfy it at appropriate level."[77]

Sections with a high share of heavy traffic in the eastern part of the R-D corridor are situated along the borders of Slovakia, Hungary, and Romania:

- Čunovo/Rajka <--> Hegyeshalom more than 50 %
- Mosonmagyaróvár<--> Győr 28 %
- Makó<--> Nagylak / Nădlac 27 %.

To show all before mentioned areas, the following map gives an overview on all road sections with high capacity utilization.

Figure 29: Areas with high road capacity utilisation

Source: iC consulenten

4.3.5.2 Availability of Alternative Fuels

The Regulation 1315/2013 sets up a list of the alternative fuels that substitute (at least partly) the fossil oil sources in the supply of energy to transport. This includes electricity, hydrogen, biofuels (liquids), synthetic fuels, methane (natural gas (CNG and LNG) and biomethane) and liquefied petroleum gas (LPG).

The worldwide commercial ***synthetic fuels*** production capacity is still rather limited and thus, has very limited practical importance. Among the RD countries Germany is

[77] *Source: OPT HU 2007-2013, page 44*

the only one that has operational Biomass to Liquids (BTL) demonstration plant that produces 300 barrels of synthetic fuels per day.

The issue of ***electric vehicle networks*** as infrastructure systems of publicly accessible charging stations and possibly battery swap stations to recharge electric vehicles is a matter of discussion for the time being. Establishment of such networks requires many agreements between the national and/or regional governments, car manufacturers, and charging infrastructure providers. As of December 2013, Estonia is the only country to have completed the deployment of an electric car charging network with nationwide coverage. Along the Rhine-Danube Corridor public charging stations are available in:

- Strasbourg, Frankfurt, Stuttgart, München, Nürnberg, Passau[78] (DE)
- Praha, Brno (CZ) Wien, Linz, Salzburg A4 Ost Autobahn Göttlesbrunn (AT)
- Bratislava, Poprad , Kosice (SK)
- Budapest, Győr, Mosonmagyaróvár (HU)

The other alternative fuels (LPG and LNG) are much widely available in all RD countries, although the density of the stations along the Corridor differs from country to country. It should be pointed out that the Regulation 1315/2013 does not set specific requirement in this respect. Art. 39 2 (c) states alternative fuels shall be available along the core road infrastructure.

The availability of LPG and CNG stations per RD country and/or along the corridor is as follows[79]: (as the market for such services is growing rapidly, the figures below may not be actual anymore; they are from a survey made in July 2014)

- In Germany there are over 9,000 LPG[80] and 912 methane[81] stations all over the territory
- In Czech Republic the total number of LPG stations is almost 1200[82]. 125 of these are located at less than 1 km distance from the R-D Corridor route. At national level there are also 63 CNG filling stations A further growth up to 80 stations till the end of this year can be expected.[83]
- In Austria there are 52 LPG stations[84], out of which 13 are located at less than 5 km distance from the corridor route[85]. The total number of CNG methane stations is 176. Smatrics in cooperation with ASFINAG and a power supply company offers a rapid charge service for e-mobility at one rest area at the A4 near Göttlesbrunn, one station on the A1 near Mondsee and and another one at the A21 at Steinhäusl. Smatrics has made cooperation agreements with "The New Motion" thus offering e-charging also in Germany, Belgium and the Netherland.
- In Hungary there are over 780 LPG stations of which over 130 lie within 5km of the R-D Corridor. There are 4 CNG stations which are located in Győr, Budapest and Szeged. In immediate vicinity (less than 1 km from the Corridor[86]) there are 39 LPG stations. Nevertheless, it should be pointed that the National Transport Strategy from 2013 depicts the "general lack of alternative, clean fuel stations" as one of the deficiencies of the Hungarian transport system[87]. Probably one of the

[78] *http://www.goelectricstations.com/stations-electric-cars.html*
[79] *As of July 2014*
[80] *http://www.mylpg.eu/stations/germany/map*
[81] *http://cngeurope.com/*
[82] *http://www.mylpg.eu/stations/czech-republic/map*
[83] *http://www.cng.cz/*
[84] *http://www.mylpg.eu/stations/austria/map*
[85] *http://www.mylpg.eu/lpg-station-route-planner*
[86] *http://www.mylpg.eu/stations/hungary/map*
[87] *Source: National Transport Strategy, Status Quo, 2nd vol., (Nemzeti Közlekedési Stratégia), 2013*

reason for this conclusion is the relatively low number of CNG facilities – 3 for the whole country

- Along the Slovak section of RD road corridor there are 47 LPG stations located at less than 5 km distance from the main route[88]; in total there are 10 CNG stations in the country
- The total number of LPG stations in Romania is about 540[89], out of which 145 are located along the corridor (less than 5 km distance); the first CNG station in Romania was opened in April 2014 in the city of Cluj, which is not located along the R-D Corridor.

4.3.5.3 Availability of Secure Parking

The Regulation 1315/2013 sets also specific requirement in respect to the core road network with respect to the provision of sufficient parking areas with an appropriated level of safety - at least every 100 km (art. 39 2 (c)).

Next table presents the estimated availability of parking areas for commercial vehicles with minimum level of services and security. Rest areas along the roads that provide only parking lots without any other services were not considered in the estimation.

Table 23: Identified RD Overview on secure parking

Road section	Number of commercial vehicles parking areas (Road number) per direction
Strasbourg – Frankfurt (DE)	5 (A5) 3 (A67)
Frankfurt – Nürnberg (DE)	9 (A3) 1 (A73)
Nürnberg - Passau(DE)	5 (A3) 1 (A73) 1 (A9)
Nürnberg (DE)– Czech Border	1 (A73) 1 (A9) 1 (A6) 1 (A93)
Karlsruhe – München (DE)	8 (A8)
München (DE) – Austria Border	2 (A8) 1 (A1)
German Border – Praha (CZ)	1 (D5)
Praha (CZ) – Slovakian Border	1 (E462)
Slovakian / CZ Border– Slovakian /Ukraine Border	9 (D1)
Salzburg (AT) – Wien (AT)	13 (A1)
Wels (AT)<--> Suben (German Border)	4 (A8)
Wels <--> Haid (J. A1/A25) (AT)	1 (A25)

[88] *http://www.mylpg.eu/stations/slovakia/map*
[89] *http://www.mylpg.eu/stations/romania/map*

Steinhaeusl <--> Voesendorf (AT)	1 (A21)
Voesendorf <--> Schwechat (AT)	1 (S1)
Bruckneudorf <--> Nickelsdorf (AT)	1 (A4)
Wien (AT) – Hegyeshalom (HU)	3 (A4)
Hegyeshalom – Budapest (HU)	4 (M1)
Budapest (HU) – Nădlac (RO)	4 (M5) 1 (M43)
Nădlac - Lugoj (RO)	1 (E68)
Lugoj – Craiova (RO)	14 (DN6)
Craiova – Alexandria- București (RO)	2 (DN6)
Lugoj – Sibiu (RO)	7 (E68)
Sibiu - București (RO)	4 (E81)
București- Constanta	9 (A2)

Source: Google Map and TransPark (IRU)[90]; Roads Executive Agency of Bulgaria[91]*

The above review shows reasonable supply of parking facilities in Germany, Czech Republic, Slovakia, Austria, Hungary and Romania.

In the Czech Republic the number of parking areas per 100 km of R-D Corridor is considerably lower (0.6/100km in CZ) compared to the above mentioned countries, this is largely due to the long sections that are completely without suitable facilities, such as the section Plzeň - Praha and Praha – Brno. There are facilities located in Brno and Praha but not along the route D1 between.

The average number of parking facilities per 100km of R-D Corridor is: DE 3.3/ 100km, CZ 0.6 /100km, AT 4.2/100km, SK 2.25/100km, HU2.25/100km and RO 3.36/100km.

4.3.5.4 Interoperability of ITS and Road Tolling Systems

Intelligent transport systems

According to Article 18 of Regulation 1315/2013 the Member States shall ensure that any intelligent transport system deployed by a public authority on road transport infrastructure complies with Directive 2010/40/EU. 'Intelligent Transport Systems' or 'ITS' means systems in which information and communication technologies are applied in the field of road transport, including infrastructure, vehicles and users, and in traffic management and mobility management, as well as for interfaces with other modes of transport. Priority actions for ITS in road transport infrastructure are[92]:

- the provision of EU-wide multimodal travel information services; The cross-border characteristics of multimodal travel information require an integrated European approach, as reflected by European transport policy[93]
- the provision of EU-wide real-time traffic information services
- data and procedures for the provision, where possible, of road safety related minimum universal traffic information free of charge to users

[90] *https://www.iru.org/transpark-search-route-action*
[91] *[13:06:33] Vlad Chakarov: http://www.api.bg/index.php/bg/karti/nalichni-parkingi-za-tezhkotovarni-avtomobili-po-napravleniyata-na-osnovnite-transportni-osi-v-republika-blgariya/*
[92] *Art. 3, Directive 2010/40/EU*
[93] *Towards a roadmap for delivering EU-wide multimodal travel information, planning and ticketing services, Commission staff working document, SWD(2014) 194 final, June 2014*

- the harmonised provision for an interoperable EU-wide eCall
- the provision of information services for safe and secure parking places for trucks and commercial vehicles
- the provision of reservation services for safe and secure parking places for trucks and commercial vehicles.

While advanced road traffic management systems are operational in many places throughout Europe, regional and national ITS services still form a fragmented patchwork. The general objective is national ITS to be mutually compatible, which means a general ability of a device or system to work with another device or system without modification. Thus, the scope of ITS compatibility is much wider and lies beyond the R-D Corridor.

A difficulty is that each European country has its own structure in terms of operators and responsibilities, although nearly all Member States developed Action Plans for ITS deployment according to Directive 2010/40/EU. In detail Austria[94], Germany[95], the Czech Republic[96] and Slovakia each developed a National Action Plan on ITS, but Romania and Hungary did not address ITS as a separate topic. For Romania there is only a strategic document without an Action plan.

Germany has already a number of ITS installations on the BAB 8 and 5 in operation, close to the larger agglomerations such as Frankfurt, Darmstadt, Offenbach, Fürth/Erlangen, München, and Stuttgart.

Austria has implemented an ITS system in the larger area of Wien and is currently installing such system for the areas of Linz and Salzburg.

Tolling systems

Regulation 1315/2013 sets up requirements for interoperability of the electronic toll collections systems, i.e. the Regulation does not impose obligation to Member States to introduce payment for using the road infrastructure. It calls if electronic fee collection system/s are implemented these to be in line with relevant standards, so to provide for interoperability[97]. Directive 2011/76/EU sets a common framework for Member States in setting up distance-related tolls and time-based user charges for heavy goods vehicles (HGV) above 3.5 tonnes for the use of certain infrastructure.

Although an increasing number of Member States are putting in place road user charging systems, there is a clear and recognised problem with the diversity of current road user charging systems in place. The lack of interoperability between systems and differences in charging principles cause increased burdens for hauliers and administrators and represent a clear barrier to what could be described as a harmonised road charging system.

However, a distance based charging system is generally accepted as an ideal solution in the long term. This type of system also receives the most support from industry as it is recognised as the fairest way to charge vehicles.

Furthermore, distance based schemes have shown to be the most effective in reducing empty running and vehicle kilometres. Finally, any road user charging system should ensure fairness and transparency for goods vehicles and other road users.

Distance or time based system for paying the use of certain roads exist in all RD countries, but electronic fee collection systems are in place only in five of them:

[94] *IVS Aktionsplan Österreich, 2011*
[95] *IVS-Aktionsplan Straße Deutschland, 2012, Projektplan Straßenverkehrstelematik 2015*
[96] *Action plan for ITS deployment in the Czech Republic*
[97] *Directive 2004/52/EC of the European Parliament and of the Council of 29 April 2004 on the interoperability of electronic road toll systems in the Community and*

Germany:

HGV toll for goods vehicles is based on the distance driven in kilometres, the number of axles and the emission category of the vehicle; system offers:

- automatic and manual log-on system for truckers, based on a combination of GSM and GPS; truck drivers shall register the freight company as well as each individual truck; after registration, an on-board unit (OBU) can be installed by anybody
- Manual log-on system is possible at 3,500 toll station terminals, or over the internet. The driver enters the vehicle information, origin and end location.

Czech Republic:

- the vehicles with maximum gross weight above 3.5 tonnes are subject to the toll must be equipped with a small electronic device - on board unit- which communicates with the tolling system based on modern microwave technology
- Cars and other vehicles below 3.5 tonnes pay vignette stickers; the RD sections on Czech territory are covered by the tolling system

Slovakia:

- travelling along R-D Corridor section all vehicles above 3.5 tons maximum permissible total weight (including busses) must pay electronic toll; the system is based on a combination of GPS, GSM and DSRC technology; drivers shall stop at one of the distribution points located on each border crossing used by heavy traffic and registering the vehicle to obtain an electronic on-board unit needed for correct calculation of the toll; the unit shall always be plugged into the cigarette lighter socket and on-line
- vehicle with maximum permissible total weight below 3.5 tons are obliged to pay vignette sticker

Austria:

In Austria three different kind of tolling systems are in place:

- Toll Sticker for passenger cars and motorcycles on the Austrian motorways and expressways
- Special toll sections refer to alpine road sections and thus, this system is not relevant to R-D Corridor
- GO system is distance-related tolls for motorways and expressways are charged for all vehicles over 3.5 t maximum gross weight (trucks, buses and heavy motor homes). Toll collection is conducted with microwave technology, using a fully electronic system which does not hinder the flow of traffic (multilane free-flow system). Vehicles required to pay tolls which use the primary road network in Austria must be fitted with an on-board unit, the so-called "GO-Box

Hungary:

In Hungary the entire section of R-D Corridor is included in the network that can only be used against payment of a road fee

- for vehicles exceeding 3.5 tonnes maximum weight distance related electronic toll system HU-GO is in place covering a total length of 6,500km of motorways, express roads and national roads (1. Dec. 2013)

- vehicles of less than 3.5 tons must procure e-Vignette that can be purchased online

Romania:

Romania applies a time related sticker system for all roads along the R-D Corridor and for all vehicle categories. The vignette differentiates between Euro engine standards.

France:

France has had concession based tolls for a long time on its motorways, bridges and tunnels that include all vehicles. In 2013 France will introduce a network-wide system on state-operated motorways and other roads for HGVs.

As described above each of the countries applying electronic toll collection system has its own system, although all these meet the stipulations of the Directive 2004/52/EC. For the moment the only cross-border cooperating system is established between Germany and Austria. The advantage for toll system customers who use the TOLL2GO service is that they only need one in-vehicle unit – the Toll Collect OBU – to pay toll charges in both countries.

4.3.5.5 Critical issues on the corridor

"Missing links" in the sense of the Priority Projects are those line sections, which might be existing but do not fulfil the relevant technical standards. According to the study analysis, this particularly applies for the following sections:

Some of the cross-border sections form missing links of the Rhine-Danube Corridor as they are not fulfilling the technical standards of the Regulation.

Cross-border sections road – missing links

The major cross-border bottlenecks on the corridor are the following:

- Czech – Slovakian border: between Zlín and Žilina: on the Czech side from Zlín to the border R49 and on the Slovakian side the R6 from the border to Beluša.
- Hungarian – Romanian border: On the Hungarian side the M43 motorway section (2x2 traffic lanes + emergency lanes) from Makó to Csanádpalota city (Romanian border) being under construction is to be completed by the end of 2014 (Part of Priority Project 7).
- Slovakian – Hungarian border: M15 (Mosonmagyaróvár-HU/SK border) relates also to the OEM Corridor with impact to the R-D corridor: The M15 Expressway (14 km between Rajka/SK border – Hegyeshalom/M1) is only a half motorway and functions currently as an expressway with 2x1 traffic lanes. It needs completion for capacity (70%) and safety reasons.

Figure 30: Road alignment of the Rhine-Danube Corridor - missing links of cross border sections

Source: iC consulenten
** Hugarian section completed 2014*

National bottlenecks – road – missing links

Compliance with the main parameter on type of road (motorway, express way or ordinary road) has been achieved on a larger part of road sections of the R-D corridor except on the following sections with critical road conditions, which do not comply with the technical requirements as they are still classified as ordinary roads:

- In Slovakia the situation regarding the corridor alignment is as following:
  The connection from the CZ border to the motorway D1 is the R6 at Lysá pod Makytou – Púchov to Beluša. The R6 is classified as express way, has a length of approximatrely 26km, whereby 7.5km are in operation. The project is under study–> Status: unfinished EIA process;

  The corridor alignment follows then the D1 motorway up to the border to the Ukraine. The strategy of D1 motorway development will follow up on the OPT programming period 2007–2013, i.e. previous financial assistance, and the funds will be primarily used to co-finance major project delivered in several stages. The priority axis funds will be used, in particular, to finance the project preparation and construction of the following sections:

  - D1 Hričovské Podhradie – Lietavská Lúčka (2nd phase),
  - D1 Lietavská Lúčka – Višňové – Dubná Skala (2nd phase),
  - D1 Hubová – Ivachnová (2nd phase),
  - D1 Turany – Hubová,
  - D1 Budimír – Bidovce,
  - D1 Prešov, West – Prešov, South.

  Once the construction of all D1 motorway sections is completed – those started before 2014 and those to be co-financed under the OPII –, the two largest Slovak cities (Bratislava and Košice) will be interconnected by quality road infrastructure at a total length of approx. 442km in a horizon of several years.

- In Romania the situation is as following: Projects concerning the Nadlac – Arad and Timişoara – Lugoj – Deva – Sibiu sections are on-going or were contracted in 2012. Completion is expected by 2015. A revision of the study on the difficult and expensive section between Sibiu and Piteşti was completed by 2012. 47% of total length of the A1 (591km) is in operation. On the relation between Arad and Calafat (A6) Romania is not planning to make major investments, only minor rehabilitation projects are envisaged. Preparatory study are planned to be made in 2013 and work shall start immediately afterwards. Only rehabilitation measures of the A6 road between Bucureşti and Craiova are planned.

Figure 31: Road alignment of the Rhine-Danube Corridor – unfavourable road conditions

Source: iC consulenten

Critical issues on capacity

Other sections can be seen as bottlenecks due to high traffic utilisation, capacity reasons and safety reasons.

- Germany: Critical sections due to capacity problems and heavy traffic are on the A5 between Appenweier and AS Baden-Baden (extension to 3x3 lanes) and on several sections of the A8 from AS Karlsbad to the German/Austrian border (extension to 3x3 lanes). Similar situation appears on the A3 in Bavaria, where bridges have to be rehabilitated and reinforced together with extension of 3x3 lanes. Also the capacity for parking areas for trucks alongside the motorways is required in order to improve road safety.

- Austria: capacity problems due to heavy traffic and safety problems exist on the A4 between Airport Wien/Fischamend and the following sections towards Bruckneudorf and on the A1 between Pöchlarn and Ybbs. The construction of a third lane is in realisation. A number of existing parking areas need to be replaced by secure parking areas accompanied by an innovative information system due to security reasons.

- Czech Republic. After more then 30 years in operation the main route D1 between Praha and Brno is nearly at the end of its planning lifetime period. Modernization measures are therefore needed. For the period 2012-2022 the comprehensive modernization of the section Mirošovice - Kývalka (km 21 - 168 of D1) will be realized. This modernization will include widening of the width parameters, rebuilding of some bridges and also implementation of some new telematics systems.

- In Hungary the following critical sections were identified and reported:

The second carriageway (2x3 traffic lanes + emergency lane) of the M0 ring motorway around Budapest is to be built between interchanges M1/M0 and M7/M0 (2.8 km) in 2014-2016.

The deteriorated asphalt pavement of the old/first carriageway on the Southern Section of M0 Ring Motorway between interchanges M1/M0 and M51/M0 (approximately 26 km) is to be replaced by concrete pavement (including the renewal of the bridge across the Danube).

Due to the traffic volume close to capacity, the widening of M1 motorway section between Tatabánya and Budapest (approximately 44 km) up to 3x3 lanes is under consideration due to capacity (75%) and safety reasons.

4.3.6 Characteristics Airports

There are in total 11 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(each 2) and as well as one per other member state.

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.

Of particular relevance for the airport characteristics are the standards set by the Regulation 1315/2013. Concerning airports, the following core parameters and standards are defined:

- 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*

The analysis of the current status of connections shows the following situation for airports without rail connections in 2013 (cp. Table 25, page 139):

Praha, Bratislava, Budapest, Timişoara

Thus, the Airport of Praha (Václav Havel International) and Budapest Airport (Ferenc Liszt International) are to be connected to heavy rail until 2050.

Figure 32: Airports to be connected with TEN-T network by 2050

Source: iC consulenten

The following tables provide a summary of the traffic figures, the availability of the connection to the airport and the availability of alternative clean fuels on the airports falling under the obligation.

Table 24: Airport traffic figures

Airport	Country	Year	Passengers in mn pax	Cargo/Freight in t	Source
Frankfurt	DE	2013	58.04	2,048,000	Anna-aero database: European airport traffic trends, 2014, Website Fraport
Stuttgart	DE	2013	9.589	32,042	European airport traffic trends, 2014, Website Stuttgart
München	DE	2013	38.672	287,800	European airport traffic trends, 2014, Website München
Praha	CZ	2013	10.97	54,974 (2006)	European airport traffic trends, 2014, Website Praha
Wien	AT	2013	21.99	256,194	European airport traffic trends, 2014, Website Wien airport
Budapest	HU	2013	8.52	73,033 (2005)	European airport traffic trends, 2014, Website Budapest
Other airports:					
Bucharest Henri Coanda	RO	2013	7.6	24,210 (2011)	European airport traffic trends, 2014, Website Budapest
Timișoara	RO	2013	0.75	1,360	Website airport
Bratislava	SK	2013	1.7	17,717 (2010)	European airport traffic trends, 2014, Website
Nürnberg	DE	2013	3.31	90.973	Website
Ostrava	CZ	2012	0.3	2.584	Website

Source: iC consulenten

Table 25: Availability of connection to road and rail network

Airport	Country	Year	Road	Heavy Rail	S-Bahn/Metro	Source
Frankfurt	DE	2013	With A3 and A5 motorways	Railway station, Separate rail cargo station	S-Bahn, regional trains	Website Fraport
Stuttgart	DE	2013	With A8	--	S-Bahn	Website Stuttgart
München	DE	2013	With A92	--	S-Bahn	Website München
Praha	CZ	2013	With D7	--	Only bus service to next metro stations A & B	Website Praha
Wien	AT	2013	With A4	--	S-Bahn (electrified, double track, PAX only)	Website Wien airport
Budapest	HU	2013	With M0 and M5, main road no 4	--	Combined bus and train/metro connection via Ferihegy train station (former terminal 1)	Website Budapest
Other airports						
Bucharest Henri Coanda	RO	2013	With E60	--	Combined shuttle bus and train service via airport train station to city	Website
Timișoara	RO	2013	With A1	--	--	Website
Bratislava	SK	2013	With D1	--	--	Website
Nürnberg	DE	2013	With A3	--	Metro connection	
Ostrava	CZ	2013	By road 58	--	--	

Source: iC consulenten

The following figure presents those airports, which have a connection to the railway or the metro system of the urban node.

Figure 33: Airports with connection to railway or metro

Source: iC consulenten

Concerning availability of alternative clean fuels on airports the situation is as follows: Regarding the availability of alternative clean fuels for airport ground services (e-mobility, hydrogen, CNG, 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 München 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 Wien. 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.

Table 26: Availability of alternative clean fuels for ground services (electric, hydrogen, CNG, LNG)

Airport	Year	existing	Source
Frankfurt	2013	Electric stations for e-cars, trucks and minibuses	Website Fraport,
Stuttgart	2013	Hydrogen station, charging stations for e- cars	Website Stuttgart
München	2013	Hydrogen station	Website München
Praha		No information	
Wien	2013	Electric station for e-cars, gas filling station for the operation of 37 natural gas-powered vehicles	Website Wien airport
Budapest		No information	

Source: iC consulenten

4.3.7 Transport Market Study

4.3.7.1 TMS Introduction

The purpose of the multimodal Transport Market Study (TMS) is to give necessary input to Member States and other stakeholders by prioritising needs and requirements for efficient transport along the Rhine-Danube Corridor.

In order to analyse current and future conditions for passenger and freight transport in the corridor, information will be gathered on:

- General characteristics of the catchment area and drivers for transport
- Demand (traffic) data for freight and passengers
- Supply (network & nodes) data for terminals and ports

The review of data gathered in the TMS identifies transport trends, capacity utilization and bottlenecks. Additionally when looking at expected future transport demands, low utilized modes may attract flows from high utilized modes, resulting in a modal shift. The realisation of modal shift will enhance addressing (administrative, technical, operational) barriers and seeking possibilities to stimulate and increase multimodal transport along the corridor.

Approach

The overall TMS concept was developed for this report in order to have a clear integrated view of the process, as well as its expected outcomes. For each of the tasks all partners contributed with data from national sources, such as national forecasting models as well as European sources. Data sources that are used are presented throughout the study. A harmonized approach to present data has been attempted. Still all data sources are different per country, region or mode of transport; therefore some elements of the TMS have more detailed data than others.

The sources used are summarized as follows:

- National Transport Master Plans of Member States
- RFC7, RFC9, PP22, IWT medium and long term perspectives
- Airport websites
- Port survey results, Port websites
- Road supply side data sources, ETISplus (2010) and national sources (detailed in the appropriate section of the TMS)
- Rail supply side data sources (detailed in the appropriate section of the TMS)
- IWW supply side data sources is ETISplus (2010) and national source, Planco, Viadonau and BAFG (detailed in the appropriate section of the TMS).

No new numerical forecasts on future modal split are produced for this TMS due to practical reasons: first, the project list was prone to change in the course of the project and finalised at the end of November; second, the listed projects have a peak roughly at the year 2022 and more projects are reasonably to be expected in future years i.e. for the period 2020-2030 the project list is, most likely, not fully complete;

third the unfavourable timing between the last Corridor Fora and the finalisation of the Progress report; finally, there is a large amount of existing material on forecasts, this will be demonstrated in the chapter.

In future research, with a larger time span it is possible to make a Europe-wide transport volume forecast. The large geographical scope means developments outside the corridor are taken into account. Assumptions on modelling would be similar per corridor, base year data would be the same, modal shift assumptions would be the same. Similar assumptions mean that at least different forecasts per corridor would produce results that can be compared with each other. Finally a Europe-wide approach would prevent the double counting of results. When for example rail traffic increases in Romania it should either be assigned to the OEM corridor or the R-D Corridor, for other overlapping corridor countries this is even more complex. Another example of double counting is port volume growth. Port forecasts can assume a growth of market share, when all individual port forecasts are summed up, the sum can be higher than the actual future market volume. Lastly, per corridor different assumptions are needed to represent the unique character of that corridor. This can be based on the identified Strengths, Weaknesses, Opportunities and Threats of the multimodal transport study.

A bottom up approach of projects is a solution to deal with the issue of a developing project list. A bottom up approach in this context means that assumptions are made on transport costs and service on a global level, not per individual project. For example: the travel time of inland waterway vessels is more reliable due to works on navigability, the implementation of ERTMS brings down costs and increases capacity for rail, upgrades and maintenance of motorways increase road service and safety. This is basically an assumption that all relevant/necessary projects are implemented, including some of the gaps in the project list. The gaps in the project list are identified in this report and during the fourth corridor forum. This would produce new numerical forecasts on future modal split.

Drivers for growth and scenarios

Overall, the transport system is influenced by several parameters of high or low uncertainty. In order to project the current demand to the future, it is important to identify these parameters (drivers) which influence the demand. For the demand of personal transport, these are factors related to trips (generation and distribution), as well as modal split. Similarly, for freight, demand drivers are related to trade (generation and distribution) and modal split. Examples include, amongst other, the population and income parameters for estimating the future number of trips, GDP and sectoral growth for the projection of trade, transport distances for routing and transport times (barriers) and costs for modal split. These parameters can be defined externally, or, in case of scenarios, they can be modified in order to present a range of plausible futures,example.g. modelling the effect of decreasing transport times for a specific mode on the transport demand and the total mode share.

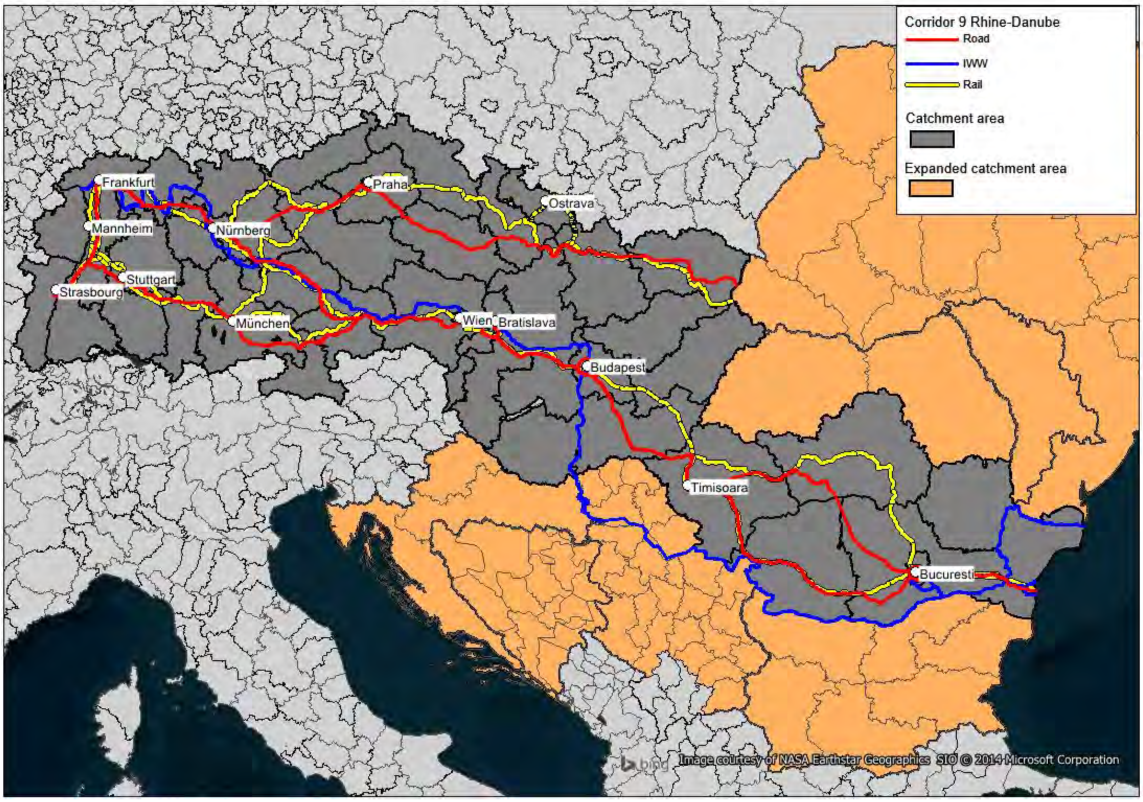
The present report presents for the national scenarios the socioeconomic assumptions, which are externally defined and shape the picture of the future passenger and freight demand. Other parameters, including policy have an effect on the volumes. The two GDP and population parameters are the most representative when presenting a scenario; this is the reason to describe them in the TMS. Other parameters of interest, such as the fuel prices, motorisation and urbanisation rates, are not described in this report in every detail as they are internal model variables and not always publicly available. Secondly, the report presents the status of the Corridor demand. This is an extraction of the catchment area regional Origin-Destination demand (in tonnes and trips) from the ETISplus database. ETISplus is the main source of information which can provide the scale of the demand reflecting only the Corridor-related flows for the R-D Corridor. Regarding the demand, the TMS also presents the expected growth on demand (passenger and transport), depending on the available data; in most cases, these are parts of national models (covering larger parts than the Corridor areas) and are divided per market sector (domestic, imports, exports and transit) and mode shares. Even though these projections are reflecting the flows beyond the Corridor activity, they still provide an insight on the potential for specific demand and modes growth and could be used to derive conclusions on the future market demand also in the Corridor area. These projections are, in most cases, baseline scenarios, i.e. scenarios that assume that the framework of analysis will remain the same during the projection years; therefore, these scenarios do not simulate any policy changes or structural changes. In case, there are changes simulated these are developed through various scenarios. In this case the national forecast for Austria and Germany presents different scenarios, depicting different macroeconomic assumptions.

Next to the national scenarios, there are several studies targeted to specific Corridor parts (e.g. rail studies and related forecasts) or transport plans. These depict specific parts of the Corridor catchment area and will be examined to draw conclusions on the effects of specific attributes on the transport demand.

Catchment area

The geographical coverage of the TMS is called the catchment area. The core infrastructure is included and the NUTS2 regions that are directly in it, of rail, road and inland waterways. Additionally adding extra regions and countries were evaluated for the TMS based on transport demand. Catchment areas of Bulgaria and Croatia are included in the market study as well. Neighboring countries evaluated are: Bosnia-Herzegovina, Serbia, Moldavia and the Ukraine.The relevance of these countries is different per mode of transport and per mode of transport these countries will be covered accordingly. The Rhine-Danube corridor has an east <-> west form, international transit traffic is either covered by other overlapping corridors, most notably the Orient-East Med corridor, or the international north-south traffic of the Baltic-Adriatic corridor. The corridor has entrance and exit points at the edges of the catchment area. Roughly five points can be identified at the edges of the catchment areas.

Figure 34: Catchment area Rhine-Danube Corridor



Source: Panteia

4.3.7.2 Analysis of the demand side of the market

4.3.7.2.1 Socio economic data

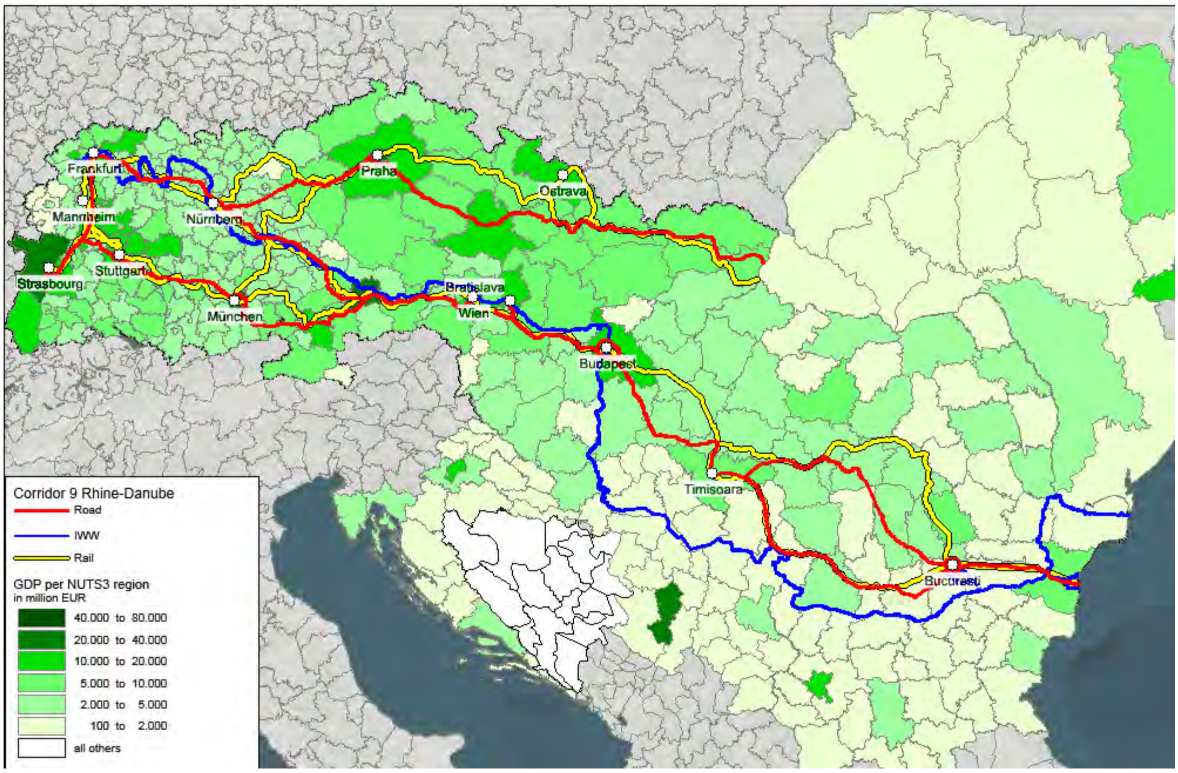
Corridor wide

This section covers a major driver of transport. The current corridor situation is presented on a regional level. National socio economic data from national models is also presented.

For each of the regions in the catchment area macroeconomic indicators have an influence on the demand for transportation services. Hence, the transport of goods and passenger is affected by national or regional economic growth and population. Gross Domestic Product (GDP) value is considered as an important driver for trade and therefore freight transport. Regional socioeconomic (GDP, population, population density) has been collected from the ETISplus database (year 2010).

Firstly the GDP map of the corridor shows that most GDP in current market prices (EUR) is centered on the selected corridor nodes, urban nodes and ports.

Figure 35: Overview of GDP in current prices per NUTS3 region in Catchment area



Source: ETISplus, Panteia

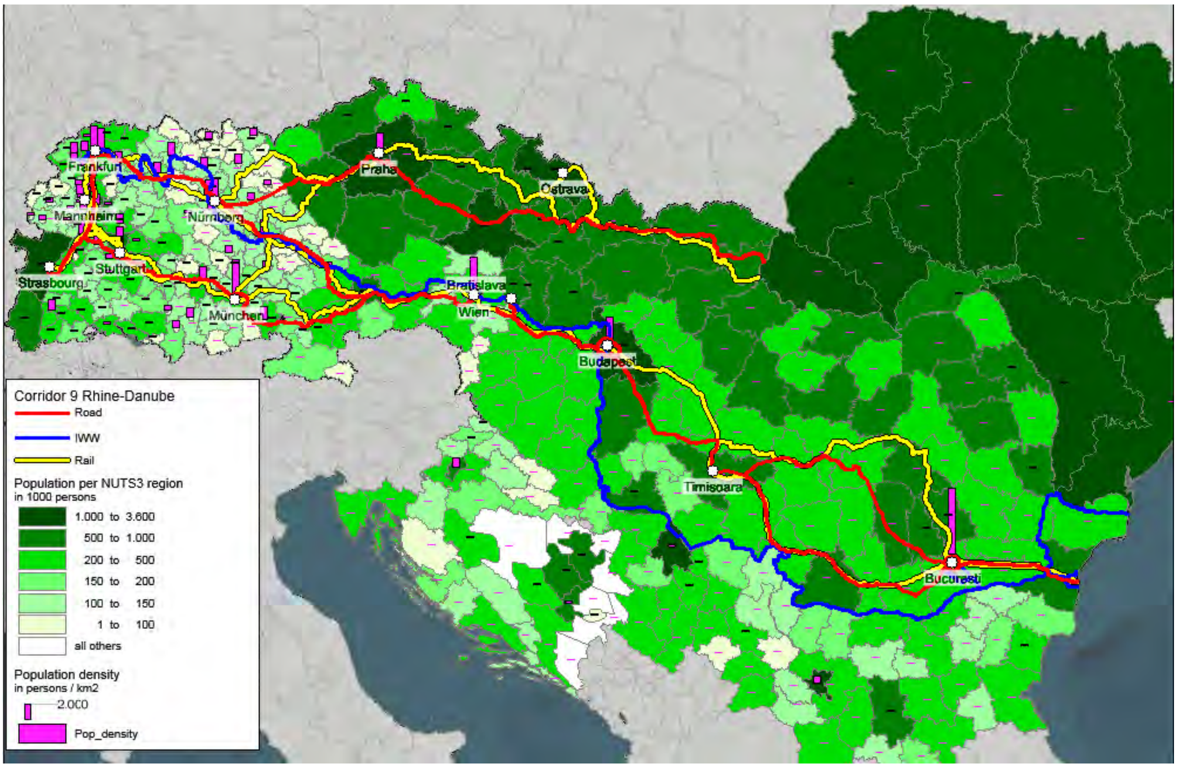
Totals of the regions are visible in table format. The selection of Germany has by far the highest Gross Domestic Product. Data for Bosnia-Herzegovina was not available.

Country	Total regional GDP
AT	194,440
BA	
BG	36,034
CZ	147,022
DE	1,021,605
FR	52,113
HR	45,297
HU	107,831
MD	4,381
RO	129,630
RS	41,227
SK	63,511
UA	29,000
Total	**1,872,092**

Source: ETISplus, Panteia

Population is an important driver for transport as well as GDP. Due to the difference in sizes of European NUTS 3 zones, Germany seems to be less populated. This is actually not the case as the NUTS 3 zones are simply smaller due to existing zoning conventions and existing governance structures. To compensate for the smaller regions, population density has been added. This shows that Ukraine is less densly populated than the map would suggest.

Figure 36: Overview of population and population density per NUTS3 region in Catchment area



Source: ETISplus, Panteia

The table below shows that the population distribution is more balanced than the GDP distribution on the corridor.

Table 27 Corridor population in 1000s and persons/km^2 for 2010

Country	Total regional population	Average population density
AT	5,525	309
BA	3,768	101
BG	7,364	86
CZ	10,434	291
DE	28,927	518
FR	1,862	224
HR	4,293	125
HU	10,015	250
MD	3,560	120
RO	21,439	277
RS	7,293	97
SK	5,431	132
UA	20,026	73
Total	**129,934**	**335**

Source: ETISplus, Panteia

Urbanisation is a recurring element on the corridor. Urbanisation on NUTS 3 region level is visible in Figure 36: Overview of population and population density per NUTS3 region in Catchment area . It is most occurring in Germany. This is consistent with the corridor alignment with a large number of urban nodes in the German part of the corridor. Capitals additionally have a high degree of urbanisation. The ETISplus data is also consistent with the picture sketched in the regional focus study of the EC[98].

National socio economic data forecasts

Austria

The BMVIT of Austria commissioned a traffic forecast Verkehrprognose Östereich 2025+. In this study socio economic assumptions are detailed. The indicators GPD has grown in the past by 2.2 per year. In the period up to 2025 a growth rate of 1.9% per year is expected. Population growth from the study is taken from the national Austrian statistical bureau STATISTIK AUSTRIA. The most current population forecast from 2012 is a growth of 0.36% per year until 2030 according to the main scenario.

Aging of population is expected and further urbanisation will keep Wien the largest region with a growth of 0.74% per annum.

Czech Republic

In the Czech Republic the national forecast has detailed socio economic forecast on GDP, population, share of economically inactive population, Motorization rate, Fuel prices and fossil fuel assumptions. These are the drivers that are used to forecast for Czech transport demand. GDP is expected to grow by more than 1.5% annually. Population is expected to increase by 0.02% per year. Aging of population, increased motorization rates and higher fuel prices are important assumptions of the model.

France

The Alsace region of France is involved in the R-D Corridor. The INSEE publication provides population projections per region. Between 2007 and 2030 yearly population growth of 0.36% is forecasted. By comparison, total metropolitan France has an average 0.41% growth rate. Regional GPD forecasts are not available.

Germany

Most detailed information for German socio-economic forecast is available in the Überprüfung des Bedarfplans für die Bundesscheinenwege of 2010. At the time of drafting this report the 2015 version has some aggregate intermediate results and figures will be mentioned.

Population in Germany is expected to decline in both versions of the BVWP around the average of 0.25% per year. GDP projections for 2007 indicate the economy of Germany will grow 1.7% each year.

Economic projections from the German Bundesverkehrswegeplan of 2015 indicate 1.14% pa growth between 2013 and 2030 in terms of Economic power. The effect of the crisis and other new information has dampened average growth by more than 0.5%, compared to the 2007 projections.

Hungary

[98] *EC, Regional Focus: A series of short papers on regional research and indicators produced by the Directorate-General for Regional Policy, Regional typologies: a compilation by Lewis Dijkstra and Hugo Poelman, 2011*

Hungary's National Transport Strategy, responsibility Hungarian Transport Administration, summarizes trends. The document uses global sources of EU reference scenario, NSO, and calculations of the consortium performing the study. GDP is expected to grow around 1% up to 2030. The period 2020-2030 will see the highest growth. Population is expected to decrease by 0.25 % per annum.

Romania

Economic projections are presented in the Preliminary Report on the Master Plan Short, Long and Medium Term. Up to the year 2030 an annual growth of 3% is forecasted. This is in contrast with the population forecast of -0.3% per annum, for the same period. Employment increases, economically active population decreases (aging of population) and private car ownerwhip increases significantly in the forecast.

Slovakia

The Strategic Development Plan of Transport infrastructure of the Slovak Republic by 2020 presents information on population. The population of 5.4 million people is expected to decline in the future, according to the national forecasting bureau Infostat. The middle variant projections foresee stagnation of the population until 2025, followed by a decline of 9% until 2050 to around 4.9 million people. No economic forecasts are presented in the Strategic Development Plan of Transport infrastructure of the SR.

Socio-Economic conclusions

Currently the most economic power lies in the western part of the corridor. The same can be said about the population and the corridor is urbanised. Germany and Eastern European countries have remained strong during the economic crisis. Still, in the past years the growth rate has slowed down in the corridor countries. This means that the existing economical gap needs more time to be bridged. The given national projections indicate that the growth rate on the corridor in terms of annual GDP is roughly between 1 and 2 percent and therefore differ not too much.

Population is expected to decline, but not around urban nodes. Aging of population is also expected throughout the corridor, reducing somewhat the need for speedy modes of transportation. Individualization is a trend that increases mobility demand and individual wealth promotes car ownership on most corridor countries.

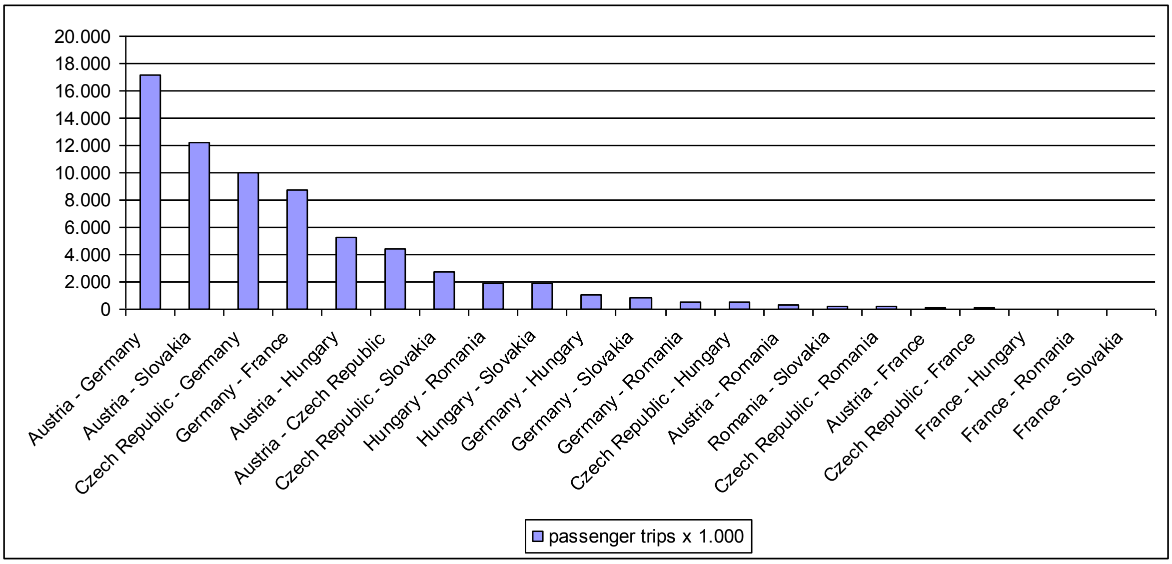
4.3.7.2.2 Current transport demand

Corridor passenger

The transport description for passenger transport is, similar to freight, based on data from the Etisplus database. The data in this database is collected for the year 2010. From this database the transport volumes between and within RD regions on NUTS2 level has been derived, this data is aggregated to country level. This means that since only a part of Germany belongs to the R-D Corridor, the German induced RD-related transport is considerably smaller than the national figure. The same applies for other countries.

In Figure 37 for all modes (road, rail and air) the passenger traffic flows between the RD countries are presented. The most important bidirectional traffic flow is the one between Austria and Germany. Between these countries 17.2 million trips were observed, representing 25% of the total trips. The second highest flow is the bidirectional traffic flow between Austria and Slovakia: 12.2 million trips, 18% of the total trips.

Figure 37: Passenger traffic between teh RD regions grouped by Member States (2010) in 1000 trips, all modes



Source: ETISplus, Panteia

In the tables below for respectively road, rail and air the passenger traffic between the RD regions are shown on country level. In total 68.4 million trips were made in 2010. The most important mode is road, covering 83% of the total trips, followed by rail with 13% and air with 4%. Air is naturally a more long-distance, beyond the area of this corridor. For the individual modes the bidirectional traffic flow between Austria and Germany is also 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 NUTS 2 region of France also has a high number of road traffic. For rail this is the flow between Austria and Germany, and for air the flow between Germany and Hungary.

Table 28: Passenger traffic between the RD regions by road grouped by states (2010), in 1000 trips

	Austria	Czech Republic	Germany	France	Hungary	Romania	Slovakia	Total
Austria	-	1,491	7,417	27	1,744	43	5,488	**16,210**
Czech Republic	1,491	-	4,313	32	204	61	849	**6,951**
Germany	7,417	4,313	-	4,235	348	119	290	**16,722**
France	27	32	4,235	-	9	4	7	**4,314**
Hungary	1,744	204	348	9	-	813	755	**3,873**
Romania	43	61	119	4	813	-	76	**1,116**
Slovakia	5,488	849	290	7	755	76	-	**7,467**
Total	**16,210**	**6,951**	**16,722**	**4,314**	**3,873**	**1,116**	**7,467**	**56,652**

Source: ETISplus, Panteia

Table 29: Passenger traffic between the RD regions by rail grouped by states (2010), in 1000 trips

	Austria	Czech Republic	Germany	France	Hungary	Romania	Slovakia	Total
Austria	-	681	797	1	896	4	604	**2,985**
Czech Republic	681	-	576	0	20	4	493	**1,775**
Germany	797	576	-	115	29	3	26	**1,547**
France	1	0	115	-	0	0	0	**116**
Hungary	896	20	29	0	-	75	193	**1,214**
Romania	4	4	3	0	75	-	7	**94**
Slovakia	604	493	26	0	193	7	-	**1,324**
Total	**2,985**	**1,775**	**1,547**	**116**	**1,214**	**94**	**1,324**	**9,055**

Source: ETISplus, Panteia

Table 30: Passenger traffic between the RD regions by air grouped by states (2010), in 1000 trips

	Austria	Czech Republic	Germany	France	Hungary	Romania	Slovakia	Total
Austria	-	15	380	26	8	113	4	**546**
Czech Republic	17	-	88	12	51	27	43	**239**
Germany	372	92	-	3	172	161	109	**907**
France	24	11	3	-	14	8	2	**62**
Hungary	8	59	175	14	-	84	1	**342**
Romania	112	31	169	7	85	-	35	**440**
Slovakia	4	43	104	2	1	27	-	**181**
Total	**538**	**251**	**919**	**63**	**332**	**419**	**194**	**2,717**

Source: ETISplus, Panteia

Corridor Freight

The transport description for freight is based on data from the Etisplus database similar to passenger transport.

From this database the transport volumes between and within RD regions on NUTS2 level has been derived, which data is aggregated to country level. This means that since only a part of Germany belongs to the R-D Corridor, the German induced RD-related transport is therefore considerably smaller than the national figure. The same applies for other countries. The data in this database is from the year 2010.

In the tables below for respectively road, inland waterway and rail the transport volumes between the RD regions are presented on country level. Only international transport is presented. When considering regional and national figures 69% of the freight volume is interregional, 27% of the volume is extra-regional domestic traffic and 4% is international traffic.

The figures in the tables show that road transport is the most dominant transport mode within the R-D Corridor. The transport volume for road within the R-D Corridor is twice as big as for rail, and four times as big as for inland waterway. (or 58% road, 28% rail and 14% IWT). The Czech Republic has the highest rail and highest road volume of the regionalized corridor countries.

Table 31: Road freight transport volume between the RD regions grouped by states (2010) in 1000 tonnes

	Austria	Czech Republic	France	Germany	Hungary	Romania	Slovakia	Total
Austria		1,540	47	4,073	1,357	146	957	**8,121**
Czech Republic	2,101		70	4,324	1,085	182	5,095	**12,857**
France	37	64		1,138	24	29	34	**1,326**
Germany	5,624	3,446	1,497		858	260	621	**12,305**
Hungary	1,781	957	26	743		972	2,249	**6,728**
Romania	131	104	27	240	831		48	**1,382**
Slovakia	1,418	4,557	37	722	2,995	178		**9,907**
Total	**11,092**	**10,669**	**1,704**	**11,239**	**7,149**	**1,768**	**9,004**	**52,625**

Source: ETISplus, Panteia

The catchent area of IWW includes the corridor Member States and, Bosnia-Herzegovina, Serbia, Moldova en Ukraine. Bulgaria and Croatia are considered in terms of ports and inland waterways of the Danube and Sava rivers This all together adds a freight volume of 7.5 million tonnes to the 12.95 million to a total of 20.45 million.

The table below presents international IWT volumes on the Danube and Mainz-Donau canal. The countries of Ukraine, Bulgaria, Bosina-Herzegovina, Moldova and Croatia rank lowest. The Czech Republic has mostly domestic flows and flows to northern Germany (which is not part of the corridor) the country is therefore not represented in the table. Romania ranks highest, especially Serbia has a high volume of import and export to Romania. The high IWT volume of Romania and of the transport between Serbia and Romania in particular is largely related to the port of Constanta. 2010 data was used to compare between the other modes of transport. Hungary-Romania is a relation with high volume. Slovakia-Austria is also a connection with high volume; Ukraine has a high volume in relation to Austria. This is one-way traffic only from Ukraine to Austria. One-way traffic is further discussed in the supply side section of the TMS. Transit traffic is the higest on the Donau river for Serbia and Croatia.

