Orient/East-Med

Core Network Corridor Study

Final Report

December 2014

Disclaimer

The information and views set out in this Report are those of the author(s) and do not necessarily reflect the official opinion of the Commission. The Commission does not guarantee the accuracy of the data included in this study. Neither the Commission nor any person acting on the Commission's behalf may be held responsible for any potential use which may be made of the information contained therein.

Table of content

Figures

Tables

Abbreviations

bln	Billion
CBA	Cost/Benefit Analysis
CEMT class	Classification of Inland Waterways
CNC	Core Network Corridor
CNG	Compressed Natural Gas

DG MOVE	European Commission – Directorate General for Mobility and Transport
EC	European Commission
EIA	Environmental Impact Assessment
ERTMS	European Rail Traffic Management System
ETCS	European Train Control System
EU	European Union
GDP	Gross Domestic Product
GSM-R	Global System for Mobile Communications - Rail
IM	Infrastructure Manager
IU	Infrastructure User
IRU	International Road Union
IWW	Inland waterway
Jct	Junction
km	kilometre
LPG	Liquefied petroleum gas
m	metre
mln	Million
MC	Major Cities & agglomerations
MoS	Motorway(s) of the Sea
MS	Member States of the European Union
MTMS	Multimodal Transport Market Study
n.a.	not available / not applicable
NA	National Authority
NGO	Non-governmental organization
NUTS	Nomenclature of statistical territorial units (in EU)
O	Other (stakeholders)
OEM	Orient / East-Med (Corridor)
PAX	Passengers
p.a.	per year / annual
PP	Priority Project
RA	Regional Authority
RFC	Rail Freight Corridor
TBD	to be defined
TEN-T	Trans-European Transport Network
TMS	Traffic Management System

Country Codes after ISO 3166:

AT	Austria
BG	Bulgaria
CY	Cyprus
CZ	Czech Republic
DE	Germany
EL	Greece
HU	Hungary
RO	Romania
SK	Slovakia

1 Information on the Study

1.1 Consortium information

The study on the Orient / East-Med Core Network Corridor is conducted by a group of international consultants, led by iC consulenten. The Experts involved are listed below:

iC consulenten Ziviltechniker GesmbH	AT	Albrecht MALCHEREK (Head of Study Team), Sebastian STEINBRECHER, Roland HACKL
Panteia B.V.	NL HU	Arnaud BURGESS, Simon VAN DER REE, András TIMAR
Railistics GmbH	DE RO	Ferdinand STUMPF, Raluca ATANASSOV
ITC Institute of Transport and Communication OOD	BG	Kristiana CHAKAROVA, Zoia DIMITROVA
SYSTEMA Transport Planning and Engineering Consultants Ltd.	EL	Panayota MORAITI, Dimitris TSAMBOULAS (†)
Prodex d.o.o.	SK	Marek LUKAČ, Alexandra MURGOVÁ
University Politehnica of Bucharest	RO	Mihaela POPA
PricewaterhouseCoopers Advisory SpA	IT CZ	Diego ARTUSO, Marco AVOLIO Libor ČECH

This Study has been elaborated for and in close cooperation with:

the European Coordinator for the Orient/East Med Corridor:
- Mr. Karel VINCK (interim, until June 30th, 2014)
- Mr. Mathieu GROSCH (from July 1st, 2014)

and the European Commission, DG MOVE, Unit B.1, Brussels, Belgium, represented by
- Mr. Philippe CHANTRAINE, Advisor of the Coordinator until Sept 30th, 2014, and
- Mr. Patrick VANKERCKHOVEN, Advisor of the Coordinator from Oct 1st 2014
- Mr. Herald RUIJTERS, Head of Unit

1.2 Background

The new guidelines for the development of the Trans-European Transport Network (TEN-T Regulation No.1315/2013) have introduced the new TEN-T Core network corridors. The guidelines lay down the requirements for the management of the infrastructure and the priorities for the development of the TEN-T network, which is designed to cover all Member States and regions as well as all transport modes. The Core Network Corridors, which will be headed by the European Coordinators, are the new implementation tool of the TEN-T Guidelines. Achieving cross-border connections in a multimodal and interoperable way are the three fields that are the remit of the new Corridors.

The basis for the TEN-T Core Network Corridors is the following:

- Until 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 is the basis for the new Corridors, wherever possible.
- Of the 9 Rail Freight Corridors provisioned by Regulation (EU) No. 913/2010, the one formerly designated as No. 7 has already been created, and has become operational in 2013. As all Rail Freight Corridors, it has been integrated into the Core Network Corridors by aligning its name and primary route to the respective Core Network Corridor, in this case, Orient / East-Med. 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 (EDP) have also been integrated into the new policy
- Other types of corridor 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, Mr Mathieu Grosch, will draft the Corridor Work plan, which will indicate the development of the corridor, and receive approval of the Member States involved. This is a step that will allow the focusing of attention on the most important actions to be undertaken along the Orient/East Med Corridor, which will also most probably remain priorities for a long(er) period of time.

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

1.3 Corridor Forum

1.3.1 Corridor Forum Meeting 1/2014

The 1st 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 Precise Alignment of the OEM 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, deemed as a basis for establishing the Multimodal Transport Market Study (MTMS);
- 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, which was further ongoing.