Table 32: IWT volume on the Rhine-Danube corridor. 2010 volumes in 1000 ton

	Import	Export	Transit
DE*	3.14	5.75	4.89
AT	6.25	1.67	2.94
SK	0.31	3.60	5.87
HU	1.83	4.73	4.17
HR	0.20	0.16	7.64
BA	0.04	0.03	0.00
RS	4.08	2.17	6.84
BG	2.00	1.27	4.12
RO	7.09	2.78	4.12
MD	0.08	0.06	0.00
UA	0.13	6.82	0.00
Total	**25.15**	**29.035**	**40.59**

DE is the sum of Danube and Mainz-Danube canal. Source MDc: Verkehrsbericht 2010 WSV. Source for the rest: Danube Navigation in Austria, Via Donau 2010.*

Table 33 Rail freight transport volume between the RD regions grouped by states (2010) in 1000 tonnes

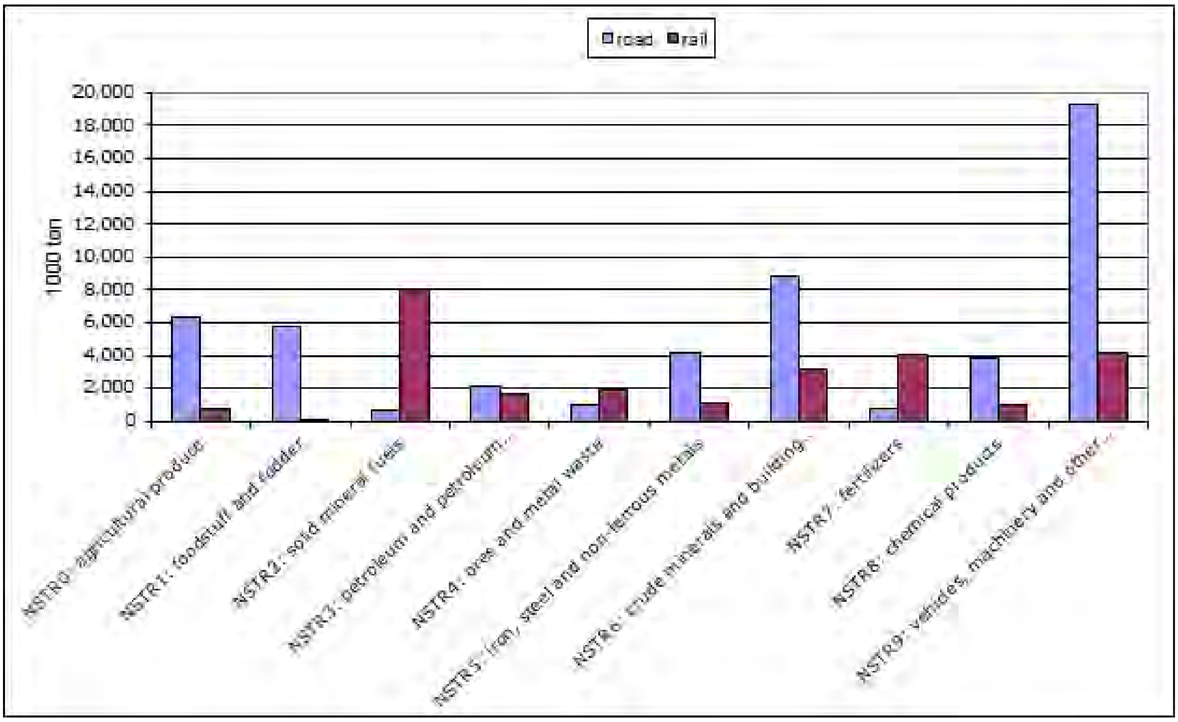
	Austria	Czech Republic	France	Germany	Hungary	Romania	Slovakia	Total
Austria		283	45	1,268	1,347	51	122	**3,115**
Czech Republic	2,618		0	468	966	50	3,560	**7,663**
France	17	0		36	0	0	7	**60**
Germany	2,105	69	19		437	0	14	**2,644**
Hungary	2,064	141	1	439		116	669	**3,430**
Romania	10	8	0	0	659		74	**751**
Slovakia	1,760	5,541	1	113	770	0		**8,185**
Total	**8,573**	**6,043**	**66**	**2,325**	**4,180**	**217**	**4,445**	**25,848**

Source: ETISplus, Panteia

Bulgaria’s entire rail freight volume on the corridor is 1 million tonnes. 59% percent of that volume is traffic related to Romania.

A comparison of commodity types indicates typical international goods for rail and for road and overlapping products were markets are shared. Agricultural products and Foodstuffs are currently the domain of road transport. Coal is transported by rail. Petroleum products (in the broadest sense) are shared between road and rail. Road has a relative high share for the metal related bulk goods. Chemicals and Containers are again a shared market, but where road has an higher volume in the current situation.

Figure 38 International commodity types transported on the corridor for road and rail. Volumes of 2010



Source: ETISplus, Panteia

4.3.7.2.3 Current node demand

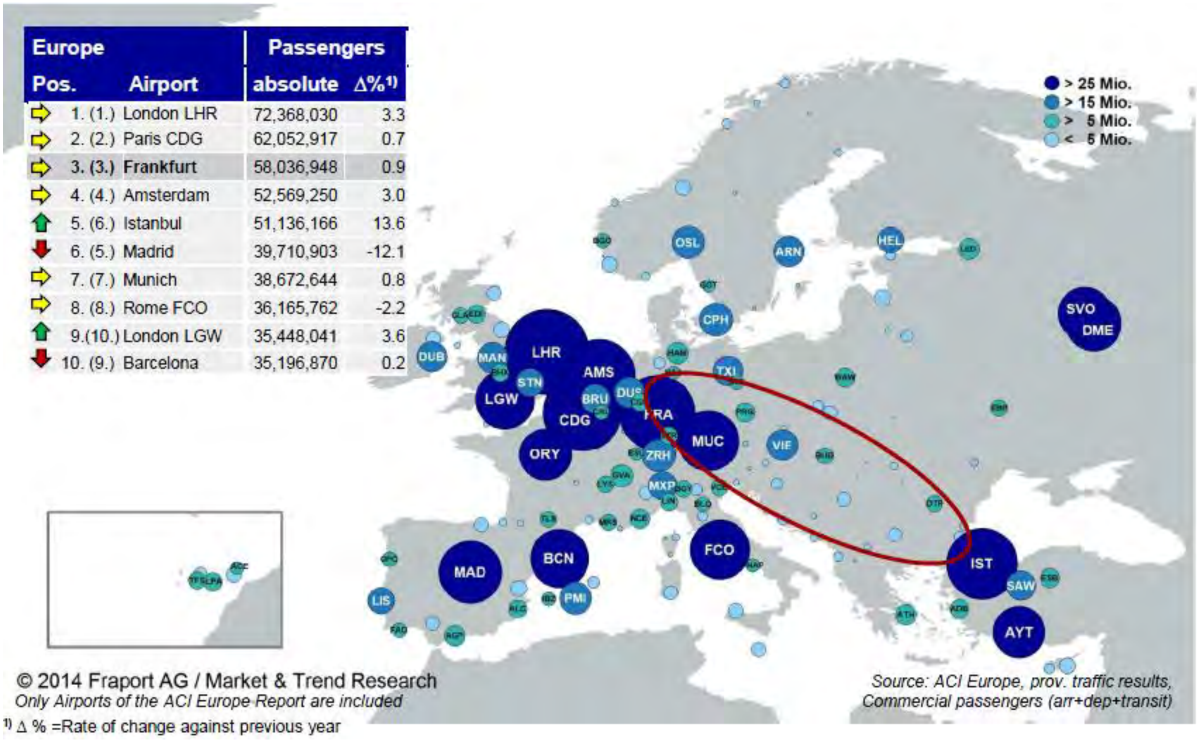
Seaports, inland ports and airports form a very important part of the Transport Market Study as they serve as gateways for traffic travelling across the corridor or entering and exiting the Rhine-Danube Corridor. This section presents available information on the specific performance of ports and airports in the Rhine-Danube Corridor. The focus of this analysis is not only the actual volumes of handled cargo and/or passengers, but also the types of cargo and when available, the multimodal performance of these ports.

Airports demand

Current airport figures are presented in this section. These results are described here. Where a national forecast is available, the forecast and the base data is presented in the node demand forecast section Table 35. This is the case for all airports with exception of the German Airports Frankfurt and München.

Frankfurt airport statistics were used to identify the large market players on the corridors, both for passenger and freight, although the two are closely related.

Figure 39: Overview of passenger handling per node in Europe for 2013



Europe		Passengers	
Pos.	Airport	absolute	Δ%[1]
1. (1.)	London LHR	72,368,030	3.3
2. (2.)	Paris CDG	62,052,917	0.7
3. (3.)	Frankfurt	58,036,948	0.9
4. (4.)	Amsterdam	52,569,250	3.0
5. (6.)	Istanbul	51,136,166	13.6
6. (5.)	Madrid	39,710,903	-12.1
7. (7.)	Munich	38,672,644	0.8
8. (8.)	Rome FCO	36,165,762	-2.2
9.(10.)	London LGW	35,448,041	3.6
10. (9.)	Barcelona	35,196,870	0.2

Frankfurt

Frankfurt airport is the largest airport on the corridor, both in passenger and freight. With 58 million total passengers in 2013 and 28 million passenger departures it is the third airport in Europe. Main passenger area is Europe and the table of Frankfurt presents the main departures to Countries. In 2013 the most growth was in the Near East traffic.

Table 34: Frankfurt passenger statistics 2013 (by country destinations)

Ranking (previous year)	Country	Departing (million pax)	Share of total
1 (1)	USA	3.4	11.7
2 (2)	Germany	3.1	10.6
3 (3)	Spain & Canaries	1.7	6
4 (4)	Italy	1.5	5.2
5 (5)	UK	1.3	4.5
6 (8)	Austria	0.9	3.2
7 (7)	Turkey	0.9	3.1
8 (6)	France	0.9	3.0
9 (9)	China	0.8	2.9
10 (10)	Canada	0.7	2.4
11 (11)	Russia	0.6	2.2
12 (13)	India	0.6	2
13 (12)	Japan	0.5	1.9
14 (15)	Poland	0.5	1.8
15 (14)	Switzerland	0.5	1.7
	Rest of the world	10.7	37.2

Source: Frankfurt Airport, Air Traffic Statistics 2013.

In total for 2013, the cargo in the Frankfurt airport was slightly more than 2 million tonnes (all destinations), most of which (1.9 billion tonnes) had international destination and was accommodated in passenger flights. Europe-wise, Frankfurt accommodated around 250 thousand tonnes –close to 12% of the total- showing an increasing trend (compared to 2012) of 4.4%. In the Frankfurt Air Traffic Statistics 2013 it is shown that Frankfurt was the largest freight airport in Europe in 2013.

München

München produces its own annual statistics of passenger and freight Annual Traffic Report 2012, München airport with 38 million total passengers in 2012 and 19 million passengers embarkments. München airport is the seventh airport in Europe. 23% of passengers transported are of domestic destination, International destination Europe has a share of 56% for passengers.

Total freight was 287,000 tonnes in 2012. 86% of freight was international, 9% domestic and 5% was transit freight.

Port node demand

A survey has been sent to port authorities, asking whether or not they could provide data on the transport volumes handled at ports, as well as the types of commodities. This has been asked for all three modes. The following ports have answered to the survey and have provided data.

Table 35: Table of node demand data sources

	Port	Survey	National source	Other source
FR	Strassbourg			
DE	Mainz		X	
	Frankfurt	X		
	Nürnberg	X		
	Regensburg	X		
AT	Enns	X		
	Wien	X		
SK	Bratislava	X		
	Komárno	X		
HU	Komárom	X		
	Budapest	X		
HR	Vukovar	X		
	Slavonski Brod			
RS	Novi Sad		X	
	Beograd			X
RO	Drobeta-Turnu-Severin		X	
	Calafat		X	
	Cernavoda		X	
	Galați		X	
	Giurgiu		X	
	Constanta	X		
BG	Ruse	X		
	Vidin	X		

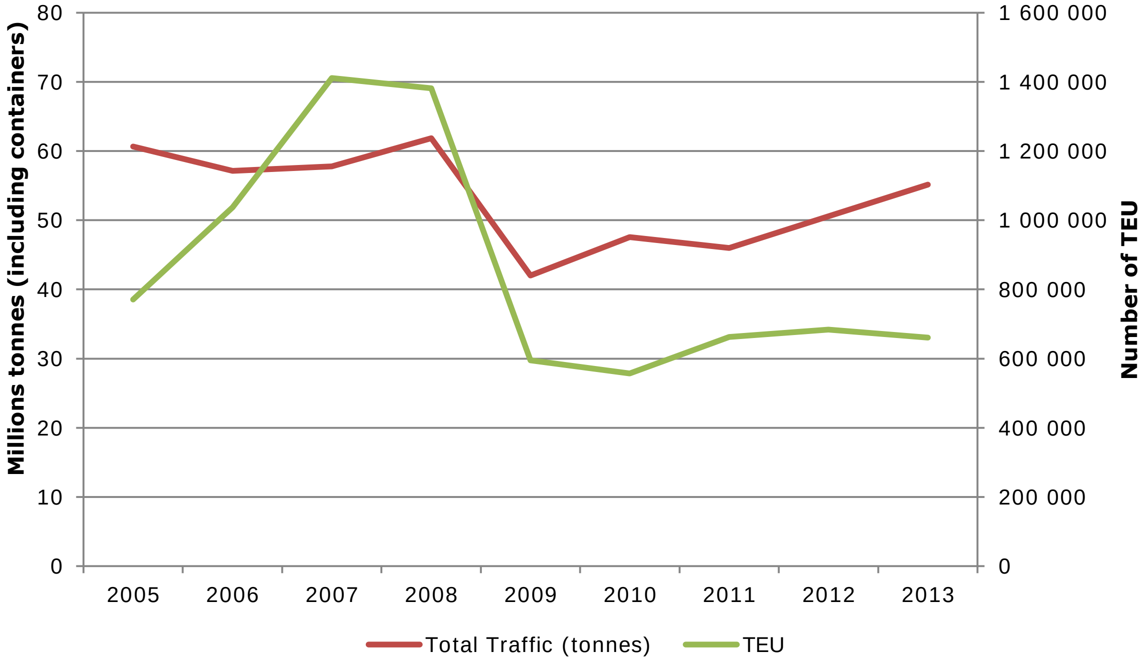
Seaports

Constanta and Galați are the identified maritime ports in the Rhine-Danube Corridor.

Constanta

Constanta is the largest seaport in the Rhine-Danube Corridor. In the recent years, the port of Constanta has handled over sixty million tonnes per year. The financial crisis reduced handling statistics to slightly over 40 million tonnes in 2009, since then volumes are increasing. The crisis had a large effect on the amount of TEU handled. This has dropped from 1.4 million in 2007 and 2008 to 595,000 in 2009. Whereas general and liquid cargo managed to retain its original pre-crisis values, the amount of TEU is still not back at the level pre-crisis. In 2013, the amount of cargo handled topped at 55.1 million tonnes of cargo, including 661,000 TEU.

Figure 40: Constanta seaport - cargo handling

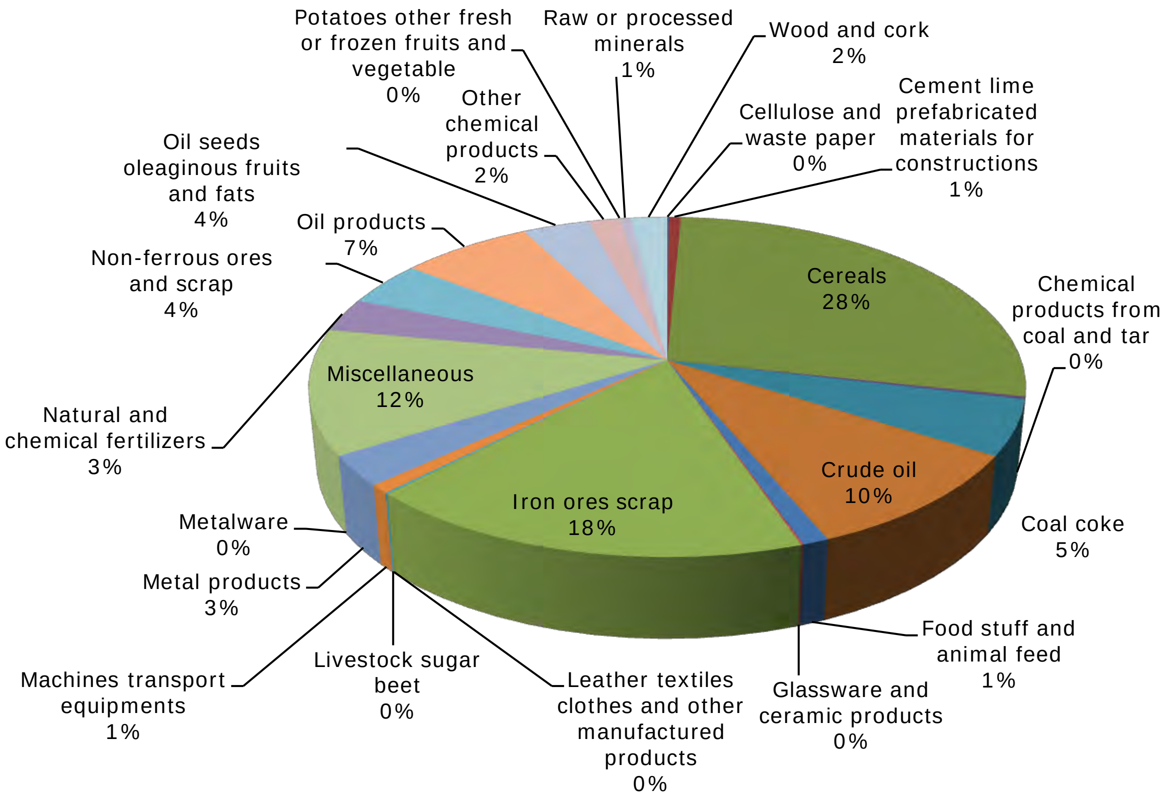


In commodities, the number of containers shows a declining trend and so does the amount of liquid bulk. Up to 15.4 million tonnes of liquid bulk has been handled in 2005, dropping to 14.4 million tonnes in 2008. Since the crisis, this number has showed an ever-declining trend to a bare 10.1 million tonnes in 2013. Opposing, the amount of dry bulk cargo has increased from 31.4 million in 2005 via 21.1 million in 2009 to 34.9 million tons in 2013.

In 2013, 4,833 sea-going vessels were handled at the Port of Constanta, opposed to 9,233 river vessels. The sea –going vessels accounted for 42.7 million tonnes of cargo and the river-vessels hauled 12.5 million cargo.

The main commodities in the Port of Constanta are cereals, comprising 28% of the total transport volume in 2013. Also Iron ores and coal coke have a decent share.

Figure 41: Commodity split of the port of Constanta



According to ViaDonau (2007), the modal split of container handling in the Port of Constanta is 70% by truck, 27.5% by rail and the remaining 2.5% by inland barge.

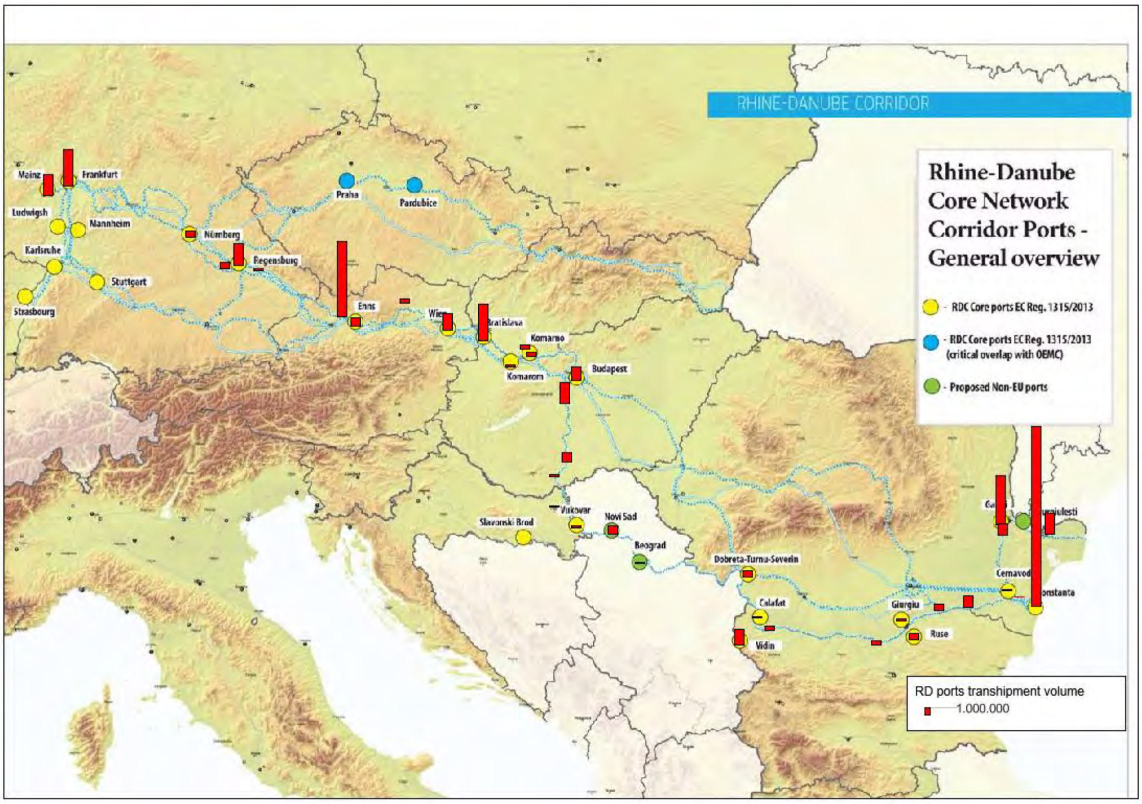
Galați

The port of Galați is the second largest Romanian port. In 2013, 3.5 million tonnes of cargo were handled. River traffic accounted for the majority of the traffic volume: 2.2 million tonnes have been transhipped by 1,420 barges, opposed to the 1.3 million tonnes that were brought in by the 380 sea-going vessels. The port has been faced by a significant decline in transport volumes, from over 10 million tonnes in 2005 and 2007 to 3.5 million tonnes in 2013, the lowest volume since 1991.

Inland core ports

The collection of IWW port data has resulted in the following port map.

Figure 42 Current total inland port transhipment volumes for core and comprehensive ports where data is available and non-EU ports.



Source: Consortium

Figure 42 illustrates the sheer inland waterway volume currently transhipped. This volume includes all types of cargo, bulk and containers. The volumes of the seaports of Constanta and Galați are for IWT volume only. If sea-related volumes were to be included the ports would show more volume. The port of Constanta has the largest IWT transhipment. The port of Linz has the second largest IWT volume of about 5 millions tonnes. The eastern ports near the Black Sea handle a large amount of cargo on the corridor.

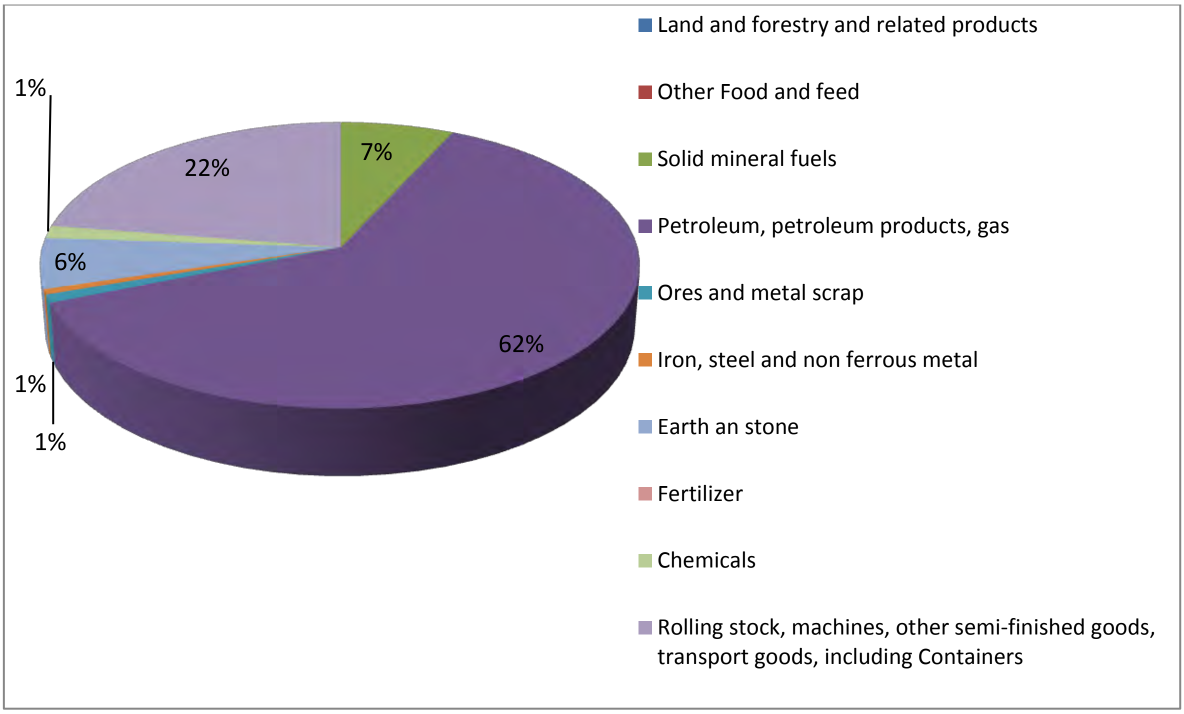
<u>Mainz</u>

Mainz lies at the confluence of the Rhine and Main River. Although it was agreed that Mainz will be analysed in the Rhine-Alpine Corridor study the port of Mainz is considered in the TMS of the Rhine-Danube Corridor study. In 2012, as much as 1,538,342 tonnes of cargo were handled at the Port of Mainz, a decline of 5.3% as compared to 2011. Import and export are more or less balanced in Mainz, with 815,122 tonnes imported and 723,220 tonnes of cargo exported.

Frankfurt

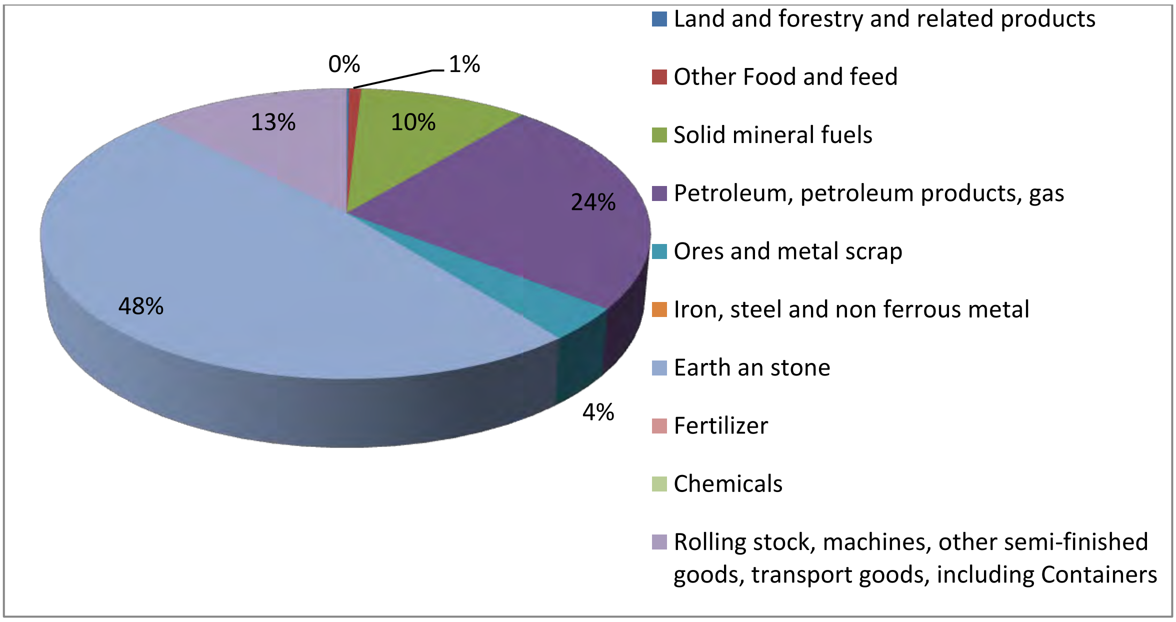
Port of Frankfurt has demonstrated growth for rail services in the past three years. In 2010, 50,372 wagons have been handled with a total of 1.5 million tonnes of cargo. Moreover, 30,740 TEU were handled by rail. The main commodities for rail services are building materials, fuel products and machinery and transport equipment, which also involve containers. Also ores are transported frequently by rail.

Figure 43: Frankfurt rail commodity breakdown



Opposing, a small decline for inland waterway services has been noted, in both volumes (tonnes, TEU) and the number of vessels. Still, 1,812 river vessels have been handled at the port of Frankfurt, equalling 2.4 million tonnes of cargo and 31,669 TEU.

Figure 44: Frankfurt IWT commodity breakdown (2010)

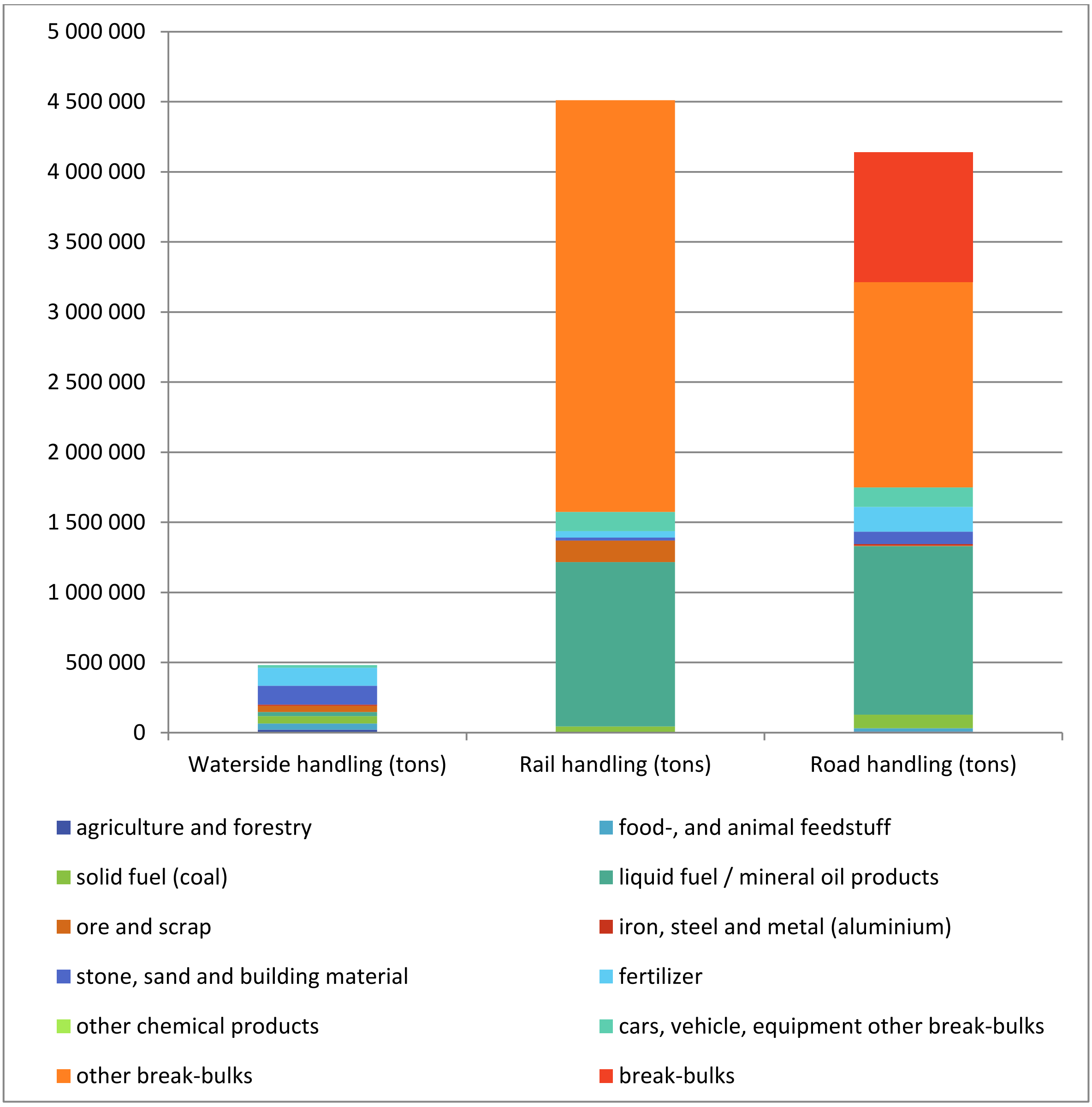


Nürnberg

Nürnberg is a large trimodal port in the middle of Bavaria. In 2010, as much as 561 vessels, 86,126 wagons and 415,417 trucks were handled at the port of Nürnberg, resulting into a transhipment of 15 million tonnes. Trucks have accounted for 67% of the transport volume, trains for 30% and the remaining 3% is IWT traffic. Further, 543 passenger vessels moored at Nürnberg, bringing in 65,160 passengers.

The main commodity by IWT is fertiliser for the inbound traffic and sand, stone and building materials for the outbound traffic. These commodities account for 50% of the traffic volume by IWT. By rail transport, the main commodities are liquid fuels and mineral oil products (25%) and containers (67%). The main commodities by road are the same as for rail: other break bulk (containers) and liquid fuel and mineral oil products.

Figure 45: Nürnberg port inland handling in tonnes



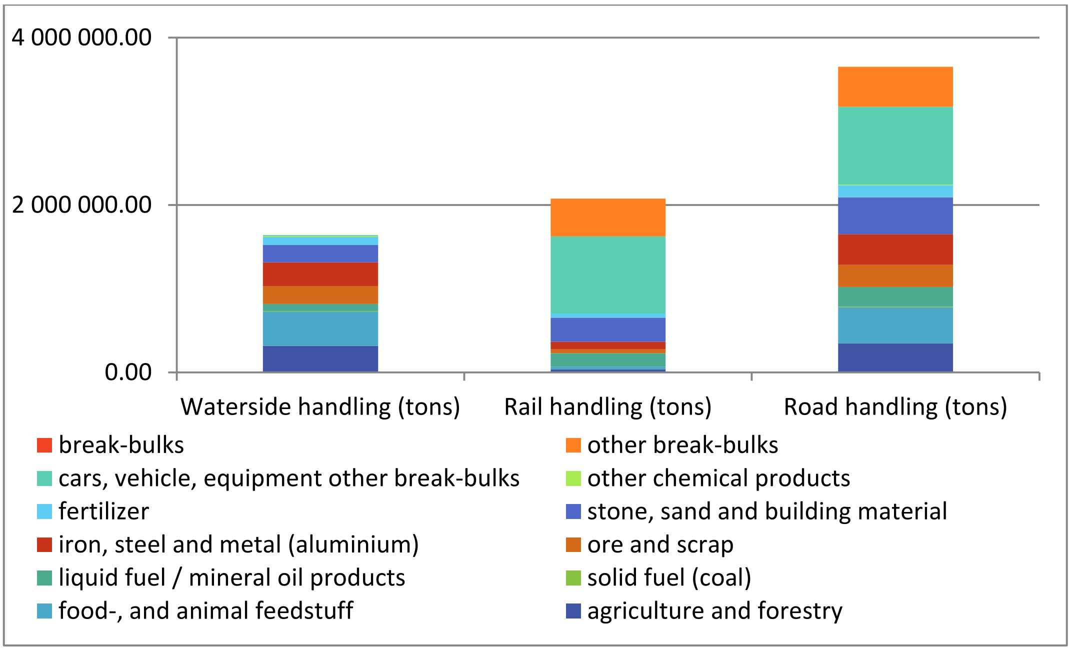
Regensburg

The port of Regensburg has handled 2,147 cargo vessels, 57,927 train wagons and 152,167 trucks in 2010. This has resulted in a total transhipment of 7,371,745 tonnes of cargo, of which 22% was brought by IWT, 28% by rail and the remaining 50% by truck. Moreover, also 568 passenger vessels were handled, bringing in 68,160 passengers.

The port of Regensburg shows a great diversity of commodities, as presented in Figure 46. For IWT, the most dominant commodities relate to agricultural products, both cereals but also food stuff. By rail, cars and containers are the most dominant commodities. Also, liquid fuels are quite dominant in the port of Regensburg.

It should be noted that the inbound traffic flows are larger than the outbound traffic flows for rail. Inbound flows account for 35% of the total IWT flows. For rail, this percentage is 40%.

Figure 46: Regensburg port - inland handling in tonnes

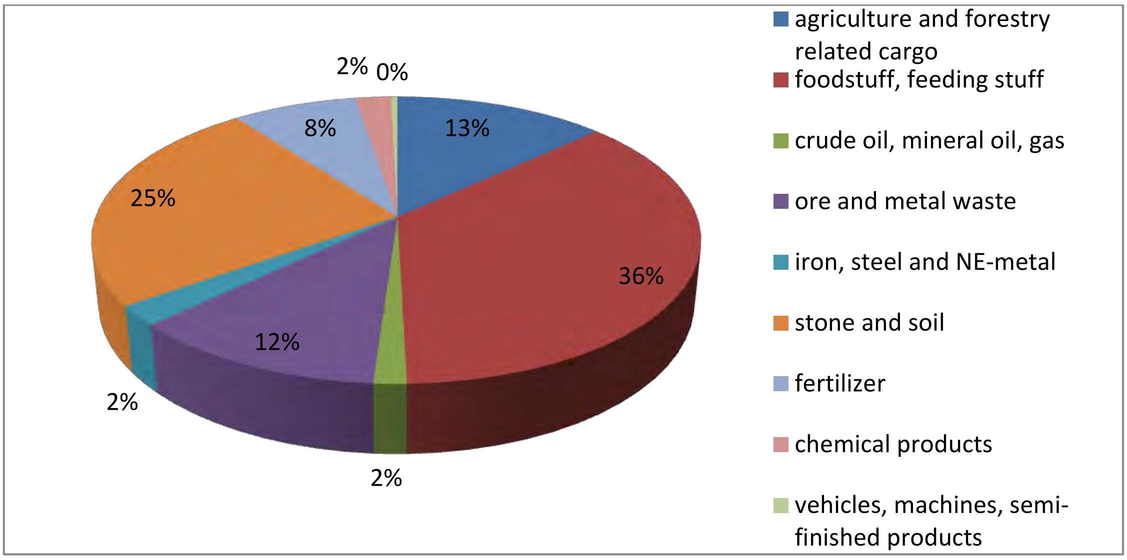


Enns

For the port of Enns, only data for IWT has been made available. In 2010, 663,013 tonnes of cargo were transhipped. Besides, 308 containers were (un)loaded by IWT. For rail and road, comparisons with regards to container volumes can be made: rail accounted for 117,505 TEU and road for 108,217 TEU.

Most IWT cargo is related to foodstuff and animal feed. Also, stone and sand has got a large share in the traffic volume.

Figure 47: Enns commodity split

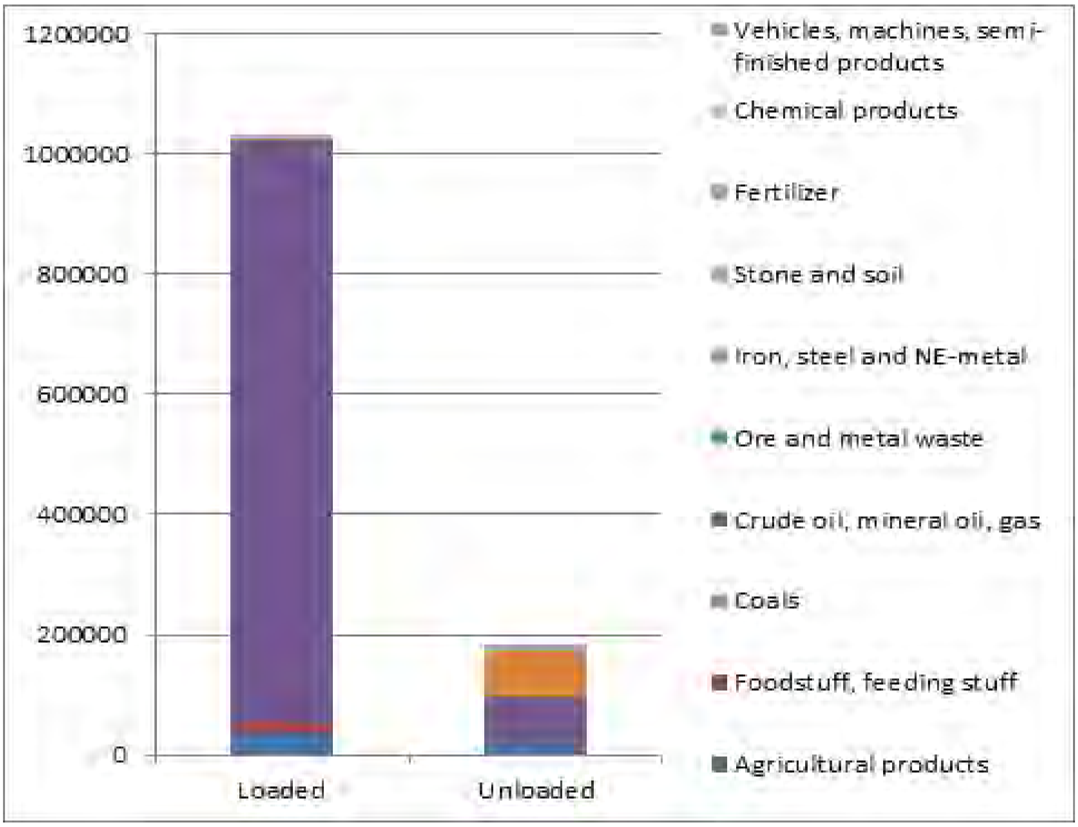


<u>Wien Freudenau</u>

For the port of Wien, only volumes have been provided for container transport. In 2010, 120 TEU have been transported by IWT. On contrary, 191,322 TEU were transported by rail and 127,548 by road.

Detailed statistics on the port of Wien can be found in the Austrian statistics. For 2012, a total cargo handling of 1,217,650 tons has been reported for Wien. The majority of the cargo can be accounted as mineral oil products, accounting for 1,045,752 tonnes in 2012 and thus 86% of the total transport volume in the Port of Wien. Most of the cargo is transported from Wien.

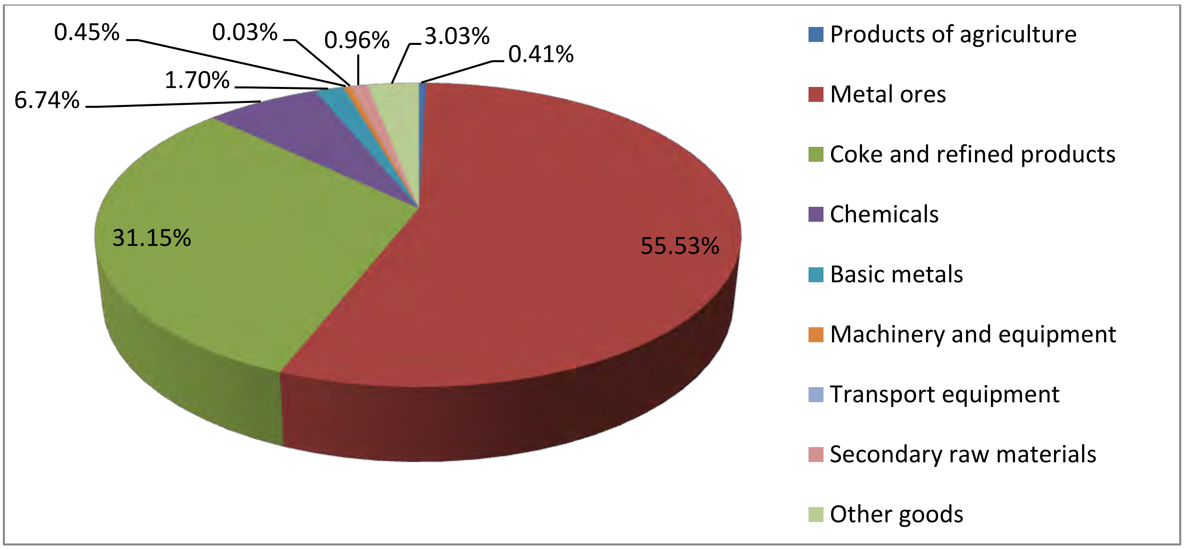
Figure 48: Wien port volumes in tonnes



Bratislava

The port of Bratislava provided data for IWT transport only. No details have been provided on the amount of cargo handled by rail or road transport. In total, 2,644,135 tonnes of cargo have been transhipped in 2010. One year later, traffic volumes have dropped to 2,349,962 tonnes. 55% of the transport volume concerns metal ores. Also coke and refined products have a large share in the transport volume of 31%.

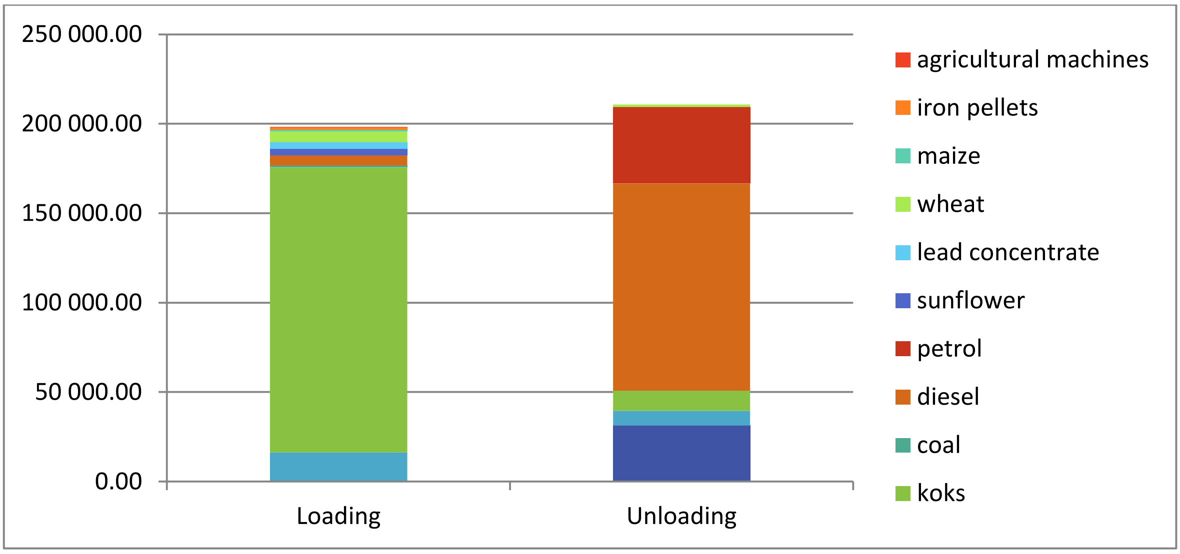
Figure 49: Bratislava commodity split



Komárno

The port of Komárno (SK) has transhipped 408,970 tons of cargo in 2010. Inbound and outbound flows have nearly the same volume. It should be noted that most outbound traffic flows concern petrol cokes: 159,262 tons of this products were exported in 2010. The inbound flows are more diverse, although diesel oil still is the most dominant with 115,715 tons imported.

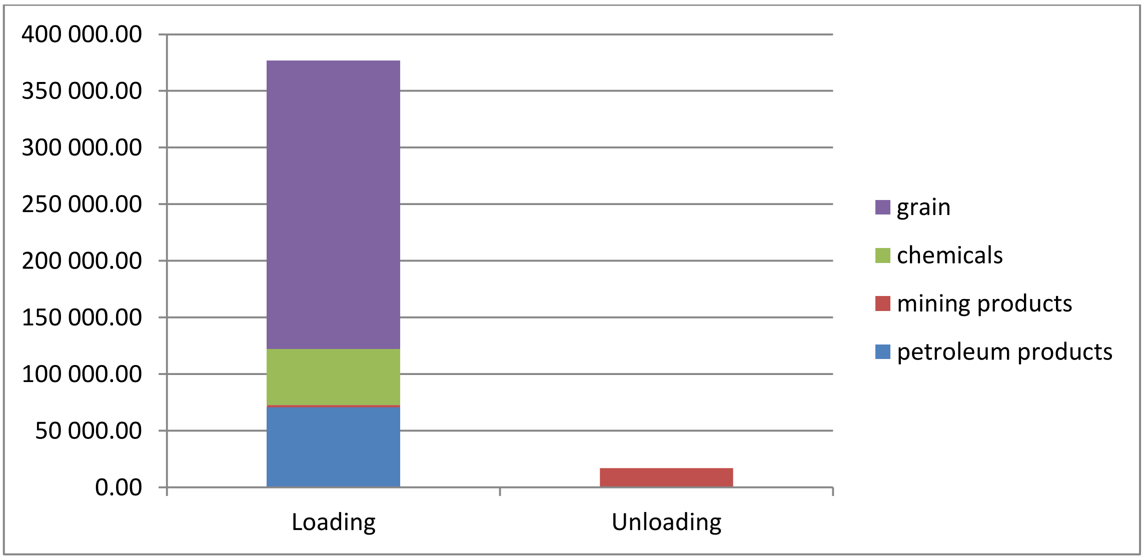
Figure 50: Komárno port statistics, volume in tonnes



Komárom

Komárom (HU) lies on the other bank of the Danube and also provides a decent number of traffic flows by IWT. In 2010, 394,021 tonnes of cargo have been transhipped. Unlike Komárno on the Slovakian border of the Danube, traffic flows are unbalanced here. 377,098 tons of cargo is exported. On contrary, the inbound flows only account for 16,923 tons. For commodities, it can be noted that for the outbound flows, grain is the most dominant commodity. Inbound, only mining products are transhipped.

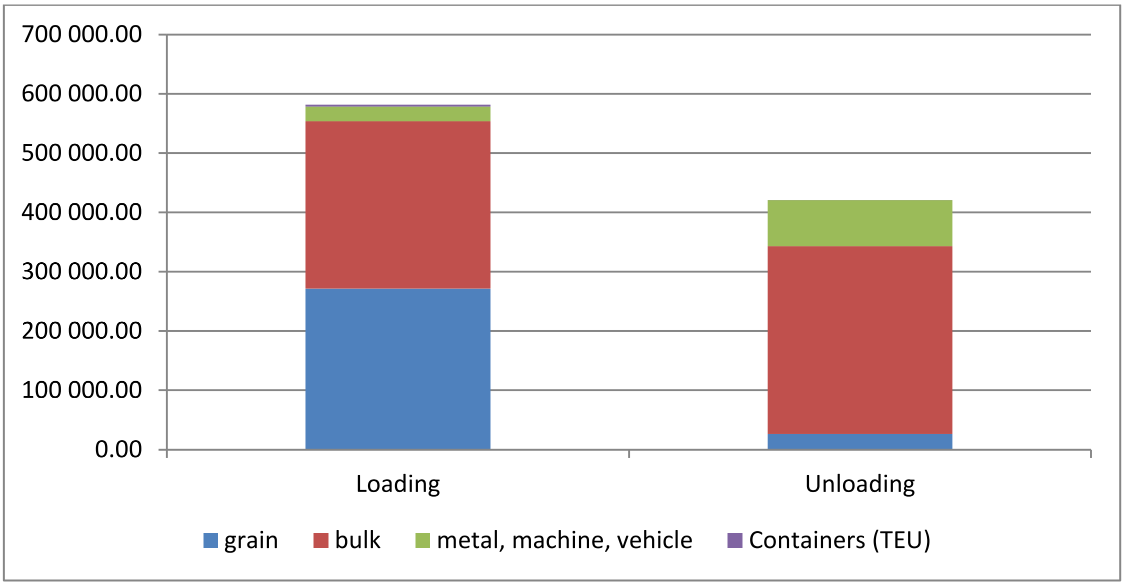
Figure 51: Komárom port statistics – commodities in tonnes



Budapest

The port of Budapest has transhipped nearly a million tonnes of cargo in 2010. Outbound, 581,678 tonnes of cargo were transhipped. Grain is the main commodity exported. Inbound, traffic flows are lower but still significant with 420,477 tonnes of cargo. No distinction can be made between the commodities.

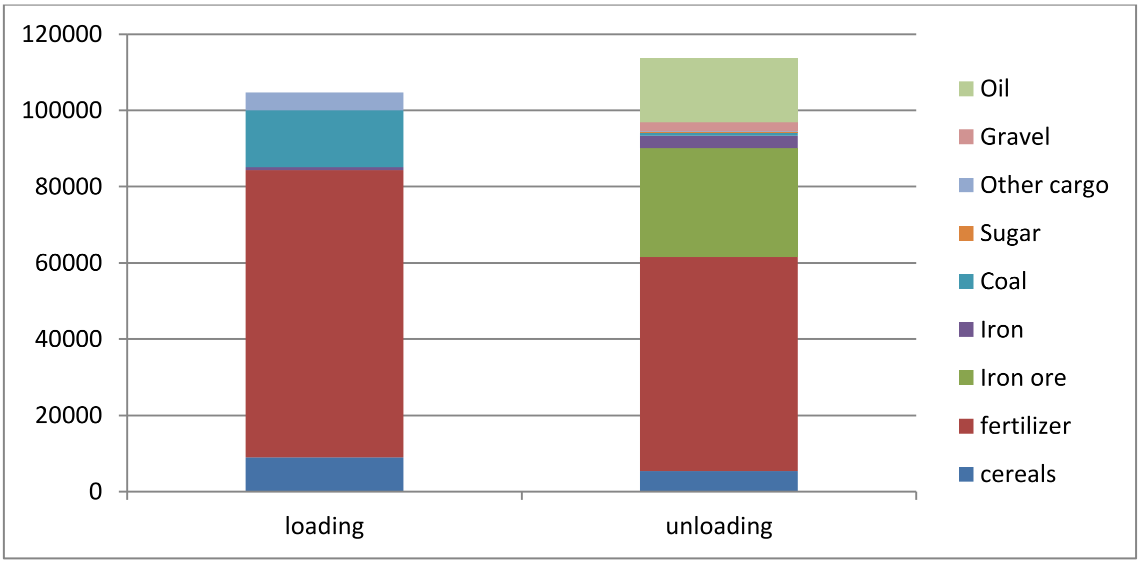
Figure 52: Budapest port data in tonnes



Vukovar

Vukovar is one of the major ports of Croatia. In 2010, 218,507 tons of cargo was transhipped. Inbound and outbound flows balanced each other in volume: 104,718 tons were loaded in 2010 whilst 113,789 tons of cargo was unloaded. Fertilizers are the most important commodity for both inbound and outbound flows.

Figure 53: Vukovar port data in tonnes



Novi Sad

The port of Novi Sad is located halfway the navigable Danube river at km 1254. Due to its position, the port can be considered as an important transport and cargo handling site in Central Europe. In 2010, 635,300 tons of cargo was handled in Novi Sad. Most of the flows are export flows: 508,500 tons were loaded at Novi Sad and exported to other ports. Import cargoes mainly involve bulk and fertilizers from Ukraine and Russia, whilst export cargo often has their directions to Constanta.

Drobeta-Turnu Severin

In Drobeta-Turnu Severin, 490,112 tons of cargo was handled in 2011. No further information is present about this port, apart from the fact that is has a container terminal that has handled 1849 tons of containers in 2011. For 2007, a total volume of 350,051 tonnes has been reported, indicating that the amount of cargo handled at this port has increased by 40% since then. In 2007, inbound flows accounted for 144,676 tons whilst outbound flows involved 262,621 tons of cargo.

Calafat

The port of Calafat is located on the left bank of the Danube at km 795. In 2011, the port of Calafat has handled 139,105 tonnes of cargo.

Giurgiu

In Giurgiu, 256,288 tons of cargo was handled in 2011, including 44,347 tons of container cargo. The crisis has had effects on the traffic volumes: in 2007 still 537,658 tons of cargo was handled at the Port of Giurgiu.

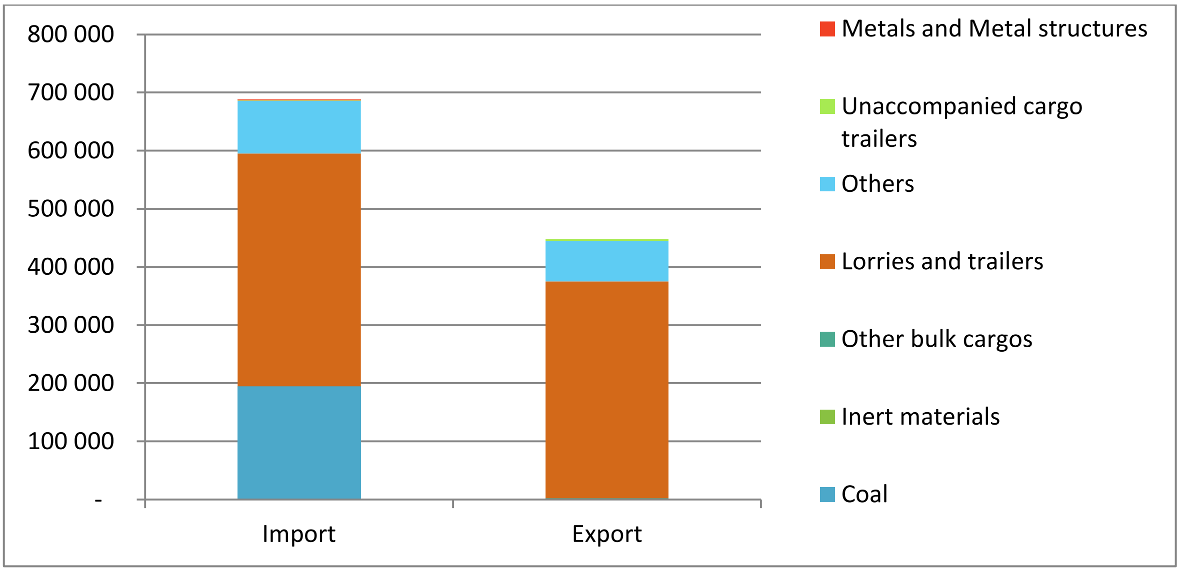
Cernavoda

The port of Cernavoda has handled 131,833 tons of cargo in 2011.

Vidin

The port of Vidin has handled 1,144,978 tons of cargo in 2010. Most traffic flows are inbound and involve coal or other cargo. Also the Ro/Ro traffic has got a large share in the total traffic volume.

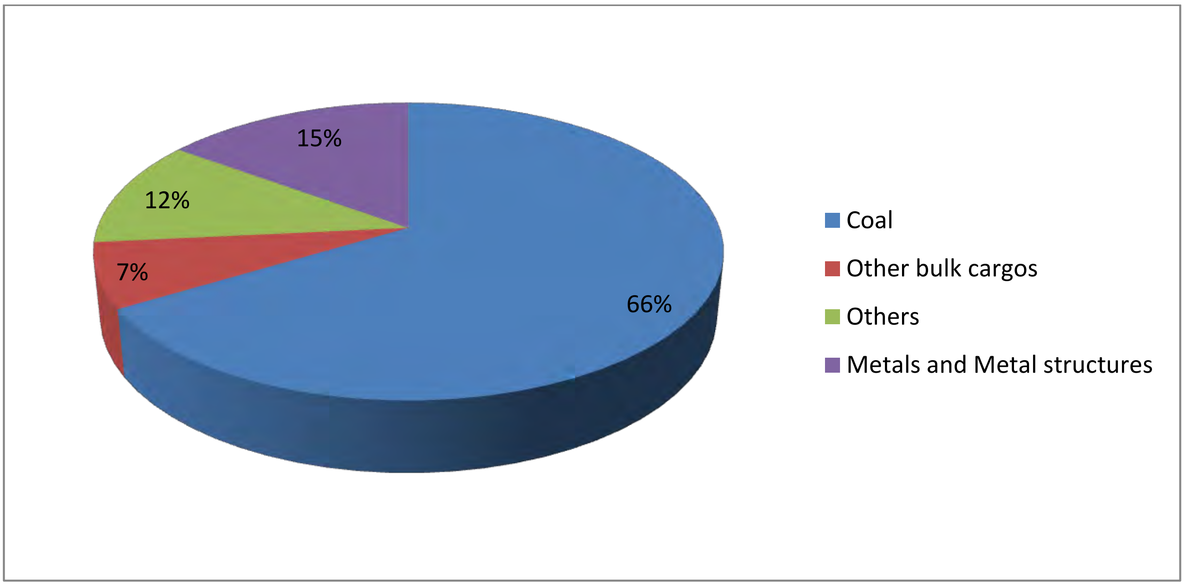
Figure 54: Vidin port data in tonnes



Ruse

In Ruse, 501,102 tonnes of cargo were handled in 2010. Coal was the dominant commodity with 66% of the total tonnage handled.

Figure 55: Ruse port data



Comprehensive ports

Besides of the core ports mentioned above, also data on comprehensive ports has been collected through http://www.danubeports.info. When available, data on import and export flows in ports have been collected. If data at this level was not available, the total transhipment has been taken.

Table 36: Comprehensive port data of the R-D Corridor in tonnes

Comprehensive port	Import	Export
Kelheim	412,499	134,673
Straubing	172,404	109,472
Linz	4,222,358	1,005,602
Krems	304,089	44,299
Győr	134,198	142,058
Dunaujvaros	1,537,854	
Paks	650,000	
Baja	150,153	555,963
Mohacs	284,917	
Osijek	160,303	
Beograd	150,000	
Lom	205,808	174,265
Orjahovo	-	
Svishtov	320,606	
Silistra	850,000	
Calarasi	-	
Oltenita	508,407	
Braila	808,071	105,526
Tulcea	1,523,103	
Medgidia	30,000	

Source: danubeports.info

The table indicates that the ports of Kelheim, Linz, Dunaujvaros, Paks, Baja, Beograd, Silistra, Oltenita, Braia and Tulcea have significant traffic flows.

4.3.7.2.4 Future transport demand

National future demand

<u>Austria</u>

The traffic forecast Verkehrprognose Östereich 2025+ provides all detailed data from 2005 on to 2025.

A baseline scenario is produced and a scenario that favours public transport. This scenario assumed increased road costs, large public transport supply and cooperation, (or integration) of regions. Passenger forecast are as follows. Commuters per state of residence will not change their patterns drastically by 2025. The international transport table (Table 37) indicates that the share of the eastern EU Member States increases. However there is still considerable growth foreseen in relation to Germany.

Table 37: International passenger traffic from 2005 to 2025 per scenario

Transport between Austria and Other European countries	2005	Baseline Scenario		PT scenario	
		2015	2025	2015	2025
	x 1000 Trips per day				
AT-CZ,SK,PL	50.2	100.3	147.4	91.2	121.2
AT-HU	50.4	78	102.2	72.3	87.5
AT-SL,HR	41.5	60.8	71	54.2	57.2
AT-IT	28.6	32.7	34.3	29.7	29.4
AT-CH	36.6	42.4	46.2	38.9	39.3
AT-DE	148	173.2	184	157.2	163.4
Total	**355.4**	**487.4**	**585**	**443.4**	**498**

Source: Verkehrprognose Östereich 2025+ , BMVIT

Driver individualization is expected in both future scenarios, leading to increased road usage in terms of passenger kilometres. Public road demand will decline however. Rail passenger kilometres will increase by 30%. Inland waterway transport is not considered in the forecast. Air transport is covered in the **node** section.

Road Freight volume will grow 1.33% per year in the period 2010-2025. Domestic will grow by 0.96 per year between 2010 and 2025. Transit traffic will grow most, such that transit traffic is 108 million tonnes in 2025, import + export is 110 and domestic 365 million tonnes. Commodity groups agricultural, food&feed and building material will grow below average. Vehicles, machinery, & motors and containerized goods will grow the most.

Rail freight has a similar image in the baseline scenario and public transport scenario. In the baseline total volume will grow to 142 million tonnes in 2025, at a rate of 2% per year. Domestic traffic will grow the least and transit the most to 47 million tonnes in 2025. The goods forecast predict strong container transport and chemicals.

Regional forecasts are presented in the following table. Only sections relevant for the corridor catchment area have been selected. This indicates a much higher demand for road than for rail. Only data was available for the reference scenario.

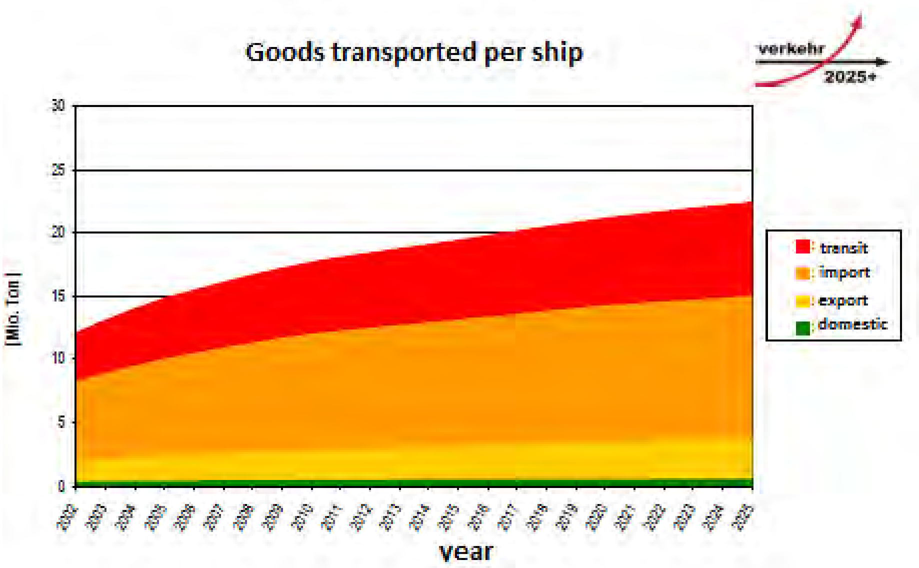
Table 38: Forecasted road and rail tonnage per section

[Mio. Tonnes]	2005		2025 Ref. Scenario		2025 total growth	
Section	**Road**	**Rail**	**Road**	**Rail**	**Road**	**Rail**
Nickelsdorf - Hegyeshalom	8.8	4.4	20.1	5.8	128%	32%
Bratislava - border	3.2	3.6	6.7	6	109%	67%
Suben / Passau	28.4	14.2	43.7	17.3	54%	22%
Braunau	3.2	0	4.2	0	31%	0%
Vöcklabruck – Timmelkam	11.3	8	14.6	12.3	29%	54%
Total R-D Corridor	54.9	30.2	89.3	41.4	63%	37%

Source: Verkehrprognose Östereich 2025+ , BMVIT

The forecast volume on the Danube of the Verkehrprognose is a forecast of the growth of the currently transported on the Danube flows of goods. Any further relocations from other modes of transport, which would be expected should all technical bottlenecks of the Danube be relieved, are not taken into account.

Figure 56: Forecasted IWT volumes 2002-2025 in million tonnes



Source: Verkehrprognose Östereich 2025+ , BMVIT

Czech Republic

For the Czech Republic the identified traffic forecast study is included in the Transport Sector Strategies, 2nd Phase of 2013, approved by the Czech Government as a strategic document for development of transport infrastructure in the Czech Republic. A transport model is elaborated for this purpose to help and evaluate to some degree, policy decisions. The traffic demand in the model is affected by socio economic factors and production. Transport supply and demand interact inter modal and the main output is the traffic loading, transport volumes and performances for passenger and freight transport. The base year is 2010 and the forecast years are 2020 and 2040.

Shortcomings in the model generation of short distances trips and other improvements are discussed. The study states that bus and air travel are forecasted with a higher degree of uncertainty.

Forecasts are made for a scenario with a zero state of infrastructure development. The total volume of *passenger* trips will grow in 2020 by 11%, in 2035 by 35%. The total number of commuting trips and business trips will decrease by 11%. Long-distance trips will decrease by 8%.The highest increase of the traffic load is anticipated on the motorways. Public transport is expected to grow. The socio-economic development (such as aging of population and therefore a lower pricing of time) is expected to result in growth of railway transport. Significant growth is anticipated in air travel.

The freight forecast indicate that freight volume of domestic and international demand is around 420,000 tonnes in 2010 and will grow around 23% to approximately 515,000 tonnes in 2030. The trend for 2010-2020 is lower than the 2020-2030 trend. Classical energy sources are expected to stagnate in volume, this is not benficial for rail transport. All other commodities are expected to grow. Tonkm's, volume multiplied with the distance travelled, are expected to grow more than volumes due to a higher share of international transport. Inland waterway transport is expected to grow 215%. The highest growth will be in Tonkm's for the forecasted year of 2035 in the trend scenario. Rising fuel costs, *possible* capacity issues in rail transport and supporting EU policy are expected to stimulate growth. Rail tonkm's are expected to grow 133% in

2035 in the trend scenario. Again rising fuel costs should benefit the rail transport market. Road will keeps it dominant position in 2035 and ranks second in growth of tonkm's.

France

France has national projections. Yet given the alignment of France in this corridor, the Neighbouring German national forecast and regional forecasts of ports suffice for the purpose of this Transport Market Study.

Germany

The "Überprüfung des Bedarfsplans für die Bundesschienenwege" of 2010 includes a detailed forecast up to 2025. Commissioned by the Ministry of Transport and Infrastructure and performed by BVU and ITP. Data year is 2004 and the baseline scenario assumes significant infrastructure works and supporting transport policy for rail and IWT. Infrastructure works are of such a magnitude that there is no decrease of capacitiy for all transport modes. A full update of the BVWP document is expected in 2015. Aggregate data of 2015 is available, but no details as of yet. For this reason the older forecast is used. This also is for consistency with other national infrastructure planning.

Road individual transport will strengthen in 2025. In the long distance segment rail and air travel will grow the most in 2025.

Table 39: Main passenger forecast results Germany

	Value		Modal-Split (%)		change 2025 : 2004	
	2004	**2025**	**2004**	**2025**	**total in %**	**in % p.a.**
Passenger transport (Million Persons)						
Road (individual)	57277	62401	83.6	85	8.9	0.4
Rail	2071	2199	3	3	6.2	0.3
Public road transport	9055	8557	13.2	11.7	-5.5	-0.3
Air	107	222	0.2	0.3	107.5	3.5
Total	**6851**	**73379**	**100**	**100**	**7.1**	**0.3**

Source: Überprüfung des Bedarfsplans für die Bundesschienenwege of 2010

For 2025 road freight an increase of 1.2% per year is forecasted, rail 1.4% per year. IWT has the lowest growth of 0.9%, compared to older growth rates this is an improvement for IWT as the issues with low water conditions were more problematic around the early years of 2000, according to the study. For tonne-kilometres the freight trend is similar. Rail has the highest growth rate, in terms of volume road has the highest growth. The current volumes are already high and moderate growth still results in high volumes. The modal share of road volume will grow from 72.2% of the total transport in 2004 to almost 76%, Rail from 16% in 2004 to 14.5%. And IWT decreases from 11.7% to 9.5% of the total volume. More international traffic is expected in 2025 both in import and exports and transit traffic. This is consistent with the total European scenario where an increase in European traffic is expected and as Germany is central in Europe. Comparing the average travelled distances between the modes, there is a strong shift to long-distance trips for rail, where distance is expected to increase by 24% within the 2004-2025 time periods, reaching the 353 km as well as for road, which is expected to reach the 300 km (increasing 19%).

Hungary

Hungary's National Transport Strategy, responsibility Hungarian Transport Administration, gives transport demand figures. In August 2014 the document was updated. Socio economic developments and transport cost developments are used as input for forecasting. A baseline scenario and full project implementation scenario is present. In the baseline scenario passenger transport is expected to grow until 2030. After 2030 the growth rate is higher. Road transport is expected to increase and public transport (bus and rail) expected to decrease. The reasoning in the study is that effects of private car ownership due to economic growth offsets effect of population decline and aging, that are more favourable to other modes.

Freight transport is favourable for road. An increase of 4.5% per year is indicated until 2030. Rail freight growth is estimated at 3.5% per annum, IWT developments are similar. It is assumed in the study that the navigability of the Danube is increased.

Romania

The Preliminary Report on the Master Plan Short, Long and Medium Term for the Romanian Ministry of Transport provides useful data on transport projections for all modes and nodes up to 2020. Road traffic (in vehicle kilometres) is expected to increase by 244% for passengers as compared to now on the motorway network – which itself is expected to increase in length by 86% - and on 39% on the national roads. The rail passenger figures of the report do not have a final status yet and will therefore not be presented here.

For goods, similar figures arise with a 206% growth on motorways and 40.3% on roads of national importance by 2020. The amount of rail freight is expected to increase by 61.2% for non-containerised goods and by 23.1% for containerised goods. This is an average of 4.6% per year. Rail bulk goods grow much more that the containerised goods. For inland waterways, transport in the Danube is expected to increase from 12.2 billion ton kilometres to 13.7 ton billion kilometres for non-containerised goods. The transport of containerised goods is expected to increase from 0.6 billion ton kilometres to 1.0 billion ton kilometres. The scenario reference assumes little infrastructure improvements. The improved (do-minimum) infrastructure scenario forecast is favourable for road and IWT, it reduces the market volume for rail transport. The volume growth for rail is still estimated at 4.5% per year and again the result of the report is preliminary.

Slovakia

The national total forecast of Slovakia is expected in 2016 and therefore not available for this study. The Strategic Development plan of Transport infrastructure of the SR by 2020, June 2014 has been provided by the Ministry of Transport, Construction and Regional development of the Slovak Republic. The document recognises the need for a relevant and realistic forecast of future developments. There is no forecast available however due to the unavailability of a transport model. A complete forecast is to be expected in the so called Phase II of the preparation of the sectorial strategy. Qualitative data towards 2020 is presented.

Automotive individual transport is expected to increase, at the expense of road public transport. Rail public transport will stagnate or grow modestly; the strong automotive transport is dominating the modal share. Air transport is uncertain. Inland ship passengers will vary from the 100,000 per year that it is now and between 200,000. Freight transport will see an increase in road, not only by national carriers, but mostly by international transit. The development of Steel and Automotive Industry is uncertain in the Slovak Republic. Opportunities for rail freight are also described. Air freight transport has a small volume in the Slovak Republic of 20,000 tonnes. Forecasts do expect air volume growth. IWT is identified as a transport mode with potential and capacity.

Table 40: Summary of growth rates results. Yearly growth rates of volumes, where available. Growth rates are derived from the base year until 2030 (where available).

Country	Road freight	Rail freight	IWT freight	Study	Forecast period
AT	1.3%	2.0%	1.6%	VPÖ	2005-2025
BG	2.6%	1.8%		Preparation of a general transport master plan for Bulgaria	2011-2030
CZ	<2%	<1%	<3%	Transport Sector Strategies, 2nd Phase	2010-2035
DE	1.2%	1.4%	0.8%	BVWP 2007	2005-2025
FR					
HR					
HU	4.5%	3.5%	Similar to rail	National Transport Infrastructure-Development Strategy 2014	2011-2050
RO		4.6%	1.6% (Danube only tkm)	Preliminary Report on the Master Plan Short, Long and Medium Term	2011-2020
SK	Growth in international traffic	Growth potential	Potential and capacity	Strategic Development Plan of Transport Infrastructure of the SR by 2020, Phase I	2014-2020

Source: consortium. Czech results are based on Tonkm data extrapolations.

Node demand forecast

Ports

In general the ports on the corridor are considerering capacity sufficiently. According to regional demand forecast, all ports indicate capacity expansions were needed. The reviewed studies indicate no discrepancies between the forecasted demand and the forecasted supply, at least until 2020 and for other ports until 2030. Demand is expected to increase in total for the port nodes on the corridor.

By 2025, significant potential volumes are identified by the port of Strasbourg in their Alsace Rhine ports Masterplan. For the French Rhine ports + 67.5% more volume is expected, including a 3.5-fold increase in container traffic. The masterplan recognizes that this is volume potential and that proactive actions are needed to realize it.

The amount of cargo handled at the port of Constanta will increase from 6.6 million tons in 2011 to 7.2 by 2020 according to the national transport forecast of Romania. For containerised goods, the amount will increase from 90,197 tons in 2011 to 127,154 tons in 2020. The other Danube ports will see an increase in traffic volumes as well: from 4.7 million tonnes in 2011 to 5.8 million tonnes in 2020. Containerised goods will more than double, from 32,226 tonnes to 71,525 tonnes.

Airports

The German Ministry of Transport and Digital Infrastructure has produced a long-term forecast on air passenger traffic in the BWVP of 2015 (Verkehrsverflechtungsprognose 2030 Schlussbericht, 11. Juni 2014). Passenger traffic is expected to increase with 2.3% per year. The growth is due to increasing international traffic. The growth rate is lower than that of the past. This is due to the weaker assumed economic growth which has a particularly strong impact on the aviation sector.

Frankfurt airport expects a similar growth rate in their projections. It is also expected by the airport that by 2020, the terminal capacity is expected to be exhausted by 2020. Expansion plans are underway.

München airport also has own forecasts. Extrapolating the BWVP trend would result in 51 million passengers. München's own projections come up with 58 million passengers and growth in freight figures as well. For this reason a third runway at München airport is envisaged to handle future demand. Currently the airport indicates the demand at runways is at its limit during peak hours.

Austria's air transport is forecasted in the Verkehrprognose 2025+. Passenger transport is based on expansion plans of the Vienna airport of 2007. Vienna is the main airport with about 75% of the passenger in Austria. Trends in the study indicate that Vienna airport will increase its share in the future. In the study it is expected that the capacity of the airport needs expansion in 2012. To increase capacity a third runway is needed. This will facilitate a growth of 46 million passengers in the year 2025. At present the expansion is not realized and the airport's data indicate 22 million passengers were facilitated in 2012. This means the airport is operating at current capacity. Freight transport is based on the national statistics of Stat.Austria, data from the Airport of Vienna (2005) and data from the expansion plan of 2006 by Back et al. A linear growth of airfreight of almost 3% p.a. between 2002 and 2025 is the resulting forecast. The 2007 freight realization data of the airport of Vienna is in line with the forecast.

The Budapest airport is forecasted in the NST strategic document. It is expected that economic development may cause growth, but the total freight volume will not be dominant. Further the forecast uncertainty in air transport is discussed in the NST document.

Vaclav Havel Airport Praha transport currently handles about 10.9 million passengers and less than 200,000 tonnes of freight. The airport expects more traffic in the future. This increased traffic puts strain on the capacity around 2020-2050. It is not the airport itself, but the runway system that limits the capacity). Financing of an upgrade plan is expected to be from own sources of the airport, not the state budget.

Henri Coanda International Airport of Bucharest is the largest Romanian airport. In 2011 it handled 7.2 million passengers of which 74% international traffic. The annual airport capacity is six million passengers and the airport's terminal was recently expanded to reach that figure. In addition, plans exist to build a second terminal at Bucharest Ariport, with a maximum estimated capacity of 20 million passengers per year.

Table 41: Air passenger forecast for international airports of Romania, total growth of international passengers presented

Airport Name	2011 total pax	2020 total pax	International pax growth%
Bacău	748,323	915,581	26.40%
Henri Coandă (București)	7,223,679	8,968,452	22.00%
Cluj-Napoca	1,225,735	1,410,991	17.40%
Iași	444,774	623,909	24.00%
Sibiu	597,541	758,802	16.90%
Târgu Mureș	360,918	451,523	10.60%
Timișoara	2,641,717	3,008,042	14.00%

Source: Preliminary Report on the Master Plan Short, Long and Medium Term, Aecom 2013

Additional expansion plans identiefied in the preliminiary Romanian Master Plan are for the airport of Iasi. Development and modernization of taxiways, apron (gates) and related facilities are envisaged.

4.3.7.2.5 Corridor demand forecast

PP22

PP22 is a priority axis project aimed at linking Western and Eastern Europe through a major railway axis. Geographically the scope is similar to the Rhine Danube Corridor. In a number of cases the geographical scope of PP22 is bigger and figures on that scope will be left out, without harming the total result. Details in data are different and the study focusses on freight and passenger railway transport data. Air transport is not included in the calculation, there is high uncertainty in predicting modal shift and the likelihood of such a modal shift is also uncertain.

Scenarios differ in infrastructure investments and can be ordered according to investment rate. The scenarios are described below with the accompanying average annual growth rates for the period 2010-2030. Results include national transport figures, where for the TMS mostly international transport is considered:

- Do-nothing, assumes the 2011 contemporary technical standards remain the same and there is no investment in rail infrastructure. It is a reference scenario. Passenger growth in passenger-km is 0.05%. Freight growth rate in tonne-km is 3.7%.
- Do-minimum, assumes that all works that have started before 2012 will be finished. Passenger growth in passenger-km is 0.06%. Freight growth rate in tonne-km is 4.07%.

Four development scenarios Euro-1, Euro-2, Euro-3 and Euro-3* have accumulating infrastructure investments.

- Euro-1 foresees an upgrade on the Praha-Constanta section and electrification of the Nurnberg-CZ border section. Passenger growth in passenger-km is 0.07%. Freight growth rate in tonne-km is 4.5%
- Euro-2 foresees an upgrade on the Praha-Constanta section and a High speed line between Dresden and Praha and an upgrade on the München-Praha section. Growth in passenger-km is 0.05%. Freight growth rate in tonne-km is 4.45%.
- Euro-3* is as Euro-1 plus an upgrade of Romanian and Bulgarian tracks. Growth numbers are similar to those of the Euro-3 scenario.

- Euro-3 is a nuance of Euro-3*, the difference is that the Euro-3 upgrades of Romania and Bulgaria are more advanced and therefore need a bigger budget. Growth in passenger-km is 0.04% Freight growth rate in tonne-km is 5.27%

Passenger transport km's are expected to stagnate. In the Czech Republic and Hungary there is a decline. Germany is expected to increase passengers due to the construction of the High Speed line to Praha, the Czech Republic is not. The highest growth is expected in Austria and the Slovak Republic.

Ores, metal products and building materials are the main commodity flows in Bulgaria; these remain high in all scenarios. The Czech Republic is the most dominant rail country on the PP22 axis (Germany is not included in the figures, but is taken into account). The main commodity group is petroleum products, followed by agricultural, coal, ores and building materials. Austria has a similar commodity distribution, at the base year and in the future. Germany and Hungary also have petroleum products as their main rail freight commodity group. Romania is expected to have a strong presence of containerized goods.

An assignment model performed calculation on infrastructure section level for future rail demand. The change in passenger patterns is very limited. Transport centres locally around domestic urban areas and economic centres. The main flows can be observed on the western part of the corridor. Main flows from Budapest to Győr & from Bratislava to Praha and Dresden. These sections account for about 10 million passengers. The triangle of Wien, Bratislava and the Hungarian border is identified as a high international demand section. The stream around Nürnberg is high with about 4 million passengers, but less than 25% is international. Further large international flows are not identified. Romanian and Bulgarian flows are intense around both capitals.

Modelled freight results indicate that the western part of the corridor has more domestic and international traffic. Identified busy sections are: Brno – Praha; Hegyeshalom – Bratislava; Budapest – Győr; Constanta – București. The area around Wien is expected not to increase its rail volume.

The study shows that the connection Zagreb (Croatia) –Budapest has some international traffic. Beograd (Serbia) also has potential; however Serbia's traffic is directed towards Bulgaria. In the forecast no other eastern European countries are identified as missing on the corridor or in the catchment area. Additionally there is no obvious missing EU-wide infrastructure in the current corridor alignment according to the forecast.

In the scenarios the most prominent change is seen in Romania and Bulgaria, for all scenarios. The difference between the Euro scenarios for Romania and Bulgaria is small however. In the Euro-3 scenarios infrastructure is upgraded in the two countries and results in growth. The Timișoara-Arad-Ties sections are sections with high forecasted growth.

<u>PP17</u>

Priority project 17 on railway axis Paris-Strasbourg-Stuttgart-Wien-Bratislava covers a significant part of the corridor. However no public report was found that contains detailed forecasts.

<u>Rail Freight Corridors</u>

The transport market studies of Rail Freight Corridors 7 and 9 of 2010 and 2013 respectively produce forecasts on a geographic area that is similar to the catchment area of this corridor. Rail Freight Corridor (RFC) 7 contains the countries of Czech

Republic, Slovak Republic, Austria, Hungary and Romania. Other countries included are Bulgaria and Greece. RFC 9 is about the Czech Republic and the Slovak Republic. Projections are presented for rail freight only in the document. Both documents have a high, medium and low scenario.

The scenarios of RFC 7 differentiate between economic revival (with the emphasis on intermodal), timing of planned infrastructure and border waiting times. Rail freight growth on the corridor is most homogeneous, averaging around 0.8% per year depending on the scenario. Hungary and Austria slightly lose their share to the other involved corridor countries.

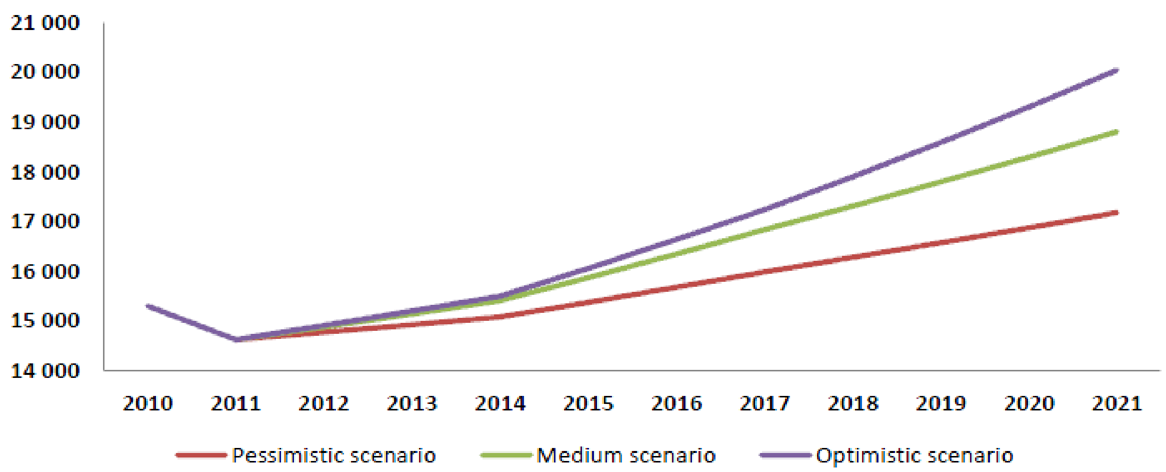
Table 42: Growth rates of rail freight volume on RFC 7 between 2012 and 2021

Country	**growth p.a.**		
Scenario	Low	Med	High
AT	0.41%	0.72%	0.82%
BG	0.65%	0.65%	0.97%
CZ	0.69%	0.86%	1.04%
HU	0.38%	0.55%	0.72%
SK	0.52%	0.90%	1.10%
RO	0.58%	1.01%	1.24%

Source: Data derived from RFC 7

Currently the main commodity groups on RFC 7 are energy products, metals (including ore) and containers.

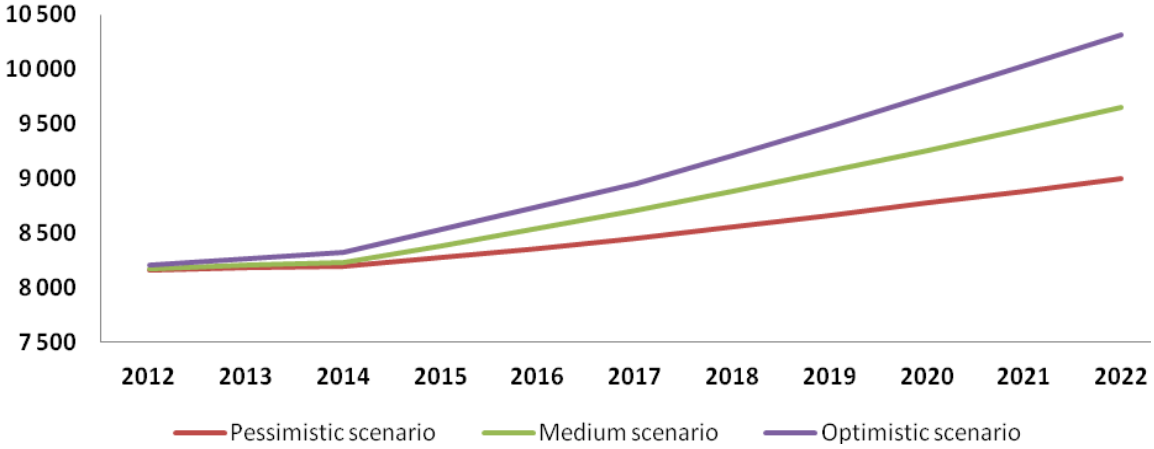
Figure 57: Development of transport volumes of RFC7 in million tonne-km according to particular scenarios



Source: RFC 7

For RFC 9 infrastructure supply, economic development (with the emphasis on intermodal) and the impact of travel time (time spent at border crossing) are important drivers of the scenarios. Yearly growth rate until 2022 for rail freight tonnage is between 1% and 2.3% p.a. for the Czech Republic, depending on the scenario. Yearly growth rate for rail freight tonnage is between 1.1% and 2.6% p.a. for the Slovak Republic, depending on the scenario. In tonne-km the result is presented in a graph. The growth rates for both countries show a slow start around 2013-2015, and higher growth towards 2022. The growth rate is different than RFC7, but within range. Currently the main commodity groups on RFC 9 are energy products and metals (including ore). Increasing container volume is expected.

Figure 58: Transport performance development of RFC9 in millions of net tonne-km according to particular scenarios (on the main lines)



Source: RFC 9

<u>The Medium and Long Term Perspectives of IWT</u>

The Medium and Long Term Perspectives of IWT in the European Union study provides corridor wide IWW demand forecast. The study by NEA et. al. was recommended by the Platina II information package. The Danube region in this study is defined similarly to the corridor alignment. In 2007 the study estimates Nearly 20 billion tonne km of freight transport in the Danube region. By 2040 this is expected to be almost double. In the report market opportunities are presented. Petroleum products and metal ores (a typical product transported by IWT in bulk) are expected to grow most in tonne-km, then agricultural and foodstuffs, then container products. Another typical IWT product: coal is expected to stagnate over the time period 2007-2040.

Table 43: Danube forecast per NSTR commodity in million tonne-km

NSTR		2007	2020	2040
0	agricultural produce	2,967	4,413	6,828
1	foodstuff and fodder	939	1,396	2,160
2	solid mineral fuels	2,094	2,094	2,094
3	petroleum and petroleum products	1,312	1,967	3,716
4	ores and metal waste	5,050	6,313	8,838
5	iron, steel and non-ferrous metals	2,070	3,105	5,865
6	crude minerals and building materials	2,549	2,828	3,456
7	fertilizers	930	955	1,264
8	chemical products	486	553	656
9	vehicles, machinery and other goods	1,544	2,059	3,089
	TOTAL	19,940	25,683	37,966

Source: Medium and Long Term Perspectives of IWT in the EU, NEA et al.

4.3.7.2.6 Preliminary conclusions on transport demand

Conclusions on transport demand are made with the available materials. While the data of the current situation is known, future data is not always present. Filtering corridor relevant data and harmonizing the data sources is also an important step. Conclusions are presented for a baseline case, considering the scenarios of the studies, but not taking into account the full implementation of all corridor projects of the implementation plan. This is further discussed in the supply section of the Transport Market Study. Socio-economic data has been put into forecast models and the combination of these studies lead to the conclusions below.

The **main conclusion** is that road transport is dominant in the current market, international and national, passenger and freight. The modal split for passengers on the corridor of 2010 is 83% of the total trips is by road, 13% by rail and 4% by air. For freight, modal split is measured in volume, this is 58% for road, 28% for rail and 14% for Inland Waterway Transport in 2010. Road it is expected to be even more dominant in the future practically corridor wide in the baseline case, that means without fully taking the corridor implementation into account. There are countries on the corridor where growth rates for road transport are low, but total volume growth is high because road already has a high modal split. For passenger transport individual car ownership is expected to have a large influence, especially in the less developed economic areas.

In baseline scenarios Freight always has to compete with roads current dominant position and relative flexible service. Forecasts indicate that implementing rail and IWT projects do improve modal share. This is further discussed in the supply section of this report.

Further important observations are:

- Air transport is expected to be the highest growing transport mode. Yet the modal share will remain low.
- In the Czech Republic the forecast scenarios assume policy support of IWT, and less favourable road market conditions. This means the highest freight growth in the national projection of CZ is IWT. The rail network is *potentially* at its capacity and will grow the least by 2025.
- The IWT medium and long term projections of the Danube region indicate growth in typical IWT bulk goods.
- In Romania growth of road is expected by 2020 partly due to the condition of the railways passenger system. Container freight growth is expected for rail and IWT.
- The traffic of the Eastern part of the corridor will grow more. However the Countries of Austria, Czech Republic, Germany and entry/exit node France (Strasbourg) on the corridor are expected to maintain the high transport demand. The position will need to be revaluated by 2030.
- International traffic, import, export and transit is expected to grow in all forecasts. Not only for air. In most scenarios it is beneficial for road, yet this does create a larger playing field for modal competition.
- Most national scenarios assume a continuation of trends and no do not assume a specific modal shift support. These assumptions are beneficial for road transport. The infrastructure developments are taken into account in different scenarios.
- Rail freight corridors and PP22 data help shape the national forecast and confirm the national figures of medium rail demand growth. PP22 also illustrates the effect of rail infrastructure investments: it is forecasted that between 7 and 9 billion tkm’s will be shifted from road to rail.

4.3.7.3 Analysis of the supply side of the market

4.3.7.3.1 Approach and data sources

This chapter deals with the capability of the infrastructure networks of Rhine-Danube corridor (road, rail and Inland waterways) and core nodes on those networks to accommodate the use of the network now and in the future.

In order to analyse the supply the following activities/steps will be required:

- Step 1: to study the links of the infrastructure networks and establish the demand related properties of those links s (e.g. capacity to process transport flows, waiting times, specific costs to access links etc.);
- Step 2: to examine for a recent year the actual traffic flows on the links;
- Step 3: to identify the key bottlenecks and spare capacity in the current use of the infrastructure (levels of capacity utilisation);
- Step 4: to look the expectations with regard to changes of the properties of links and the network in the future (planned projects on various levels);
- Step 5: to investigate changes in the use of the networks in the future (by means of forecasted transport flows on the networks);
- Step 6: to judge to what extent the bottlenecks are indeed eliminated by the changes in the networks or the size of the negative impacts of the bottleneck are reduced.

The result of steps 3 and 6 in particular contain the key findings of the analysis of the supply side. Identifying current and future bottlenecks presents an important benchmark to guide and judge efforts to improve (multi modal) transport in Rhine-Danube corridor and, more in particular, the already proposed actions/ projects.

The first three steps and the second three steps constitute two groups of activities, which are specified further in the subsections below.

The approach and data sources to the analysis of the present situation in the corridor

<u>Step 1: required link information</u>

The unit in which capacity is measured is in the maximum volume of traffic per time period (e.g. numbers of trucks, trains, vessels, trains per hour/ day).

In chapter 4.2 the links and nodes are specified and the parameters of those links are discussed and described in detail in the TENtec glossary. However, not all properties that are needed for the analysis of the available capacity can be obtained from the link properties alone; the capacity of the infrastructure network also depends on other factors, partly of an organisational nature and partly uncontrollable circumstances e.g. weather / climate conditions. In some cases also the link information needed to be completed. For the analysis the factors as listed in Table 44 are taken into account.

However, not always can the additional information be obtained and not all factors are equally important. Therefore it is indicated with a √- symbol which additional factor is taken into account in the analysis.

Table 44: Other factors/ information needed affecting the supply side

Type of factor	Incorporated in analysis yes/no
Road transport	
• Impact of weather conditions on infrastructure availability	
• Non-availability of links because of accidents and construction works	
• Border crossing waiting times	√
• Waiting times in loading/ unloading points	
Rail transport	
• Available rail paths on sections	√
• Impact of weather conditions on infrastructure availability	
• Non-availability of links because of accidents and construction works	
• Border crossing waiting times	√
• Waiting times at terminals loading/ unloading	
Waterways transport	
• Locks: not only the lock capacities but also queuing discipline in locks (usually it is not simply first-first out, but forms of priority queuing are applied)	√
• Capacity does not only depend on link properties but is mainly determined by the state of the navigational status of the free-flowing sections and weather conditions (water levels, ice days).	√ (only water level information)
• Non-availability of links because of accidents and construction works	
• Waiting times at ports loading/ unloading	
• Border crossing waiting times	√

Source: Panteia

Step 2: actual traffic flows on links

The relevant unit to use for the analysis of traffic flows is the same as was used for the measurement of capacity, namely the volume of traffic per time period (e.g. numbers of trucks, trains, vessels, trains per hour/ day).

Therefore, data on actual traffic flows on links should be used. Since these data are generally not available, estimated traffic flows derived from official traffic count surveys are used. Such data are for many corridor links available for the year 2010 in the ETIS Plus database[99]. Where available, this data was used. This involves a three step procedure:

1. Checking whether or not the information on the corridor link is available in ETIS
2. If not, complete the information using the same official traffic count sources source
3. It this turns out to be impossible as well other official (national) data sources are examined to complete the link information.

[99] *See http://www.etisplus.eu/data/default.aspx*

This procedure is followed successfully for the road network links in R-D corridor. All corridor links in all countries could be completed in this way, only for Romania; there are neither ETIS data nor official traffic count data sources available. However, data on the use of road network links can be derived from a recent study for Romania[100].

For rail freight and inland waterways the approach is slightly different. Here traffic count data can be completed with annual transport flow statistics. The low density of this infrastructure network makes it possible to assign regional transport flows uniquely to the network. e.g. for the transport between various regions the Danube it's the only connecting waterway corridor link , so in that case flows by waterways between these regions can be taken to be flows via the Danube.

Step 3: level of capacity utilisation

Having determined for each link the actual transport flow per time period (in step 2) and the capacity (in step 1), the level of capacity utilisation is simply calculated as the quotient of these quantities.

By means of maps of the corridor networks the level of capacity utilisation will be visually presented. This will allow the easy identification of the most important bottlenecks. The presentation by maps will, more importantly, allow the assessment of the capacity utilisation on particular links, groups of links/ sections in the entire corridor.

As remarked, this analysis on links and sections needs to be enhanced by data with regard to the other factors which may affect the quality and capacity supply in the corridor as listed in Table 44. From various other recent studies, (as reviewed in chapter 3) information can be obtained on the size of the other bottlenecks factor, also different per bottleneck. Only for inland waterway transport some,(modest) additional necessary analyses are performed on important factors like water levels on the Danube and other weather related factors.

It should be observed that in this chapter only bottlenecks to the physical characteristics and performance (in particular travel and voyage times and waiting times) are listed. There are also other factors primarily working to reduce or increase demand on networks: e.g. various forms of infrastructure charging, like tolls on sections of the road network, rail network access charges, port and fairways charges etc.

Finally, projects to increase capacity have the difficulty of dealing with a delicate balance. Capacity needs to be increased by a project, but not by too much at once as this creates ineffiency of new capacity. For example if a section is at >100% capacity utilisation, the new project could bring it back to 70 or 80%, but not to 50% as this could be seen as "wasted capacity". Even though in future years the capacity is consumed, it would be seen as inefficient today. Thefore a project that is seen as succefull creates not too much capacity at once. Should one for example wish to triple capacity in the period 2014-2030 a series of follow-up projects is needed to gradually increase capacity step-by-step.

The approach and data sources to the analysis of changes in the market in 2030

In the second part of the analysis of the supply side the situation in the R-D corridor in 2030 is assessed. This analysis is primarily based on three inputs:

[100] *See Preliminary Report on the Master Plan Short, Long and Medium Term" (Aecom, 2013)*

- Various national studies and other reports on the situation in the corridor countries, and in particular the catchment areas, as presented in the transport demand section
- The list of projects, in particular European supported project aiming to improve the infrastructure
- The analysis of the demand side of the market in particular the growth rates of traffic volumes in the corridor. See the previous section. Note that the analysis of the demand was to some extent also based on the sources mentioned in point 1.

Since the analysis of the developments in 2030 will be based on existing sources, it will not require the processing of new data or a traffic assignment analysis. Furthermore, since for the present situation the main bottlenecks will be known, the analysis can largely be incremental: looking at how the present bottlenecks will be reduced or eliminated by the changes that will occur in the corridor until 2030. Of course it would also be necessary to investigate whether possible new bottlenecks will emerge in 2030; i.e. whether on links or sections of the modal corridor networks which were not fully utilised in the present situation, in 2030 a problem might be expected.

In the analysis of the supply side in 2030 also three steps can be distinguished, these are the steps numbered as 4-6 below.

<u>Step 4: changes in network in the future (planned projects on various levels)</u>

The relevant EU supported and national projects for the R-D corridor will be examined and the projects that may help to relieve bottlenecks or very tight (near bottleneck) situations will have to be identified and the nature of the impact on the bottleneck will have to be indicating. Since exact quantification of the impact will not be possible, 4 categories of impacts will be distinguished: Elimination of bottlenecks, Substantial reduction of impacts of bottleneck, modest reduction of bottlenecks, or no impact at all.

<u>Step 5: to investigate changes in the use of the networks in the future (by means of forecasted transport flows on the networks)</u>

The analysis in step 4 is still based on the demand in the present situation. In step 5 the impact of growth of traffic volumes (analysed in the previous section) in the corridor will be incorporated in the bottleneck analysis. Two questions that need to be answered in particular are:

- To what extent does the growth in traffic volumes change the results obtained in step 4
- Do perhaps new bottleneck situations arise, and what will be the size and nature of these?

In case new bottlenecks are expected to occur in 2030 the list of projects need to be re-examined to what extent the list already anticipated these. The result of step 5 of the analysis will be a changed and modified list of bottlenecks,

<u>Step 6: Final analysis of the supply side in 2030.</u>

Step 6 corresponds to step 3 the analysis of the present situation. In this step the bottlenecks will again be reviewed, taking into account developments in the corridor with regard to developments in other supply side affecting factors Table 44 until 2030. This analysis will again take a wider view across the corridor and re-interprets the developments with regard to bottlenecks for multimodal transport in the entire corridor.

4.3.7.3.2Analysis of the current supply side of the corridor infrastructure services

The road network

Road Traffic flow sources

The analysis of road traffic flows in Romania is based on ETISplus data for 2010 for all countries except Romania, for which the analysis is based on the recent report "Preliminary Report on the Master Plan Short, Long and Medium Term" (Aecom, 2013).

The traffic flow data in ETISplus in turn is based on official traffic count data, for which the sources are listed in Table 45. For Romania traffic count data were not available in ETIS plus, and capacity utilisation rates will be directly be derived from the above mentioned report for Romania.

Table 45: Data sources ETIS plus road traffic count data (2010)

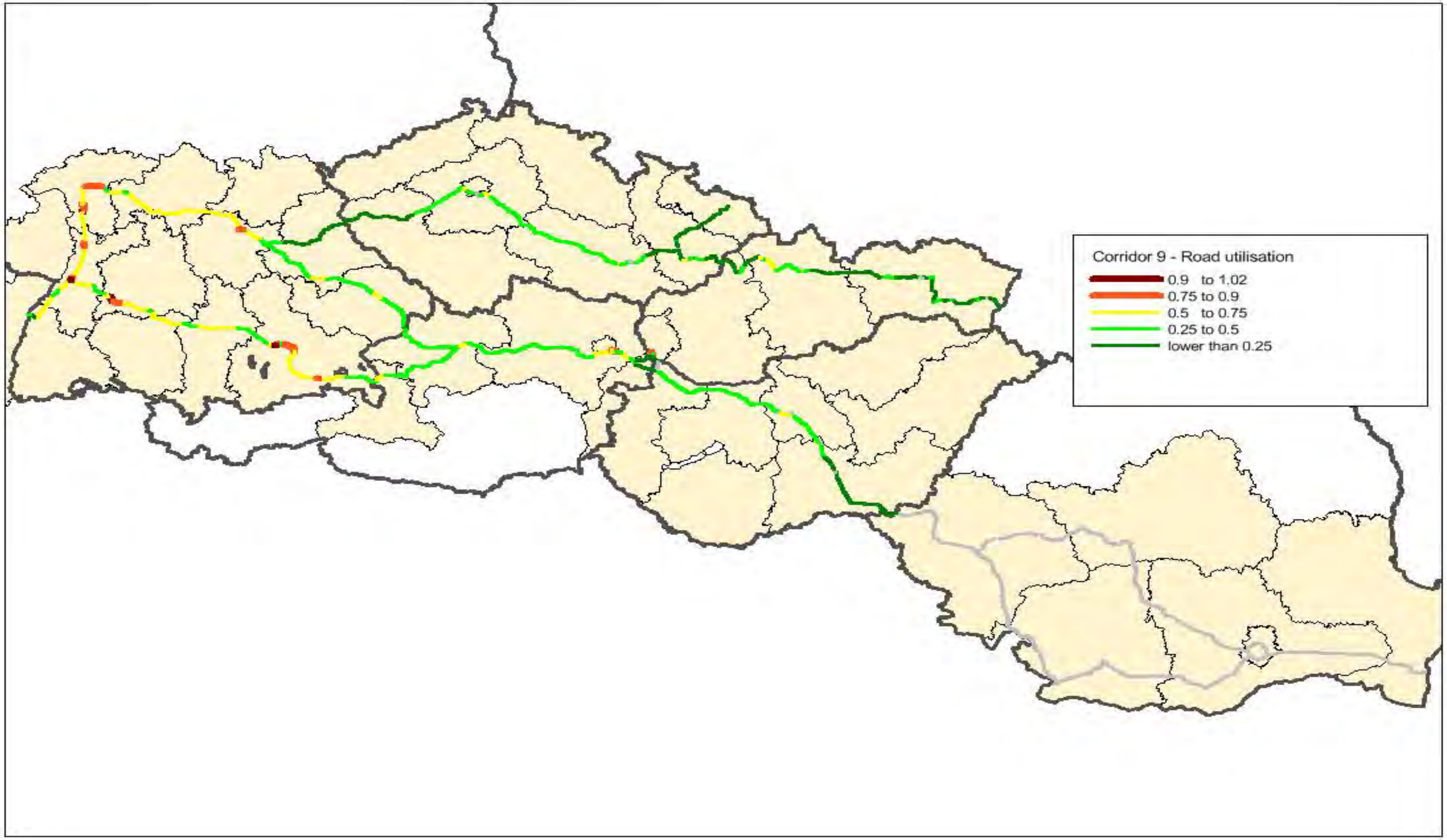
Country	Data source(s)
Austria	Bundesministerium für Verkehr, Innovation und Technologie: Straßenverkehrszählung 2010. + ASFiNAG: Dauerzählstellen 2010.
Czech Republic	Ředitels tví silnic a dálnic ČR : Celos tátní sčítání dopravy 2010.
Hungary	Magyar Közút: Az országos közutak 2010. Évre vonatkozó keresztmetszeti forgalma. +
Slovakia	Slovak Road Administration + National Highway Company.ceste: Karta prometnih obremenitev 2010.
Germany	Bundesanstalt für Straßenwesen (BASt): Manuelle Straßenverkehrszählung 2010.

In some cases the traffic data for links of the corridor are not available, so that the original sources needed to be checked to complete the ETISplus database.

Since the ETISplus database also contains data on the link capacity it was straightforward to calculate the link capacities (see Figure 59):

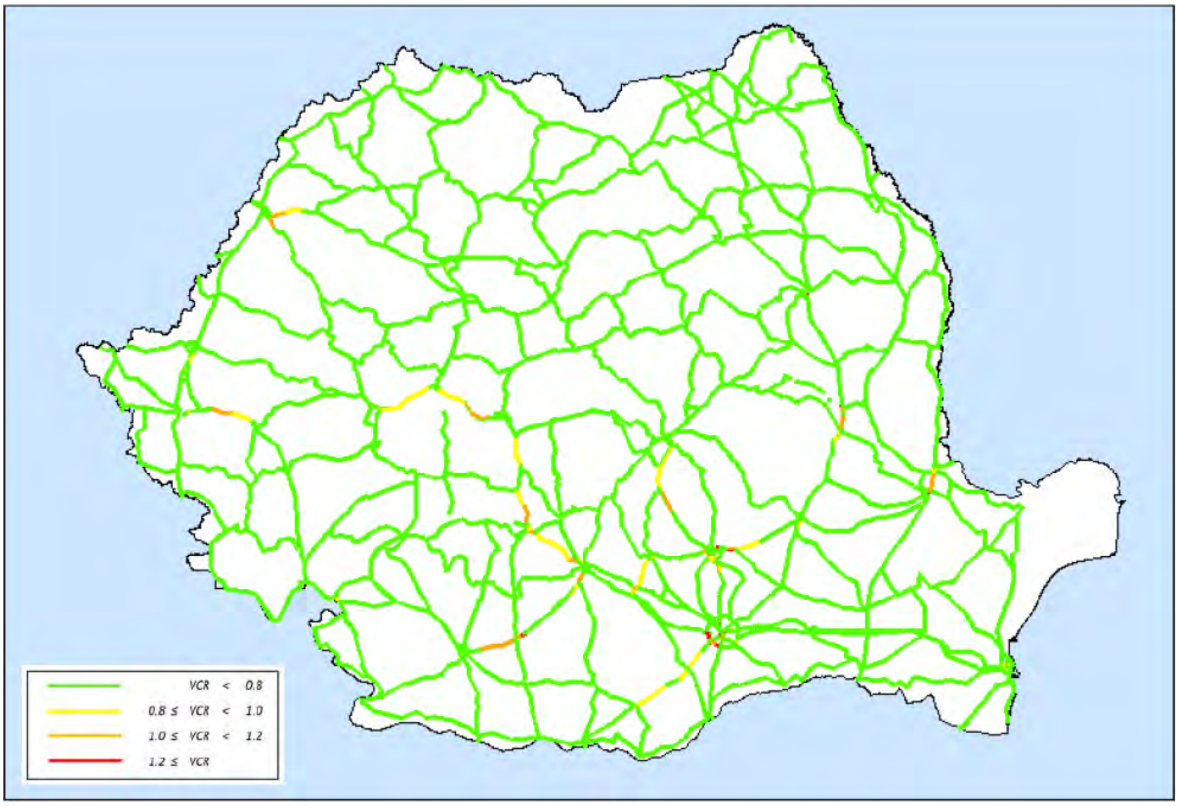
Capacity analysis on link level

Figure 59: The link capacity utilisation rates on the road network

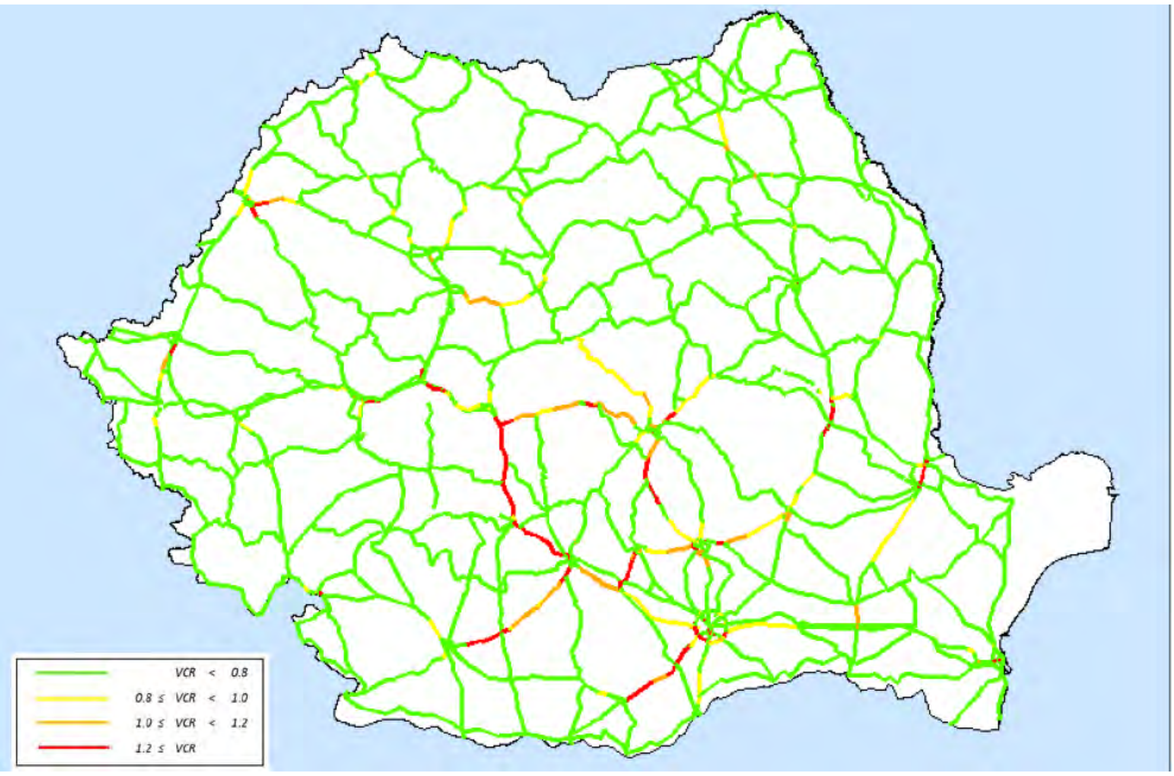


Source: ETISplus, Panteia

Figure 60: The 2011 link capacity utilisation rates on the road network for Romania, situation 2011



2020 national reference scenario



Source: Preliminary Report on the Master Plan Short, Long and Medium Term, Aecom 2013

Links with capacities constraints are identified on city level as that is where the congestion presents itself. Utilization is daily average. It is implied that congestion during peak hours will be worse.

Links with capacities constraints are identified on city level as that is where the congestion presents itself. Utilization is daily average. This implies that congestion during peak hours will be worse.

Utilisation rate above 100%:

- None on daily average
- Bucharest-Alexandria

Utilisation rate between 90% and 100%:

- Darmstadt
- Karlsruhe
- Stuttgart
- München
- Linz
- Wien

Utilisation rate between 75% and 90%:

- Frankfurt
- Heidelberg
- Mannheim
- Bratislava
- Praha
- Brno
- Rural road southwest of Zilina

Wien has significant congestion, nonetheless on a number of sections there is capacity available so that it does not match the trouble areas..

Initially, under-use of capacity can be spotted in the long-distance stretches of Austria, The Czech and Slovak Republic and Hungary. However this is not really under-use since a long distance journey will very likely encounter a congested node somewhere during the journey.

Other factors determining the actual availability of infrastructure to customers

As has been argued in the previous section, the link capacity utilisation bottlenecks give only a partial impression of the availability of services of the road network to customers. Also other factors play a part in determining the actual availability of the infrastructure. For road transport with trucks and busses (contrary to cars) one also has to take into account that in most countries there are restrictions on driving at certain days and times, in particular in the weekends and on national holidays.

<u>Driving restrictions in road freight transport</u>

All countries in R-D corridor have implemented restrictions on driving in weekends and national holiday. In Romania this is limited to the summer period; elsewhere there are restrictions throughout the year. This changes availability of trucking services in the corridor.

Table 46: Current driving restrictions on certain weekend- and national holidays for trucks (>3, 5 ton)

Country	Driving restrictions on road freight transport vehicles
Germany	On Sundays and national holidays from 00:00 h until 22:00 h and in July and August also on Saturdays (07:00h -20:00 h)
Czech Republic	On Sundays and national holidays from 13:00 h-22:00 h
Slovakia	On Sundays and national holidays from 00:00 h until 22:00 h and in July and August also on Saturdays (07:00h -19:00 h)
Austria	On Saturday, Sundays and national holidays from and on Saturdays from 15:00 h until 22:00 h Sundays
Hungary	On Sundays and national holidays and on Saturdays from 22:00 h Saturday until 22:00 h Sundays (or on festive day) and in July and August starting Saturdays on 15:00 h
Romania	Saturday, Sundays and national holidays on main motorways from half June until September

"Exemptions usually exist for special types of transport

<u>Infrastructure charges in road freight transport</u>

In road freight transport for all corridor countries a tolling or vignet system is in place which usually distinguishes between various types of vehicles, number of axles and engine categories used (EURO norms). The form and payment methods are different and also tariffs differ per country. However, on average for competing transport with IWW and rail freight they will be about € 0.15-0.3 per km for bigger trucks 4 axles and EURO4 engines. Most R-D corridor roads in the tolling countries are motorways and these are generally not exempt from paying tolls.

The railway network

Rail traffic flow sources

The utilisation of the railway infrastructure of the corridor has been analysed, using the following studies and reports:

Table 47: Data sources Rail link analysis

Country	Data source
Germany	Beratergruppe Verkehr + Umwelt GmbH (2010), Überprufung des Bedarfsplan für die Bundesschienwege; Beratergruppe Verkehr + Umwelt GmbH (2011), Elektrifizierung Marktredwitz – Regensburg;

Slovakia	Siet' Zelezníc Slovenskej republicky (2010), Priepustnost' trat'ových kol'ají pre GVD 2010/2011
Rail Freight Corridor studies	RFC 7 (2013), Implementation plan of Rail Freight Corridor 7: "Orient Corridor" RFC 9 (2013), Transport Market Study Rail Freight Corridor 9: "Czech – Slovak Corridor"
Freight and Logistics Advancement in Central/South-East Europe – Validation of Trade and Transport processes, Implementation of improvement actions, Application of co-ordinated structures studies	FLAVIA (2013), WP 3: Trade and transport between Central Europe and South-East Europe, Report Action 3.5.7: Cross Border Problems; FLAVIA (2013), WP 3: Trade and transport between Central Europe and South-East Europe, Report Action 3.5.1: Capacity rail network
Other studies	1. DIOMIS (2009), Evolution of intermodal rail/road traffic in Central Eastern European Countries by 2020; 2. KombiConsult / Hacon Ing. (2013/2014), COSMOS project: Cooperative Solutions for Managing Optimized Services Intermodal road maps per country 3. Panteia et al. (2012), Carrying out a study on the completion of the Priority Project Nr 22

Based upon these studies, information could be obtained about the utilisation of railway tracks in the corridor. It should be noted that utilisation rates vary per link: some links have capacity constraints while other links are not even used up to 50%. Unlike roads, railways commonly have an equal amount of tracks for long stretches. Precision solutions of adding a lane on the best location are not common in rail. This influences the capacity picture, where road shows high congestion near cities, the picture of rail is more diverse.

Germany has the most utilized rail infrastructure of the corridor. The only rail section with ample spare capacity is Přerov-Kosice between the Czech and Slovak Republic. The northern route of Arad-Brasov is undergoing works already and this changes the intensity picture. So this means that if train operation is limited on this section during construction, the capacity use is artificially low.

There are no critical permanent capacity constraints on Slovakian and Romanian sections of the corridor. Romanian capacity is exceeding 50% for the sections around Bucuresti and Arad - Craiova. For the section Curtici - Sighisoara high utilisation is due to construction works and the issue is of temporary nature. With the corridor developing in the future more restrictions due to construction can be expected on the corridor.

Capacity analysis on link level

Figure 61: The link capacity utilisation rates on the rail network

Source: HaCon based on study review

The figure is exactly the same as presented in the rail characteristics. Utilisation is an overlapping subject that is relevant for the Transport Market Study. As similar categoristation of utilisation rates as for roads has been chosen: 75%-90%; 90%-100% and >100%.

Links with capacities constraints can be identified as follows:

Utilisation rate above 100%:

- Karlsruhe – Mannheim – Frankfurt (both left and right side of the Rhine)
- Hanau – Nürnberg
- Regensburg node
- Bratislava node
- Kolin – Pardubice
- Choceň - Česká Třebová

Utilisation rate between 90% and 100%:

- Cross border section Hungary - Romania
- Budapest node
- Ostrava node

Utilisation rate between 75% and 90%:

- Kosice – Ukrainian border
- München - Freilassing
- Freilassing – German/Austrian border
- Wien-Nickelsdorf
- Furth i.W - Domažlice
- Praha – Kolin
- Česká Třebová - Ostrava

Other factors determining the actual availability of infrastructure to customers

Infrastructure charges in rail freight transport

Access charges have to be paid to access the rail networks. These charges are based on the Regulation of the European Commission under the Directive of the European Parliament and the Council No 2001/14/ES of 26 February 2001 on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety. On the basis of train km a comparison is made of these charges and how they developed for 2012.

Table 48: Comparison of rail infrastructure access charges in €/train-km

	Access charges for a typical 960 gross ton freight train (€/train-km) in 2012'	Access charges for a typical 2000 gross ton freight train (€/train-km) in 2012
Country		
Germany	3.28	3.28
Czech Republic	3.87	6.22
Slovakia	2.24	3.60
Austria	2.18	3.30
Hungary	2.05	3.07
Romania	3.40	3.95

Source: Table 1: Implementation plan rail freight corridor 7 (Nov 2013). ,Germany 2013-2014. Das Trassen Preissystem der DB Netz AG, (Kategorie Fernstrecken F2, Faktor: Standard).

Average border waiting times in rail freight transport[101]

User of rail freight services are still confronted with considerable waiting times at various border crossing point on the corridor.

The waiting times are partly caused by internal processes of railway operating companies (this involves mostly waiting for locomotive and/or staff of the cooperating RU, technical control, etc.). Partly other factors are responsible, like lack of interoperability of infrastructure (e.g. the electric systems, signalling devices, technical equipment of border stations and lines), low capacity (e.g. single track line, restricted capacity of stations / line section) and restricted speed (e.g. max. speed of 60 km/hour)

In practice small Railway undertakings have the longest waiting times at borders due to the lack of locomotives or staff. Ad-hoc trains usually have higher waiting times at borders than regular trains. In case technical or commercial inspections are needed at the border station, it may increase the duration of the procedure by 30–90 minutes.

The length of waiting times at borders ranges from 10 minutes to 48 hours. The following sheet summarizes actual data.

[101] *These texts are based on Implementation plan rail freight corridor 7 (Nov 2013).*

Table 49: Rail freight transport waiting times at the borders (status in 2013)

Country	Station*	Reality		Forecast 2021
		Waiting time at the borders	**Average waiting time**	**Average waiting time**
Czech Republic	Břeclav (CZ/AT)	3-60min	30	5
Hungary	Rajka (SK/HU)	n/a	n/a	n/a
	Komárom (SK/HU)		25	5
	Lőkösháza (HU/RO)	30 min	30	5
Austria	0 min (handover of trains is realized on the network of Czech Republic and Hungary)			
Romania	Curtici (HU/RO)	100 - 240 min	140	30
	Calafat (RO/BG)	100 - 240 min	140	20
Slovakia	Kúty (CZ/SK)		120	20
	Štúrovo (SK/HU)		140	20
* the waiting times at stations situated on the main lines are used for the purposes of calculation				

Source: Table 60: Implementation plan rail freight corridor 7 (Nov 2013).

The Rhine-Danube inland waterways network

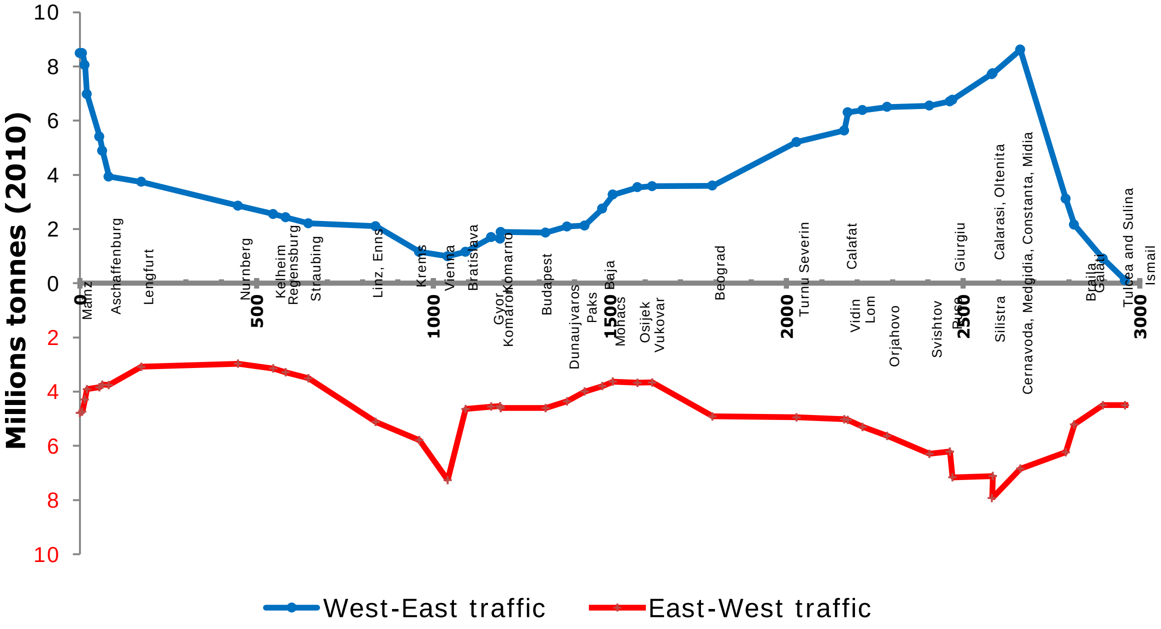
Traffic flow analysis

The source of traffic flow data for the IWW R-D corridor network is ETISplus (2010) which in turn uses national statistics as sources. Further sources were Planco (for lock capacity), Viadonau and BAFG.

Capacity analysis on link level

Based upon an analysis of ETISplus (2010) transport flows data for NUTS-3 regions connected to the Main, Main-Danube Canal, Danube, Sava or the Danube – Black Sea Canal, an analysis has been made on the transport flows via IWT for the Rhine – Danube Corridor.

Figure 62: Traffic flows on the Inland waterways network, East<->West volumes, per port and with distance information



Source: ETISplus, Panteia

Figure 62 presents a complex but informative picture. Here the flows are plotted per port. To illustrate consider Beograd. It is at the 1700 km point on the Danube corridor, starting from Mainz and has a West-East flow of about 4 million tonnes and an East-West flow of about 5 million tonnes. The graph shows imbalances in Danube transport. Imbalances make transport less efficient as this means the return route has to be made empty. For road transport there are alternative routes, for rail this is possible, but with less options than road transport. For Inland Waterway Transport this is an issue. For example, Austria has more imports from the Black Sea than exports to the Black Sea. The national prediction of Austria assumes that this trend continues. On the Lower Danube section, the amount of cargo transported on the Danube River is balanced for the Romanian / Bulgarian parts. Also on the Main River, imbalances can be noticed. A lot or cargo is transported from the Rhine axis to industrial areas up to Aschaffenburg. On contrary, from Aschaffenburg to the Rhine only 50% of this traffic is present. On the Main-Danube Canal, traffic flows balance each other with nearly 3.5 million tonnes in each direction.

For the Lower Danube, it can be observed that most export cargoes are handled via the seaport of Constanta. Imports on the other hand also originate from TulceaGalati and Giurgiulesti. This mainly concerns iron ore and coal, used in steel plants in Austria. On the Bulgarian/Romanian sections of the Danube, the import and export flows balance each other. The highest traffic in terms of tonnage transported can be found in the section between the Danube – Black Sea Canal and the ports of Silistra and Călăraşi. In this section, an annual amount of 8,614,650 tonnes is transported downstream and 7,927,755 tonnes downstream.

Traffic volumes decline on the Middle Danube, as well does the balance between the East-West and West-East flows. Up to Mohacs (Hungary), the traffic volumes decline steadily, meaning that the import of the ports from the Black Sea direction is higher than the export in the Rhine direction. Whereas a maximum of nearly 8 million tonnes per year is transported upstream to the ports of Silistra and Calarasi, only five millions remain in Beograd and only 3.6 million tonnes are transported up to Mohács. In the downstream direction, traffic flows significantly increase from Dunaujvaros (Hungary).

In the higher Danube, high traffic volumes (more than 7.6 millions) can be noticed in the section between Bratislava and Wien. Apart from the Cernavoda – Silistra section, this is the busiest section in upstream direction of the corridor. A lot of oil transport from the Black Sea ports is transported up to Wien, whilst Bratislava shows large export numbers to Austria and Germany.

Other factors determining the actual availability of infrastructure to customers

Capacity on Inland Waterways can be measured in transport units, being the amount of ships that can theoretically pass through locks or sections, depending on the fairway depth and also by the draught of vessels.

Information on lock capacity on the German and Austrian section show capacity utilisation rates from 10-25% on the Austrian Danube and 35-60% on the Main-Danube axis, meaning that West-East traffic could easily double, taking into account the existing renovation plans.

Table 50: Level of capacity utilisation for various locks

Lock	Fairway	Capacity utilisation of locks
Kostheim	Main	59%
Obernau	Main	52%
Kelheim	Main-Danube Canal	43%
Jochenstein (DE)	Danube	37%
Aschach (AT)	Danube	16%
Ottensheim (AT)	Danube	11%
Wallsee (AT)	Danube	13%
Abwinden (AT)	Danube	14%
Persenbeug (AT)	Danube	14%
Melk (AT)	Danube	19%
Altenwörth(AT)	Danube	20%
Greifenstein (AT)	Danube	17%
Freudenau (AT)	Danube	22%

Source: *Economical and Ecological Comparison of Transport Modes: Road, Railways, Inland Waterways, Planco 2007*

The German section of the Danube is the most critical, with the Lowest Navigable River levels resulting in a fairway depth of 2.0 metres. Figure 63 shows the utilisation rate of a various type of vessels, measured at the first quartile of water levels per month, meaning that in 75% of the days, higher water levels are achieved. The lowest water levels are reached in autumn: a CEMT5 GMS-110 barge can only carry 25 to 30% of its capacity in this period. For barges with a low empty draughts, such as the lighters or the self-propelled CEMT3 Gustav Koenigs vessel, 45 to 50% of the loading capacity is available in these periods.

According to point (ii) of Annex III of the AGN Agreement, only waterways navigable by ships with a draught of at least 2.50 m can be designated as E waterways (of international importance), with the proviso that this draught must be navigable[102] on an average of 240 days per year, i.e. for 60% of the navigation period and on 300 days pursuant to footnote 3 to (viii). As such, a loaded draught of 2.5 m (loaded ship at rest – "static draught") was determined for the Danube in the "Recommendations

[102] *MARKETOBSERVATION N° 15, Situation of the offer and demand in 2011, and analysis of the economic conditions early 2012, CCNR Publication*

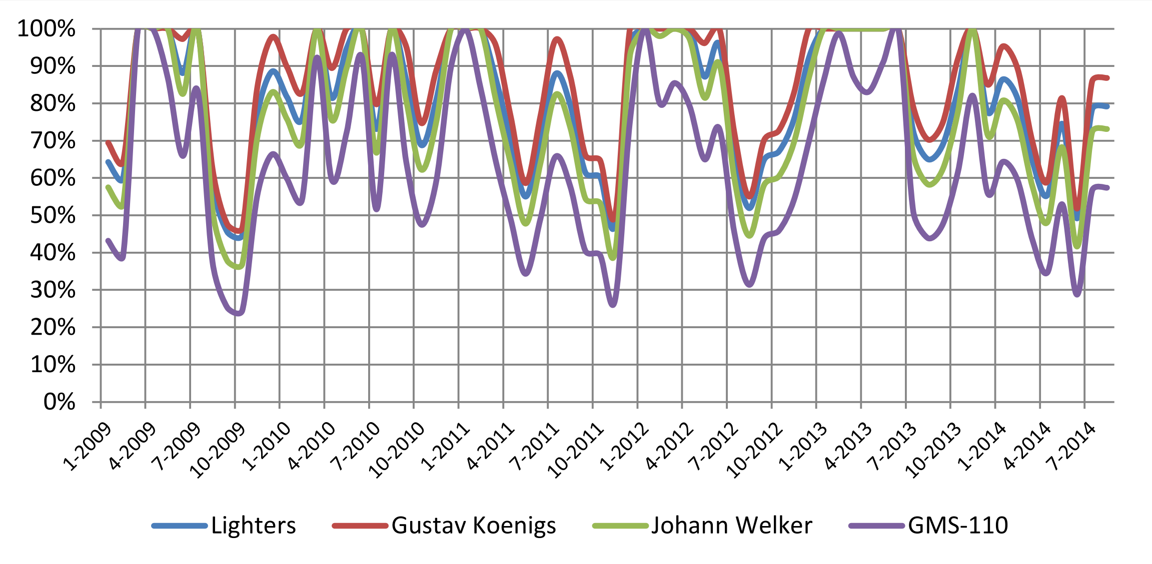
on minimum requirements for standard fairway parameters, hydro technical and other improvements on the Danube", which theoretically would have to be guaranteed for the entire waterway from km 0 of the maritime section all the way to Kelheim.

However, in normal circumstance as a result of the actual depths of critical sections of the Danube in the course of the year only an average loaded draught of 2.20 – 2.30 m is assured. In exceptional circumstances the ships' loaded draught must be reduced to as little as 1.8-2 m in the critical sectors. There were, however, also instances in which depths at the fords were 1.2 - 1.5 m.

One may, therefore, draw the conclusion that the Danube fleet systematically has to operate under low water conditions.

Figure 63: Actual capacity utilisation rate of various types of vessels in the period 2009 (Jan)-2014 (Jul)

Gustav Koenigs= CEMT3; Johann Welker = CEMT4; GMS-110 = CEMT5.



Source: German Federal Waterways and Shipping Administration (WSV)", communicated by the German Federal Institute of Hydrology (BfG)

As a consequence of the large number of free-flowing sections of the waterways in the Rhine-Danube corridor, the low-water periods cause considerable problems at times for both navigation and eco-systems along the river alike. Additionally, albeit less problematic and spatially limited low-water areas exist on the Danube in Hungary in certain sections on the 120 km-long stretch between the discharge canal of the Slovak power plant Gabcikovo and Budapest. Unlike the upper Danube, the water flow on the middle Danube between Budapest and the Iron Gate is considerably more even, allowing shipping companies to better exploit their vessels' capacity due to more calculable fairway depths.

Depending on the geological and climatic conditions as well as on the tributaries of the Danube, there are typical differences in the annual average discharge in the three sections of the Danube. Generally, on the Upper Danube the highest water levels are recorded between May and August, and the lowest water levels between October and March. On the Middle and Lower Danube low water levels are observed between August and October and high water levels in the months of April and May.

As a general rule, weather-related closures of (sections of) the Danube waterway may either result from strong icing or serious high water conditions. Strong icing may result from sustained temperatures well below freezing point. Ice impedes navigation mainly during the months of January and February. High water conditions are the result of fast snow melting or heavy rainfall and mostly occur at the beginning of spring or in midsummer. During these official weather-related closures, navigation on the Danube is prohibited.[103]

The approximately 200 km stretch in the transition from the middle Danube to the lower Danube (Bazias to Iron Gate II, river km 1,072 – 863) has stable fairway conditions for navigation due to the locks Iron Gate I and II. Although the lock themselves are in need of renovation, they present no impediment to inland navigation. Downstream Iron Gate I and II, the Danube is free-flowing, i.e. not regulated by walls. The key bottlenecks are the island of Belene (river km 576 – 560) on the Bulgarian-Romanian border section, the Batin stretch (river km 531 - 521) and the Caragheorge sandbar on the Romanian Bala arm (river km 345 – 343).[104]

Type of vessels

Convoys predominate on the Danube. Some 90% of all transports are carried out using convoys and only 10% using individual motorised cargo vessels. In the Rhine river area this ratio of convoys to motorised vessels follows a diametrically opposed pattern. A convoy consists of a motorised cargo vessel (vessel with its own cargo hold) or a pushboat and one or more non-motorised lighters which are securely attached to the motorised cargo vessel or push boat. The maximum number of lighters per convoy varies depending on the section of the Danube it is travelling. The Danube between the port of Passau in Germany and the Hungarian-Slovak border can be easily navigated by convoys with up to four lighters in normal conditions. In the middle- and lower reaches of the Danube, a convoy may consist of up to 9 or 12 lighters.

Passenger transport on the Danube

According to market observation reports, an average of 120 cabin ships operate on the Danube, transporting 300 – 350 thousand people each year; that is more than 40% of total passenger traffic on European inland waterways. The transport output is broken down as follows:

- "short" routes: Passau – Budapest – Bratislava – Wien – Passau – 30 %
- "long" routes: Passau – Danube Delta – Passau – 30 %
- Rhein – Passau – Danube Delta – Passau – Rhine – 30 %

Apart from the routes mentioned local and excursion routes (more than 100 ships) are also actively operated in tourist centres (Budapest, Wien). Unlike freight traffic, the potential of passenger navigation on the Danube, both in terms of the number of passengers transported and freight fees received, has remained unchanged.[105]

Infrastructure charges for IWW on the corridor

On the international inland waterways Danube and Rhine navigation is exempt from charges. Fees must, however, be paid for navigating on the Main (Germany) and Main-Danube Canal (Germany) and the Danube-Black Sea Canal (Romania), as these are national waterways which are not included in the Belgrade Convention of 1948.

Fees must be paid also for Sulina channel navigation. In adition vessels must pay for pilotage and for different services provided by naval authority thus the ammount varies between 3.000 and 6.000 EUR/vessel depending on gross tonnage.

[103] *http://www.donauschifffahrt.info/en/facts_figures/the_danube_as_a_major_route_of_transport/navigability/*

[104] *Manual on Danube navigation, via-donau 2007*

[105] *MARKETOBSERVATION N° 15, Situation of the offer and demand in 2011, and analysis of the economic conditions early 2012, CCNR Publication*

As stipulated by all Danube riparian states in the Convention Regarding the Regime of Navigation on the Danube, navigation on the Danube is free and open for all vessels of commerce sailing under the flags of all states. The German charges on the Main and Main-Danube- Canal differ dependent on the type and value of cargo. For the entire trajectory from Mainz to Kelheim- 555 km) it generally may amount to an additional € 1-3 per ton of cargo.

On the Danube-Black Sea Canal tariffs depend on the type vessel (barges, maritime vessels, tug boats, yachts etc.), the size of vessels, types of goods and services delivered. For barges in convoy the transfer tariff is € 0.27 ton capacity. The minimal tariff for transit on the canal with lockage is € 261 (ADMINISTRATIA CANALELOR NAVIGABILE, 2014).

Note that these are generally not the only infrastructure charges that operators have to pay for voyages. In IWT one generally also has to pay for visiting, staying in ports. General port dues have to be paid by vessel operators, The exemption on charges neither on the Rhine nor on the Danube also extends to port dues, which are usually instituted by local authorities and may widely vary according to the structure and foundation of those charges (type and size of vessels, type of cargo, nature of the activities in ports, duration of the stay) as well as the height of the charge per ton.

Generally speaking, however, this would mean that about € 0.3-1.5 will have to be added to the transport price per ton for transport from the Rhine area to the Danube in addition to the km fairway use charge on the Main and the Main-Danube.

4.3.7.4 Modal corridor comparisons and intermodal transport services

The previous sections focused on the use of the Rhine-Danube infrastructure networks for the transport services for a single mode. In this section the present modal networks in R-D corridor will be compared by means of 3 SWOT tables .This summarizes the main points in the discussion in the previous subsections, but also some new points are added to this.

Finally, also in this subsection, a special market segment, the intermodal transport market (containers, trailers), will be briefly discussed.

Table 51: Strengths and weaknesses of the present road transport corridor

Road transport corridor	
Strengths	**Weaknesses**
1. Coverage of infrastructure cost 2. Flexibility of companies 3. Density of network/ alternative routes 4. High customer orientation of companies and staff 5. Complex logistics operations 6. High value cargo 7. Adoption rate of innovations	1. High rates of capacity utilisation in Southern Germany, in a number of sections in Wien and Bratislava 2. Most expensive transport mode 3. Driving bans in weekends and national holidays 4. Negative external effects 5. Vulnerable for crime and security problems in general (e.g. cargo theft, or high insurance costs)

Table 52: Strengths and weaknesses of the present rail transport corridor

Rail transport corridor	
Strengths	**Weaknesses**
1. Comparatively many rail-road terminals and many tri-modal terminals; 2. Intermodal transport market on the corridor 3. Low negative external effects 4. Safety of transport	1. Low contribution to the coverage of infrastructure costs. 2. Low technical level, out-of-date infrastructure, high rate of failures 3. Lack of free capacity on some lines (Czech Republic, Romania) for an increase of freight volumes 4. Limited flexibility. 5. Low line speed (outside modernized sections) 6. Waiting times borders. Technical Restrictions on border lines

Table 53: Strengths and weaknesses of the present IWW transport corridor

IWW transport corridor	
Strengths	**Weaknesses**
1. Sufficient capacity of locks available to accommodate increase of freight volumes 2. No congestion on network, limited interference between freight and passenger transport 3. Low freight prices 4. Low value, bulk cargo 5. Hazardous goods (low external risk because the infrastructure is not close to concentration of population) 6. Relatively low emission levels	1. Slow, long winding and unreliable River sections (free flowing sections) 2. No alternative routes at all in case of blockage of waterways 3. Free flowing sections where low water levels can significantly reduce vessel capacities 4. Relatively high fairway charges in Germany (Main and Main Donau Canal) and in Romania (Sulina channel and Black Sea Canal) 5. Container market still underdeveloped

Intermodal transport

In the corridor regions intermodal transport is primarily rail-road transport. This transport showed prior to the economic crisis a steep growth rate, a much higher rate compared to road, rail and Inland waterways and water-road transport. However the high growth turned into a (temporary) steep decline and a sluggish recovery. Since the sudden downturn, the market development differs strongly across individual countries (and industries) some showing a robust growth again, others are still lagging behind.

It is noteworthy that the intermodal market in central European countries of the R-D Corridor is still primarily oriented to seaports. Although in some countries the market for continental cargo is substantial, maritime cargo is still dominant. Moreover the maritime links primarily consists in German Seaports, Rotterdam, Antwerp and Koper. The Black Sea and Mediterranean connection is far less dominant for the central European countries[106]. The intermodal transport in the Lower Danube region is of course strongly oriented towards the Black Sea ports.

Intermodal transport is expected to return to the higher growth paths when a number of infrastructure improvements, which are on-going or planned (in particular various CEF pre-identified projects) will be completed. More specifically, a number of expansions of rail-road terminal capacity are planned along the corridor (e.g. in the Constanta area, a terminal in Ruse and also in Austria (Linz, Enns and Wien)).

Container transport on the Danube

Unlike the Rhine and other inland waterways of Western Europe, container transport on the Danube is currently under developed for the following reasons:

- long distances and difficult direct connections between the freight centres for containers arriving from international maritime routes (e.g. from the Port of Constanta) and the most important distribution centres on the Danube (Belgrade, Budapest, Bratislava, Wien, Enns)
- the length of time it takes to transport containers to the distribution centres on the Danube owing to navigation conditions, in particular the underdeveloped infrastructure.[107]

In the past decade there were several attempts to establish scheduled container liner services from the Port of Constanta to the ports of the Central and Lower Danube, after a short period of operation all have been de-activated. One of the main reasons were the difficult nautical conditions, which made it hard to keep to the regular time plan, and the lack of support of the shipping company industry to bring loaded containers to the scheduled container liner service. However, the experiences elsewhere (on other waterways) and the lessons learned from the not-yet successful initiatives show that with appropriate navigation infrastructure and by enabling container ships to achieve significantly higher speeds (motor freighters and pusher vessels with barges), one could expect a significant increase in container traffic by redirecting the flow of goods from other means of transport onto the Danube.

In the Upper Danube region and on the Main the market for container transport is more attractive, since both in Nurnberg and Regensburg container terminal capacities are expanded.

[106] See, for example the COSMOS country reports for Hungary and the Czech Republic (COSMOS roundtable reports ; KombiConsult GmbH, 2013)

[107] MARKETOBSERVATION N° 15, Situation of the offer and demand in 2011, and analysis of the economic conditions early 2012, CCNR Publication

4.3.7.5 Analysis of the future supply side of the Rhine-Danube infrastructure based on country studies

4.3.7.5.1 Introduction

In this section the Rhine-Danube modal corridors will be re-examined looking at the growth of transport flows in the corridor on the one hand and the development of the infrastructure on the other hand. The growth in demand will be met with an increased potential of the infrastructure network to deal with this growth.

Three factors are important to consider:

- The growth in demand for transport services in the corridor
- Changes in the size and nature of the links of the network (the change in supply)
- Other, independent, factors that affect the market.

The growth in demand can be derived from studies that were reviewed in in the literature review (see chapter 3). Similarly changes in the size and nature of the links can be derived from the inventory of projects (and the background material related to these) that are described in section 4.4 (an "overview on major infrastructure projects in the Corridor").

Item 3, "Other, independent, factors that affect the market" cannot be immediately obtained from an already available and harmonized source. Examples of such factors are: changes in the political and social environment, climate change, the timing of recovery from the effects of the economic crisis. In other words these are macro- or mega trends that should be considered, because they may have a substantial influence on the market, although they as such are exogenous to the market.

In Table 40, estimates are listed of the average annual growth rates of traffic volumes for each country in the corridor, for all the modes that are relevant for the country. The estimates are derived from the most recent country studies (if available) dealing with long term forecasts of transport flows. If the studies present directly estimates on transport networks, those estimates are selected. Otherwise when only regional flows are presented, the flow in regions where the infrastructure network is located is selected.

If the properties of link do not change it is easy to calculate the rate of capacity utilisation in 2030 from the annual growth percentages listed in Table 40 and the utilisation rates for 2010. One can then immediately find out whether the utilisation rate of links that were already intensively used, crossed the boundary of 100%. In general, however, it cannot be assumed that the properties of links do not change, given the large number of identified projects that aim to change network parameters.

Therefore, one has to rely on a more qualitative approach and judge the changes in the utilisation of links by the expertise of the Consortium alone from a top-down point of view. The form chosen to present the results is by means of tables of "opportunities and threats" (see Table 54-Table 56). This combines with the results in the previous section where "strengths and weaknesses" were presented. In this way one gets a complete set of SWOT tables per transport mode.

4.3.7.5.2 Opportunities and Threats in 2030

Table 54: Opportunities and threats of the road transport corridor

Road transport corridor	
Opportunities	**Threats**
1. Improvement projects of the road network in various countries in the corridor (in particular in Romania, Slovakia and Czech Republic) 2. High rate of uptake of innovations by the industry 3. Continued relative shifts in composition of transported products to finished products instead of raw materials and semi-finished products 4. Quick improvement of environmental performance thanks to innovations in engine technology and EURO-norms 5. Increase complexity of supply chains and demands for time-critical, fast services across borders	1. Growth in passenger transport and interference and threat of increased congestion in particular in the road sections of Southern Germany 2. Increased concerns about security 3. Increases in fuel prices and excise duties 4. Staff shortages in a number of countries and social condition of personnel

Table 55: Opportunities and threats of the rail transport corridor

Rail transport corridor	
Opportunities	**Threats**
1. Substantial reduction of border crossing times 2. Cross-border cooperation between railway companies (in improvement of technical parameters of border lines) 3. Increase of average speed of services and train lengths in general and on upgrade sections Romania, Hungary, Germany and Austria in particular 4. Increase of market share of Black Sea ports also in central European countries (in particular in intermodal transport) 5. Construction of intermodal transport terminals 6. Government transport policy in favour of modal shift 7. Further increase of road freight transport costs and congestion roads 8. Harmonization of annual timetabling between countries in the corridor .	1. Further, new delays in improvement projects in the corridor 2. Resistance against further liberalisation of railway companies 3. Priority, interference of passenger transport and growth in passenger transport 4. Slow recovery from economic crisis 5. Intermodal alternatives 6. Intermodal market is still highly concentrated in a limited number of companies 7. Fast improvement of environmental performance in the road transport sector

Table 56: Opportunities and threats of the IWW transport corridor

IWW transport corridor	
Opportunities	**Threats**
1. Upgrading Main to class Vb 2. Improving draught in critical, shallow sections of the Danube by rehabilitation, maintenance and construction works 3. Harmonisation of maintenance (mainly dredging and fairway relocation) and working with agreed upon service levels 4. Potential of the use of alternative fuels; in particular LNG 5. Further/ renewed efforts to access new markets 6. Further increase of road freight transport costs and congestion of roads 7. Further development of RIS services	1. Further delay in improvement of infrastructure projects and delay in realizing good navigational status 2. Fragmented organisation of the IWT industry 3. Fast improvement of environmental performance in the road transport sector 4. Traditional markets like steel industry, petrochemical industry and agribulk market are confronted with strong international competition on the world markets and cargo volumes of the European industries may decline 5. Extreme weather events, which are projected to occur more frequently due to the change of the climate, if not considered properly in the operation of the infrastructure

4.3.8 Conclusion on critical issues

The previous chapter examined the compliance of the rail, inland waterway and road network, as well as the inland waterway ports, RRTs and airports with the TEN-T requirements. The review identified the non-compliant sections along the corridor for each mode, which in their majority generate technical and capacity bottlenecks, as well as create interoperability issues. The factors hindering the intermodality along the corridor were also identified.

The results are useful in terms of identifying prominent critical issues along the corridor, narrowed down to cross-border problems, and intermodality and interoperability issues. These are discussed in detail in the chapter on critical issues, while the chapter on implementation and measures lists the on-going and planned infrastructure projects that will partly and/or entirely upgrade sections of the Corridor to comply with the thresholds set by the TEN-T.

The modal split was presented in the transport demand section of the Transport Market Study. 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. Supply side influences the modal split. A SWOT analysis is performed to evaluate the transport market in 2030 and to see changes in modal split.

The transport market study revealed no new critical issues that realistically can be solved via new infrastructure projects, rehabiliation and enhanced maintenance. For example, imbalance of flows in IWT cannot realistically be solved with new infrastructure in the Rhine-Danube corridor. Nor the relative fragmented organisation of the IWT industry. For the existing critical issues support for inland waterway and railways is needed 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 of key importance. The port and air nodes on the corridor have plans in place to fulfil capacity needs. Especially for rail sections continuous capacity plans need to be implemented to fulfil demand and future demand. Each rail capacity project will have a high success rate as demand for capacity is high and the newly built capacity will be put to efficient use, almost right away.

Prospects for rail and inland waterways

Rail studies of RFC7&9 and PP22 show that infrastructure improvements lead to higher rail shares and a shift from road to rail. To reverse the baseline trend of further road dominance in 2030, all projects of the implementation plan are necessary and additionally support for alternative modes of transport are needed throughout 2030.

Inland Waterway transport benefit from better reliability of waterways, as this is the largest limiting factor in capacity. Once permanently solved the IWW's have capacity to handle a modal shift and further support and initiatives can improve the modal split of (international) Inland Waterway Transport in the future.

Summary of the impact of the implementation plan on the transport market

The implementation plan is a living document where projects are added and removed. Projects may be removed due to limited budgets and contributions to the corridor goals. Projects may be added because not all future projects until the year 2030 are foreseen. This uncertainty considers a bottom-up approach not as the best approach to estimate the future supply side of the corridor.

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. At the moment capacity plans for airports exist for the airports of München, Frankfurt and Wien. For Hungary no immediate growth in air travel is expected so in the foreseeable future no plans are needed. Czech expansion plans are identified in the national transport plan. Romania's largest airport Henri Coada has recently undergone expansions and new plans also exist. In total the supply side for airports offers no limitations in the future with full implementation of projects assumed.

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 projects for modernization of the existing capacities. Other large projects take place in the port of Wien (AT) Nürnberg (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.

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 utilized 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. At the time of writing no international or cross border projects are present in the implementation plan around Bratislava. 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.

Rail is heavily utilized present day and modal split is under pressure. More than one third of rail projects in the implementation plan are about infrastructure works. For Germany in the 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 is 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. The section of Přerov-Kosice between the Czech and Slovak Republics is the only long rail stretch with under-use of capacity, around the start and end points there is a high use of capacity again at Přerov and Košice itself. 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.

Inland waterways capacity addressed in three areas: locks, fairways and the fleet. The lock capacity is more than sufficient and where additional capacity is needed, it is already addressed in the implementation plan. The width of fairways is generally sufficient for accomodating 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%. Crucial therefore are projects to enhance navigability (rehabilitation, infrastructure projects and maintenance) in the free-flowing sections. These are constantly needed every few years because of changes in riverbeds and need to be done all over the corridor. If a navigation bottleneck is solved in one country then solutions are also needed in a neighbouring country simultaneously. Otherwise the bottleneck is not solved, but only shifted. In the current implementation plan it is uncertain if all navigability problems are solved for all areas until 2030 and the requirements as regards to draught in the TEN-T Regulation (2.5 m draught throughout the entire year). Finally it should be observed that the fleet capacity is sufficient on the Rhine-Danube corridor, the future trend for vessels is larger ships and 24/7 operations. If these developments go too rapidly there is the risk of overcapacity in the fleet.

4.4 Objectives of the Core Network Corridor

4.4.1 Introduction

This task entails the identification of the core objectives of the core network corridor, which together with a proposed performance measurement framework will establish a sound basis for defining the programme of implementation measures. Performance measurement is a key strategic activity and is typically in compliance with the development objectives of a transport corridor, while the criteria used to measure performance are related to the expected outcomes. In addition, performance measurement can significantly impact the development, implementation and management of transport policies, programmes and projects and largely contribute to the identification and assessment of alternatives.

The proposed evaluation framework will constitute an effective benchmarking and decision-making tool, and will be based on the identification of corridor-specific objectives and the definition of related Key Performance Indicators (KPIs) measuring the performance of the R-D Corridor against these set objectives. In general, the proposed corridor performance evaluation will build on the previous overview of corridor characteristics, objectives and assessment of main critical issues (as detailed in 2nd Progress report). It will take into consideration the input received from stakeholders and related findings obtained during the 1st and 2nd Corridor Fora already realised. The evaluation framework shall be simple, not data intensive, robust and flexible in terms of being adjusted post any application/validation exercise.

4.4.2 Framework for general objectives

Section 6.3 of the working document "Starting the Core Network Corridors" (26 February 2014) states that the work plan should contain *a proposal for corridor objectives, in particular terms of performance expressed as the quality of service. The objectives have to be in line with the objectives of the TEN-T regulation (Article 4 and 10).*

Article 4 defines the objectives of the trans-European transport network in a generic way by stating *that the network shall strengthen the social, economic and territorial cohesion of the Union and contributes to the creation of a single European transport area which is efficient and sustainable, increases the benefits for the users and supports inclusive growth. It shall demonstrate European added value by contributing to the objectives laid down in four categories:*

- ***Cohesion*** *through accessibility and connectivity of all regions, the reduction of infrastructure quality gaps between the Member States, the interconnection between transport infrastructure for long-distance traffic and regional/local traffic and a transport infrastructure that provides for a balanced coverage of all European regions.*
- ***Efficiency*** *through the removal of bottlenecks and bridging the missing links within the transport infrastructures within Member States and between them, the interconnection and interoperability of national transport networks, optimal integration and interconnection of all transport modes and the promotion of economically efficient, high quality transport contributing to further economic growth, efficient use of new and existing infrastructure and cost-efficient application of innovative technological and operational concepts.*
- ***Sustainability*** *through the development of transport modes ensuring transport being sustainable and economically efficient in the long term, contribution to the objectives of low greenhouse gas emissions, low-carbon and clean transport and promotion of low-carbon transport with the aim of*

achieving by 2050 a significant reduction in CO_2 emissions but also considering the EU biodiversity strategy and its related instruments.

- ***Increasing the benefits for its users*** *through meeting the mobility and transport needs, ensuring safe, secure and high-quality standards, supporting mobility even in the event of natural or man-made disasters, the establishment of infrastructure requirements in the field of interoperability, safety and security, and the accessibility for elderly persons, persons of reduced mobility and disabled persons.*

Article 10 of the TEN-T regulation defines the general priorities in the development of the comprehensive network to be given to the measures that are necessary to fulfil the above generic objectives.

This task identifies core objectives pursued in the corridor, in order to precisely work out the current common corridor vision among the stakeholder as well as additional propositions of individual stakeholder groups. It will be facilitated by making best use of the results collected and consolidated in the data gathering phase as well as findings resulting from the Corridor Forum's meetings; thus to create a basis for developing draft proposals for the programme of measures to be implemented in the corridor. Corridor objectives focussed at this stage are mainly related to performance benchmarks or environmental sustainability.

In order to establish a sound basis for developing implementation and investment plans the corridor objectives were collected and organized into:

- Infrastructural objectives (e.g. implementation of ERTMS, RIS, fulfilling the technical parameters)
- Organizational objectives (e.g. Re-organization of customs clearance procedures)
- Guideline implementation objectives (e.g. harmonization, liberalization)

The generic objectives of the Rhine-Danube corridor followed the approach of categorisation of objectives as laid down in Article 4. The European Commission, Member States as well as the other stakeholders have many different objectives with regard to the corridor. A suitable approach for the definition of the objectives was the multi-step methodology. The first step was the **identification and analysis of the relevant official documents** of the European Commission (e.g. 2020 Strategy, White paper on Transport, revised TEN-T Guidelines, clean fuel strategy, Fourth Railway Package, NAIADES II, the EU Danube Region Strategy) and the Member States along the corridor. The identification was based on the information gained in the data gathering phase of the project. As second step additional information were sought in **statements of the stakeholders** previously identified in the project. All relevant aspects regarding the status quo performance of the transport network along the corridor were considered and used as basis for the definition of the corridor objectives. For this purpose all gathered information from the review of the official documents and the statements of stakeholders were aggregated to core statements in the next step. These core statements were used to **define the objectives of the Rhine-Danube Corridor** in the last step of the process for the last Corridor Forum.

The objectives of the corridor have to fulfil several criteria. They shall be:

- specific
- measureable
- acceptable for the addressee
- realistic

The objectives are worked out as overall objective for the whole corridor as well as differentiated objectives e.g. for different transport modes and economic aspects.

The **White Paper** - Roadmap to a single European transport Area – towards a competitive and resource efficient transport system:

The Transport 2050 roadmap sets different goals for different types of journey - within cities, between cities, and long distance.

1. For intercity travel: 50% of all medium-distance passenger and freight transport should shift off the roads and onto rail and waterborne transport.

- By 2050, the majority of medium-distance passenger transport, about 300km and beyond, should go by rail.

- By 2030, 30% of road freight over 300 km should shift to other modes such as rail or waterborne transport, and more than 50% by 2050.

- Deliver a fully functional and EU-wide core network of transport corridors, ensuring facilities for efficient transfer between transport modes (TEN-T core network) by 2030, with a high-quality high-capacity network by 2050 and a corresponding set of information services.

- By 2050, connect all core network airports to the rail network, preferably high-speed; ensure that all core seaports are sufficiently connected to the rail freight and, where possible, inland waterway system.

- By 2020, establish the framework for a European multimodal transport information, management and payment system, both for passengers and freight.

- Move towards full application of "user pays" and "polluter pays" principles and private sector engagement to eliminate distortions, generate revenues and ensure financing for future transport investments.

2. For long-distance travel and intercontinental freight, air travel and ships will continue to dominate. New engines, fuels and traffic management systems will increase efficiency and reduce emissions.

- Low-carbon fuels in aviation to reach 40% by 2050; also, by 2050, reduce EU CO_2 emissions from maritime bunker fuels by 40%.

- A complete modernisation of Europe's air traffic control system by 2020, delivering the Single European Sky: shorter and safer air journeys and more capacity; Completion of the European Common Aviation Area of 58 countries and 1 billion inhabitants by 2020.

- Deployment of intelligent land and waterborne transport management systems (e.g. ERTMS, ITS, RIS, SafeSeaNet and LRIT[108]).

- Work with international partners and in international organisations such as ICAO and IMO to promote European competitiveness and climate goals at a global level.

3. For urban transport, a big shift to cleaner cars and cleaner fuels. 50% shift away from conventionally fuelled cars by 2030, phasing them out in cities by 2050.

- Halve the use of 'conventionally fuelled' cars in urban transport by 2030; phase them out in cities by 2050; achieve essentially CO_2-free movement of goods in major urban centres by 2030.

- By 2050, move close to zero fatalities in road transport. In line with this goal, the EU aims at halving road casualties by 2020.

[108] European Rail Traffic Management System, Intelligent Transport Systems (for road transport), River Information Services, the EU's maritime information systems SafeSeaNet and Long Range Identification and Tracking of vessels

4.4.3 Corridor objectives and key performance indicators

The TEN-T Regulation[109] defines the **general objective** of the TEN-T network as:

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 which is *efficient* and *sustainable*, increases the *benefits for its users* and supports *inclusive growth*. It shall demonstrate European added value by contributing to the objectives in the following defined categories: (i) territorial and structural cohesion; (ii) efficiency between different networks; (iii) transport sustainability; (iv) and increasing the benefits for the users.

The general objectives specified above were converted to specific objectives tailored to reflect the specificities of the R-D corridor, in accordance with the analysis of the corridor's infrastructure technical parameters' compliance to regulation standards and the identification of the main critical issues along its length carried out in previous stages of the study (in terms of cross border issues, bottlenecks and missing links, intermodality and interoperability issues of related corridor nodes and operational and administrative barriers).

To this end, the following **Specific Objectives (SO)** are identified:

Specific objectives related to cohesion:

SO 1 Upgrading of infrastructure quality level to comply with standards set out in the Regulation 1315/2013 (particular focus on core parameters for rail and road modes).

Specific objectives related to efficiency:

SO 2 Removal of infrastructure bottlenecks and "filling in" missing links by complying with the core parameters of the modes
SO 3 Interoperability of national transport networks by complying with the relevant core parameters
SO 4 Optimal integration and improved interconnection of transport modes - intermodality (ensuring/improving "last mile" connections to ports, airports and RRTs)
SO 5 Efficient use of infrastructure (new and existing)

Specific objectives related to sustainability:

SO 6 Contributing to the sustainability objectives of the European Union: low-carbon and clean transport (reducing emissions and noise), the EU Biodiversity Strategy and the related intruments where applicable (conserving biodiversity and ecosystem services)
SO 7 Contribution to the safety on road transport (safety, accidents)

4.4.4 Measuring of specific objectives rail, road and IWT

Based on the defined general and operational objectives, this section presents the selected KPIs. Important input documents are: the SUPERGREEN project[110] and the TEN-T planning methodology project[111] (October 2010). Both studies provide a list and definitions of performance indicators. These are matched with the defined operational objectives, where relevant. The 2nd Progress Report presented a larger number of KPIs, which were reviewed and reduced in order to be

- specific

[109] Regulation 1315/2013 on Union guidelines for the development of the trans-European transport network (11 December 2013).
[110] SUPERGREEN Deliverable D2.2 – Definition of Benchmark Indicators and Methodology (September 2010).
[111] Trans-European Transport Network planning methodology (October 2010).

- relevant
- measureable with the tools and resources available (make use of existing data, as collected by the study already, without necessitating the collection of new data)
- realistic
- easy to apply and simple to convey to the policy makers, other stakeholders and the general public
- provide a direct measure of the issue concerned
- encompass all relevant transport modes
- comparable across time
- applicable on a regional, national and international (corridor) level
- facilitate control and correction of characteristics measured

SO 1 Upgrading of infrastructure quality level to comply with standards set out in the Regulation 1315/2013

KPI_1 Degree of compliance to regulation standards: based on the transport infrastructure requirements stipulated in the TEN-T Regulation, presented in the table below for each individual parameter and for each mode.

Table 57: KPI1 Degree of compliance to regulation standards

Technical requirements	Technical requirements KPI
Rail: electrification	percentage or kms of compliant railway
Rail: train length (target: 740 m)	percentage or kms of compliant railway
Rail: axle load (target: 22.5 t at 100 km/h)	percentage or kms of compliant railway
Rail: line speed on core freight lines 100km/h	percentage or kms of compliant railway
Road: express roads or motorway (i.e. roads without level crossings, irrespective of number of lanes)	percentage or kms of express roads/motorway
IWT: ECMT Class IV classification	percentage of class IV sections

SO 2 Removal of infrastructure bottlenecks and "filling in" missing links

KPI_2 Distance and travel time savings of new or improved sections: percentage length of new and/or upgrade sections (related to total length of identified bottleneck sections/missing links; resp. distance–related travel time savings in minutes per km (bee-line) length that mitigate bottlenecks**.**

Table 58: KPI2 Distance and travel time savings of new or improved sections

Technical requirements	Technical requirements KPI
Rail: new / improved sections	% length, travel time saving
Road: new / improved sections	% length, travel time saving
IWW: new / improved sections	% length, travel time saving)

SO 3 Interoperability of national transport networks
See KPI_1 and KPI_2
SO 4 Optimal integration and improved interconnection of transport modes (ensuring/improving "last mile" connections to ports, airports and RRTs)

KPI_3 Connection of ports and terminals to the rail and road network as well as to the IWW: Compliance with the core parameter on available connection, KPI measurement in % length

KPI_4 Use of common traffic management systems: This refers to the deployment of traffic management systems related to each mode:

- Rail: percentage of line length with ETCS+GSM-R deployment
- Road: percentage of road length of ITS deployment (e.g. dynamic speed regulation);
- Maritime: percentage (number of ports / total number of core ports) deploying VTMIS
- Inland Waterway: percentage length of RIS deployment

KPI_5 Availability of multimodal platforms (freight): Assess the change of number of freight terminals and multimodal platforms:

- Number of RRTs
- Maritime: number of ports connected to existing rail network
- Inland Waterway: number of inland waterway ports connected to existing rail network /maritime ports
- Airports: number of airports connected to existing rail network

<u>SO 5 Efficient use of infrastructure</u>

KPI_6 Freight and passenger volumes / performance: assess to what extent the infrastructure is used and is measured in number of vehicles/trains (for volumes) and gross ton-km/a or gross pax-km/a (for performance)

KPI_7 Infrastructure utilization rate: percentage of improved sections on rail or road in length, removal of links with high utilisation rate.

- Road: Number of upgraded links, removing capacity constraints
- Rail: Number of upgraded links, removing capacity constraints
- IWW: Lock Capacity

<u>SO 6 Contributing to the objectives of low-carbon and clean transport</u>

KPI_8 Availability of alternative clean fuels infrastructure: as per the requirement of the Regulation for each related mode:

- Maritime: percentage of ports offering alternative fuels
- IWW ports: percentage of ports offering alternative fuels
- Airports: percentage of airports offering alternative fuels
- Road: number of alternative clean fuels stations

<u>SO 7 Contribution to the safety in road transport (safety, accidents)</u>

KPI_9 Freight security – availability of secured parking along road network: This KPI indicates the availability of secured parking (number and capacity of secured and equipped parking and resting areas target: 1 per 100 km).

The specific objectives may vary between the different modes. In the following chapters the specific objectives and KPI for IWW and ports are briefly presented.

4.4.5 Inland Waterways

Inland Waterways of the Rhine-Danube Corridor shall meet the infrastructure requirements as laid down by the TEN-T regulation Art. 15 and Art. 39. The following objectives specify the regulation and reflect the singular characteristics of the Rhine-Danube Corridor.

Maintain and preserve good navigation status

The good navigation status of the waterways is crucial to Inland Waterway Transport. Blockades and disruptions are to be avoided. The modal shift should be supported by providing a good navigation status and therefore increasing safety, cost-effectiveness and the reduction of emissions to air.

NEWADA duo members agreed on common minimum levels of service. On a defined, reasonably short term the Danube fairway in Austria, Slovakia, Hungary, Croatia, Serbia, Bulgaria and Romania shall comply with these levels of service by implementing the steps defined in the Fairway Rehabiliation and Maintenance Master Plan (FRMMP).

Also the operational availability of at least one lock chamber throughout the year, regular lock maintenance and ice prevention respectively ice fighting measures shall be assured.

Comply with the requirements of class IV[112] respectively– where appropriate in order to meet market demands - to a higher classification[113]

On medium and long term all Inland Waterways of the Rhine-Danube Corridor shall comply with the requirements set by the TEN-T regulation. In practice this will mean fulfilling the requirements of the AGN agreement by Austria, Slovakia, Hungary, Serbia, Croatia, Romania, Bulgaria, the Ukraine and Bosnia and Herzegovina (these countries are contracting parties to the AGN). For Germany the requirements of ECMT class IV all the year shall apply – as stipulated in the TEN-T regulation. Unless exemptions are granted by the European Commission in duly justified cases, reaching the parameters of class IV by 2030 is the minimum requirement as set out in the TEN-T Regulation, Article 15. Priority shall be given to achieving higher standards according to the class of the respective section in order to meet market demands in case of modernizing waterways (Article 16).

Projects shall follow an integrated approach, including viewpoints from all relevant interest groups (navigation, environment, tourism, flood protection, etc.) and consider relevant legislation from other sectors (Natura 2000 network, Habitats-Directive, Floods Directive, EU Biodiversity Strategy, etc.) since the earliest project stages. Spin-off effects like impulses to regional development, positive locational effects shall be taken into account.

Enhance and operate River Information Services

The next steps of River Information Services in the Rhine-Danube Corridor shall not only be based upon the expected, forthcoming amendments of the Directive 2005/44/EC and the related technical specifications, but also take into account the results of the TEN-T studies "Implementation of River Information Services in Europe" and "RIS enabled Corridor Management". Considering the advanced state of the national infrastructure in the Rhine-Danube Corridor and of the cross-border nature of the outstanding challenges, it is recommended to deal with outstanding challenges in a joint initiative, possibly even across the boundaries of the Rhine-Danube Corridor.

[112] *as required by Article 15 of the TEN-T Regulation (Transport infrastructure requirements)*
[113] *as defined by Article 16 of the TEN-T Regulation (Priorities for inland waterway infrastructure development)*

Reduce administrative barriers and strengthen the competitive advantages of inland waterway transport

Inland Waterway Transport shows manifold positive effects for the societal benefits (emissions, congestion, noise…) but is a difficult market with low profit margins for the transport industry on the Danube. Investments in innovative vessels and new technologies as well as the simplification and harmonisation of administrative processes shall aim to support market players and the shift to Inland Waterway Transport. The recommendations of EUDRS PA1a Working Group shall be taken into account.

KPI in relation to inland waterway transport:

The quality of service in inland waterway transport on the Rhine-Danube Corridor largely depends on the reliability, the waiting times at border crossings, availability of locks and the readiness of information.

- Reliability: % of days per year with draught over 2.5m
- Waiting time at border crossings: average hours of idle time at border crossings
- Operational availability of lock chambers: No. of days per year with partial / complete closure of locks
- Availability of RIS: availability of key services

None of the above mentioned KPI is already measured by European or other international statistics but are part of nationally collected data resp. may be collected in a harmonized way. For example the operational availability of locks is contained in the Notice to Skippers, the waiting time at border crossings may also be obtained from RIS.

As regards the availability of RIS not only the number but also the level of quality would be crucial. As a harmonized, EU wide definition of service levels does not yet exist the performance is not measurable adequately.

4.4.6 Ports

Legal and policy basis for proposed port objectives are

TEN-T Regulation 1315/2013

Starting points for the objectives of the corridor in terms of ports, apart from Articles 4 and 10 which contain provisions on general objectives of the TEN-T network and general priorities, are Article 15 for inland ports and Article 22 of the new TEN-T regulation (1315/2013). The requirements for the core network are consistent with those for the comprehensive network but need to be accomplished in 2030. For inland ports infrastructure, in addition to the infrastructure requirements stated in Article 15, the availability of alternative clean fuels is requested on the core network (Article 39 of the TEN-T regulation). The requirements related to the core network need to be complied by 31 December 2030. These requirements are summarized in Table 59.

NAIADES II

In addition to TEN-T regulation, and specifically for IWT and inland ports, the framework for objectives is provided by the NAIADES II Communication "Towards quality inland waterway transport" (MEMO 13-771).

The main objective of NAIADES II is to create the conditions for IWT, including ports, to become a quality mode of transport: well-governed, efficient, safe, integrated into the intermodal chain, with quality jobs occupied by a skilled workforce, and adhering to high environmental standards. The NAIADES II aims thus at improving the quality performance of inland navigation and ports, while remaining cost-effective. This goes in line with the working document "Starting the core network corridors" which contains a requirement that the corridor objectives should be expressed in terms of quality of service.

NAIADES II has issued an action programme for 2014-2020 to achieve quality through different key areas of intervention which have a strong link with TEN-T corridor project. These areas, relevant for inland ports, amended by the Consortium, are as follows:

- Quality infrastructure: removal of bottlenecks in ports, modernization of operational infrastructure (conversion of sloped quays into vertical, thus increasing the loading/unloading times), provision of sufficient depth (minimum depth to match that of the waterway class where a port is located);
- Smooth functioning of the market: assess barriers for the further development of inland ports and the need for a legislative framework to address these constraints. This is related to market access to port services and financial transparency of ports.
- Environmental quality through low emissions: greening of ports.
- Integration of inland ports into the multimodal logistics chain through infrastructure facilitation and adequate equipment.

Summary of possible objectives of the Corridor in terms of ports is given in Table 59:

Table 59: Proposed corridor objectives for ports.

Legal and/or policy source	Objectives
TEN-T Regulation 1315/2013 Article 14 (Inland ports)	- Member States shall ensure that inland ports are connected with the road or rail infrastructure. - Inland ports shall offer at least one freight terminal open to all operators in a non-discriminatory way and shall apply transparent charges.
Article 22 (Maritime ports)	- Maritime ports are connected with railway lines or roads and, where possible, inland waterways of the comprehensive network, except where physical constraints prevent such connection. - Any maritime port that serves freight traffic offers at least one terminal which is open to users in a non-discriminatory way and which applies transparent charges - Member States shall ensure that ports include equipment necessary to assist the environmental performance of ships in ports, in particular reception facilities for ship generated waste and cargo residues in accordance with Directive 2000/59/EC and in compliance with other relevant Union law. - Member States shall implement VTMIS and SafeSeaNet as provided for in Directive 2002/59/EC and shall deploy e-Maritime services, including in particular maritime single-window services, as provided for in Directive 2010/65/EU
Article 39(2b)	- For inland waterway and maritime transport infrastructure: availability of alternative clean fuels
NAIADES II Communication "Towards quality inland waterway transport" (Inland ports)	- Quality infrastructure. - Smooth functioning of the market. - Greening of ports. - Integration of inland ports into the multimodal logistics chains
Directive 2000/59/EC (Maritime ports)	- Provision of port reception facilities for ship-generated waste and cargo residues

Directive 2010/65/EU (Maritime ports)	- Harmonization of reporting formalities for ships - Provision of a maritime single-window facility for documents

Source: iC consulenten

The above proposed objectives have been verified and confirmed by 18 out of 19 core ports, via the questionnaire-based survey conducted by the consultant. This proves high correlation of the proposed objectives with the realistic needs of the core ports.

Key Performance Indicators in relation to ports

In view of the consortium, the Key Performance Indicators (KPIs) are intended to measure the quality of service in ports. However, as neither the KPIs nor the quality of service in ports are defined in EC legislation or in specifications for the current study, and as there is no common agreement on such definition in the port experts' community, the KPIs had to be kept on a very low and basic level, easily measurable and obtained from the existing records of the statistical data.

Recent EU-funded projects such as PPRISM[114], INWAPO[115] or PORTOPIA[116] have developed, inter alia, different sets of KPIs for ports.
In the first run, the consultant has performed a survey among all 19 core ports along the corridor (excluding the Rhine ports), proposing an introduction of KPIs developed within the INWAPO project which is not so easy to record. Only 3 ports accepted the proposal, 9 ports accepted them partially (with their own different suggestions), 2 ports did not provide any opinion on this question, 4 ports have not replied to the questionnaire, while 1 port suggested that the work on KPIs is coordinated with ESPO's PORTOPIA initiative. Since the PORTOPIA is an ongoing project, the potential follow up of this Study could be coordinated with the findings of the PORTOPIA project

Taking into account the various standpoints of various ports in terms of the proposed KPIs, as well as the limited scope, resources and time available for this study, the consortium suggests avoiding the lengthy processes of coordination of different opinions or creation of yet another set of KPIs in spite of the existence of the aforementioned sets of KPIs. Instead, for a part of KPIs, the consortium proposes the adoption of a limited number of selected KPIs from the PPRISM project as the final set of KPIs was accepted by all stakeholders, including European ports.

Project PPRISM, as so far the largest and the most important EU project related with port performance indicators has developed five groups of indicators, namely[117]:

- indicators on market trends and structure,
- socio-economic indicators,
- environmental indicators,
- logistic chain and operational performance indicators, and
- governance indicators.

In the process of selection of the proposed KPIs out of the PPRISM project, as well as the KPIs suggested by the consortium, three boundary conditions, applicable for the Corridor study, were taken into account:

- KPIs must be easily applicable in both sea and inland ports;
- KPIs must be easily measurable;
- KPIs must be obtainable from the existing statistical records.

[114] *PPRISM – Port Performance Indicators Selection and Measurement: http://pprism.espo.be/Home.aspx*
[115] *www.inwapo-project.eu*
[116] *www.portopia.eu*
[117] *Source: http://pprism.espo.be/ProjectResults.aspx*

In this view, the proposed KPIs are the following:

- *Waterborne traffic (WT)*, measured in tons/year for six different types of cargo: total tonnage handled, total general cargo (tons), total liquid bulk (tons), total dry bulk (tons), containers (tons + TEU) and passengers (number). According to PPRISM project, this KPI indicates the market trends and structure which, therefore, can quantify the quality of service as well.

- *Intermodal connectivity (IC)*, measured dually: as a number of weekly rail container services (IC_{rail}) in a port, and as a number of weekly barge container services (IC_{barge}). This KPI, according to PPRISM, belongs to the category of logistic chain and operational performance indicators and is convenient for the assessment of quality of service.

- *Storage capacity (SC),* measured in tons or TEU for a determined number of cargo types. Mass / bundling capability at ports is seen as the quantifier of the quality of service in ports.

- *Passenger boarding time (PBT),* measured in average daily values (similar to airports). Measures the boarding formalities (checking, baggage drop off, passport control, security, etc.) for passengers at passenger ports/terminals, from checking at the terminal to boarding a vessel. The consortium believes that this KPI is of high importance for the assessment of quality of service in passenger terminals.

4.5 Implementation

This section is included as the final step of the study work plan:

- The implementation plan of projects for each transport mode in order to remove physical, technical, operational and administrative barriers between and within transport modes and for the enhancement of efficient multimodal transport and services
- The list of projects with the investment required and the envisaged sources of finance, where possible
- A deployment plan for traffic management systems (ERTMS and RIS)
- The indication of any other element as referred to Art. 47 para 1 of the Regulation.

The general procedure as explained below for the consolidation of information on rail projects is also applied for the other transport modes.

4.5.1 Implementation Rail

This chapter describes the rail related improvement measures on the Rhine-Danube Corridor that are summarised in ANNEX II – list of projects. This overview also includes ERTMS projects, which are further specified in a dedicated chapter 4.5.7.

4.5.1.1 General procedure

The information on rail projects is gathered and consolidated according to the following procedure:

1. In a first step, a "basic list" has been generated, either by exploitation of official documents like governmental Transport Master Plans (compare chapter 3) or by information directly provided by the Ministries. This basic list contains all data – as far as available – required by the Commission ("Common structure for project information", e-mails Herald RUJTERS 25.06.2014) plus further information for detailed analyses (e.g. different sources of funding, current status of the project). The data has been laid down in an Excel database. Such basic lists have been elaborated for all corridor countries with relevance to rail except for France (no response towards enquiry) .

2. In some cases the Ministries suggested to coordinate the basic list with the Infrastructure Managers. This second step has been performed with DB Netz AG and ÖBB-Infrastruktur AG. Partially this coordination process has been conducted by the Ministries themselves already (e.g. Czech Republic).

3. Afterwards, EU funding projects of the "priority list" (see chapter 3) and other relevant measures were added, as far as not already covered by the project list of step 2.

4. The resulting list has been submitted to the Ministries for final approval. In some cases (e.g. Slovakia), this approval was already gathered with the basic list, if this list had not been changed.

   All country-related project lists are merged in an overall project list for the corridor which has been used for the analysis. In order to provide a complete overview, all projects related to the alignment of the Rhine-Danube Corridor have been considered. Thus, in case of overlapping sections with other corridors, some of the projects will be also considered in the project list of the overlapping corridor. This must be kept in mind if total values for all TEN-T corridors are calculated, e.g. number of projects, costs/funding, etc.

5. For this report, the information of the overall project list has been transferred into the format provided by the Commission (ANNEX II - List of projects).
6. On request of the Commission (e-mail Herald RUJTERS 21.10.2014), three additional columns have been added to the structure of the project list:
   a. An ID, which allows to order the projects by country;
   b. A categorisation of the projects regarding their correspondence with the identified "critical issues". These critical issues have been identified within the analysis of the rail characteristics of the corridor (see chapter 4.3.1); thus, the improvement of the following critical issues are considered as the rail objectives of the corridor:
      - 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,
      - Providing sufficient line capacity to remove existing bottlenecks and to enable additional future rail volumes,
      - Removal of operational restrictions caused by strong inclines,
      - Removal of single track sections.

      The correspondence of the projects with these critical issues/objectives is analysed in chapter 4.5.1.3. All projects corresponding with at least one of these critical issues/objectives have been marked accordingly in the project list. In addition, also projects dealing with the rail connection of airports have been classified as "critical".
   c. An assignment of the projects to CEF Annex I.

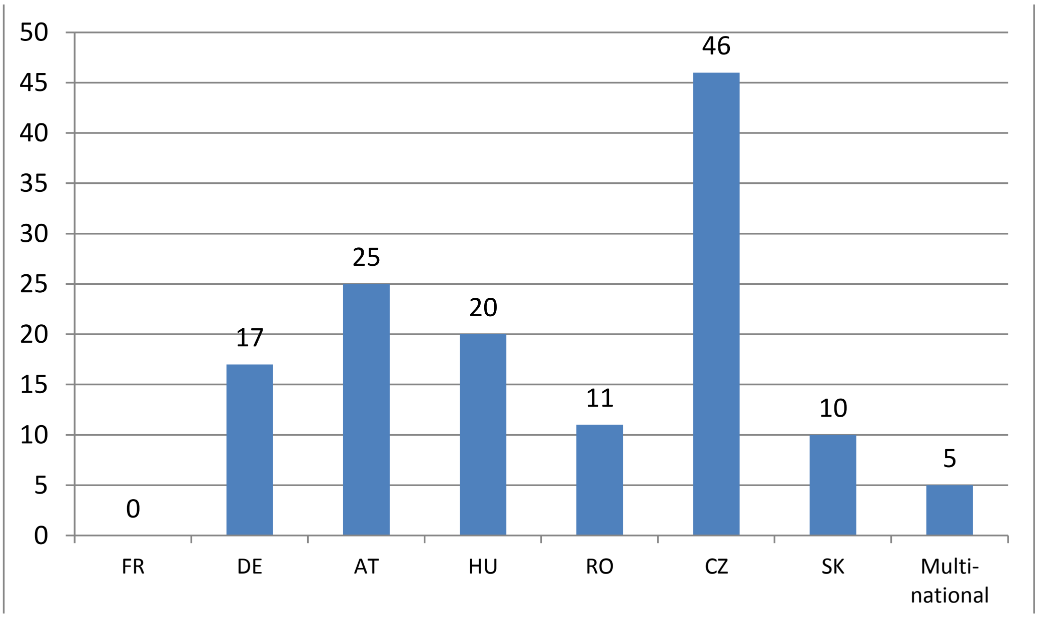
The categorisation of the projects regarding their correspondence with the identified "critical issues" has been revised by the European Commission/Corridor Coordinator.

4.5.1.2 Overview on rail projects along the Rhine-Danube corridor

By end of November 2014, the overall project list for the corridor contains 134 rail projects (incl. ERTMS). As Figure 64 points out, more than 34% (absolute number: 46) of these projects are located in Czech Republic, the other corridor countries provide between 10 (Slovakia) and 25 (Austria) projects. Five further projects are not allotted to a dedicated country, but to multi-national activities, mostly covering pan-European consulting like supporting ERTMS implementation etc. No dedicated project lists was available for France (no response towards enquiry).

Looking at these figures it has to be considered that the scope of projects varies considerably – between studies for a single issue with limited scope and large infrastructure projects covering all kinds of implementation. In some cases, several implementation stages have been indicated as separate projects (and therefore counted separately), whereas in other cases these construction stages were aggregated to one entire (large-scale) project.

Figure 64: Number of rail projects per Member State



Source: HaCon based on ANNEX II, status 11/2014

Regarding the scope of work, the projects have been assigned to eight "scope clusters". These scope clusters have been defined in correspondence to the definitions laid down in the TENtec Glossary and describe the final goal of the project and the purpose of the budget: thus, the scope "study" means that the final outcome of the project is the elaboration of a study without subsequent infrastructure or other works; "Infrastructure works – new construction" means that at the end of the associated projects a piece of new infrastructure will have been built – including all previous work steps like feasibility or construction studies, of course.

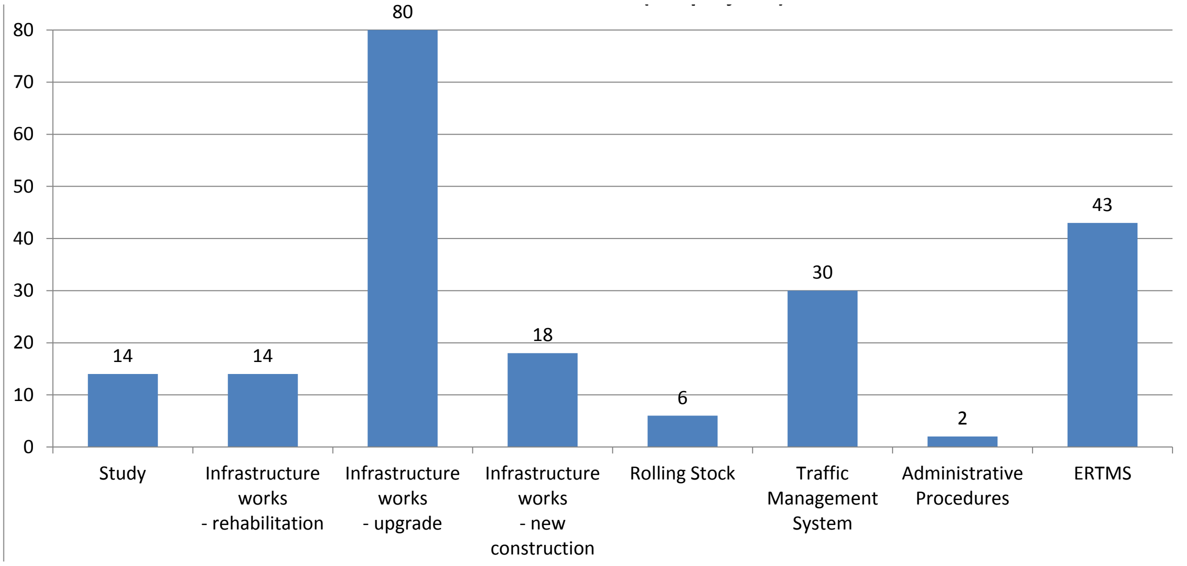
The result of this cluster analysis is shown in Figure 65. Multiple associations of the projects to dedicated scope clusters were possible and practised in many cases.

As a main result it can be stated that the vast majority of projects (91 projects = 68%) are assigned to at least one of the clusters "Infrastructure works – rehabilitation", "Infrastructure works – upgrade" or "Infrastructure works – new construction". In addition, most of the "Study" projects are related to infrastructure issues as well. Within this total "infrastructure works" cluster, most of the projects (80) are allotted to upgrade measures.

Further relevant clusters are ERTMS and "Traffic Management System"; the latter comprises projects dealing with traffic information, operation and optimisation systems. The ERTMS projects will be analysed in 4.5.7 in detail.

In contrast to these main clusters, projects for acquiring new rolling stock and administrative procedures play only a minor role within the current project list.

Figure 65: Scope clusters of rail projects, all Member States



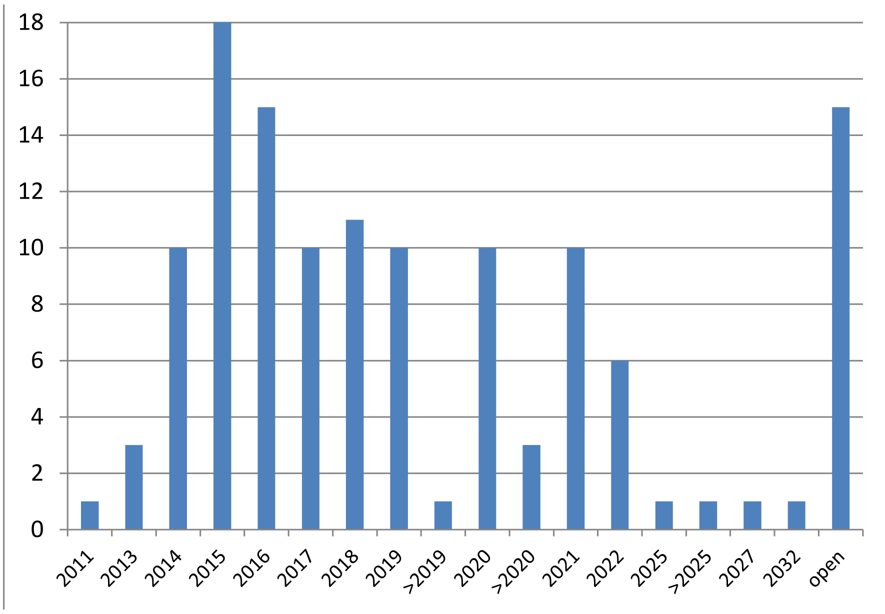
Source: HaCon based on ANNEX II, status 11/2014

Figure 66 provides an overview on the number of rail projects envisaged for finalisation per year. It is evident that the finalisation years as stated in the project list mainly cover a timeframe until 2022. In summary,

- 64 projects (48%) are expected to be realised within the next three years (until 2017); some of these projects are already finalised from the infrastructural point of view; however, they are still included in the project list because financial and/or administrative issues are not yet concluded;
- Until 2020, 95 projects (71%) shall be concluded;
- Until 2030, 113 projects (84%) will be finalised according to the current timelines.

The finalisation of further 21 projects (16%) is expected after 2030 or not yet specified.

Figure 66: Envisaged year of project finalisation – all rail projects, all Member States

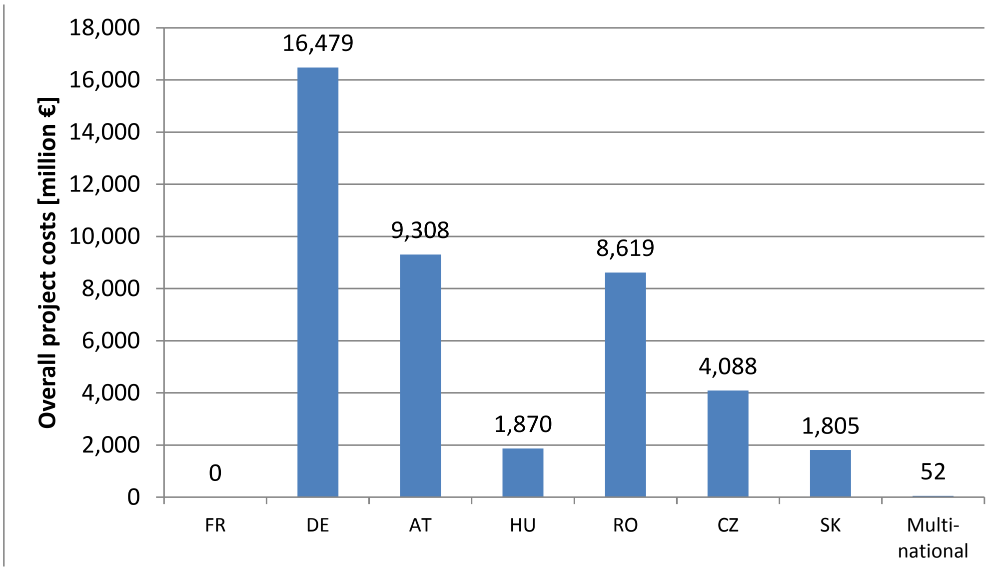


Source: HaCon based on ANNEX II, status 11/2014

Having a closer look to the financial figures, the total costs of all rail projects amounts to 42.2 billion €, covering a huge range from 1.5 million € to almost 6 billion € per project; on average, the budget per project amounts to 350 million €.[118]

Also the presentation of the overall project costs per country give a heterogeneous picture. According to Figure 67, the lion's share is assigned to German rail projects, followed by Austria and Romania. In contrast, the large number of Czech projects only amounts to some 4 billion €.

Figure 67: Total costs of all rail projects per Member State

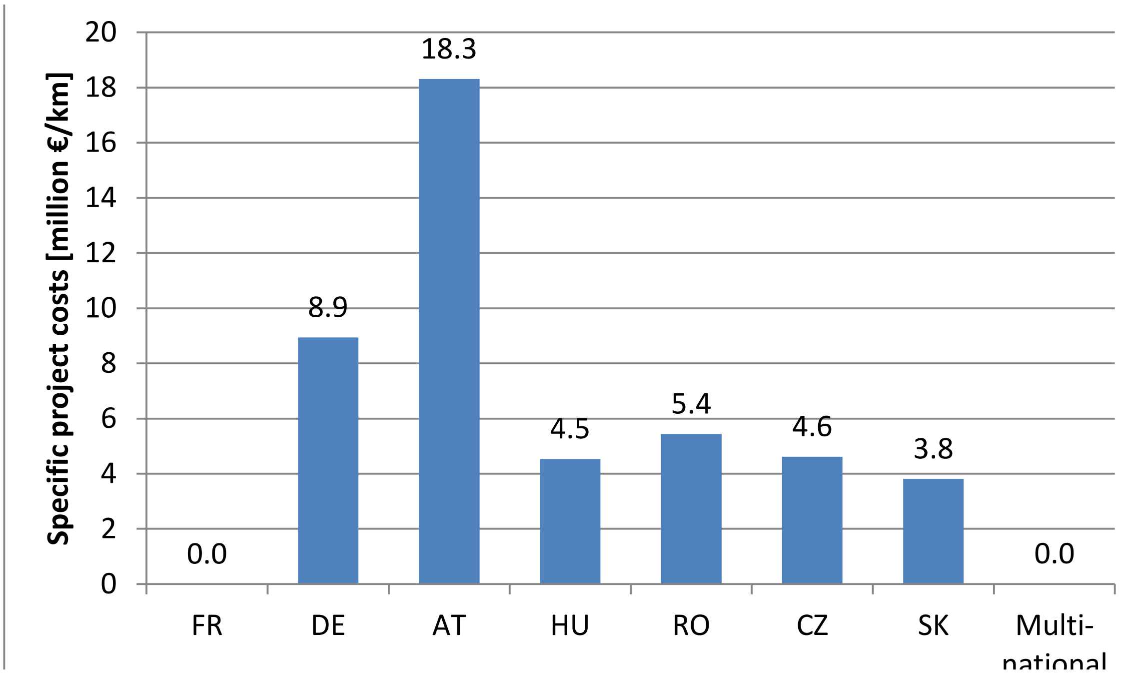


Source: HaCon based on ANNEX II – List of Projects, status 11/2014

As the Rhine-Danube corridor includes large corridor networks (Germany, Romania) as well as smaller ones (Austria, Hungary, Czech Republic, Slovakia and particularly France), specific cost figures per corridor kilometre have been calculated. The results of this calculation are displayed in Figure 68 This shows that Austria is far ahead with more than 18 million €/km. This is due to the rather small corridor length which is almost completely covered by infrastructure upgrade and new construction projects ("Neue Westbahn"). Germany is second in this view, providing a rather small amount of high budgeted projects and a large corridor network. All other countries (Romania, Czech Republic, Hungary, Slovakia) are more or less on the same level.

[118] For 14 projects, cost information are not yet available. These projects have not been considered for the calculation of the average cost value.

Figure 68: Specific costs of all rail projects per Member State



Source: HaCon based on ANNEX II – List of Projects, status 11/2014

The allocation of these costs to different financing sources is illustrated in Figure 68: Specific costs of all rail projects per Member StateAccording to current information, 46% of the overall project costs are covered by state budgets, 12% are financed by EU funding and 9% by "other sources" (e.g. regional/local associations, private companies, railways; also in cases of unknown budget splitting among the financing sources). 33% could not been allocated to financing sources so far.

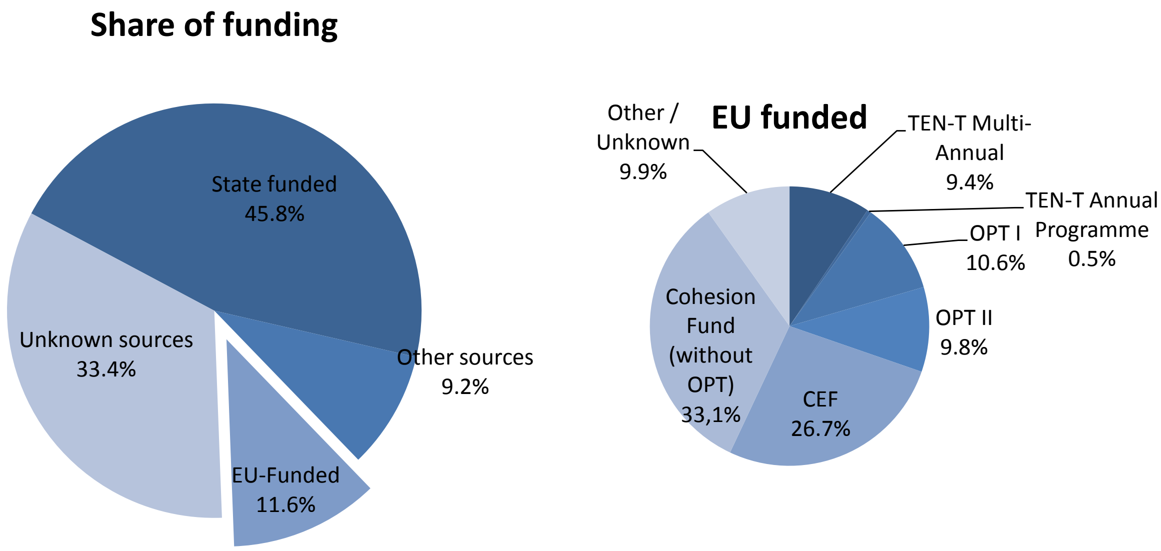
This means that for 81 (out of 134) rail projects, the envisaged financing of the costs is completely known. These 81 projects consolidate 28.3 billion € (i.e. 67%) of the overall rail project costs. The remaining 53 projects split up to 13 projects with even unknown costs and 40 projects with known costs but either (partially) incomplete financing and/or missing information.

For German projects it has to be considered that financing is secured only for the respective budget period as far as state budget is concerned.

In a second step, the EU funding for rail projects has been further allocated to the different funding programmes. As the diagram in Figure 69 shows, the EU funding is distributed between the following programmes:

- Cohesion Funds (~33%);
- Connecting Europe Facility (CEF; ~27%);
- Operational Programmes for Transport (OPT I - 2007-2013 and OPT II – 2014-2020; together ~20%)
- TEN-T (annual and multi-annual) funding programmes (~10%).
- The remaining share of some 10% has been allocated to EU funding in general, but not to a dedicated programme.

Figure 69: Main sources of costs financing and EU funding sources – all rail projects, all Member States



Source: HaCon based on ANNEX II – List of Projects, status 11/2014

Due to their outstanding relevance, the location and timing of the 91 projects assigned to infrastructure works (i.e. without ERTMS projects) are displayed in the following figures, subdivided into projects related to upgrade/rehabilitation measures (Figure 70) and to new constructions (Figure 71). Some projects appear in both figures, as they often consist of several sub-projects with different scopes of work, maturities and realisation timelines. In some cases, several construction stages of the same project have been summarised to one entry in order to facilitate overview. For the same reason, projects covering the entire corridor network of a country are not displayed in these figures.

In both figures, the different status of project maturity have been aggregated to

- "Works planned": includes all concrete project activities ahead of infrastructure work (study/planning phase). This is the case for 49 projects (54%);
- "Works under construction" (infrastructure works have already started and are still ongoing), valid for 33 projects (36%);
- "Works (partially) completed": This status corresponds to the respective category in the German Bundesverkehrswegeplan. It is assigned to projects with major components already in operation or to projects with concluded infrastructure works, but with open financial and/or administrative issues. This status applies to 6 projects (7%).

For the remaining three projects (3%), the status of maturity is unknown.

In summary it can be stated that infrastructure upgrade and new construction projects cover almost the entire corridor alignment. This is shown in both figures by respective colour marks on the lines and in the nodes.

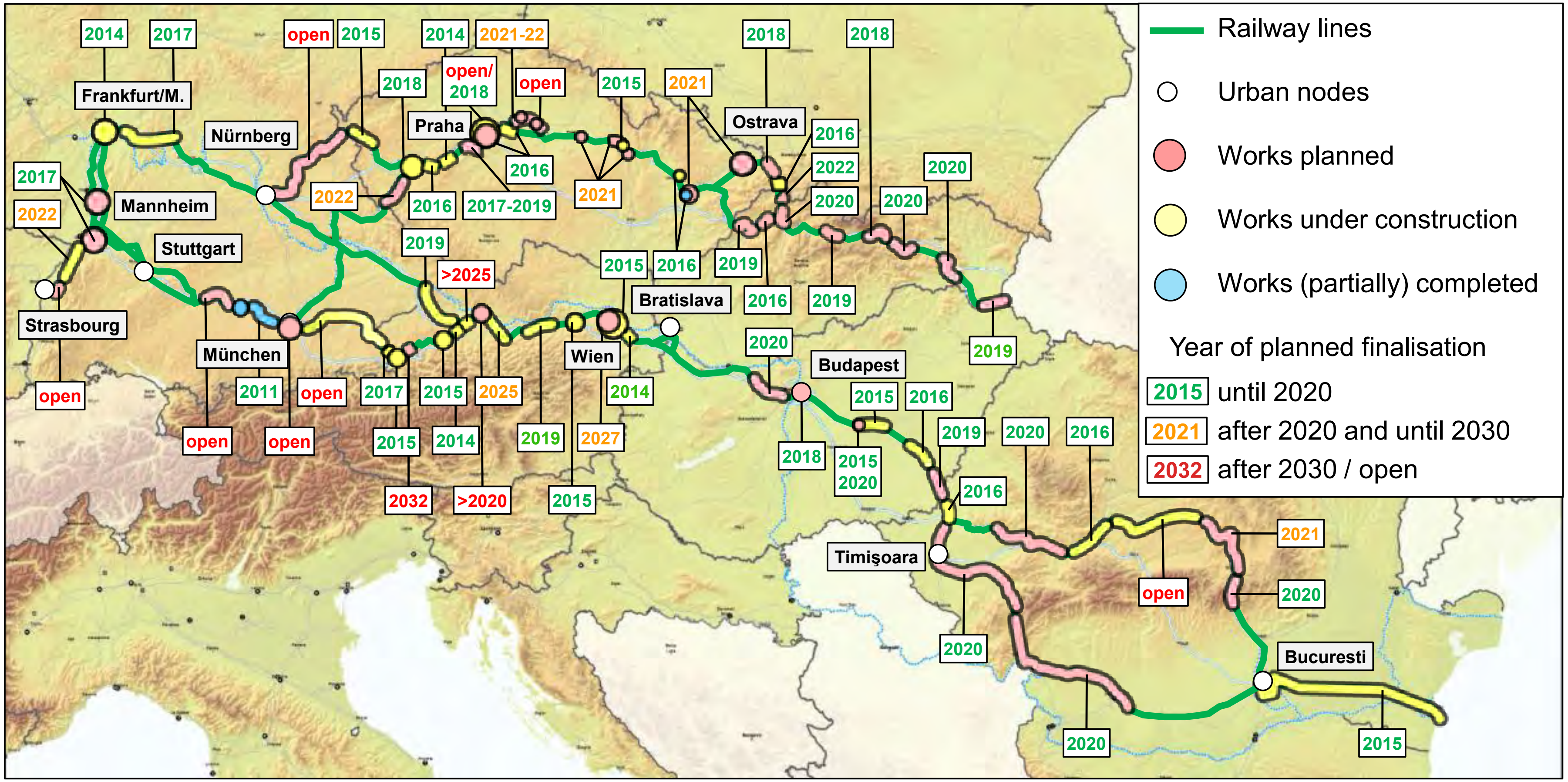
Further corridor parts, which are not matter of current infrastructure projects, are in Germany (Black Sea Branch between Würzburg and Passau, on the CS branch between München and the DE/CZ border), between Wien and Tata (east of Györ) and in Romania between Craiova and Bucuresti.

The construction of complete new railway lines is restricted to

- France/Germany border: New Rhine bridge (already completed);

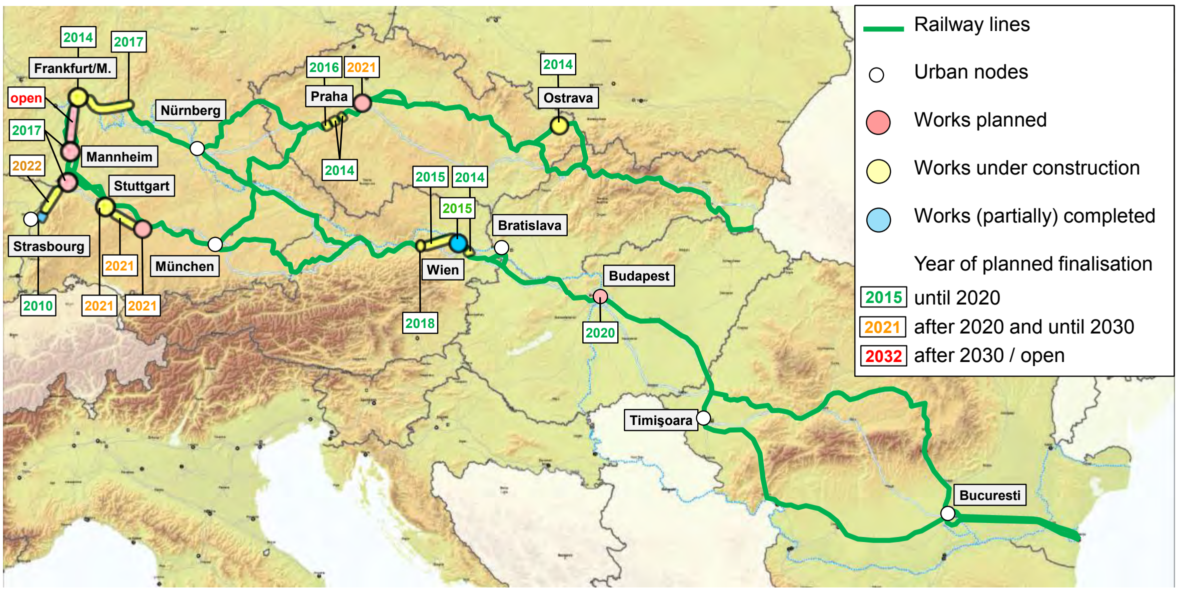
- Germany (new high-speed lines Rhine/Main, Karlsruhe-Basel, Stuttgart-Ulm, incl. new Stuttgart main station and Laufach-Heigenbrücken (Spessart east of Frankfurt) new tracks/stations in the nodes of Mannheim, Ulm, Frankfurt;
- Austria (neue Westbahn, airport connection and new main station in Wien);
- Czech Republic (new construction of station and tunnels), rail connection of Ostrava airport. For Praha-Beroun section there is also a plan to build up a brand new alignment in long term perspective. The final routing has not been chosen yet.

Figure 70: Overview on projects related to infrastructure works (upgrade/rehabilitation)



Source: HaCon based on ANNEX II status 11/2014

Figure 71: Overview on projects related to infrastructure works (new construction)



Source: HaCon based on ANNEX II, status 11/2014

4.5.1.3 Analysis of rail projects with reference to the main objectives of the corridor

Detailed analyses of the rail projects have been performed with reference to the identified "critical issues" (see chapter 4.3.1). These refer in a first instance to the "core parameters" of Regulation 1315/2013, with slight modifications:

- The core parameter "track gauge" has not been analysed explicitly, as this criterion is fulfilled on the entire corridor. This will also be the case with respect to the realisation timeframe on the TEN-T corridors.
- The core parameter "ERTMS implementation" is treated in a dedicated chapter 4.5.7.
- Additionally, the criteria "line capacity", "inclinations" and "single track sections" have been included.

Thus, the rail projects will be checked if they secure the required standards for the remaining core parameters (electrification,axle load, line speed and train length) and improve the situation with respect to line capacity, inclinations and double tracked equipment.

This checking procedure is based on the descriptions of the respective projects, which have been made available and approved by the Member States. As far as possible, projects were assigned to a dedicated critical issue and inserted in "project maps". In some cases, the descriptions were too general to reflect them clearly to a dedicated critical issue and a dedicated location. This has been pointed out by respective symbols in the maps and must be clarified within subsequent discussions with the Member States.

<u>Corridor objective: Providing sufficient line capacity to remove existing bottlenecks and to enable additional future rail volumes</u>

Current rail capacity bottlenecks on the Rhine-Danube corridor have been displayed in Figure 12 (page 72). It can be assumed that most of the infrastructure upgrade and new construction measures according Figure 70 and Figure 71 will contribute to capacity increase in the Rhine-Danube corridor, e.g. by modernisation of the signal systems, by implementation of ETCS (level 2) instead of PZB, by traffic management systems as well as by new railway lines and/or additional tracks to existing lines.

However, the exact impact of all these measures on the available capacity and thus of the elimination of bottlenecks cannot be specified within this study. This issue should be tackled as part of a follow-up of this corridor study. In this context it would be necessary to receive capacity impacts from the Member States and to introduce a harmonised corridor-wide evaluation procedure.

As an example the possible effects are shown for the German network. DB Netz AG has provided utilisation clusters for the corridor line sections, which are based on the forecasted volumes for 2025 and the respective infrastructure status 2025, assuming that dedicated measures of the project list according to the "Überprüfung des Bedarfsplans für die Bundesschienenwege of 2010" will have been implemented until then.

The results are shown in Figure 72. Compared to the status quo figure it is evident that several parts of the corridor remain "fully utilised" or even "overloaded". This also applies for those sections, where substantial upgrade and new construction measures are foreseen (e.g. along the River Rhine or on Stuttgart-Ulm, Frankfurt-Würzburg or München-Mühldorf-Freilassing lines). Moreover, some additional sections with high or even critical utilisation can be found, which apparently follow the potential rail flows of the Rhine-Danube corridor (München-Regensburg, Regensburg/Nürnberg-DE/CZ border, Nürnberg-Passau).

Concluding these findings in relation to the entire corridor this means that the gain in line capacity will be at least partially consumed by additional volumes. Therefore, pure infrastructure measures will not be sufficient to cope with the (explicitly demanded) traffic increase. Instead, such infrastructure measures have to be combined with other measures like traffic management systems or operational/infrastructural separation of freight and passenger traffic. This is a mandatory requirement to manage envisaged volumes with a high level of service quality.

Figure 72: Expected capacity utilisation of railway lines in Germany 2025

Source: HaCon based on data provided by DB Netz AG

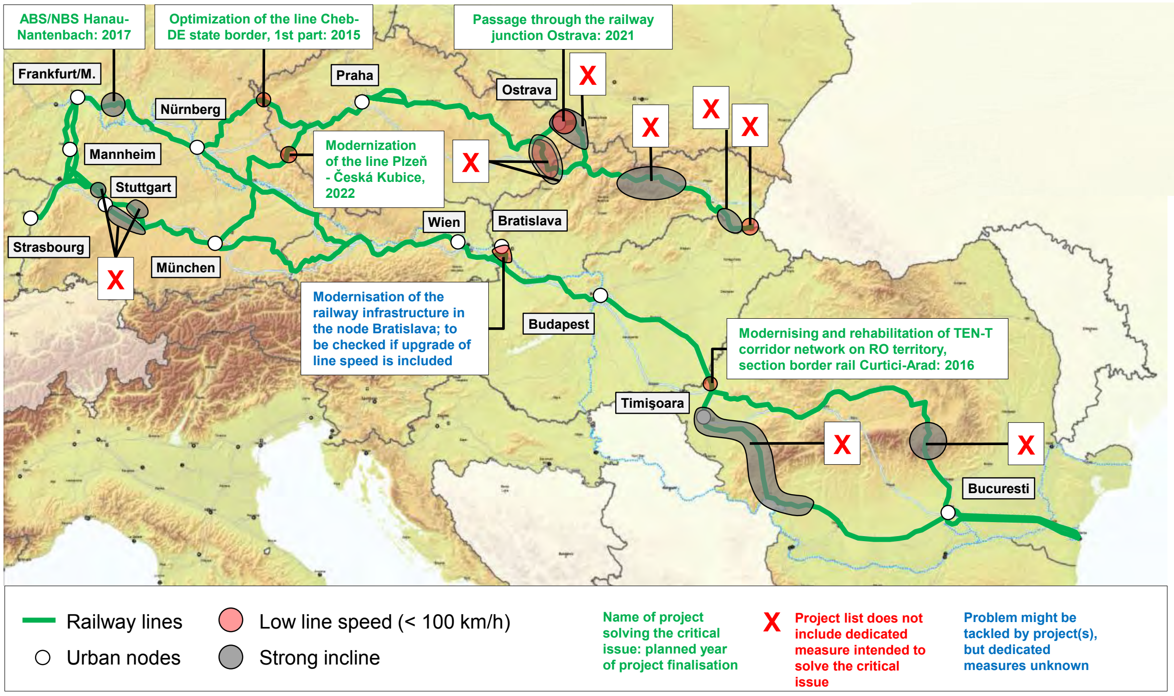
<u>Corridor objective: Enabling 100 km/h on core freight lines by 2030</u>

The assignment of projects to corridor sections with permitted line speed of less than 100 km/h is displayed in Figure 73. In four cases (out of seven), dedicated measures are underway:

- Between DE/CZ border-crossing and Cheb, to be finalised until 2015;

- Between DE/CZ border-crossing (Furth im Wald/ Česká Kubice) and Domažlice, to be finalised until 2022;
- In Ostrava node, to be finalised until 2021;
- Between HU/RO border and Arad, to be finalised until 2016.

Figure 73: Assignment of projects to critical issues "Line speed" and "Strong incline"



Source: HaCon based on ANNEX II

In contrast, no dedicated projects are currently known to eliminate the existing speed restrictions on the CS Branch between Hranice na Morave and Púchov (CZ/SK border) and on the Slovakian/Ukraine border. Furthermore it has not been explicitly stated that the feasibility study on the modernisation of the railway infrastructure of the Bratislava node also considers an upgrade of the line speed.

In summary, it can be stated that at least one through-going 100 km/h route for freight trains on the entire corridor will be available by 2021. The only exception is the Ukraine border section; however, this is no severe impediment, since all transit trains must stop at this border due to change of the track gauge.

Corridor objective: Removal of operational restrictions caused by strong inclines (no core parameter)

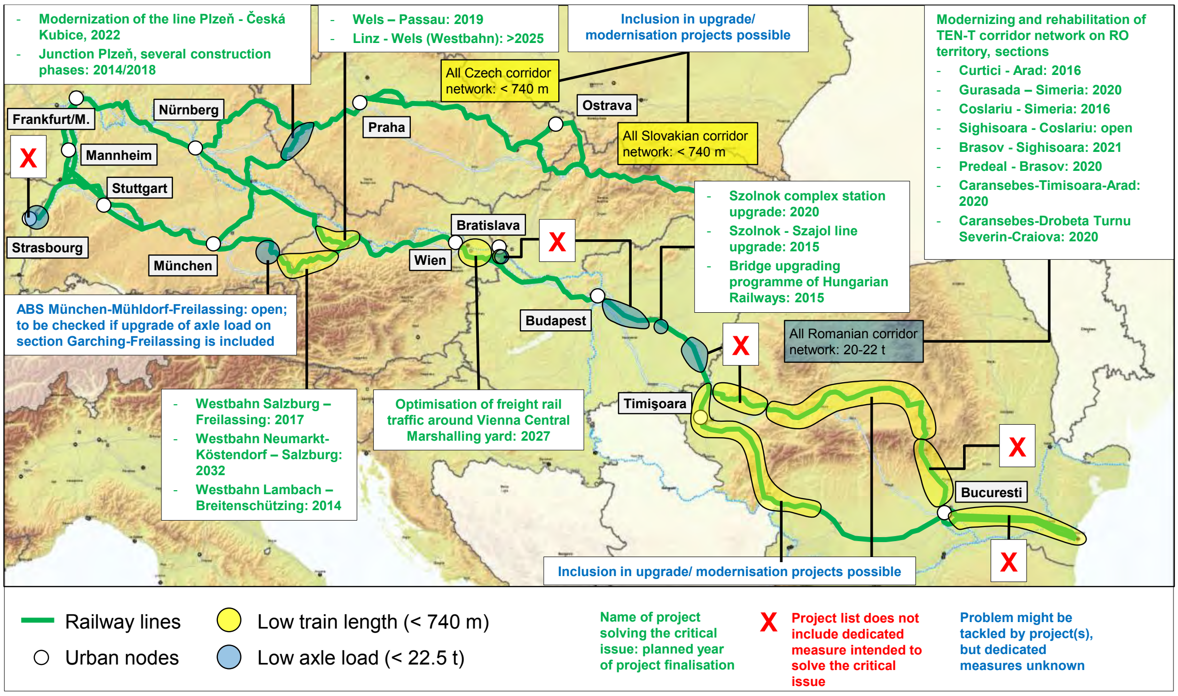
As Figure 73 points out, the corridor sections affected with long and strong inclines are mostly not covered by dedicated measures. This is according to expectations as the elimination of those critical issues always goes along with large-scale infrastructure measures, in most cases a complete new construction of the affected line section. Such large-scale measure is currently going on in Germany east of Frankfurt/M. Within the section Laufach-Heigenbrücken, the old line is replaced by a new construction; finalisation of this project is expected until 2017.

The other corridor parts with strong inclines will remain in the future and will thus cause operational restrictions especially for freight trains. This also applies for the new high-speed line Stuttgart-Ulm, which has been traced out for passenger traffic exclusively, but is now classified as mixed line.

Corridor objective: Core freight lines to allow for 740 m trains by 2030

Measures to increase the permitted train length on the lines are not explicitly mentioned in the project descriptions, except for an upgrading programme of DB Netz aiming at the elongation of sidings for 740 m trains. In addition, it can be assumed that general upgrades of the line with reference on compliance with the TEN-T corridors also include expanding of the usable length of sidings and/or implementing additional sidings capable for 740 m trains. Such measures cover great parts - although not the total - of the Czech, the Slovakian and the Romanian network.

Figure 74: Assignment of projects to critical issues "Train length" and "Axle load"



Source: HaCon based on ANNEX II

Furthermore, upgrade measures are ongoing in Austria on Passau – Linz sections (realisation between 2019 and beyond 2025), on several parts between Salzburg and Wels (realisation foreseen between 2014 and beyond 2032) as well as inside Wien node (completion until 2027). As these projects show similar standards as the "Neue Westbahn" between Linz and Wien it can assumed that this also includes the 740 m standard.

Corridor objective: Core freight lines to allow for 22.5 t axle load by 2030

Problems with insufficient axle loads are covered by projects as follows (compare Figure 74):

- Between Strasbourg and the FR/DE border no project is known to improve this parameter on this section;
- On some line sections between München and Freilassing a project for upgrading this entire line has been set up. However, specific measures for axle load upgrading as well as a concrete deadline for completion are missing;
- The line between Česká Kubice (border DE/CZ) and Plzeň (incl. Plzeň node) is covered by modernisation projects that will be realised stepwise until 2022;

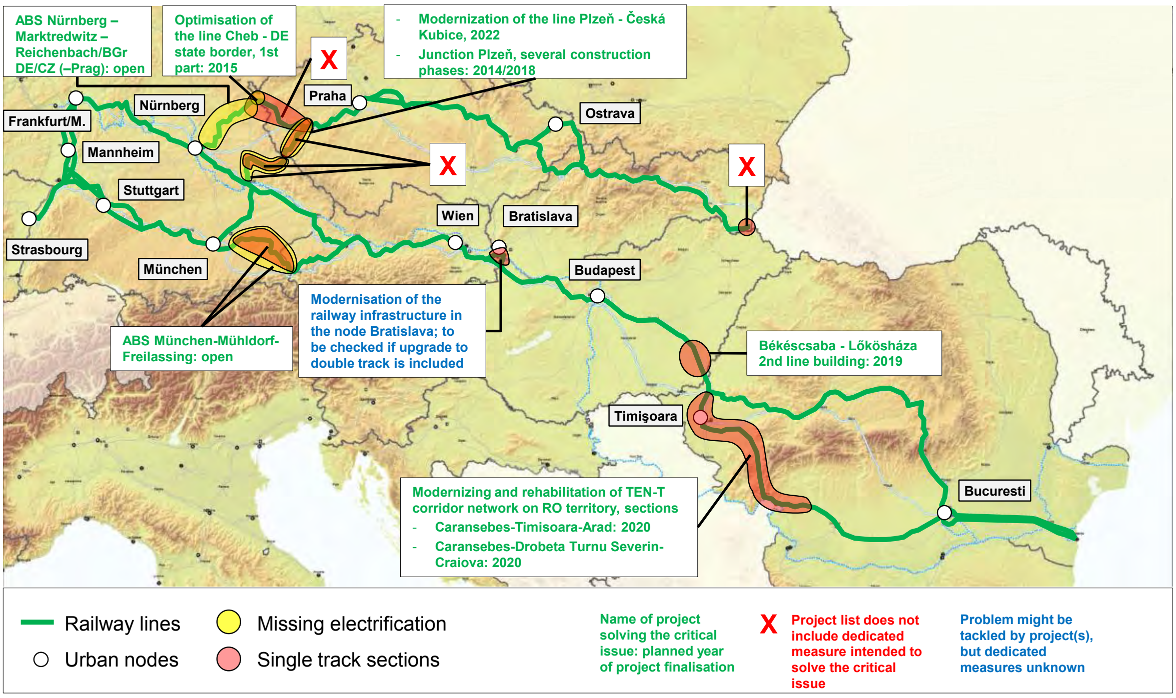
- In Hungary, dedicated projects for line upgrades have been reported preliminarily for the Szolnok-Szajol section (incl. bridges and Szolnok station), to be finalised until 2020;
- The southern branch of the Romanian rail network (between Arad and Craiova) will be upgraded until 2020. It is assumed that these measures will also lead to compliance with the demanded axle load. On the northern branch of Romania, several projects are ongoing as well, which shall be concluded until 2021. However, some line sections (Arad – Gurasada, Predeal - Bucuresti and București – Constanta) are not included in the current version of the project list.

Corridor objective: Removal of single track sections (no core parameter)

As shown in Figure 75, projects with dedicated measures to upgrade single track to double track sections are mainly allotted to the following lines: München – Freilassing in Germany (realisation time open), Békéscsaba – Lőkösháza (finalisation until 2019) and Arad – Craiova in Romania (finalisation until 2020). Furthermore, studies are ongoing for the Wien-Bratislava line.

In contrast, the single track border sections Germany/Czech Republic and Slovakia/Ukraine are not subject of dedicated projects. It cannot be estimated generally, if this leads to capacity problems on the respective lines in the future (with increasing volumes). The capacity forecast of DB Netz AG for 2025 indicates possible capacity problems for the Schirnding/Cheb cross-border section (compare Figure 72). It must be analysed for every single case if this also applies for the other single track sections on the corridor.

Figure 75: Assignment of projects to critical issues "Single track sections" and "Missing electrification"



Source: HaCon based on ANNEX II

Corridor objective: Core network to be electrified by 2030

The request for electrification is one of the "core requirements" of Regulation 1315/2013. According to the current version of the project list it is intended to electrify all remaining diesel lines of the corridor. The only exception is the section on the CS Branch between Regensburg and the DE/CZ border.

The other currently not electrified lines in Germany are all matter of corresponding projects: However, the year of finalisation has not been specified yet, neither on the Nürnberg-Schirnding nor on the München-Freilassing line. On the Czech sides of the DE/CZ border crossing, the electrification shall be finalised within the next years.

4.5.1.4 Summary of critical sections not sufficiently covered by projects

According Regulation 1315/2013, (21) *„Cross-border projects typically have a high European added value, but may have lower direct economic effects compared to purely national projects. Such cross-border projects should be the subject of priority intervention by the Union in order to ensure that they are implemented.*"

Looking at the corridor alignment it has to be stated that almost all parts of the corridor are congruent with cross-border sections according the definition of Regulation 1315/2013 (cp. Table 11, page 85). Thus, nearly all projects are located on one of the assigned cross-border section. All other rail projects correspond with important sections linking these border sections. For these reasons, the cross-border issue is no suitable criterion for the prioritisation of projects.

Prioritised need for action can be deduced from the critical issues analysis in two ways:

(1) Projects which solve problems related to the core parameters of the regulation which have not a specified deadline until 2030 (cp Table 60). These projects need to be accelerated or provided with a reliable finalisation date until 2030.

Table 60: Rail projects without a finalisation year until 2030

Location (Country)	**Core parameters according regulation 1315/2013 not covered by Annex II – List of Projects**					**Other parameters not covered by Annex II – List of Projects**	
	Low line speed (<100 km/h)	Train length (<740 m)	Axle load (<22.5 t)	Non-electrified	No ERTMS	Strong inclines	Single track
Linz - Wels (Westbahn) (AT)		> 2025					
Neumarkt-Köstendorf – Salzburg (Westbahn) (AT)		2032					
Sighișoara–Coșlariu (RO)			open		open		
București – Constanta (RO)					open		
ABS Nürnberg – Marktredwitz – Reichenbach/BGr DE/CZ (DE)				open			
ABS München-Mühldorf-Freilassing (DE)				open			open

Source: HaCon based on ANNEX II

(2) Problems related to the core parameters of the regulation, which are not covered by any project as documented in ANNEX II –List of Projects. These corridor parts (cp. Table 61) need to be further tackled in a coordination process between the European Coordinator, the Member States involved and the related rail infrastructure manager(s) to ensure a complete implementation of the core network corridor until the aimed at finalisation year 2030. The following listing provides an overview on all

corridor parts where measures on critical issues are missing or where such measures are not clearly indicated in respective project descriptions.

Table 61: Sections with critical issues not sufficiently covered by projects

Location (Country)	**Core parameters according regulation 1315/2013 not covered by Annex II – List of Projects**					**Other parameters not covered by Annex II – List of Projects**	
X – Critical issue not covered (X) To be checked if project covers specific issue	Low line speed (<100 km/h)	Train length (<740 m)	Axle load (<22.5 t)	Non-electrified	No ERTMS	Strong inclines	Single track
Strasbourg – FR/DE border (FR); Section length only 8 km			X		(X)		
FR/DE border – Stuttgart / Mannheim (DE)					(X)		
Stuttgart-Ulm (DE)					(X)	X (New high speed line + Geisling-er Steige)	
Ulm – München – Salzburg (DE)			X (Garching a.d. Alz – Freilassing)		(X)		
Mannheim – Frankfurt/M (DE)					(X)		
Frankfurt/M – Hanau (DE)					X		
Hanau – Nantenbach (DE)					(X)		
Nantenbach – Nürnberg – Passau (DE)					X		
Nürnberg – Marktredwitz – DE/CZ border (DE)					(X)		X (Marktred-witz DE/CZ border)
DE/CZ border – Cheb - Plzeň (CZ)							X
Regensburg – Schwandorf – DE/CZ border (DE)				X (Regens-burg – DE/ CZ border)			X (Schwan-dorf – DE/ CZ border)
DE/CZ border Ceska Kubice – Plzeň (CZ)							X
CZ corridor network		(X)					
Hranice na Moravě – Púchov (CZ)	X					X	
Ostrava – Čadca (CZ/SK)					X (Ostrava – Dětma-rovice)	X	
SK corridor network		(X)					
Vrútky – Štrba (SK)						X	
Krásno nad Kysucou – Žilina (SK)					X		
Barca – Čierna nad Tisou (SK)						X	
Čierna nad Tisou – Chop (SK/UA); 4km section to Chop border station	X						X
Bratislava – Rajka (SK/HU)					(X)		
Budapest –			(X)				

Location (Country)	**Core parameters according regulation 1315/2013 not covered by Annex II – List of Projects**					**Other parameters not covered by Annex II – List of Projects**	
X – Critical issue not covered (X) To be checked if project covers specific issue	Low line speed (<100 km/h)	Train length (<740 m)	Axle load (<22.5 t)	Non-electrified	No ERTMS	Strong inclines	Single track
Lököshaza – Curtici (HU)			(Budapest – Cegled; Gyoma – Lököshaza – Curtici) Note: 22.5 tonnes is possible with reduced line speed				
Curtici - Arad – Timișoara – Filiași (RO)		(X)				X (Timisoara – Filiasi)	
Craiova – București (RO)					X		
Arad – Sighișoara– București – Constanta (RO)		(X)					
Predeal – Brazii (RO)						X	

Source: HaCon

4.5.2 Implementation Inland Waterways

4.5.2.1 General procedure

The programme of measures includes projects provided by Member States, infrastructure managers and other actors. The following sources have been used in relation to inland waterways:

- EU Strategy for the Danube Region, PA1a project data sheets
- Draft national programmes of transport and transport master plans as provided by the Member States
- Fairway Rehabilitation and Maintenance Master Plan for the Danube and its navigable tributaries
- Overview on ongoing projects and proposed measures for the Bundesverkehrswegeplan 2015 (Germany)
- Feedback by the representatives of Member States, Third Coruntries and Infrastructure Managers of Inland Waterways invited to the Corridor Fora
- Information Packages as provided by PLATINA II

The list of inland waterway projects contains 49 projects summing up to a project volume of 3.78 billion Euros. The most extensive project is the systematisation of the Argeş and the Dâmboviţa River to build the Danube-Bucuresti Canal amounting to 1.38 billion Euros followed by the new bridge between Komárom (HU) - Komárno (SK) amounting up to a range between 111 and 375 million Euros. The collected projects cover studies (4 projects) and works related to infrastructure rehabilitation (14 projects), infrastructure upgrade (15 projects), new constructions (6 projects) and river information services (8 projects).

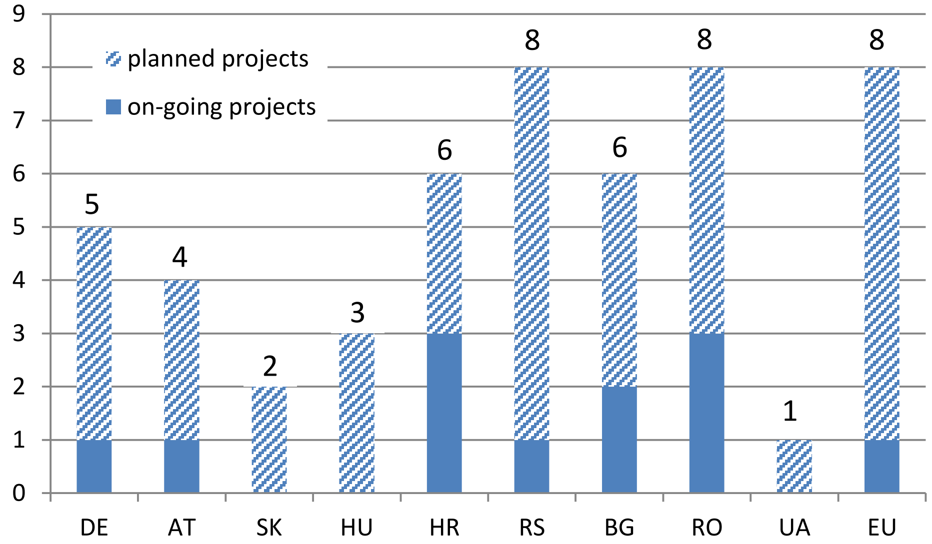
12 of the listed projects are already under implementation but have been added to the list as activities are still on-going.

4.5.2.2 Overview on IWW projects along the Rhine-Danube corridor

At the Rhine-Danube Corridor 51 projects relate to the development of inland waterways. Figure 76 shows the number of projects per State respectively the number of cross-border projects. As 42% of the navigable Danube constitutes a border between two countries a large number of projects are cross-border projects (1 on-going and 7 planned). Serbia promotes the highest number of projects (7 planned, 1 on-going). Romania plans to implement 5 projects, Bulgaria and Germany four projects each, Hungary three and Slovakia two projects. For the Ukraine one project has been identified. Generally the newest Member States of the EU and Serbia implement and plan a high number of projects to develop the inland waterways of the Corridor.

The projects cover different thematic fields and scopes. Therfore the number of projects gives only a vague indication on the commitment of a country. While in some cases a larger project includes a study phase and the realisation of works, in others a project has been designed for each of the phases.

Figure 76: Number of IWW projects per Member State



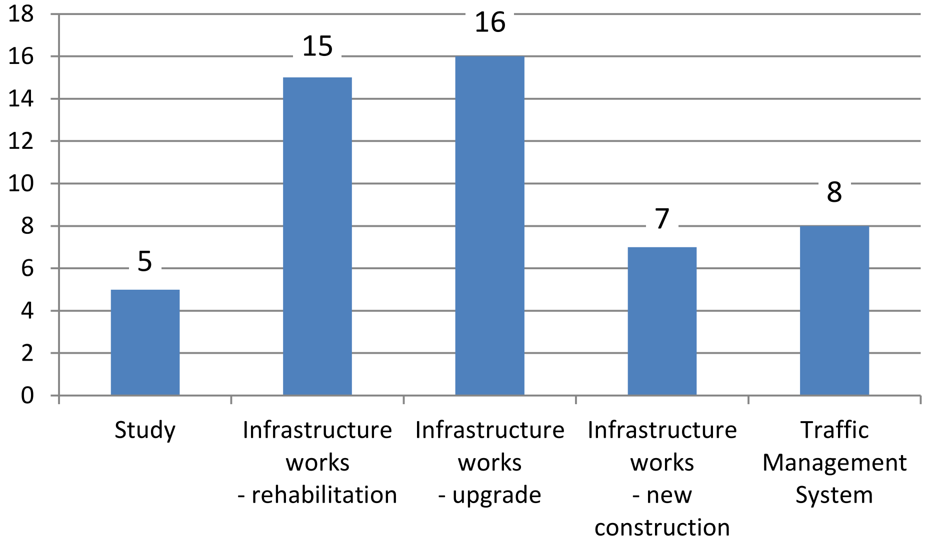
Inland waterway projects relate to five "scope clusters". The five studies aim at preparing works including the co-ordination with neighbouring countries, public consultation, enviromental impact assesments, detailed designs etc. Projects which combine studies and works have been assigned to one of the scope categories describing infrastructure works as this is the ultimate goal of the project.

15 projects have been identified in relation to infrastructure rehabilitation. Infrastructure rehabilitation serves the preservation of a good navigation status through maintenance works, the renewal of locks and the removal of obstacles like sunken vessels. The highest number of projects (16) deal with the upgrade of infrastructure in order to comply with waterway class IV or higher. Seven projects aim to construct new infrastructure, this comprises the building of new bridges (e.g. between Komárno and Komárom) as well as the costruction of the Danube-Bucharest Canal.

Eight projects fall under the category of Traffic Management Systems, in this case River Information Systems.

Figure 77 show the scope or thematic categorisation of inland waterway projects. The projects have been allocated to only one category, in line with the predominant goals of the project. In relation to administrative barriers or improved vessels no projects were added to the project list as they lie beyond the scope of this study and are covered by other programms (e.g. Horizon 2020).

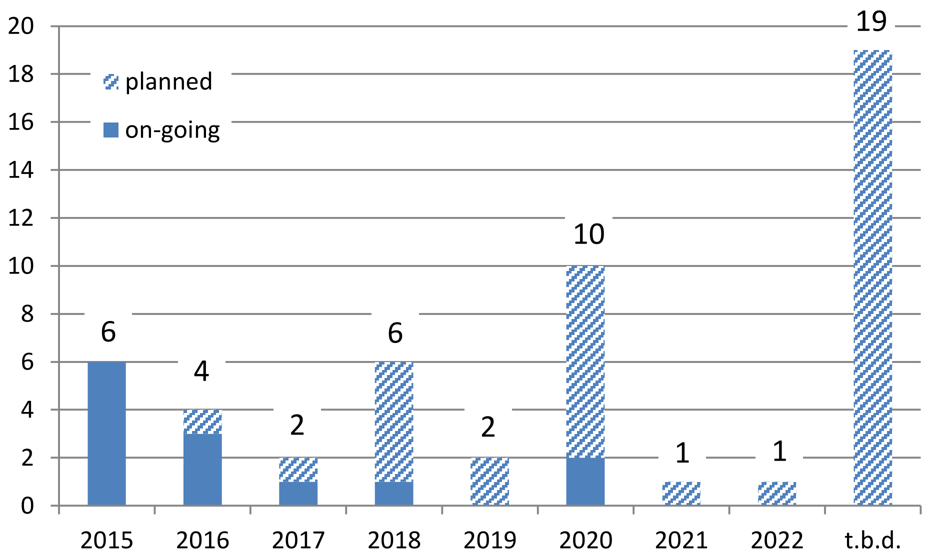
Figure 77: Scope of IWW projects



For 38% of the inland waterway projects no finalisation date is known yet. This means that the project has not been defined to detail, the realisation may still depend on preliminary steps or national descisions on the implementation.

Most of the projects with a finalisation date are envisaged to be finalised by 2020, which coincides with the end of the EU financial period. Most of the on-going projcts are planned to be concluded by 2015. Figure 78 shows the envisaged finalisation years of inland waterway projects.

Figure 78: Envisaged finalisation of IWW projects

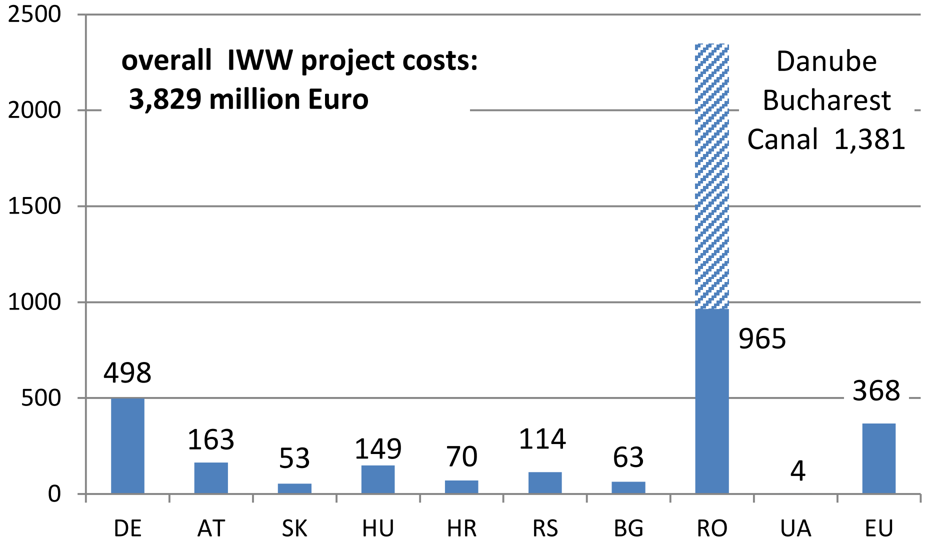


The total costs of projects related to the development of inland waterways of the Rhine-Danube Corridor sum up to 3.8 billion Euros, while the most extensive project is the new construction of the Danube-Bucharest Canal amounting to 1.39 billion Euros.

Excluding the Danube-Bucharest Canal the average project costs are 48 million Euro and lie way below the average project costs of rail projects.

In comparison with the high number of cross-border projects the aggregated costs of such projects are relatively low.

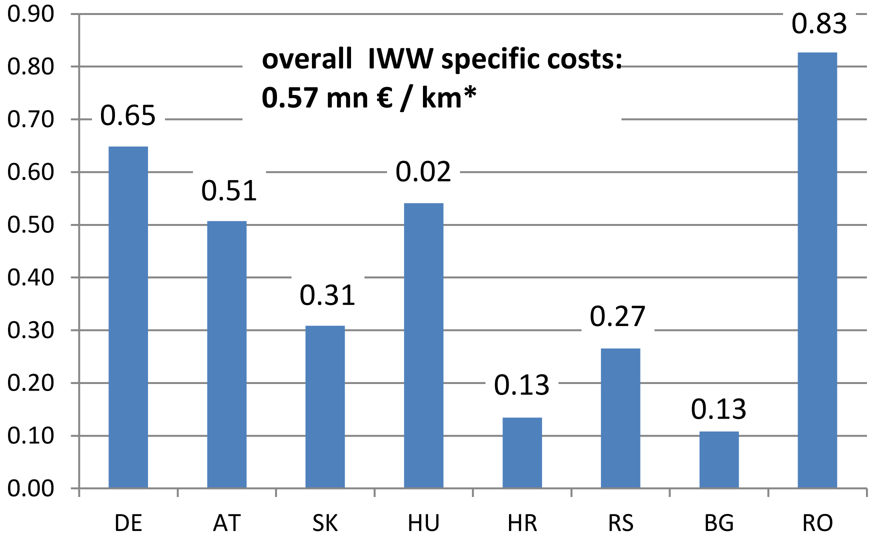
Figure 79: Total costs of IWW projects per Member State



The specific costs show the costs in relation to the share of the Corridors inland waterway network (see Figure 80). The Danube-Buchares Canal as well as the cross-border projects have been excluded form the calculation.

Romania has with 1,270 km the largest share of inland waterways of the Corridor and plans invest the largest amount in the infrastructure. 770 km of the inland waterways run trough Germany which also invests large numbers in the rehabilitation of locks as well as the upgrade of the section between Staubig and Vilshofen. Hungary, Croatia and Bulgaria invest the lowest amounts per kilometre of inland waterways.

Figure 80: Specific costs of IWW projects per Member State



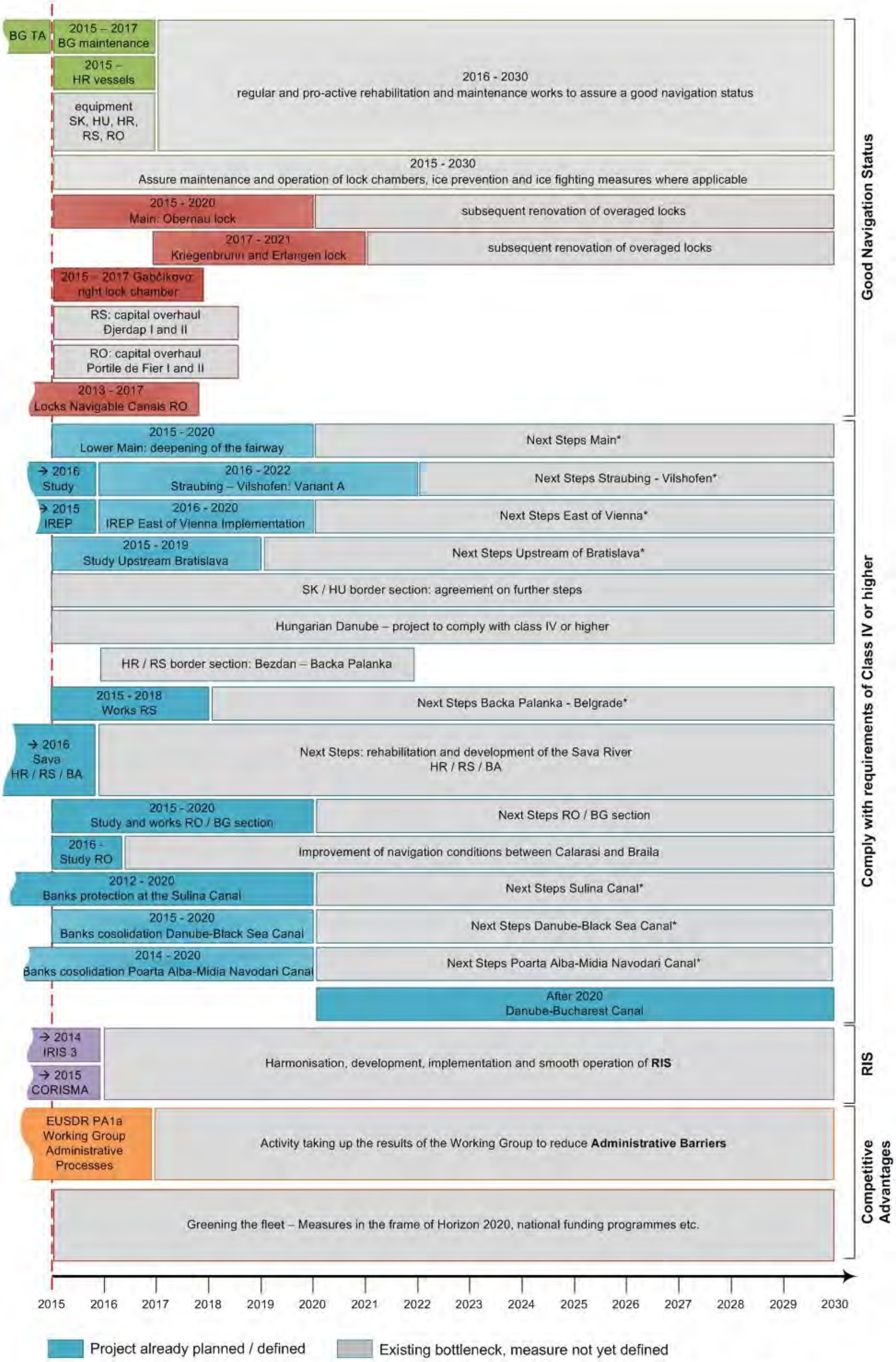
* excl. cross-border projects and Danube-Bucharest Canal

4.5.2.3 Analysis of IWW projects with reference to the main objectives of the corridor

The projects are grouped into four specific objectives on the time line from 2015 up to 2030

- Maintain and preserve good navigation status by maintenance equipment and works, improving the availability of locks and the removal of obstacles of ship wrecks
- Comply with the requirements of class IV or – as appropriate in order to meet market demands - higher by river engineering and training works and the removal of obstacles bridges
- Enhance and operate RIS
- Strengthen the competitive advantages of IWT, by reducing administrative barriers and greening the fleet

Figure 81: Time frame of inland waterway projects



The overview figure contains the most relevant measures to tackle identified bottlenecks between 2015 and 2030.

* next steps required if the parameters of the TEN-T regulation respectively the AGN agreement (where applicable) are not yet met.

Corridor Objective: Maintain and preserve a good navigation status

Rehabilitation and maintenance equipment and works

According to the Fairway Rehabilitation and Maintenance Master Plan by the EU Strategy for the Danube Region PA1a several riparian states aim to bridge their needs in order to assure common minimum levels of service. Fairway monitoring is a crucial element in the maintenance cycle, nevertheless up-to-date sounding vessels and additional automatic gauging stations are lacking in most of the cohesion. For the execution of maintenance works marking vessels and dredging equipment is needed. Well trained staff should be provided on short, medium and long term.

It is strongly recommended to take up projects for the acquisition of gauging, surveying and dredging equipment and training of staff in the work plan for Slovakia, Hungary, Croatia, Serbia, Romania and Bulgaria.

The projects should start on short term and as early as possible in order to establish the good navigation status and therefore support the modal shift towards inland waterway transport. Bulgaria already made a start and receives technical assistance by the EUSDR to prepare a project for modernising and optimising maintenance activities.

Improving the availability of Locks

The reconstruction of the Obernau lock at the Main and the Kriegenbrunn and Erlangen locks at the Main-Danube Canal are scheduled for 2015 and 2017. After concluding the ongoing works on Gabčíkovos' left chamber, a complete reconstruction of the right lock chamber will follow and is planned to be concluded until summer 2017. Also the Iron Gate locks in Romania and Serbia are over aged and need capital repairs, the envisaged time schedule could not be obtained yet. The rehabilitation of locks on the Danube-Black Sea Canal and the Poarta Albă-Midia Navodari Canal are on its way and should be finished until 2017.

Ship wrecks and unexploded ordinances are about to be removed by the Danube Ship Wreck Removal project until 2018. A similar project was under definition for the sector Prahovo (RS).

Corridor Objective: Comply with the requirements for class IV or – as appropriate in order to meet market demands - higher standards

There are several river engineering and river training works planned. The deepening of the fairway at the Lower Main, the upgrade of the Danube between Straubing and Vilshofen, the rehabilitation of the right bank and the riverbed in Croatia, river training and dredging works on the Danube in Serbia, the reconstruction and upgrade of the Sava in Croatia as well as the banks consolidation projects on the Romanian Canals are under the more advanced initiatives. Works are expected to be conducted within the next years.

Other important project activities are envisaged but still need preparatory steps before works could start. In some cases cross-border issues have to be solved and closer coordination with other interest groups (ecology, tourism flood protection etc) is necessary. In other cases additional scientific evidence is needed as basis for decision making (e.g. Romanian – Bulgarian border section and Romanian section) or prior studies have to be updated with new facts. The start of construction works highly depends on the outcomes of the respective preparatory steps.

There is no new project concerned with the reconstruction of bridges. Žežely Bridge in Novi Sad should be finished by 2015.

Corridor Objective: Enhance and operate River Information Services

Currently the RIS enabled IWT corridor management project as well as IRIS Europe 3 investigates how to foster interoperability and compatibility between the different deployed types. The RIS implementation on the Sava and in Bulgaria (BULRIS) is under way; a follow-up activity is planned in Bulgaria. There are also concepts to implement RIS in the Ukraine.

Giving consideration to the cross-border nature of the outstanding challenges, joint initiatives, possibly even across the boundaries of the Rhine-Danube Corridor are recommended.

Corridor Objective: Reduce administrative barriers and strengthen the competitive advantages of inland waterway transport

In the field of reducing administrative barriers no project activity has been planned yet but measures will be planned in the frame of the EUSDR PA 1a Working Group. Green the fleet is an activity which also relates to Horizon 2020 measures and initiatives supported by national funding programmes.

4.5.2.4 Summary of critical sections not sufficiently covered by projects

Waterway administrations are lacking staff and budget in several countries. Long term planning, solid procurement procedures, inclusive approaches and cross-border cooperation are sometimes not well developed. Technical assistance in these and similar cases should be provided. High co-financing rates for third countries are seen as an important obstacle to the implementation of projects.

Several activities to tackle important bottlenecks and to reach the corridors objectives are missing. Bulgaria is the only country which plans to acquire rehabilitation equipment and to optimize their maintenance activities. Nevertheless, the Fairway Rehabilitation and Maintenance Master Plan states, that also Slovakia, Hungary, Serbia and Romania lack the necessary equipment.

The present operational scheme of Gabčikovo led repeatedly to a complete closure of the Danube. Measures to improve the lock operation are strongly recommended. Iron Gate I and II locks are over aged, capital repair works will be necessary a concrete project intention was not yet presented.

In terms of projects to comply with class IV or higher the more advanced initiatives should proceed in realising the already detailed and/or approved plans. Projects which still need preparatory works as cross-border coordination, involvement of other interest groups, solid scientific evidence, detailed designs… bear the risk of being delayed. Goal-oriented, integrative planning processes should be designed and pursued persistently.

As the RIS enabled IWT corridor management and IRIS Europe 3 are not finished yet a follow-up project which shall take up its results has not been defined yet.

A project to reduce administrative barriers depends on the outcome of the EUSDR PA 1a Working Group.

Summary of sections not sufficiently covered by projects

Figure 81: Time frame of inland waterway projects gives an overview on existing bottlenecks where measures have not yet been defined. The following table the sections not sufficiently covered by projects relating to good navigation status as well as to compliance with the parameters of class IV or higher.

The projects have been retrieved from official planning documents by the respective countries and were amended through inputs received by the responsible administrative organisations. The list is considered as work in progress.

Table 62: Sections not sufficiently covered by projects related to physical infrastructure

Location (Country)	Good navigation status		Comply with class IV
	Maintenance equipment and works	Availability of locks	River engineering and training works
Main (DE)	✓	+	+
Straubing-Vilshofen (DE)	✓	not relevant	~
East of Wien (AT)	✓	not relevant	~
Upstream of Bratislava (SK, AT)	–	not relevant	~
Slovakian-Hungarian border stretch (SK, HU)	–	~ (SK: Gabčikovo)	–
Szap to Mohács port / Batina (HU)	–	not relevant	–
Bezdan to Backa Palanka (HR, RS)	–	not relevant	~
Danube in Serbia (RS)	–	not relevant	+
Serbian-Romanian border stretch (RS, RO)	– (ice breaking equipment Iron Gate I, II)	~ (Iron Gate I, II)	✓
Portil de fier II – Călăraşi (RO, BG)	~ only BG side	not relevant	~
Călăraşi-Brăila (RO)	–	not relevant	~
Ukrainian-Romanian border stretch (RO, UA)	–	not relevant	✓
Sulina Channel (RO)	–	not relevant	+ (bank protection)
Danube-Black Sea Canal (RO)	✓	+	+ (bank consolidation)
Poarta Albă-Midia Navodari (RO)	✓	+	+ (bank consolidation)
Sava (HR, BA, RS)	–	not relevant	~
Danube-Bucharest Canal (RO)	not yet relevant	not yet relevant	~

✓ Parameters have been established, no additional activity needed
\+ Covered by a project aiming at establishing required parameters by 2030
~ Approached by a project, but further activities may be needed to establish the required parameters
\- No project activity identified

If the parameters have been established or a certain activity is not an issue at a corridor section there is no need for action in the frame of a TEN-T project. Of course further improvements may be useful but are not considered as essential to the corridors development.

A number of bottlenencks are covered by a project aiming at establishing the required parameters by 2030. Those projects should be supported to proceed with their activities. Attention should be paid to smooth project execution.

Bottlenencks which are only approached by an initiative but the entire process of establishing the required parameters is not yet clearly defined bear a risk to the corridors development and implies a prioritised need for action. Roadmaps and more detailed project initiatives are needed.

It is considered as highly critical if no project activity could be identified to tackle a bottleneck. In this case also a prioritised need for action is evident.

RIS, administrative barriers and measures for greening the fleet have not been included in the table as they need common steps along the corridor and in most cases depend on the outcomes of on-going projects.

4.5.3 Implementation Ports

The programme of measures includes projects provided by Member States, infrastructure managers and other actors. The following sources have been used in relation to ports:

- EU Strategy for the Danube Region, PA1a project data sheets
- Draft national programmes of transport and transport master plans as provided by the Member States
- European Federation of Inland Ports, projects database
- Direct inputs from port administrations (in most of the cases).

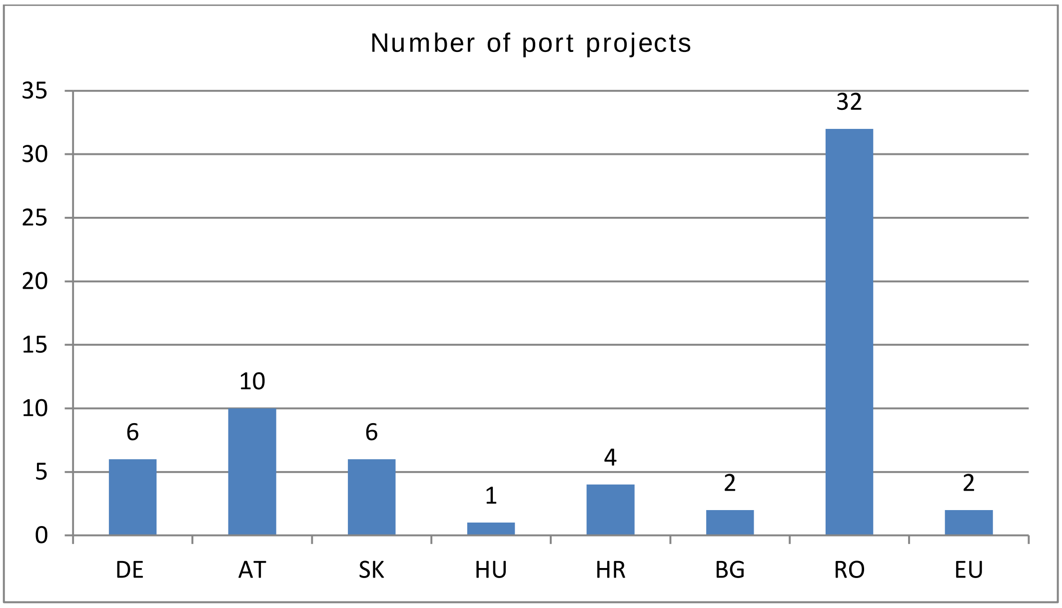
4.5.3.1 Projects

All projects (63 in total) contained in the list in Annex II have been duly confirmed and validated (in writing) by Member States during the validation process in October 2014. Total costs for all these projects sums up to 2.33 billion Euros. This sum is provisional as some projects currently do not have their costs precisely determined or forecasted. There are 9 projects which are studies, one project related with administrative procedures while all remaining projects are categorized as studies + works of different nature and status. Thirteen projects are already being implemented but have been included in the list as the activities are on-going. Three projects in the Port of Constanta will end in December 2014 so they are also kept in the list for the overview purposes. Vast majority of projects are related to capacity extensions and modernization of infrastructure, followed by projects related to improvement of hinterland connections, while some projects are related to implementation of telematic applications, all in accordance with Article 16 of the new TEN-T Regulation (1315/2013).

The most complex project, with consequently the highest cost, is the project related to the completion of infrastructure works and construction of berths for specialized terminals in the Port of Constanta, with the total cost of 378 million Euros. Apart from this project there are 5 more projects with total costs exceeding 100 million Euros.

Figure 82 represents a total number of identified port-related projects in 19 core ports on the Main, Main-Danube Canal, the Danube River and on the Black Sea. Rhine and Neckar ports are analysed in the study on the Rhine-Alpine Corridor.

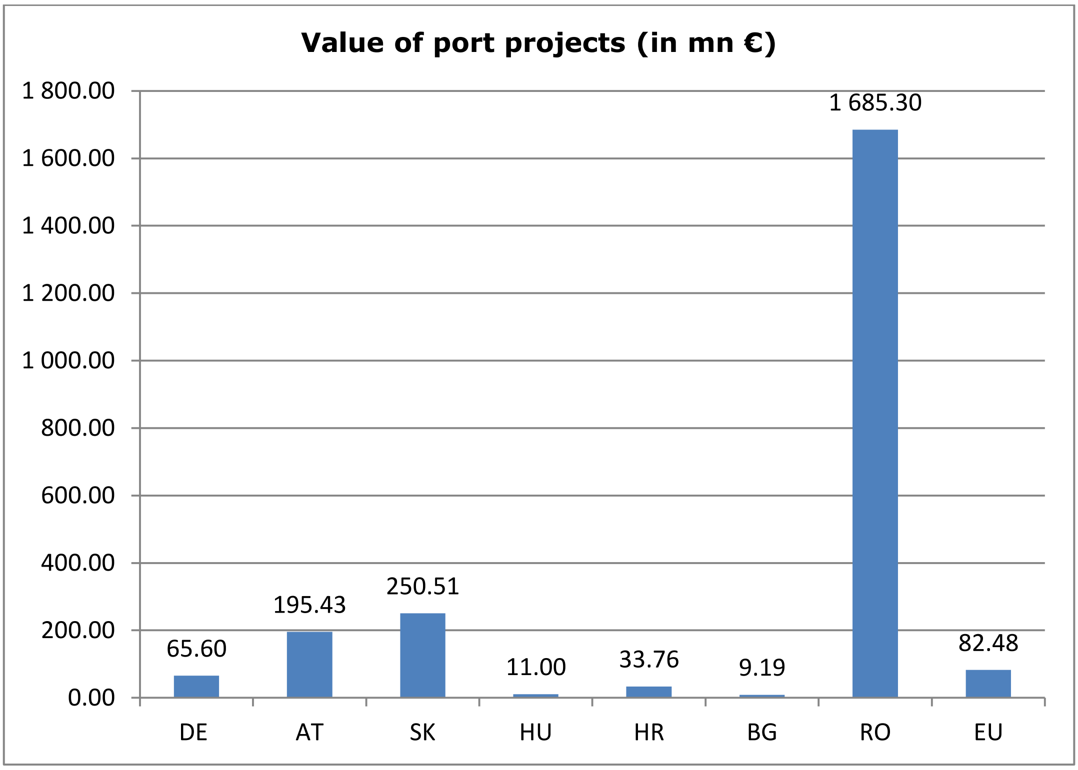
Figure 82: Number of identified port project in each Member State



Source: iC consulenten, based on study review

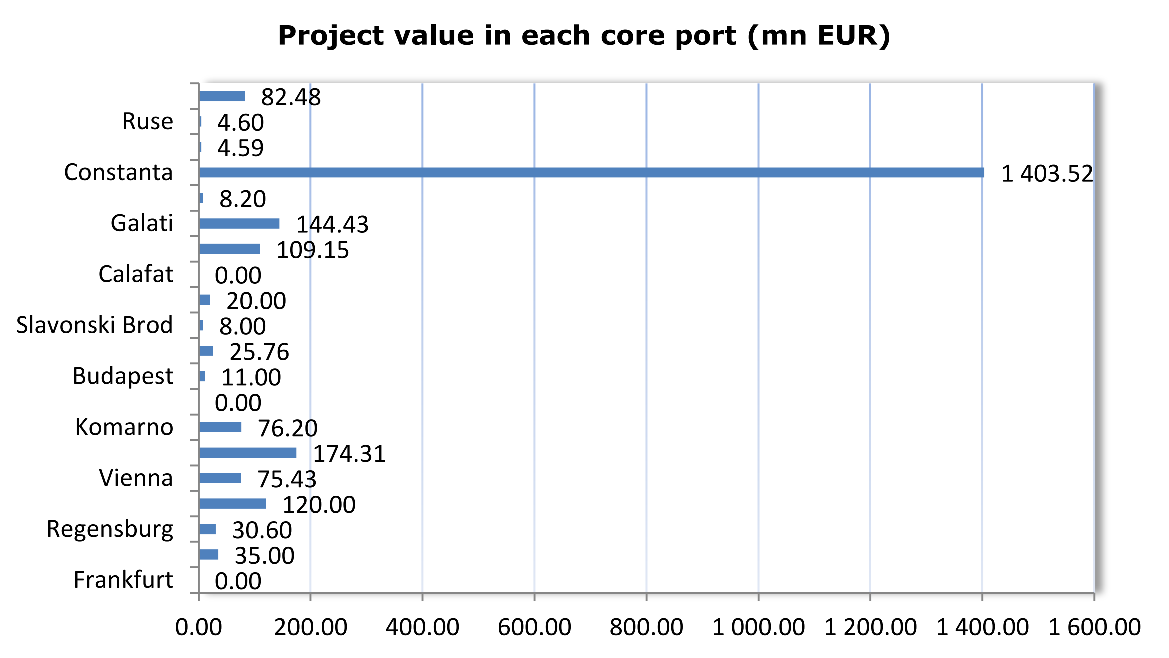
The costs of the projects in each Member State are represented in Figure 83, while the cost of each project is given in Figure 84.

Figure 83: Costs of port projects per Member State



Source: iC consulenten, based on study review

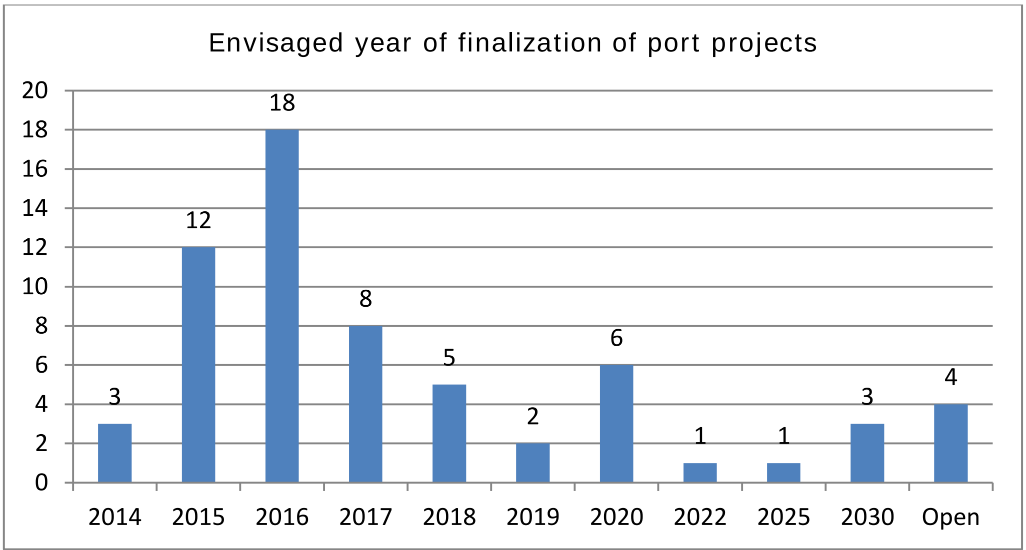
Figure 84: Costs of individual port projects /those with existing cost estimates)



Source: iC consulenten, based on study review

Time horizons of on-going and planned port projects are given in Figure 85.

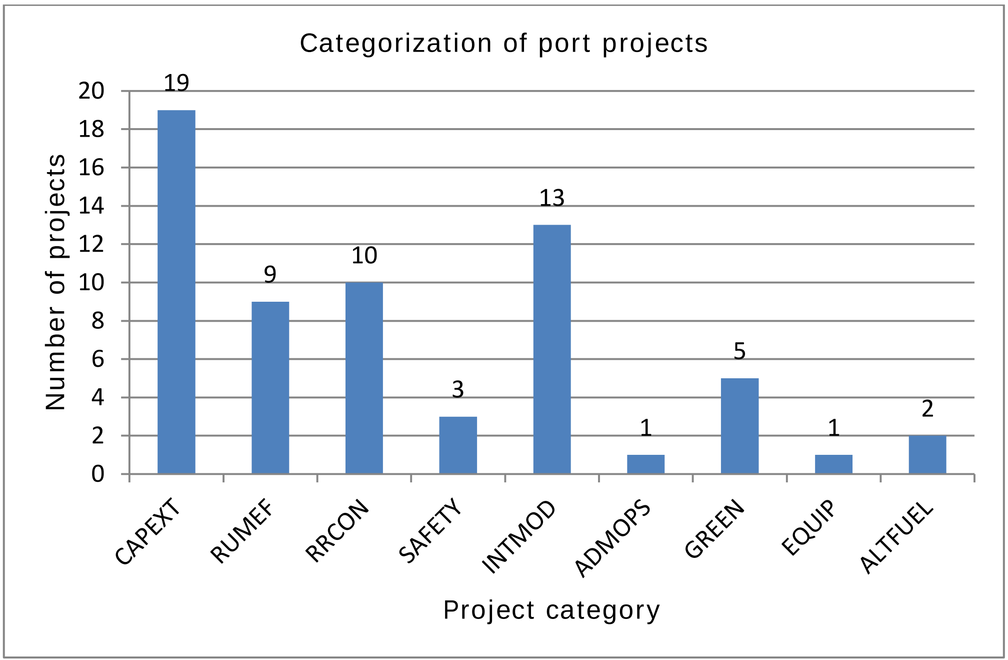
Figure 85: Envisaged year of finalization of port projects



Source: iC consulenten, based on study review

All projects have been categorized into 9 different categories, according to the nature and contents of each project. Figure 86 (below) represents the distribution of projects in different categories.

Figure 86: Categorization of port projects



Source: iC consulenten, based on study review

Legend: CAPEXT – capacity extension; RUMEF – rehabilitation, upgrade, modernization of existing facilities; RRCON – road and rail connections; SAFETY – all projects related to safety; INTMOD – intermodal facilities; ADMOPS – projects of administrative and operational category; GREEN – projects related to mitigation of environmental footprint in ports; EQUIP – acquisition of eligible equipment; ALTFUEL – projects related to procedures and facilities for alternative clean fuel supply in ports.

The following projects represent the Consultant's selection of on-going or planned projects along the Corridor, for mere overview purposes, without any prejudice whatsoever.

Germany:

Construction of the third module of the container terminal in the Port of Nürnberg (rail-road terminal within the port) is needed due to growing demand for transhipment capacities for container and combined intermodal services.

Port of Regensburg is currently engaged in an extension of the existing container terminal in terms of reconstruction of the quay wall, construction of terminal rails, pavement construction within the terminal area and container crane with range for vessel, rail and truck transshipment. Being focused on the aspect of multimodality of the port, the project is expected to have an important impact on the cargo flows along the Corridor, as well as the positive modal shift. The project is very mature as the feasibility and technical-economic studies are finalized, including the cost-benefit analysis.

Austria:

Expansion of the tri-modal inland port of Wien consists of works aiming to expand the port, in order to increase the capacity for handling additional freight – especially in the light of recent increases of throughput. These works specifically concern the extension of the port's container handling capacities through land recovery and the construction of a new quay wall in order to optimise the areas of operation.

Slovakia:

Modernization of the Port of Komárno consist of an upgrade of agricultural and container terminal. According to the reports received from the port managers, Slovakian ports need significant interventions in terms of modernization.

Hungary:

Infrastructure development in the Port of Budapest (Csepel), including the project for reparation, reconstruction and development the infrastructure of Freeport of Budapest. Hungarian MS representatives reported additional projects in comprehensive ports, but due to the subsequent clarifications with the Commission as well as the restrictions related to the tender specifications, available time and resources, and scope of the study such projects were not included in this review.

Romania:

Romania has by far the largest number of projects, many of which have important corridor effects. The Port of Constanta has a number of important projects such as bridge/flyover over the link canal planned for 2015-2020 which will create a connection between the current port territory and the future artificial island. Another project deals with the road bridge at km 0+540 of the Danube – Black Sea Canal and it will directly connect the northern and southern parts of the port by the end of December 2014. In addition, the Port of Constanta will complete the infrastructure on Pier III and Pier IV South for specialized terminals.

The port of Giurgiu is currently engaged in a study of greening the port operations through implementation of green & energy efficiency operations model, an infra- and supra-structure concept, enhanced IT systems as well as customer-oriented operational business processes. It should enable the port to reduce the specific greenhouse gas emissions of port operations. The port of Giurgiu also works on a development of a multimodal platform and hinterland connections from the port's new industrial area.

Port of Galati plans to construct an intermodal terminal, whereas the study phase is currently in progress. The works in the Galati intermodal terminal will upgrade the existing infrastructure and will develop new specialised facilities in order to set up an intermodal terminal capable to operate transport flows between Black Sea ports and Danube region. Thus, the port of Galati will develop as a continental gateway on the east border of the EU. The added value to the Rhine-Danube corridor of the terminal will be significant due to increasing the use of the maritime sector of the Danube.

Multilateral projects

The **LNG Master plan** is a multinational project which will deliver a policy advocacy document which proposes an integrative strategy together with concrete actions as well as a set of recommendations. Short-term, medium-term and long-term measures to be taken by the European Commission, the River Commissions, national authorities as well as the concerned industry are part of a detailed road map which will be prepared by the end of 2015.

Passenger transport

As regards to passenger transport, most of the core ports along the Corridor have facilities for passenger transport of various quality and contents. Those ports that have not reported any passenger flows did not record any demand for regular passenger vessels or cruise industry.

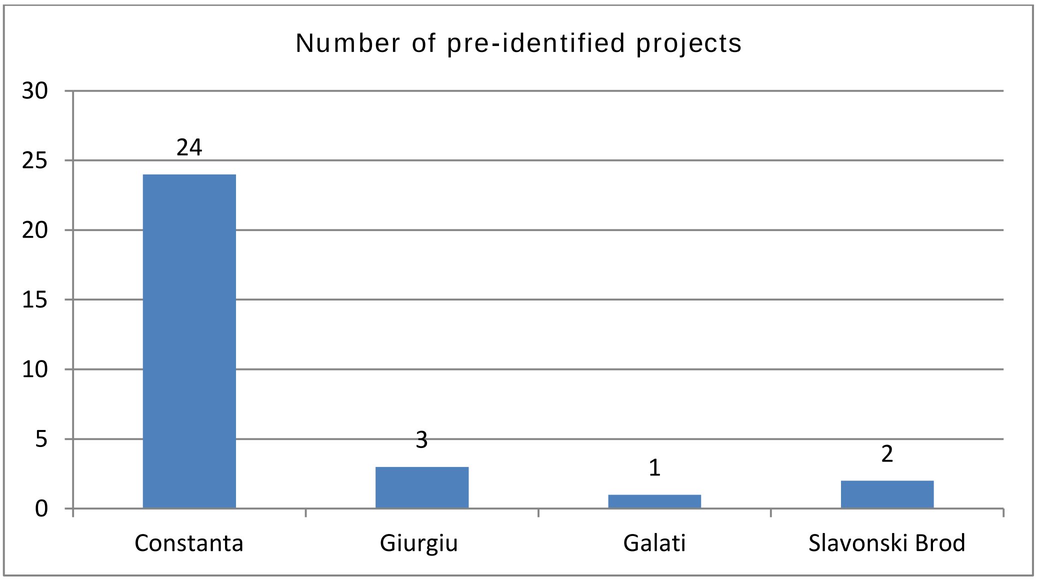
In this view, port of Bratislava reported plans for construction of berthing and accompanying facilities for passenger vessels. In addition, port of Constanta plans to increase the safety level at the "Tomis touristic port" area by construction of a breakwater.

The rest of the studies are listed in Annex II of this report. Some of the projects in the list of port related projects in Annex II are marked as "critical issue", whereas some are marked as "CEF pre-identified project" according to Annex I of the CEF Regulation (1316/2013). The reasoning behind the marking of certain projects as "critical issue" was the following: in the case of ports, all projects related with the compliance with the corridor objectives, all projects which have a multimodal approach, all projects which are increasing the port capacity and all projects which are improving the safety or hinterland connections were considered as "critical issues".

Pre-identified projects

Annex I of the CEF Regulation (1316/2013) contains pre-identified projects (or scope of projects) in determined ports on the Rhine-Danube Corridor. These ports are Slavonski Brod (HR), Giurgiu (RO), Galați (RO) and Constanta (RO). Out of the total 63 identified projects, 30 projects are related to pre-identified projects: 24 projects in the port of Constanta (RO), 3 projects in the port of Giurgiu (RO), 1 project in the port of Galați (RO) and 2 projects in the port of Slavonski Brod (HR), as given in Figure 87. These projects are clearly marked in Annex II – List of projects.

Figure 87: Pre-identified projects in ports



Source: iC consulenten, based on study review and EC Regulation 1316/2013

The following chart contains the time plan of implementation of the projects which, in the opinion of the consortium, have the strongest corridor effect. In addition, the given chart contains the projects that are missing, in terms of identified bottlenecks in ports, as well as studies which might have a positive impact on the performance of core ports along the Corridor.

This chart does not pretend to prioritize projects or to have any prejudice on further decision making on funding.

Table 63: Timeline of the implementation of sample port projects

Project	Port	Study/ Works	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Selected identified studies/projects																			
Planning and construction of the expansion of the trimodal Port of Vienna (Freudenau)	Port of Vienna	Works																	
Road bridge over the link canal (Flyover) (Constanta South Bridge)	Port of Constanta	Works																	
Masterplan of the Port Constantza	Port of Constanta	Study																	
Port approaches and basin dredging and deepening	Port of Constanta	Works																	
Pier IIIS– Pier IVS- Completion of infrastructure works and berths construction	Port of Constanta	Works																	
Completion of Barge Terminal	Port of Constanta	Works																	
LNG Terminal in the Port of Constanta	Port of Constanta	Works																	
Gate 7 - A4 junction road extension	Port of Constanta	Works																	
Development of artificial Island in the Port of Constanta	Port of Constanta	Works																	
Development of a multimodal platform and hinterland connections	Port of Giurgiu	Works																	
Galati multimodal platform	Port of Galati	Works																	
Development of the existing container terminal	Port of Nürnberg	Works																	
Container terminal enlargement	Port of Regensburg	Works																	
Road and railway underpass alignment ("Auweg / Strecke Regensburg – Hof")	Port of Regensburg	Works																	
Cargo City Enns	Port of Enns	Works																	
Ro-La terminal and container terminal design and construction	Port of Slavonski Brod	Works				TBC	TBC	TBC	TBC										
Port reconstruction - New port East	Port of Vukovar	Works																	

Table 64: Timeline of the implementation of sample port projects – continued

Project	Port	Study/ Works	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Selected identified studies/projects																			
Modernizaton and completion of connecting elements in cargo and passenger port	Port of Bratislava	Studies and works																	
Modernization and completion of the port quays and paved areas in Palenisko basin	Port of Bratislava	Studies and works																	
Upgrade of agri products terminal, container terminal and gas station	Port of Komárno	Studies and works																	
Port infrastructure developement	Port of Budapest (Csepel)	Works																	
LNG Master Plan 2012-EU 18067-S	Inland ports of DE, AT, SK, RO & BG	Study & Works																	
Updating the Master Plans of Danube River ports	Ports of Ruse, Vidin	Study																	
Missing studies/projects																			
Dredging of the port approaches and basin	Cernavoda	Works																	
Rehabilitation and extension of the railway connections	Komarom	Works																	
Rehabilitation and extension of the railway connections	Cernavoda	Works																	
High quality road & rail connection with port's hinterland	Galati	Works																	
Provision of e-Maritime services	Constanta	Works																	
Suggested studies/projects																			
Feasibility Study on Administrative Facilitation of IWT (FAIT)	Rhi-Dan Core ports	Study																	
Greening of Inland Ports (GRINPORT)	Rhi-Dan Core ports	Study																	
Public Financing and Charging Practices in EU Inland Ports (FINCHPORT)	Rhi-Dan Core ports	Study																	
Feasibility Study and CBA of Electrification on Ports Internal Railways (EPIR)	Rhi-Dan Core ports	Study																	

Table 65: Timeline of the implementation of port projects with the strongest corridor effect – continued

Project	Port	Study/Works	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Selected identified studies/projects																			
Port reconstruction - New port East	Port of Vukovar	Works																	
Infrastructure modernizaton and completion of connecting elements in cargo and passenger port	Port of Bratislava	Works																	
Modernization and completion of the port quays and paved areas in Palenisko basin	Port of Bratislava	Works																	
Upgrade of agri products terminal, container terminal and gas station	Port of Komárno	Works																	
Port infrastructure developement	Port of Budapest (Csepel)	Works																	
LNG Master Plan 2012-EU 18067-S	Inland ports of DE, AT, SK, RO & BG	Study & Works																	
Updating the Master Plans of Danube River ports	Ports of Ruse, Vidin	Study																	
Missing studies/projects																			
Dredging of the port approaches and basin	Vidin	Works																	
Dredging of the port approaches and basin	Cernavoda	Works																	
Railway connection with port's hinterland	Komarno	Works																	
High quality road connection with port's hinterland	Galati	Works																	
Suggested studies/projects																			
Feasibility Study on Administrative Facilitation of IWT (FAIT)	Rhi-Dan Core ports	Study																	
Greening of Inland Ports (GRINPORT)	Rhi-Dan Core ports	Study																	
Public Financing and Charging Practices in EU Inland Ports (FINCHPORT)	Rhi-Dan Core ports	Study																	

Legend:

- Capacity extension and/or modernization
- Road and rail connections
- Alternative clean fuel facilities
- Dredging
- Administrative/operational activities

Source: iC consulenten, based on the inputs from Member States, port authorities and own sources

Modernization and capacity extensions of port infrastructure

In terms of capacity extensions, all ports reported adequate actions in order to combat the existing capacity constraints or to prevent such bottlenecks according to the demand forecasts. According to the characteristics of ports and the review of studies that were identified and/or reported, there are no gaps between the current and forecasted demand and the on-going or planned projects. All projects addressing port capacities are either on-going or planned to commence as of 2015, ending in 2022 at the latest. In this view, out of the total 63 identified studies/projects there are 20 projects (studies and works) directly related with capacity extensions. The most notable capacity extensions projects, in terms of scope and costs, are projects in the ports of Wien (AT), Constanta (RO), Nürnberg (DE), Regensburg (DE), Giurgiu (RO), Vukovar (HR) and Bratislava (SK).

In addition to projects of capacity extensions, a number of ports have undertaken or planned projects related to the modernization of the port infrastructure necessary to perform transport operations. The modernization activities in ports are mostly related to reconstruction and upgrade of quay walls with berths which are degraded either due to the lack of maintenance over years or due to the age of such structures. These types of works are notable in the ports of Bratislava (SK), Budapest (HU), Drobeta Turnu Severin (RO), Giurgiu (RO), Galați (RO), Cernavoda (RO) and Regensburg (DE) where the quay wall in the west basin dates from 1910/1911. The proposed project in Galati (RO) is focused on port infrastructure modernization in order to increase the efficiency of port infrastructure use and in order to improve the freight distribution via rail and road.

Connecting inland port infrastructure to rail freight and road transport infrastructure

As mentioned earlier in this study, all ports have functional railway connections with their hinterlands, whereas the Port of Komárom (HU) has a severely deteriorated railway link which is rarely used due to its condition and it does not reach the quay (berth) line, thus preventing any possibilities of direct ship-to-rail (and vice-versa) transhipment. All other ports have rail and road connection to their hinterlands and such connections are of various quality and length.

Out of the total of 63 identified/validated studies, there are 6 planned projects related to road and rail infrastructure (4 in Constanta (RO), and 3 in ports of Giurgiu (RO), Regensburg (DE) and Vukovar (HR), respectively). It must be noted that all these projects are related to the rail and road infrastructure in the port areas, whereas the planned internal road and rail infrastructure is connected to the outside network of roads and railways. Rail and road infrastructure projects outside port areas are not in jurisdiction of port administrations which therefore requires narrow cooperation with the infrastructure managers of road and railway networks in each Member State.

In this view, it is highly recommended to take up the project of railway connection rehabilitation and extension in the Port of Komárom (HU) with its hinterland. In addition, the quality of rail and road connection of each port (outside the port areas) should be assessed, whether or not such roads or railways are sections of the core network or not, and Member States should be encouraged to consider such projects as well, whereas the Commission should follow up these actions.

Port of Galați reported a need to provide much higher quality road and railway connection with the hinterland. This initiative is supported by the consortium and should be coordinated with the relevant Member State institutions. The consortium reasonably assumes that this situation might be the case for other ports which should carefully assess their local situations and coordinate further activities with their respective Member States.

Alternative clean fuel supply facilities

During the survey on characteristics of ports, all port administrations (excluding the Rhine ports which are analysed in the Rhine-Alpine Corridor) were asked about plans to provide LNG supply facilities up to 2030 and only ports of Ruse (BG), Galați (RO), Constanța (RO) and Komárno (SK) reported general intentions to provide such facilities. However, the only core port on the Corridor which reported concrete projects on providing LNG supply facilities in the next 5 years period is the Port of Constanta. There is a memorandum of understanding signed between TTS Group (partner in the LNG Master Plan) and Constanta Port Administration which established the cooperation of Constanta Port Administration to the Feasibility Study for the LNG Import Terminal (TTS Group) in the port of Constanta as part of the LNG Master Plan (2012-EU 18067-S).

In addition to this, a Corridor wide project (in fact, it stretches even beyond the Rhine-Danube Corridor) titled LNG Master Plan for Rhine-Main-Danube is currently on-going, planned to be completed by the end of 2015. The objectives of this study are to contribute to legal framework for LNG as fuel of inland vessels and as a cargo on inland waterways, to analyse supply and demand of LNG in the Danube and Rhine corridor, prepare feasibilities for LNG small scale terminals along the Danube, implement the first LNG terminals and to deploy LNG fuelling system on pilot vessels. It is expected that after the final results of this project more ports will be able to plan their activities in this field in more details.

It is also recommended that the ports are encouraged to provide shore-side facilities for electricity supply to vessels.

Depth maintenance in port areas and port approaches

Study review and port survey revealed that there are only two ports where minimum depth according to (at least) the class IV waterway is not available, that is, the Port of Vidin (BG) with the draft of 2.4 meters and the Port of Cernavoda (RO) with the draft of only 1.5 meters in certain periods of a year.

In this view, Bulgaria planned the dredging works in the port of Vidin, within the project BG1 in the project list in Annex II. However, the port of Cernavoda did not report any project related to dredging and depth maintenance.

It is highly recommended to consider the financial support for dredging equipment acquisition in ports, in Member States where waterway administrations are not in charge of maintaining minimum depths according to the class of the waterway in which such ports are located.

The missing projects correspond to the performed Gap Analysis and are included in the above overview chart of projects on the Corridor.

4.5.3.2 Gaps and missing projects

Based on the analysis of ports characteristics, identified missing projects (Chapter 4.3.2) and performed gap analysis, it can be concluded that none of the port-related projects listed in Annex II, or those listed in Table 63 (*Timeline of the implementation of sample port projects*), can be considered as urgent, as all these projects are tackling the foreseen bottlenecks, not the existing ones, meaning that they are well planned, sufficiently ahead of critical point in time.

However, there is a number of bottlenecks that are not covered by any of the identified projects (on-going or planned), and these can be considered as conditionally "urgent" projects, as given in Table 66.

Table 66: Missing projects, not covered by any on-going or planned projects

Port	Urgent projects	Possible implementation period
Cernavoda (RO)	Dredging to min 2.5 m draft at all WL at all terminals	2016 - 2017
Cernavoda (RO)	Extension of railway tracks along the quay (berth) line	2017 - 2019
Komárom (HU)	Rehabilitation and extension of the railway link	2018 - 2020
Galați (RO)	Improvement of the road & rail connection	2018 - 2020
Constanța (RO)	e-Maritime facilitation	2018 - 2020

Source: iC consulenten, based on port data, study review and gap analysis

In addition, based on the gaps as elaborated in Chapter 4.3.3.2, under "Conditional infrastructure bottlenecks", the Consultant recommends the following projects (Table 67) for those ports having no or limited shore-side power supply facilities.

Table 67: Missing projects in terms of Directive 2014/94/EU

Port	Missing projects	Possible implementation period
Wien (AT)	Feasibility study and CBA for provision of shore-side supply facilities	2017-2018
Bratislava (SK)	Feasibility study and CBA for provision of shore-side supply facilities	2018-2019
Komárno (SK)	Feasibility study and CBA for provision of shore-side supply facilities	2018-2019
Galati (RO)	Feasibility study and CBA for provision of shore-side supply facilities	2017-2018
Frankfurt (DE)	Feasibility study and CBA for provision of shore-side supply facilities	2019-2020

Source: iC consulenten, based on port data, study review and gap analysis

In relation to the missing projects on shore-side power supply in Table 67, the Consultant has undertaken a survey amongst the affected ports. While the ports of Bratislava, Komárno and Galati had no objections, the port of Frankfurt did not agree to include the lack of full scale shore-side power supply as a "conditional" bottleneck, and to recommend such studies to ports either. The port of Wien did not reply to the survey.

4.5.3.3 Additional projects

In addition, the Consultant proposes the following projects which are not related to individual ports only but to the entire port system along the Corridor:

- *Feasibility Study on Administrative Facilitation of Inland Waterways Transport (FAIT).* Due to the non-harmonized administrative procedures for vessels calling inland ports causing additional administrative work by vessel operators and skippers, a project on harmonization of such procedures and documentation requirements is suggested for the period 2016-2017. The study could be aimed at adoption of an international convention similar to the Convention on Facilitation of Maritime Traffic (FAL Convention) or an adequate Regulation or Directive.
- *GReening of INland PORTs (GRINPORT).* This horizontal study for all ports on the Corridor could encompass various activities aimed at (perhaps even regulation-based) reduction on environmental footprint of inland port operations, which, eventually, might be supported with adequate EU legislation. This project initiative could involve greening initiatives related with, inter alia, electrification of ports' internal railways, reduction of pollution from port handling equipment, provision of compulsory shore-side electricity supply facilities for vessels, etc. Last, but not least, such project would investigate the port management tools (pricing, monitoring and measuring, market access control and environmental standard regulation) that would enforce or encourage green port development at functional activities (shipping traffic, cargo handling and storage operations, intermodal connection, industrial activities, and port expansion) of port operations and development.
- *Public Financing and Charging Practices of Inland Ports in EU (FINCHPORT).* Based on a similar study commissioned by (then) DG TREN in 2006, which tackled only EU seaports, this study would be aimed at providing transparent information about financial flows from public funds into the port sector and about financial flows back from the port sector to the state (region, municipality) in terms of charges. Moreover, such study would provide transparent information on port governance systems, charging systems and principles for fees charged by port authorities to port operators, ship operators and cargo owners, as well as charging systems of port operators in ports where port authorities and port operators are not the same legal entity.
- *Feasibility Study and Cost-Benefit Analysis of Electrification of Ports Internal Railways (EPIR).*The Consortium recommends this study either on local level (every port for itself) or on Corridor level. Although not a straightforward requirement in terms of Regulation 1315/2013, electrification of internal railways in ports is an issue which deserves additional attention. According to the opinion expressed by the German Federation of Inland Ports (Bundesverband öffentlicher Binnenhäfen e.V. - BÖB), which the Consortium fully supports, shunting operations with diesel locomotives over long connecting distances to the main public railway infrastructure is cost intensive. Such costs are part of the costs of intermodal supply chains in competition with direct truck transport of containers and/or trailers. By electrifying ports' internal railway tracks the intermodal supply chain will become faster, more efficient and more economical, thus facilitating the acquisition of a larger market share for intermodal cargo. Therefore, it is strongly recommended to support intentions towards the electrification of internal railway tracks in ports whenever possible.

The above proposed horizontal and multidisciplinary studies/projects would facilitate the compliance of the core ports with the objectives of the trans-European transport network on cohesion, efficiency, sustainability and increase of benefits for users, as laid in Article 4 of the new TEN-T Regulation (1315/2013), and would contribute to the measures to be taken in order to mitigate greenhouse gas emmissions, pursuing Article 47(1e) of the aforementioned regulation.

In relation to the above four proposed studies, the Consultant has conducted a survey in November 2014, whereas the majority of ports supported such horizontal studies. The results of the survey are given in Table 68.

Table 68: Results of a survey on proposed additional horizontal studies

Port	Responses on proposed horizontal studies			
	FAIT	GRINPORT	FINCHPORT	EPIR
Frankfurt	Negative	Positive	Negative	Negative
Nürnberg	No response	No response	No response	No response
Regensburg	No response	No response	No response	No response
Enns	Positive	Positive	Positive	Positive
Wien	No response	No response	No response	No response
Bratislava	Positive	Positive	Positive	Positive
Komárno	Positive	Positive	Positive	Positive
Komarom	Positive	Positive	Positive	Positive
Budapest	Positive	Positive	Positive	Positive
Vukovar	No response	No response	No response	No response
Slavonski Brod	Positive	Positive	Positive	Positive
Drobeta TS	Positive	Positive	Positive	Positive
Calafat	Positive	Positive	Positive	Positive
Vidin	Positive	Positive	Positive	Positive
Ruse	Positive	Positive	Positive	Positive
Giurgiu	Positive	Positive	Positive	Positive
Galati	Positive	Positive	Positive	Positive
Cernavoda	Positive	Positive	Positive	Positive
Constanta	Positive	Positive	Positive	Positive

Source: iC consulenten, based on port survey

4.5.3.4 Other elements

Regulation 1315/2013 contains a provision which foresees an analysis of measures to be taken in order to mitigate greenhouse gas emmissions, noise and other negative environmental impacts.

In view of ports, electrification of internal railways and provision of shore-side electricity supply for vessels and any other measure aiming at reduction of environmental footprint of port operations are fully in line with the requirements set in Article 47 of EC Regulation 1315/2013. Out of 62 identified port projects, there are two projects in port of Constanta that are directly related to reduction of environmental foot print of port operations and those projects are the following:

- Photovoltaic park in the port of Constanța (2015-2016), and
- Wind power park in the port of Constanța (2018-2020).

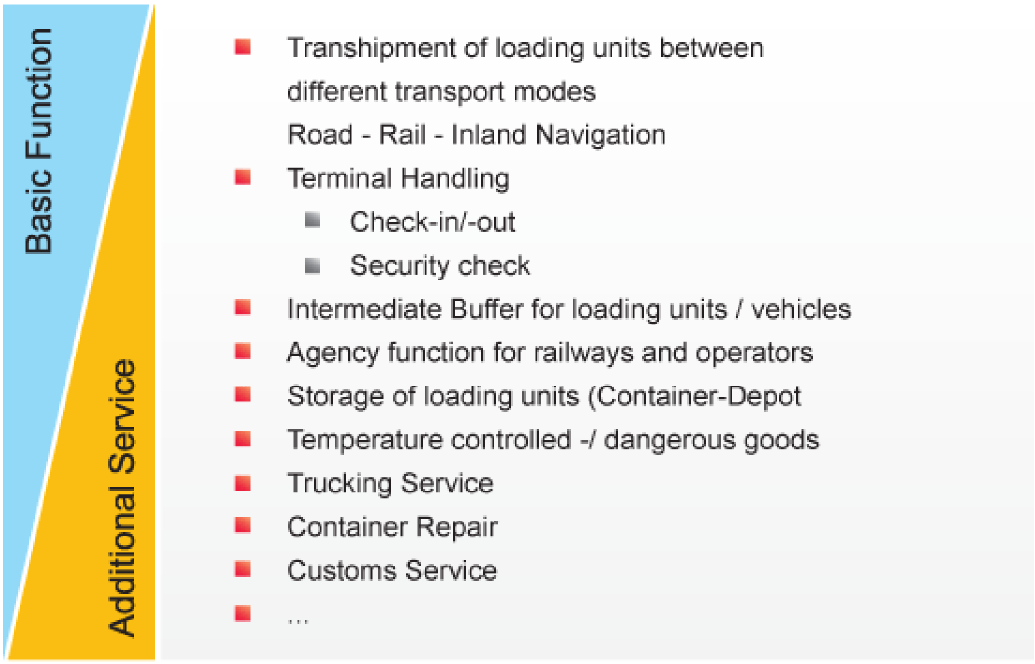
4.5.4 Implementation Rail/Road Terminals

The programme of measures as basis for the implementation of rail/road terminals is founded on the following principles:

- Non-discriminative access to terminals;
- Rail-side access for all licensed railway undertakings and other applicants (pursuant to Directive 2011/14/EC, Annex II no. 2 letters a) to h));
- Road-side access for all operators;
- Transparent capacity allocation and pricing;
- Bundling of different cargoes (maritime container, continental cargoes), and market segments (international and domestic relations) and thus improved capacity utilisation.

Projects and measures might refer to the overall bandwidth of terminal functions. Figure 88 shows so-called "basic functions", which are related to the pure rail/road transhipment and required at any intermodal terminal, and "additional services", which a terminal operator may or may not offer depending on the local demand for them. There is a smooth transition between the different functions and between the demand either from the intermodal terminal operator or from other parties in the supply chain (e.g. intermodal operators, trucking companies).

Figure 88: Basic functions and additional services of rail/road terminals



Source: KombiConsult

The main KPI, which most of the projects reflect upon, is of course the capacity of the (rail/road) terminal. This figure is determined by several factors, such as the position of the terminal within the rail and road network, the size and shape of the area, the length of the handling tracks, and the number and capabilities of the handling equipment. In recent years, a modular shape of terminals has been developed which is composed of

- Single- or better double-sided rail access, where signalling and train control allows for direct entry with momentum and direct departure of the train by the main line traction unit;

- Three to five transhipment tracks capable for entire block trains, with
- Rail-mounted gantry cranes (RMG) or reach stackers in less demanding cases;
- Two to three interim storage or buffer lanes;
- One loading and one driving lane for the trucks;
- Road side access to qualified roads with
- Check-in / check-out area (gate) and sufficient parking space;
- Terminal management and information system.

One can discuss if the existing and planned transhipment tracks really must provide a usable length of 740 m to be consistent with the targeted value for the permitted train length on the Trans-European core rail network by 2030 (compare chapters Characteristics Rail, Implementation Rail). On the one hand it would be desirable if the entire train could enter the terminal without further manipulation. On the other hand not every train will exploit the maximum length, so in these cases it might be sufficient if the terminal is connected to shunting tracks allowing to split the train into groups suitable for the maximum permitted handling track length. At this stage it can be recommended that least new built terminals should argue carefully if their handling tracks are below the target value of 740 m.

One typical module of that kind should be able to handle about 120-150,000 loading units p.a. (rail-in and rail-out handlings). A modular doubling or even triplication could improve the capacity accordingly.

Other factors are rather of an operational kind and can partly be directly influenced by the terminal manager. Such factors are e.g.

- Market share of continental and maritime loading units;
- Use of gateway transports;
- Share and duration of interim storage of loading units;
- Terminal opening and working hours per day;
- Rail handling track flow factor, determining the use of tracks for a train per day.

Due to the variety and large number of factors that determine the capacity of an intermodal terminal, it is not possible to make a fully concrete and standardized prediction regarding the capacity and utilisation of all terminals on the corridor altogether in the given time-budget framework.

Indications on the improvement measures regarding terminal capacity and operational efficiency apart from building pure infrastructure (e.g. multiple use of the tracks, bonus-malus-systems, etc.) can be obtained from the DIOMIS study performed by KombiConsult for the International Union of Railways (UIC)[119] or the good practices summarized in the framework of the AGORA project by the European Terminal Interest Group AGORA[120].

Against this background the following measures/projects on rail/road terminals could be identified. It must be considered that further projects in context with trimodal terminals are listed and described in the "port" section (see chapter 4.5.3):

- <u>France</u> (Strasbourg terminals): No projects have been provided to the consultants; as indicated earlier they are included in the Rhine-Alpine Corridor study.
- <u>Germany:</u> The project lists includes the new construction of the terminal Nürnberg-Hafen as well as expansion measures for Regensburg-Ost, Kornwestheim (Stuttgart) and München-Riem. All these projects have been

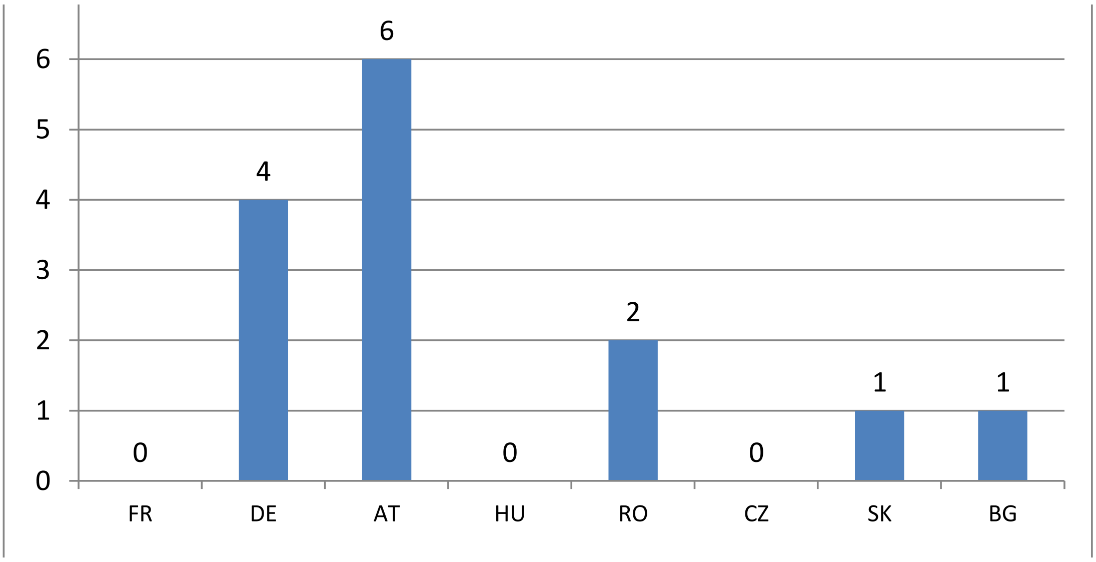
[119] *http://diomis.uic.org/spip.php?article11*
[120] *http://www.intermodal-terminals.eu/content/e3/e18/e128/index_eng.html*

concluded from the infrastructural side, the additional transhipment modules are in operation.

- Austria: Linz (improvement of the terminal located in the port of Linz), Wien Freudenau Hafen (improvement of the present RRT, acquisition of land for extending the trimodal terminal and building a trimodal terminal; projects are allocated to port project list; see chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**), Wien Inzerdorf (building of a totally new RRT to be used also for hub traffic) and Wels (extension of the existing RRT terminal).
- Hungary: No dedicated projects for rail/road terminals are known.
- Romania: The following plans in core network terminal nodes have been identified: (1) Rail Road Terminal "Timișoara – Remetea Mare", promoted by the local authorities, with studies carried between 2011 and 07.2014, with an estimated cost of 18 m Euro; (2) Rail Road Terminal "Craiova", promoted by the local authorities, with studies which will be carried between 2015 and 206, with an estimated cost of 10 m Euro. Both projects are without financing at this moment.
- Bulgaria: There is a project in preparation under the Operational Programme on Transport 2007-2013 to build a new intermodal terminal in Ruse. A feasibility study is ongoing and will be concluded by 2015. The tender procedure shall take place in 2015 with indicative costs of the planned investment of about 26 million Euros and an indicative implementation period of two years.
- Czech Republic: Currently no rail/road terminal projects are underway. However, according information from Czech Ministry of Transport most of the Czech terminals need to be modernised. For this reason a respective funding programme under OPT II has been prepared and is ready for implementation.
- Slovakia: The construction of a public intermodal transport terminal in Žilina - Teplička is included in the Transport Operational Programme 2007 – 2013 and expected to be finalised until 2015. Another public intermodal transport terminal is planned to be built in Bratislava. However, the implementation of this project is currently stopped; a resumption of works will be decided not before 2017. Therefore, the new Bratislava terminal has not been included in the project list.

In total, 14 dedicated rail/road terminal projects have been reported to the consultants in context with these activities (see Figure 89), thereof two studies and twelve projects dealing with infrastructure works.

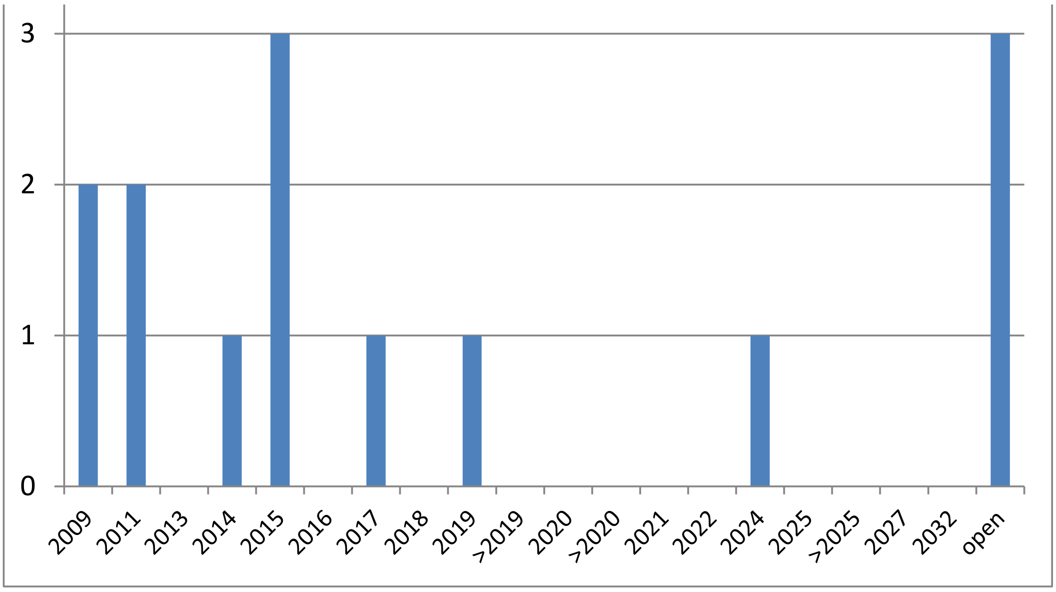
Figure 89: Number of rail/road terminal projects per Member State



Source: HaCon based on ANNEX II, status 11/2014

The four German projects are already finalised from the infrastructural point of view and in operation (see Figure 90). The other rail/road terminal projects are expected to be concluded until 2024. For the Romanian projects and one project in Wien Freudenau no binding finalisation dates were currently available.

Figure 90: Envisaged year of project finalisation – Rail/road terminal projects, all Member States



- *Source: HaCon based on ANNEX II, status 11/2014*

4.5.5 Implementation Road

4.5.5.1 General procedure

The programme of measures includes projects provided by member states, infrastructure managers and other actors. The following sources have been used in relation to road measures:

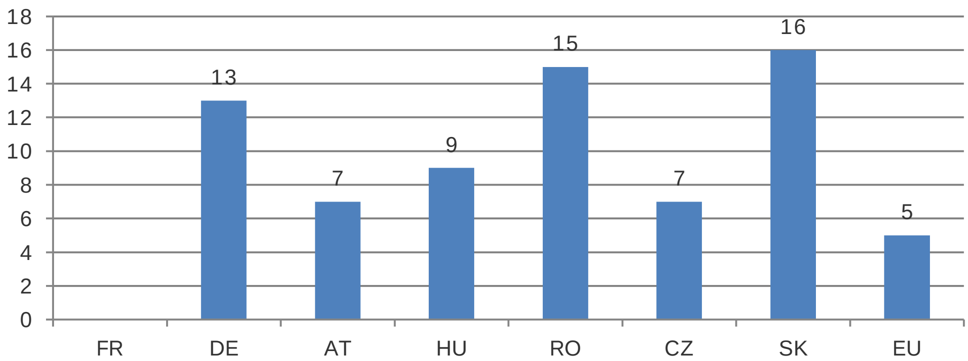
- National strategic programmes of transport development and transport master plans as provided by the Member States CZ, SK, HU and RO
- Annual Progress Report on implementation of Priority Projects, 2012
- Draft Operational Programmes Transport as provided by the Member States
- EU Strategy for the Danube Region, PA1b project data sheets
- Overview on ongoing projects and proposed measures for the actual Bundesverkehrswegeplan and the Investitionsrahmenplan 2011-2015 (Germany)
- Overview on ongoing projects and proposed measures for the Gesamtverkehrsplan 2012, the Rahmenplan 2014 and the draft version 2015 of ASFINAG (Austria)
- Feedback by the representatives of Member States, and Infrastructure Managers of Roads with validation of the project list by the Member States

4.5.5.2 Overview on road projects along the Rhine-Danube corridor

By November 2014, the overall project list for the corridor contains 72 road projects. As Figure 91 points out about 22 % (16 projects) of these projects are located in Slovakia, about 21 % in Romania (15 projects), 18% in Germany (13 projects), 12 % in Hugary (9 projects) and 10 % each in Austria (7 projects) and the Czech Republic (7 projects). Furthermore there are 5 projects where several countries such as Austria and Germany are participating in EU funded study projects.

For France no dedicated project lists could be established for this report thus it is not included in the analysis and the project list in Annex II. Therefore the following analysis doesn’t include any data of France.

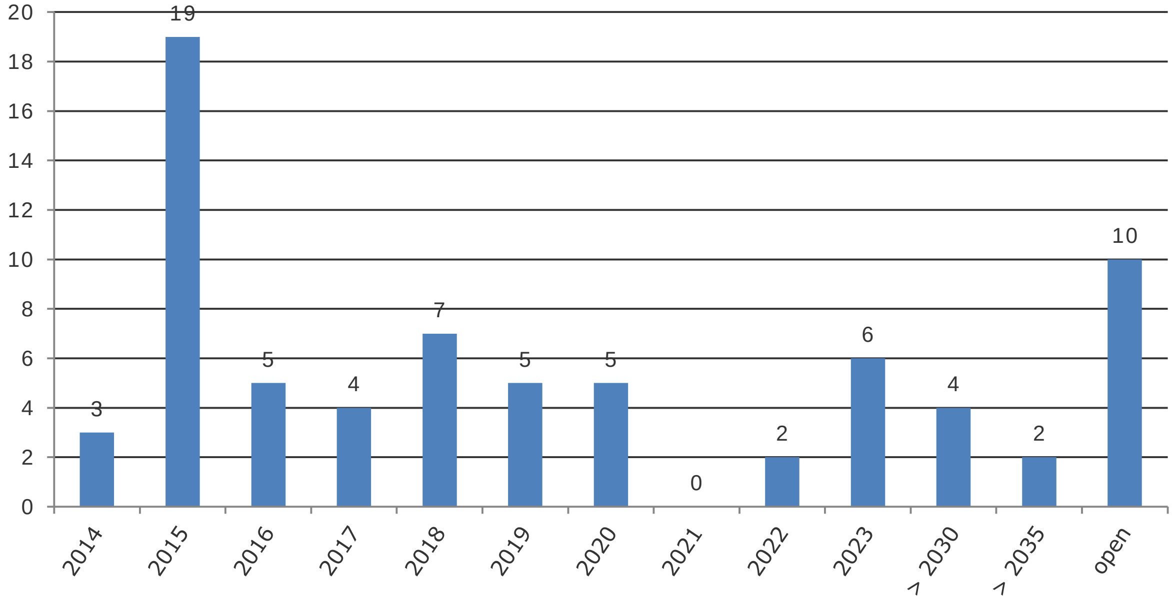
Figure 91: Number of road projects per Member State



Source: iC consulenten based on Annex II – List of projects, status 12/2014

According to the results of the analysis (Figure 92), more than 37% of the projects are planned to be completed in the near future, by year 2016, while 29% of the projects will be completed on a mid-term horizon, between 2017 and 2020. For about 17% of the projects the finalisation period is long term till 2030 and 3% will be finished 2035 latest. In addition for 14% of projects a finalisation date is not yet specified.

Figure 92: Envisaged year of project finalisation - all road projects, all Member States

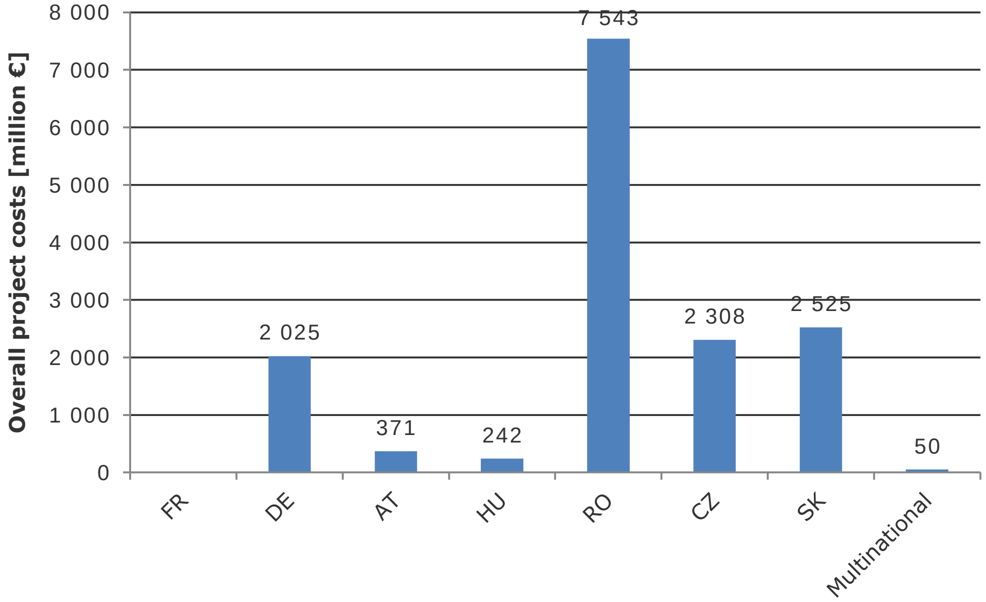


Source: iC consulenten based on Annex II – List of projects, status 12/2014

Having a closer look to the financial figures (Figure 93), the total costs of all road projects amounts to 15.06 billion €, covering a huge range from 1.8 million € to almost 1.3 billion € per project; on average, the budget per project amounts to some 200 million €.

The overall project costs per country vary between 7,754 mn € in Romania and 242 mn € in Austria. Also the presentation of the overall project costs per country gives a heterogeneous picture. According to Annex II – List of projects, the lion's share is assigned to Romanian and Slovakian road projects, (due to greater demand in complying with the core parameter), followed by the Czech Republic and Germany (partly due to capacity issues and partly due to deterioration over the life cycle) and Austria with the smallest amount.

Figure 93: Total costs of all road projects per Member State



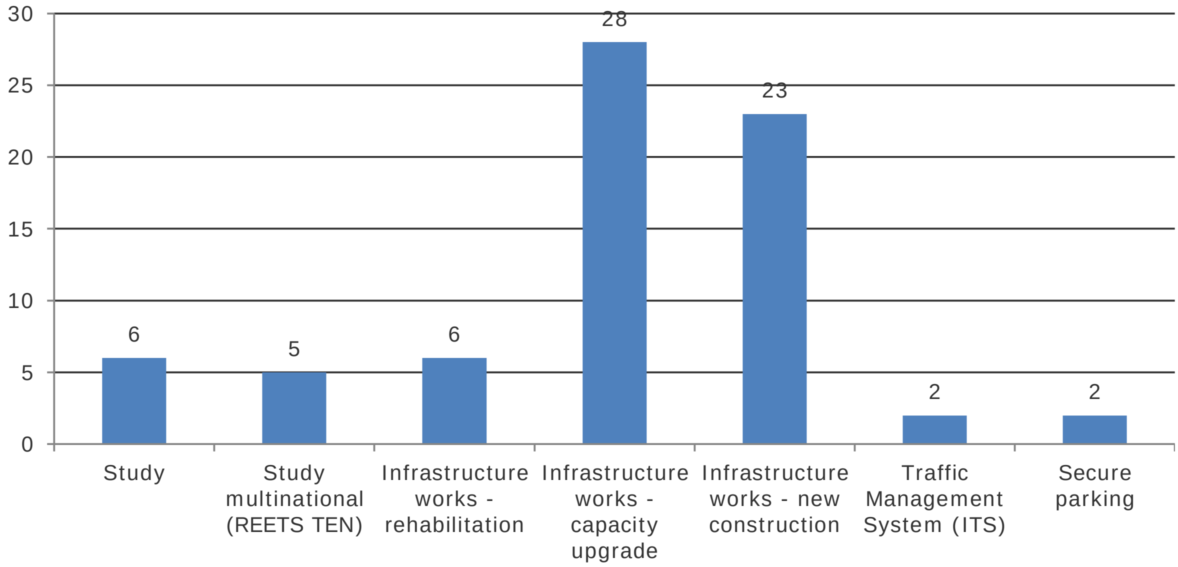
Source: iC consulenten based on Annex II – List of projects, status 12/2014

The allocation of these costs can be splitted into different financing sources, on the one hand state budgets (or budget of the road administration with state guarantee) and on the other hand EU funding. Nevertheless due to missing information or confirmation by all Member States most of the total costs can not be allocated to any financing source.

Regarding the scope of work, the projects have been assigned to seven "scope clusters". These scope clusters have been defined in correspondence to the definitions laid down in the TENtec Glossary and describe the final goal of the project and the purpose of the budget: Thus, the scope "study" means that the final outcome of the project is the elaboration of a study without subsequent infrastructure or other works. For several projects a previous study is included but it is not mentioned severally in the list of projects. Infrastructure works is separated into 3 different scopes: rehabilitation, capacity upgrade and new construction. A rehabilitation project includes work in the context of maintenance together with an upgrading of the standards and a capacity upgrade can be seen as an upgrade of roads due to capacity bottlenecks and or traffic congestion. "Infrastructure works – new construction" means that at the end of the associated projects a piece of new infrastructure will have been built.

The result of this cluster analysis is shown in Figure 94. The scope of road projects mainly concentrates on infrastructure works especially capacity upgrades and new construction of sections. Only 4 projects in the context of ITS and secure parking are actually under implementation.

Figure 94: Scope clusters of road projects, all Member States



Source: iC consulenten based on Annex II – List of projects, status 12/2014

4.5.5.3 Analysis of road projects with reference to the main objectives of the corridor

Detailed analysis of the road projects have been performed with reference to the identified critical issues (see chapter 4.4.5); This refers in a first instance to the core parameters of the Regulation 1315/2013 and the infrastructure requirements of the core network as defined in Art 37 for the roads.

Based on the objectives of the Corridor as defined in Art. 4 and 10 of the TEN-T Regulation, and concretized in chapter 4.4 of the Corridor study, the development of the Rhine-Danube Corridor may prevalently striving for certain aims of TEN-T Corridor development:

- Improving cross-border links, filling missing links and fulfilment of technical compliance
- Enhancing interoperability,
- Assuring intermodality,
- Bottlenecks affecting the entire corridor functionality

These objectives are reflected when categorizing the listed projects:

Table 69: Categorization in the context of objectives

Project category	Description
Technical Compliance	Projects addressing the reduction or mitigation of non-compliant parameters (missing links / physical bottlenecks, technical bottlenecks) on line infrastructure (road type), except last-mile connection
Interoperability	Studies and works addressing compliance with TEN-T Reg. regarding ITS/Tolling system, issues to upgrade existing infrastructure/vehicles and systems with ITS systems
Intermodality	Issues facilitating multimodal transport services for freight and passenger transport regarding last-mile connection (road)

Project category	Description
Capacity bottleneck	Capacity Upgrades e.g. road congestion in urban nodes,
Sustainability / Innovation	Issues regarding negative transport externalities e.g. noise, pollution, accidents; Innovation issues / pilot projects e.g. Alternative Fuels, LNG, e-freight, tracking and tracing

The project list in Annex II has been set up with reference to the corridor objectives and the identified 'critical issues' (see above). These refer in a first instance to the 'core parameters' of Regulation 1315/2013:

- *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 relevant objectives of the road corridor are as following:

- Upgrading of infrastructure equality level to comply with standards set out in the Regulation 1315/2013
- Removal of infrastructure bottlenecks and "filling in" missing links
- Interoperability of national transport networks
- Reduction of external costs of transport (safety, accidents)

In accordance to the objectives listed before, the comprehensive analysis of projects and studies, which are either under way or are planned, identified in total 72 projects and studies, out of which:

- 33 address technical compliance/ core parameter
- 6 address interoperability
- 22 address capacity issues
- 9 improve road safety and
- 2 address alternative fuels.

The categories Intermodality and Sustainability are not included in the list before due to the fact that no projects are planned in the context of these two categories in this chapter and the last mile problems of airports, terminals and ports were excluded from the scope in this chapter and transferred to the chapters dealing with the other nodes.

Most of the above projects are expected to contribute in a positive way to improved sustainability of the road transport. This is especially valid for projects addressing technical compliance/ bottlenecks in general and more particular in urban areas, which enhance traffic safety and decrease harmful emissions in densely populated areas.

The sustainability category should only include road projects aiming at introducing or extending the supply of alternative fuels and improving the efficiency of energy use.

Technical compliance/Bottlenecks

The main bottlenecks identified along the Rhine-Danube Corridor are those related to non-compliant road classes, namely roads without level-free junctions (mainly single carriageway).

Some of the cross-border sections and some national roads form missing links of the Rhine-Danube Corridor as they are not fulfilling the technical requirements of the Regulation. The so called missing links and roads with unfavourable conditions were already displayed in Figure 30 and Figure 31. Especially in Slovakia and Romania there are several sections with critical road conditions which do not fulfil the technical requirements as they are still classified as ordinary roads.

Total 33 projects are addressing technical compliance/bottleneck issues, in addition 4 projects are especially cross border related and 2 projects are relevant for urban areas. The majority of projects are situated in Romania, Hungary Slovakia, and for many projects the time frame varies between finalisation in the next few years and up to 2030. In addition for some projects no start and end date is being confirmed yet.

Total budget of projects addressing technical compliance amounts EUR 10,510.24 million.

In summary it can be stated that on the entire corridor missing links at critical or cross border sections will be solved and technical compliance will be met up to 2030, even though time frame and financing sources will be a subject of debate.

Table 70: Road projects addressing technical compliance/core parameter in cross border sections

ID	Location	Description	Timing	Costs (mn €)	Financing sources
HU25	M15 Rajka – Hegyeshalom Border SK/HU	Construction	2016-**2018**	29.450	CEF
RO63	Craiova (RO) – Calafat (BG)	Upgrade	2014-**2020**	41.5	FEDR
RO64	Droveta Tr. Severin (RO) – Calafat (BG)	Upgrade	2020-**2030**	50.8	FEDR
SK35	Zlín – Žilina cross border (CZ/SK)	Study & Construction	2012-**2015**	TBD	TBD

Source: iC consulenten based on Annex II – List of projects, status 12/2014

Table 71: Road projects addressing technical compliance/core parameter

ID	Location	Description	Timing	Costs (mn €)	Financing sources
CZ47	D1 Praha Jesenice – Brno Ostopovice	Upgrade	2014-**2022**	532.0	45 % public funds, 34 % OPT II CF, 21 % OPT I
SK20	D1 from Hričovské Podhradie to Lietavská Lúčka	Construction	2014-**2018**	483.1	OP Transport and OP Integrated Infrastructure
SK21	D1 Lietavská Lúčka - Višňové - Dubná Skala	Construction	2014-**2019**	400.1	OP Transport and OP Integrated Infrastructure
SK22	D1 from Dubná Skala to Turany	Construction	2011-**2015**	158.85	OP Transport
SK23	D1 from Turany to Hubová	Construction	2016-**2019**	TBD	TBD
SK24	D1 Hubová - Ivachnová	Construction	2013-**2017**	265.3	OP Transport and OP Integrated Infrastructure
SK25	D1 from Jánovce to Jablonov	Construction	2011-**2015**	232.58	OP Transport
SK26	D1 from Branisko to Beharovce	Construction	2020-**2025**	208.32	TBD
SK27	D1 from Fričovce to Svinia	Construction	2011-**2015**	137.68	OP Transport
SK28	D1 Prešov západ - Prešov juh	Construction	2015-**2019**	307.5	OP Integrated Infrastructure
SK29	D1 Prešov západ - Prešov juh	Study	2014-**2015**	TBD	NDS sources

SK30	D1 Budimír – Bidovce	Construction	2015-**2018**	209.0	OP Integrated Infrastructure
SK31	D1 Bidovce - Dargov - Pozdišovce	Construction	After **2020**	TBD	TBD
SK34	D1 Privádzač Lietavská Lúčka – Žilina	Construction	2016-**2018**	74.3	OP Integrated Infrastructure
RO55	A1: Arad- Timişoara	Construction	unknown.- **2015**	384.2	117.7 Cohesion Fund
RO68	A6: Alexandria – Craiova	Rehabilitation	unknown. – **2015**	192.5	FEDR
RO58	Dumbrava – Deva	Construction	unknown – **2016**	600.0	85 % co-financed by Cohesion Fund
RO60	A2: Cernavoda – Constanta	Construction	unknown – **2016**	409.3	67.0 Cohesion Fund
RO59	A1: Orăștie – Sibiu	Construction	unknown – **2017**	715.6	392.8 Cohesion Fund
RO57	Lugoj – Dumbrava	Construction	unknown - **2018**	252.3	172.7 Cohesion Fund
RO56	A1: Timișoara – Lugoj	Construction	unknown - **2019**	293.9	202.85 Cohesion Fund
RO66	Timişoara– Moravița	Upgrade	2014-**2020**	29.5	FEDR
RO61	Sibiu – Curtea de Arges – Pitești	Study	unknown- **2022**	4,170.0	85 % co-financed Cohesion Fund
RO62	Lugoj – Craiova	Construction	2020-**2030**	1.8	Cohesion Fund / FEDR
RO65	Craiova – București	Upgrade	2020-**2030**	103.0	FEDR
RO67	Alexandria – Craiova	Study	2009	1.89	1.42 ISPA

Source: iC consulenten based on Annex II – List of projects, status 12/2014

Table 72: Road projects addressing technical compliance/bottlenecks in urban areas

ID	Location	Description	Timing	Costs (mn €)	Financing sources
HU29	M0 Western section between no. 10 and no. 1	Study	2014-2018	17.74	TOP (KözOP) + ITOP (IKOP); Cohesion Fund
HU30	M0 Western section between no. 10 and no. 1	Rehabilitation	2020-2023	TBD	TOP (KözOP) + ITOP (IKOP); Cohesion Fund

Source: iC consulenten based on Annex II – List of projects, status 12/2014

Interoperability

Important operational bottleneck identified in the analysis phase is the missing interoperability of on-board units for freight road tolling and Intelligent Transport Systems. While advanced road traffic management systems are operational in many places throughout Europe, regional and national ITS services still form a fragmented patchwork. The general objective is national ITS to be mutually compatible, which means a general ability of a device or system to work with another device or system without modification.

As described above each of the countries applying electronic toll collection system has its own system, although all these meet the stipulations of the Directive 2004/52/EC. The only for the moment cross-border cooperating system is established between Germany and Austria.

There is just one study under elaboration addressing the interoperability of the road tolling systems; the Regional European Electronic Toll Service (REETS TEN) for Trucks. The cross-border regional project aims to deploy EETS compliant services in one single OBU compliant with multiple systems. The study is relevant to border and non-border sections, as well as to urban areas.

In compliance with and in support of the existing EC legislation regarding the interoperability of electronic road toll system (Directive 2004/52/EC and the subsequent Decision 2009/750/EC) the ongoing Project (REETS TEN) aims at deploying EETS compliant services in a cross-border regional project. The Project shall cover the electronically toll network of 7 Member States (Austria, Denmark, France, Germany, Italy, Poland and Spain) and Switzerland. From Austria the ASFINAG and from Germany the BMVI are participating in the project.

Regarding ITS two projects with cost details (in Austria and the Czech Republic) are available to install transport devices for traffic monitoring and control on motorways and highways. Germany is also installing or is planning to install ITS on their motorways in the corridor.

All Member States consider in their development plans to establish information systems ensuring the collection, processing and provision of traffic information to the travelling public.

Already established and planned activities comprising the use of transport telematics include the plan to install transport devices for traffic monitoring and control on motorways and highways – traffic survey devices with the function of automatic traffic counting and traffic flow analyser, variable traffic signs, devices for operation information, camera systems, control, supervision and communication systems, etc.

The installation of ITS is also considered as a measure to increase the capacity of roads, in particular in congested areas of agglomerations.

In addition there are three international European projects in the context of ITS. The project called CROCODILE sets up and operates a data exchange infrastructure for the information and data exchange between all involved public authorities and private users involved on safety related information services and truck parking information services. The project shall also foster cross-border ITS applications for travellers. Furthermore follow-ups of the EasyWay initiative (mentionend in chapter 3.2.6.) the European ITS platform (EIP) and EIP+ were launched in 2013 and 2014. The EIP of road authorities and operators aim at enhancing the deployment of harmonised ITS services and the coordinated management of road transport in Europe.

Total budget of interoperability projects planned between 2013 and 2023 amounts EUR 1,364.58 million.

Table 73: Road projects and studies addressing interoperability issues

ID	Location	Description	Timing	Costs (mn €)	Financing sources
EU16	Cross border stations of Motorway network AT, DK, FR, DE, IT, PL, ES	Regional European Electronic Toll Service (REETS TEN)	02/2013-12/**2015**	4.7	50 % TEN-T, 50 % Consortium
EU17	BE, FI, FR, DE, GR, IT, IE, PT, RO, ES, SE, NL, UK	European ITS Platform (EIP): deployment of harmonised ITS services and the coordinated management of road transport	11/2013-02/2015	2.7	EU support: 50 %, Action promoter: 50 %
EU18	DE, GR, ES, FI, FR, IE, IT,	European ITS Platform +	07/2014-	3.76	1,44 States

	NL, PT, RO, SE, UK	(EIP+) ITS interoperability and harmonised deployment	12/2015		Budget, 0.44 Action promoter, 1.88 EU support
EU20	AT, CY, CZ, DE, GR, HU, IT, PO, RO, SI	CROCODILE: sets up and operates a data exchange infrastructure that will be used to exchange data and information between all involved public authorities and private partners: Implement infrastructure and processes, foster cross-border coordination of ITS, provide information services to truck drivers on parking space, implement services for user information on safety critical traffic information, improve the efficiency of traffic flows and reduce congestion, stimulate investment in ITS infrastructure	01/2013-12/2015	31.42	National budget: 20.33; Action promoter: 4.8; EU support: 20%
AT51	Austrian Motorway TEN-T Network (Area Linz and Area Salzburg)	ITS	unknown-end of **2014**	22.0	ASFINAG
CZ52	Czech Republic	ITS	2014-**2023**	1,300.0	n.a.

Source: iC consulenten based on Annex II – List of projects, status 12/2014

Capacity bottlenecks

The main objective of projects addressing capacity bottlenecks is to increase the capacity of the existing road sections in order to serve the expected future road traffic demand.

The identified capacity bottlenecks are mainly located in or close to urban agglomerations due to the overlay of international, regional and local traffic flows. This is especially valid for some of the road network sections in DE and AT. The majority of projects tackling capacity bottlenecks in cross border areas are situated in the Czech Republic.

Total budget of projects addressing capacity bottlenecs are planned between 2013 and 2035 amounts EUR 2,668 million.

Table 74: Road projects addressing capacity bottlenecks

ID	Location	Description	Timing	Costs (mn €)	Financing sources
DE33	A5, AS Offenburg - AS Baden Baden (DE)	Upgrade	ongoing	126.3	public funds
DE34	A8 AS Karlsbad - AS Pforzheim-W (DE)	Upgrade	ongoing	138.2	public funds
DE35	A8 Gruibingen - AS Mühlhausen (DE)	Upgrade	ongoing	65.3	public funds
DE36	A8 AS Pforzheim-N -AS Pforzheim-S (DE)	Upgrade	planned	98.3	public funds
DE37	A8 AS Mühlhausen – Hohenstadt (DE)	Upgrade	planned	399.4	public funds
DE38	A8 Hohenstadt - AS Ulm-Ost, A8 (DE)	Upgrade	planned	237.3	public funds
DE39	A8 Ulm – Augsburg, A8 (DE)	Upgrade	ongoing	197.5	public funds

DE41	A3, Frankfurt-Nürnberg (DE)	Upgrade	2013-**2015**	60.9	90 % public funds, 10 % EU support TEN-T
DE42	A3 AS Wertheim - AS Marktheidenfeld (DE)	Upgrade	tbd	61.4	public funds
DE43	A3, Haseltalbrücke - AS Rohrbrunn (DE)	Upgrade	tbd	60.9	public funds
DE44	A3, AS Rohrbrunn – Kauppenbrücke (DE)	Upgrade	unknown-**2015**	84.5	90 % public funds, 10 % EU support TEN-T
AT46	A1: Matzleinsdorf bei Melk – Pöchlarn	Upgrade	2014-**2017/18**	31.0	ASFINAG
AT47	A1: Pöchlarn - Ybbs	Upgrade	unknown-**2014**	13.0	ASFINAG
AT48	A4: Wien Airport – Fischamend	Upgrade	2014-**2015**	43.0	ASFINAG
AT49	A4: Fischamend – Neusiedl	Upgrade	2018-**2023**	245.0	ASFINAG
CZ51	D1: Kývalka – Holubice	Upgrade	unknown-**2035**	tbd	tbd

Source: iC consulenten based on Annex II – List of projects, status 12/2014

Table 75: Road projects addressing capacity in cross border areas

ID	Location	Description	Timing	Costs (mn €)	Financing sources
DE40	A8 AS Rosenheim –Border DE/AT	Upgrade	2016-**2021** (section 1) 2017-**2023** (section 2)	311.0	Public funds
CZ48	R49 Hulín – Fryšták	Upgrade	2014-**2018**	258.0	Public funds, OPT II
CZ49	R49 Fryšták – Lípa	Upgrade	2017-**2020**	149.0	Public funds, OPT II
CZ50	R49 Lípa – Horní Lideč	Upgrade	unknown--**2035**	tbd	tbd
HU26	M1 Hegyeshalom HU/AT border	Eliminating barriers	2017-2020	17.74	ITOP/IKOP; Cohesion Fund

Source: iC consulenten based on Annex II – List of projects, status 12/2014

Table 76: Road projects addressing capacity in urban areas

ID	Location	Description	Timing	Costs (mn €)	Financing sources
HU28	M0 motorway Southern Section (m1-m5)	Upgrade	2015-2017	70.34	ITOP/IKOP; Cohesion Fund

Most road projects include measures solving the issues of bottlenecks due to capacity overload. Along the whole corridor all Member States are planning on removing capacity bottlenecks on their roads up to 2030. Nevertheless shifting road traffic to other modes will have to be considered due to capacity overload as roads will not be able to cope with future volume of traffic as stated in the Transport Market Study.

Improve road safety

Germany has indicated an extensive programme of development of secure parking areas for trucks and other vehicles, which covers the motorways A3 and A8, A5 and A6 as well. 39 parking areas with an investment volume of 183.7 mn € in the years between 2013 and 2023 shall be constructed.

Also Austria has a programme to improve and construct new secure parking areas. ASFINAG plans to construct 5 new rest parking areas on the corridor motorway between 2015 and 2019 with an investment volume of 12.7 mn €

SK: With regard to growing transport and growth of freight transport share, it is necessary to increase the number of pull-in areas and to modernise rest areas on older sections of the D1 Motorway. Basic requirements for location and equipment of rest areas are set forth in the Concept of Distribution and Equipment of Rest Areas on Motorways and Expressways in the Slovak Republic.

The Czech Republic will also start a project on safety and environment with the main focus on road traffic control systems for traffic safety, equipment for monitoring observance of emission limits and adjustment of accident localities.

Table 77: Road projects addressing safety issues

ID	Location	Description	Timing	Costs (mn €)	Financing sources
DE45	A3, A5, A8, A67	Secure parking improvement	2013-**2023**	183.7	Public funds
AT51	A1, A4, A8, A21	Secure parking improvement	2015-**2019**	12.7	ASFINAG
SK32	D1 Prešov - Budimír	exchange and completion of safety intercepting devices	2016-**2016**	16.0	TBD
SK33	D1 Ivachnová - Važec	exchange and completion of safety intercepting devices	2015-**2016**	32.8	TBD
CZ53	Czech Republic: Core network/comprehensive network	Safety and the environment	2015-2023	69.1	tbd
HU26	M1 motorways Lajta stop	Safety	2015-2016	2.03	ITOP/IKOP; Cohesion Fund
HU31	TEN-T road network HU	Saftey and environment	2015-2015	94.66	ITOP/IKOP; Cohesion Fund
HU32	TEN-T road network HU	Safety and sustainability	2015	8.20	KözOP/TOP + ITOP/IKOP; Cohesion Fund
HU33	TEN-T road network HU	Safety and sustainability	2015	1.50	KözOP/TOP + ITOP/IKOP; Cohesion Fund

Source: iC consulenten based on Annex II – List of projects, status 12/2014

Alternative clean fuel supply

Starting with the development in urban areas there is now a growing and market driven trend to provide service stations for altenative clean fuels also on the long distance connections of the corridor.

AT: the national motorway operator is developing together with other companies a network for services on clean fuels.

DE: Also in Germany alternative fuel supplies regarding e-mobility, LPG and CNG are available on the corridor.

CZ: there is development of establishing gas filling stations and charging stations for electro-mobiles in cities and on the TEN-T network. Czech Republic is in process of preparation of the "National Action Plan for clean mobility" that will serve as a national strategy for promotion of the deployment of alternative fuels. This document is prepared by three Ministries concerned (Industry, Transport and Environment) and will be also basis for further communication with the Commission as regards EU funding in this area and will also serve as implementation tool for Directive 94/2014 on deployment of alternative fuels.

SK: In the long term it will be desirable to deal with the issue of the use of alternative fuels and building of related road transport infrastructure. MTCRD SR in cooperation with NDS created conditions for construction of charging stations for electric vehicles by elaboration of the "Conception of deployment of rest areas on motorways and express ways in the Slovak Republic" (including Supplement No. 1), which envisages the installation of fast charging stations for electric vehicles. The detailed solution at the level of concrete projects and measures will be the subject of phase 2 of SPDTI SR or other relevant strategic documents of SR, if appropriate.

Although there is a general note on alternative fuel the European project, Central European Green Corridors, is the only international project in the context of alternative fuels. It includes studies and projects amining to create a recharging network with countrywide coverage in Austria, Slovenia and Slovakia and connections to Munich and Zagreb.

Table 78: Road projects/studies addressing alternative fuels

ID	Location	Description	Timing	Costs (mn €)	Financing sources
EU19	Austria, Croatia, Germany, Slovakia, Slovenia	Central European Green Corridors – Fast charging cross-border infrastructure for electric vehicles	03/2014-12/2015	7.12	Project promoter: 50%; EU support: 50%
AT52	Austrian Motorway TEN-T Network (AT)	Strategy to safeguard availability of alternative fuels (e.g. CNG, LPG), (study)	unknown	4.57	ASFINAG

Source: iC consulenten based on Annex II – List of projects, status 12/2014

4.5.6 Implementation Airports

This chapter describes the airport related improvement measures on the Rhine-Danube Corridor that are summarised in Annex II – list of projects. The overview includes in particular those projects covering the compliance with the core parameter connection with the rail and road transport infrastructure.

4.5.6.1 General procedure

The gathering of information on airport projects and the consolidation was made according to the following procedure:

A basic list has been generated through the exploitation of official documents such as national Transport Master Plan. The basic list was further discussed with the infrastructure managers of some airports and also with the infrastructure managers of the rail companies, as all the projects on the connection of airports to rail are summarised under rail projects.

Relevant objectives for the airport projects are the

- *Connection to rail network (by heavy rail or urban rail system) and the road network; certain airports have to be connected to heavy rail by 2050*
- *Capacity to make available alternative clean fuels by 2030.*

4.5.6.2 Overview on airport projects

The following airports in the Corridor are planning to improve the connection with the rail and road transport infrastructure of the TEN-T network:

For Frankfurt Airport the construction of the underground line section and the "Frankfurt (M) Gateway Gardens / Airport Terminal 2" station are planned in addition to the already existing connections with regional lines and high speed lines, to further ensure the sustainability of intermodal transport links at Frankfurt Airport.

A connection between Stuttgart airport and the national rail system is also planned. This connection is related to the construction of the Stuttgart central station which shall be completed by 2021.

To increase the accessibility of München's airport by train several local public transport projects are proposed. The construction of the train connection between 'Erding' and München Airport, the 'Erdinger Ringschluss' is one planned project to improve the connection between München city centre and the airport. To improve the connection to the northern parts of east Bavaria, the construction of the "Neufahrner Gegenkurve" is proposed.

Wien Airport: The existing rail station is extended to allow international trains to stop at the Wien Airport; the construction work will be completed by end of 2014. Additionally the connection to the new central station in Wien is under construction as well.

According to information from the Austrian Federal Railways, the construction of the 'Götzendorfer Spange' is no longer pursued. Originally the construction of the 'Götzendorfer Spange' was planned to strengthen the connection between the airport of Wien and the airport of Bratislava. Further research on the connections of the Bratislava airport will be conducted during the next project phase.

Wien Airport has a large interest to improve the long distance rail connections towards the East to Bratislava and Budapest as well as to the North towards Brno and Praha. Another plan is the connection of a future freight terminal South to the rail network for freight trains.

Budapest Airport: .As regards the connection of the airport Ferenc Liszt with Budapest a pre-feasibility study is available evaluating several cases, there is the plan to develop the rail connection.

Praha Airport: As regards rail connection from the Vaclav Havel Praha airport to Praha a feasibility study on the missing 5 km line from Praha – Kladno rail line is now ongoing.

Furthermore construction activities have started in Praha to extend the metro line A from the station Dejvická towards the station Motol (6km with a planned completion in 2014/2015. In a second stage the metro line shall be extended from Motol to Dlouhá míle (4.3km) up to 2017 and in the 3. Phase the metro shall be extended to Letiště Ruzyně (2.5km) with a target date of 2018.

Other airports:

> Romania: According to information from the website of "Henri Coandă International Airport" Bucuresti, the construction of a connection to the highway A3, a rail connection, a subway connection as well as an underground railway/subway station is planned.
>
> According to information of the Nürnberg Airport a direct connection to the highway A3 is planned.

With regard to the Ostrava airport the process of implementation of rail connection project has already started.

Table 79: Planned projects on improvement of airport access

Airport	Rail connections	Project status	Timing	Source
Frankfurt	New terminal 3 (2015 – 2021) shall be connected with new S-Bahn (Riedbahn), time horizon not yet fixed	First planning?	2021	Fraport
Stuttgart	Planned rail station with Stuttgart 21	Depending on progress of project Stuttgart 21	2021	Stuttgart airport
München	Plans for interregional connections: Erdinger Ringschluss and connections of East Bavaria München-Mühldorf-Freilassing (expansion and electrification of this railway line)	Studies, Masterplan München airport	t.b.d.	München airport
München	New tunnel for new railway connection from airport towards the direction of Erding	Studies and works	2022	
Praha	Connect the Václav Havel Airport in Praha to railway transport, both for direct connection of long-distance lines and for the connection to the city centre. (5 km line missing from Praha – Kladno rail line);	Feasibility study	2022	The Transport Policy of the Czech Republic for 2014-2020
Wien	Extension of rail station for international trains to 400 m; Connecting rail line to Wien central station for heavy trains	Construction, completion end of 2014, Construction, completion 2015	2014/15	Website Wien airport
Budapest	Railway connection to the Budapest airport Ferenc Liszt	Prefeasibility study	2019/20	Ministry of National development

Regarding the capacity of airport infrastructure to make available alternative clean fuels to ground services the existing situation and the plans are summarised below:

Frankfurt has the following plan to implement alternative drive technologies: Gradual implementation is planned until 2015. To date the following is deploying

- 8 electric pallet loaders (approx. 5 % of planned 20 %)
- 4 serial hybrid baggage tow-tractors (approx. 3 % of planned 20 %)
- 81 electric conveyor-belt trucks (approx. 86 % of planned 100 %)
- 8 electric cars
- 8 plug-in hybrid vehicles
- 2 electric minibuses
- 1 electric passenger staircase

Up to 15 charging stations are planned for cars

Stuttgart, München and Wien are implementing service stations for e-cars and have a programme to change the ground service fleet to vehicles driven by alternative fuels.

Table 80: Alternative clean fuels (electric, hydrogen. CNG, LNG), alternative technologies

Airport	existing	planned	details	Source
Frankfurt	Electric stations for e-cars, trucks and minibuses	Up to 15 charging stations are planned for cars, testing of 42 electric vehicles in daily operation;	Gradual implementation is planned up to 2015	Website Fraport, Connecting Sustainably – report 2013
Stuttgart	Hydrogen station	Research project e-fleet: Provision of charging stations for e-cars, buses, push back trucks	Target is to operate up to 2050 all airport ground fleet by hydrogen, or electric drives	Stuttgart airport
München	Hydrogen station	Provision of all parking areas of airplanes with installation for preconditioned air		München airport
Praha				
Wien	Electric station for e-cars, gas filling station	Replacement of 100 vehicles by natural gas-powered vehicles	Gradual implementation	Wien airport
Budapest		No information, pending		

Regarding the improvements of flight capacity nearly all core airports on the corridor have projects for the construction of further runways. However this issue was not taken into consideration in this corridor study.

4.5.7 Deployment plan ERTMS

In January 2012, the European Commission adopted Decision 2012/88/EU on technical specifications for control-command and signalling subsystems. Amongst other items, this Decision also contains required timelines for ERTMS implementation of six European corridors (ERTMS corridors A-F). According to the Decision, a corridor is regarded as "equipped" as soon as at least one continuous ERTMS connection along the entire corridor is available. In contrast, neither the ERTMS level nor the exact alignment is specified.

Required ERTMS deployment on the Rhine-Danube corridor according Decision 2012/88/EU

The Rhine-Danube corridor shows common sections with the ERTMS corridors A, B and E. **Fehler! Verweisquelle konnte nicht gefunden werden.** and **Fehler! rweisquelle konnte nicht gefunden werden.** provide an overview of these sections and the corresponding latest year until ERTMS has to be implemented according to Decision 2012/88/EU. This shows that on the western part of the Black Sea branch (France, Germany) the coverage by Decision 2012/88/EU is rather low. On the eastern part of this branch, at least one through-going ERTMS route should be possible between St. Pölten (Austria) and Constanta by the year 2015 (including the sections where ERTMS has already been installed). On the CS Branch only one line segment east of Praha (until Ceska Trebova) is congruent with an ERTMS corridor.

In summary, according Decision 2012/88/EU ERTMS implementation is required by 2015 on the following corridor sections:

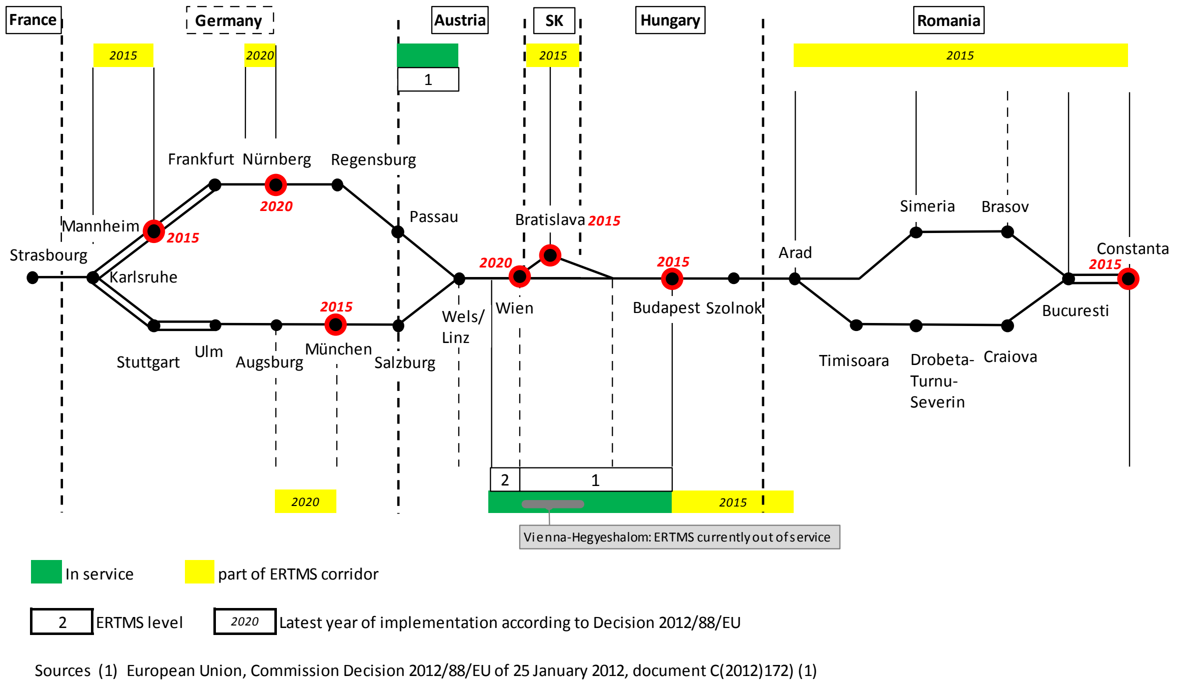
- in Germany between Mannheim and Karlsruhe (Corridor A). Furthermore the nodes Mannheim and München have to be equipped.
- in Slovakia on the section Wien-Bratislava–Hegyeshalom and in node Bratislava (Corridor E),
- in Hungary between Budapest and the Hungarian/Romanian border, also in Budapest node (Corridor E),
- in Romania from the Hungarian border via the entire northern branch to Constanta, incl. Constanta node (Corridor E),
- in the Czech Republic between Praha and Česká Třebová (Corridor E).

Further corridor sections in Germany are demanded for ERTMS implementation until 2020 latest: between Würzburg and Nürnberg and between Augsburg and München as well as in Nürnberg node (Corridor B).

On some sections in the Czech Republic and in Romania, which are currently in the testing phase, these obligations are already fulfilled (cp. **Fehler! Verweisquelle onnte nicht gefunden werden.** and **Fehler! Verweisquelle konnte nicht gefunden werden.**).

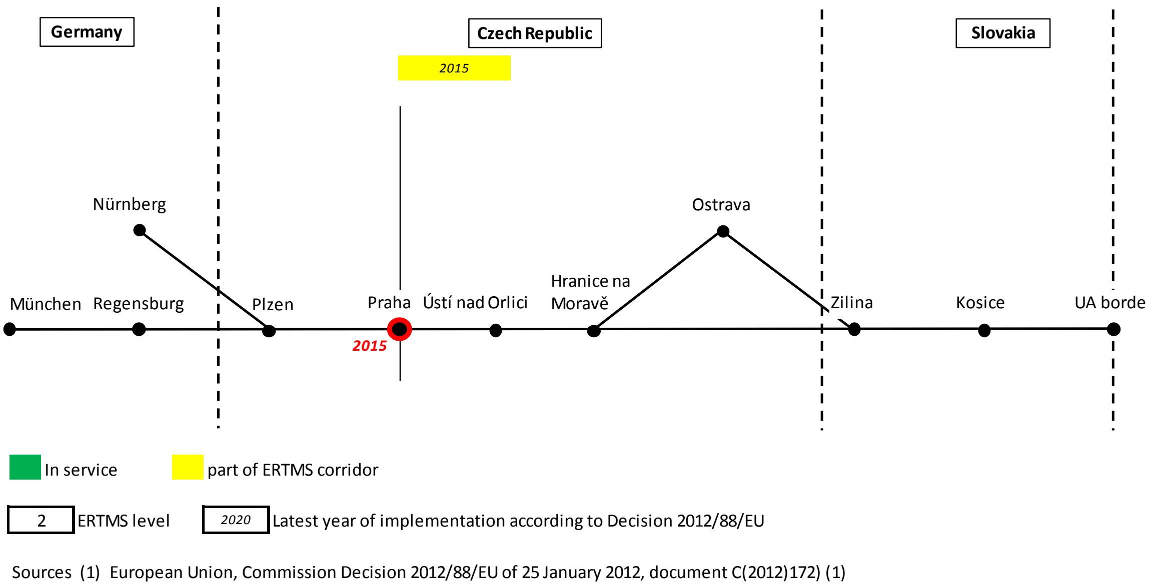
Corridor sections, not covered by Decision 2012/88/EU, have to be equipped according Regulation 1315/2013 until 2030.

Figure 95: Latest ERTMS implementation on the Rhine Danube corridor according to Decision 2012/88/EU – Black Sea Branch



Source: HaCon based on Decision 2012/88/EU

Figure 96: Latest ERTMS implementation on the Rhine Danube corridor according to Decision 2012/88/EU – CS Branch



Source: HaCon based on Decision 2012/88/EU

ERTMS state of play on the Rhine-Danube corridor

The current ERTMS deployment status has already been compiled in chapter 4.3.1. As stated and also displayed in **Fehler! Verweisquelle konnte nicht gefunden werden.**, only on Austrian and Hungarian sections ERTMS has been installed so far.

In fact, the installations on the cross-border section Wien – Hegyeshalom – Budapest can be considered as a best-practice example for international cooperation between ministries, rail infrastructure managers and safety authorities in relation to ERTMS implementation. However, after a testing phase of the ETCS level 1 system on the section Wien – Hegyeshalom, no regular operation has been started for this section. Instead, a study on the ETCS upgrade on this line to level 2 is scheduled for 2015. Based on the current planning status, ERTMS level 2 between Wien and Hegyeshalom is expected after 2019.

Further parts of the corridor - particularly located in Romania - are currently under construction.

ERTMS deployment plan

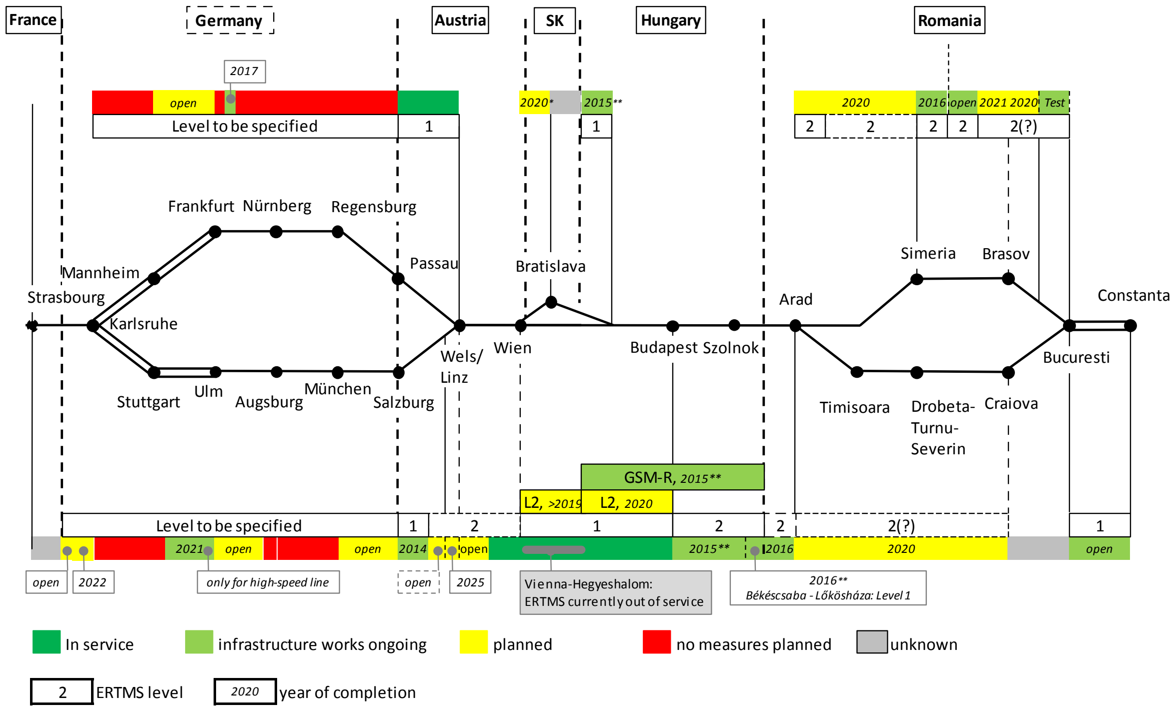
The actual ERTMS deployment planning for the Rhine-Danube corridor is based on the current ERTMS deployment status and supplemented with approved projects provided by the Member States (see *Annex II – List of projects*). The result is displayed in **Fehler! Verweisquelle konnte nicht gefunden werden.** and **Fehler! Verweisquelle konnte nicht gefunden werden.**.

In summary it can be stated that the Black Sea Branch shows the following picture: In France and Germany GSM-R has been implemented on all sections of the corridor as a precondition for the implementation of ETCS level 2. The implementation of ETCS will be done subsequently in the course of line upgrades and new construction projects.

On the eastern part on the Black Sea Branch, dedicated ERTMS projects have been set up for most of those sections, which are not yet equipped. Still in 2014, the section Salzburg-Attnang will be finalised, other sections in Hungary and Romania will follow in 2015/2016. For Hungary the implementation of GSM-R on the entire core network is foreseen until end of 2015. However, the majority of ERTMS projects is still in the planning phase; their finalisation is expected for 2020 or later and thus notably later than the requirements of Decision 2012/88/EU. For some of the corridor sections no year of completion has been defined up to now; partially, the implementation of ERTMS is coupled to the regular displacement of LZB.

Nearly all ERTMS projects refer to the implementation of level 2. As stated before, the upgrade of the section Wien – Hegyeshalom is expected to be finalised after 2019. Respective studies about upgrade to level 2 of the currently employed level 1 are ongoing.

Figure 97: Envisaged ERTMS implementation on the Rhine Danube corridor based on status quo and projects of the Member States – Black Sea Branch



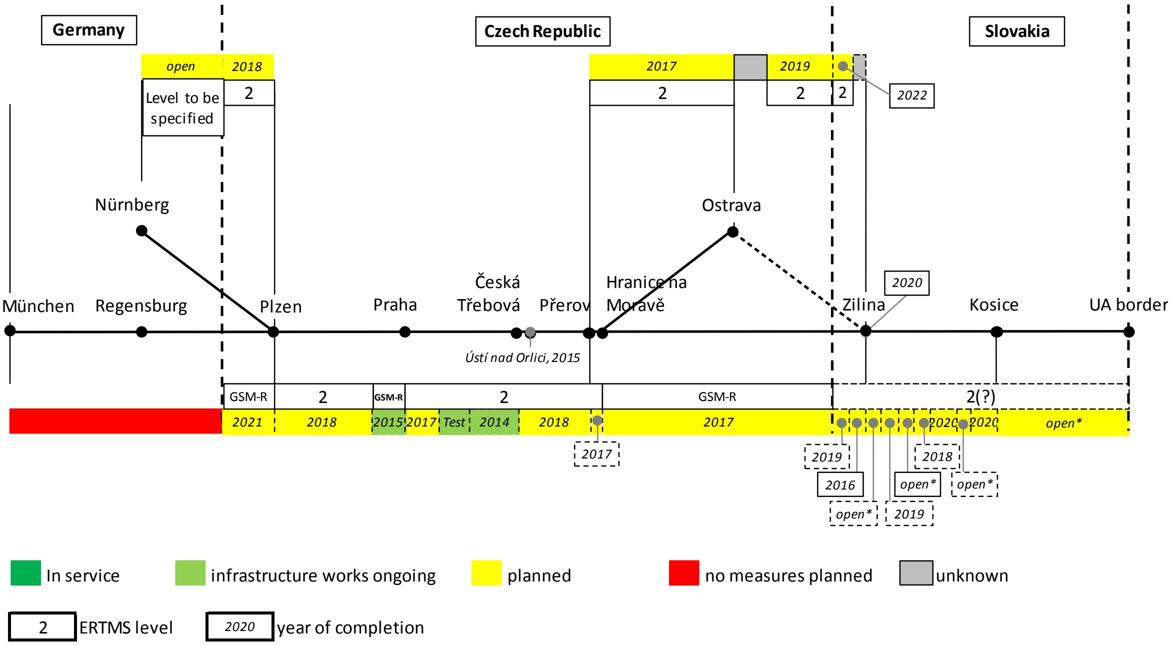
Sources (1) Project list by Member States, unless otherwise noted
(2) * Radek Čech (RFC 9): "Czech-Slovak Corridor"; Presentation Vienna, March 13th 2014
(3) ** Ministry of National Development: Report on the timeline of implementation of ERTMS corridors D and E on the territory of Hungary, March 2013, Update July 2014

Source: HaCon based on Annex II – List of projects

On the CS Branch, nearly the entire alignment in the Czech Republic and in Slovakia is covered with projects for ERTMS implementation (level 2). Most of these activities are currently in the planning phase; however, first sections are expected to be completed in 2014 and 2015. As far as binding deadlines are known, the implementation works shall be finalised until 2022.

For Germany, the CS branch shows the same picture as the Black Sea Branch: between München and the CZ border no concrete short-/mid-term ETCS implementation measures are foreseen (whereas GSM-R has been implemented already). The implementation of ETCS will be done subsequently in the course of line upgrades and new construction projects.

Figure 98: Envisaged ERTMS implementation on the Rhine Danube corridor based on status quo and projects of the Member States – CS Branch



Sources (1) Project list by Member States, unless otherwise noted
(2) * Radek Čech (RFC 9): "Czech-Slovak Corridor"; Presentation Vienna, March 13th 2014

Source: HaCon based on Annex II – List of projects

Outlook

The requirements for the deployment of ERTMS along the corridor are laid down in Decision 2012/88/EU or Regulation 1315/2013. This means that all corridor sections have to be equipped by 2015, 2020 or 2030 respectively. Apart from this it is clear that the best benefits will be generated from through-going cross-border sections with ERTMS. It is therefore obvious that a coordinated approach would be needed on international level.

For this reason the European Commission revised their ERTMS implementation strategy with the breakthrough programme for the period 2015-2016 and the intended proposal for a realistic ERTMS Deployment Plan to be presented until end of 2015. In addition to the EU wide framework, bilateral cross-border cooperation between ministries, rail infrastructure managers and safety authorities is an important issue. This is specifically important for the definition of harmonised operation rules, compatibility of technical ERTMS specifications, coordinated finalisation timelines and coordinated operation management during construction phases.

4.5.8 Deployment plan RIS

The development of River Information Services has to be viewed as work-in-progress, which needs to be done in a European harmonised way. In order to determine the future orientation of River Information Services Policy, the European Commission contracted a "Evaluation of RIS implementation for the period 2006-2011", of which the final report was published in July 2014. A Commission Report and a policy proposal on the further steps are expected as next step.

While the national authorities have implemented traffic-related RIS Services to a great extent, the following main gaps can be mentioned for the Rhine-Danube Corridor[121]:

- Harmonized RIS Deployment is on the way of being achieved at the level of minimum requirements of the RIS Directive and focussing on the needs of traffic authorities and skippers;
- Delays/gaps have been encountered due to (a) lack of budget and human resources at national level leading to severe bottlenecks in capacity for operating RIS and (b) delays in publication of the EC technical specifications for the RIS key technologies and (c) lacking interoperability of RIS infrastructures along the corridor and (d) the fact that some requirements seem to leave room for interpretation at national level and/or are implemented differently or not at all.
- The implementation of additional services beyond the scope of minimum requirements of the RIS Directive depends on the setting of national priorities (e.g. data exchange with logistics stakeholders has been implemented in pilots only in some countries, but is far from being broadly used in the entire corridor); the same applies carriage/reporting requirements (e.g. AIS carriage requirements have been issued only in several countries). In order to overcome this, the amendment of the minimum requirements, but also the harmonisation of the underlying national legislations would be needed.
- Development potential is seen especially in the area of national and international data exchange. While the vessel tracking and tracing in use for traffic management is well advanced, electronic reporting of cargo and voyage data is hardly used on the Rhine-Danube corridor (except on the Lower Main up to Hanau). The RIS Directive requires the forwarding of cargo and voyage report in case of cross-border transport, but due to technical, organisational and legal hindrances, this is not yet possible throughout the entire corridor. In the future, also the one-stop-shop for electronic reporting could be envisaged; this way additional user groups (ports, statistics, customs, etc.) could be served.
- Quality of Service parameters for RIS services and RIS reference data are under development within IRIS Europe 3. These parameters are neither yet fully defined, nor implemented in the Rhine-Danube corridor. Some of these service parameters could/should be taken into account, in case that the RIS Directive is amended.
- In some of the countries, additional attention needs to be placed on ensuring stable conditions for the RIS operation. Difficulties in this respect mainly relate to a shortage of qualified staff, but also a lack of budgets for RIS operation.
- As the Danube countries were among the frontrunners, some systems are close to the end of their operational period and will need to be replaced as of 2014-2020.

The next steps for the development of River Information Services in the Rhine-Danube Corridor will need to be based upon the following inputs:

[121] *Information based upon an expert interview with Bernd Birklhuber (Austrian Ministry of Transport, Innovation and Technology) and Mario Sattler (via donau) on 21.5.2014.*

- The main gaps as well as the the expected, forthcoming possible amendments of the Directive 2005/44/EC and the related technical specifications.
- The results of the TEN-T studies "Implementation of River Information Services in Europe 1-3" and "RIS enabled Corridor Management".

Considering the advanced state of the national infrastructure in the Rhine-Danube Corridor and of the cross-border nature of the outstanding challenges, it is recommended to deal with outstanding challenges in a joint initiative, possibly even across the boundaries of the Rhine-Danube Corridor. If a decision is made to address the outstanding challenges in a harmonized way, the Connecting Europe Facility is a recommended as a co-financing instrument not only for the EU Member States, but also for neighbouring countries. Such joint initiative could include the following elements:

- Implementing the results of the TEN-T Study RIS-based Corridor Management
- Evolution of RIS Standards and enhancement of (inter-)national RIS data exchange
- Implementing the provisions for achieving the defined Quality of Information Services

In addition, as the national RIS providers started the RIS deployment quite early, re-investments will become necessary from 2014-2020 whereas in some countries, more attention will need to be placed on ensuring stable conditions for RIS operation.

4.5.9 Summary of project list

The list of projects in Annex II - List of Projects of the corridor study contains those projects on the Rhine Danube core network corridor, which are essential to fulfil the infrastructure requirements of the TEN-T regulation and the general priorities by 2030.

Therefore projects dedicated to the comprehensive network, last mile connections in urban areas and infrastructure rehabilitation are not included in the project list.

From the total of 338 projects about 40% of the projects refer to rail infrastructure measures including the deployment of ERTMS and rail connections to airports.

15% of the projects are dealing with the improvement of inland waterways infrastructure.

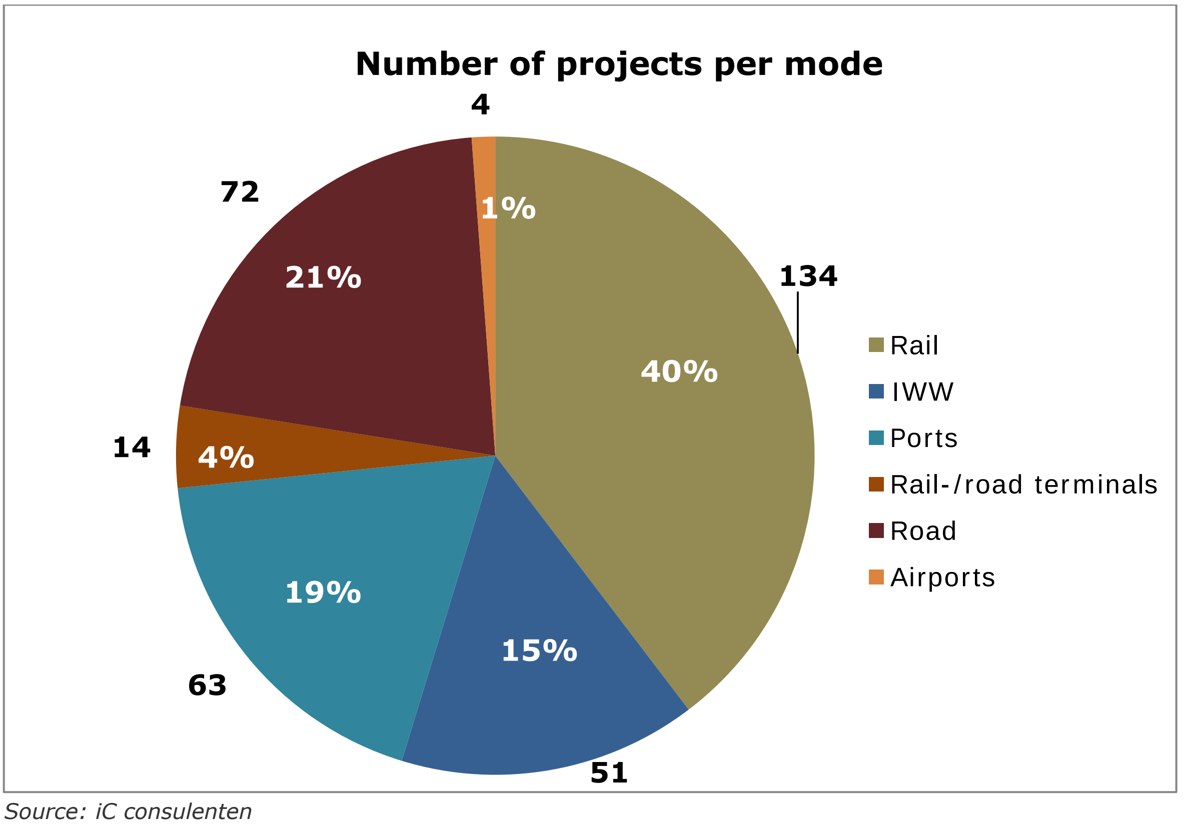
19% of the projects include the measures for the port development, including sea port and inland waterways ports.

4% of the projects are dedicated to the Rail/Road Terminals to improve the intermodality characteristics of the corridor.

21% of the projects are related to the improvement of roads, including projects for ITS and secure parking projects for trucks.

A few projects for airports are included in the list (1%).

Figure 99: Number of projects per mode

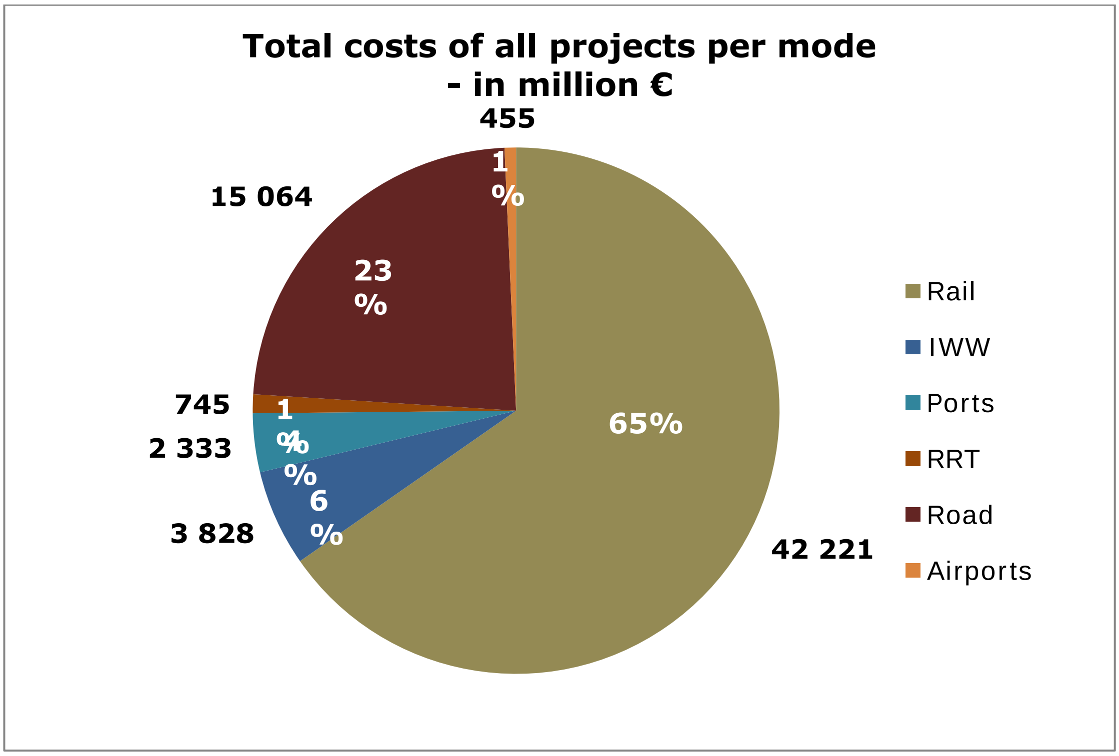


Source: iC consulenten

To the largest possible extent information on the investment costs for the listed projects were collected. In total an investment volume of 64,646 million EURO is estimated. Depending on the maturity of the projects and the information from the

Member States and the stakeholders it was possible to add the information on secured financing to the projects. The largest investment volumes are dedicated to rail with 65%, then for roads with 23%, for Inland waterways with 6%, for ports with 4% and the two other transport nodes with 1% each.

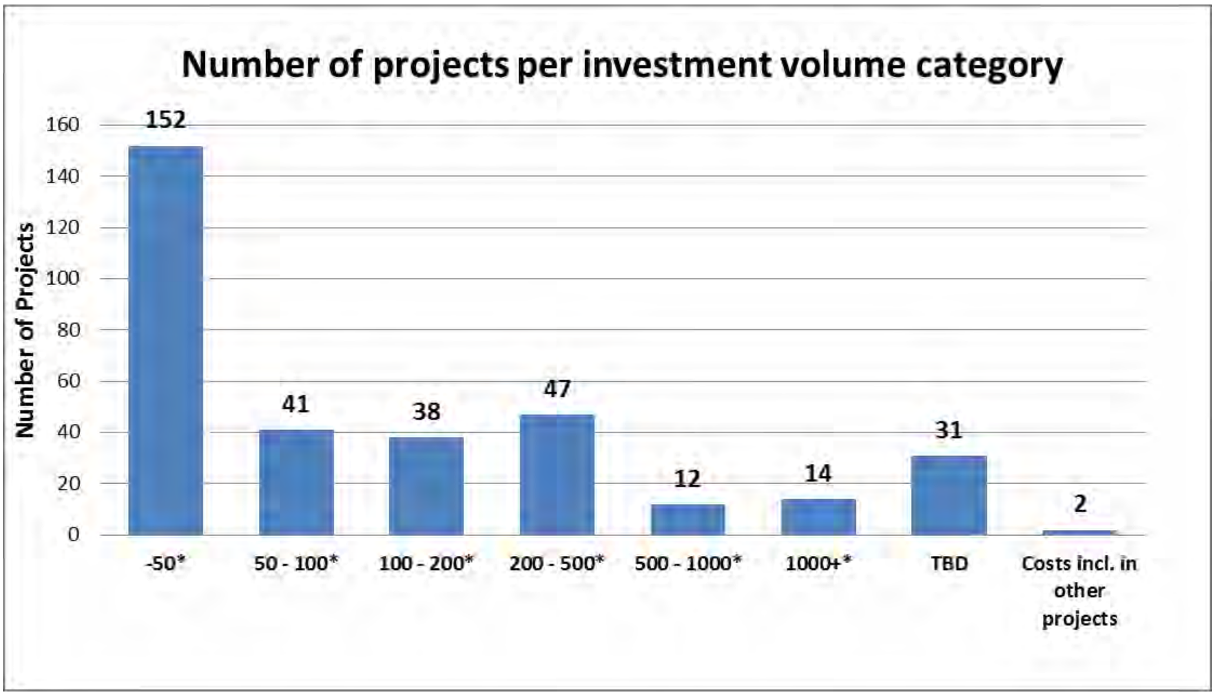
Figure 100: Total project costs per mode



Source: iC consulenten

When analysing the project costs in the project list of Annex II a selection of the projects according to categories of investment volumes provide a further interesting picture. The majority of the listed projects have an estimated investment volume of up to 50mn€ (152 projects, or 45% of all projects). About 12% of the projects are falling in the range between 50 and 100mn €. 11% of the projects are located in the range between 100 and 200mn€. About 14% of the projects are falling in the range between 200 and 500mn€. 4% of the projects have an estimated investment volume between 500 and 1,000mn €, and 4% of the projects have an investment volume of more than 1,000mn€.

Figure 101: Investment volumes categories



Source: iC consulenten