1.3.2 Corridor Forum Meeting 2/2014

The objectives of the 2nd Corridor Forum held in Brussels on 17.06.2014, similar to the focus of the first meeting were:

- Presentation of the status of the corridor study elaboration to the representatives of Member States and of Stakeholder institutions
- Discussions on the achieved progress including joint agreement on:
  - the outline of the corridor and the correctness of the corridor characteristics described in the 2nd Progress Report ;
  - the completeness of the list of studies collected and analysed by the Consultant;
  - the list of identified Critical issues (bottlenecks needing Coordinator's involvement);
  - the first results and methodology of Multimodal Transport Market study (MTMS);
  - the methodology used for the development of the work plan and the upcoming steps.
- Start of cooperation with the Management Board of Rail Freight Corridor 7 (RFC7).

The meeting was held with:

- the representatives of the EU Member States responsible for the TEN-T policy and implementation of high-ranking transport infrastructure along the Core Network corridors;
- the Railway Infrastructure Managers including the representative of Rail Freight Corridor "Orient /East Med" (RFC7);
- the Stakeholders of the Inland Water Transport (ports and IWW) [1];
- the Stakeholders of the Maritime Transport (seaports and Motorways of the Sea).

Starting on 01.07.2014, Mr. Mathieu Grosch was appointed as European Coordinator for the Orient/East Med Core Network Corridor.

1.3.3 Corridor Forum Meeting 3/2014

The 3rd Corridor Forum on 30.09.2014 in Brussels took place with a broadened participation, additionally comprised of

- the Motorway Infrastructure Managers,

[1] Based on decision made in the 1st Corridor Forum, in terms of IWW the OEM Corridor Study and Corridor Fora focusses on the Elbe / Vltava Inland Waterway, while the Danube is addressed in the Rhine-Danube Corridor Forum (see also General Note in section 5.2.3.1).

- the Airport Infrastructure Managers,
- representatives of the Regional Authorities.

The meeting focussed on the presentation and discussion of preliminary results of the Corridor work plan, notably:

- the draft final results of the Multimodal Transport Market study;
- the national list of corridor-relevant infrastructure projects and operational measures and their scheduling and potential funding (Implementation Plan);
- the deployment plan of ERTMS and RIS;
- the finalized characterization of the Corridor infrastructure including the TENtec data collection and presentation.

The 3rd Corridor Forum was accompanied by a Working Group meeting with the Representatives of Seaports (Germany, Bulgaria, Greece, Cyprus), during which the importance of the Orient/East Med Core Network Corridor as hinterland connection, as well as the topic of Motorways of the Sea were discussed with the Coordinator.

1.3.4 Corridor Forum Meeting 4/2014

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 Corridor regarding:

- Characteristics of the multimodal corridor infrastructure and bottlenecks/missing links/critical issues;
- Characteristics of the corridor traffic, based on the MTMS results;
- Objectives of the Orient/East Med Core Network Corridor;
- Implementation plan / List of projects per mode;
- Outlook to the structure of the Corridor Work Plan as separate document, issued by the Coordinator;
- Next steps in the upcoming period 2015 – 2016.

Prior to this meeting a working group on the Regions was set up, whereby regional topics were specifically collected and the Coordinator discussed issues, such as regional cross-border activities and traffic development in urban nodes. Similar to the group meeting with the Seaports, these meetings shall be resumed in the next period.

1.4 Content and Structure of the Report

The present study constitutes the first part of a more extensive and long-term process of the implementation of the TEN-T Regulation 1315/2013 and the CEF Regulation 1316/2013. In the initial phase of this process, "Studies on the TEN-T core network corridors", aiming at providing a general overview of the Orient/East-Med Core Network corridor, were elaborated in order 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 OEM 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 2015-2017 period.

The Study on Orient / East-Med Core Network Corridor (OEM) has been ordered by the Directorate-General Mobility and Transport of the European Commission in December 2013. The awarded Transport Consultants' consortium under the lead of iC consulenten (see Consortium information in section 1.1), presents this document as the Final Report including Annexes.

This **Final Report** provides the results of the Corridor Analysis with the characteristics of multimodal transport infrastructure as well as the market-related transport flows, the corridor development objectives and the implementation schedule (cf. Figure 1), being the most significant results and outcomes of the working period from January to December 2014[2].

It also comprises all project information provided and coordinated with the Member States. More specifically, it provides an analysis of the projects regarding scope of measures, maturity / status as well as costs and funding sources. Furthermore it examines whether these projects are compliant with the identified critical issues. The above results were finally validated by the Member States for the Final Report.

The Final Report includes a number of comments and inputs given by the Stakeholders during and after the 2nd, 3rd and 4th Corridor Forum meetings.

The final comments made by the MS representatives and Stakeholders in the 4th Corridor Forum or received in writing until the end of November 2014 have been appropriately considered by the Consultant when producing this Final Report. The finalised report was sent by the Study team on 5th December 2014 to the Technical Advisor of the Coordinator.

Parts of this study report will be used for the **OEM Corridor Work Plan**, a separate document issued by the Corridor Coordinator in December 2014.

[2] Additional documents of this process are the Minutes of Corridor Forum Meetings.

In line with the contractual and scheduled requirements of the study elaboration, this document follows the common structure[3] for all 9 Corridor studies conducted in parallel during 2014 and presents:

- INFORMATION ON THE STUDY AS SUCH; containing any information on progress in carrying out the study (e.g. in data collection, further steps to be taken, consortium information, etc.).

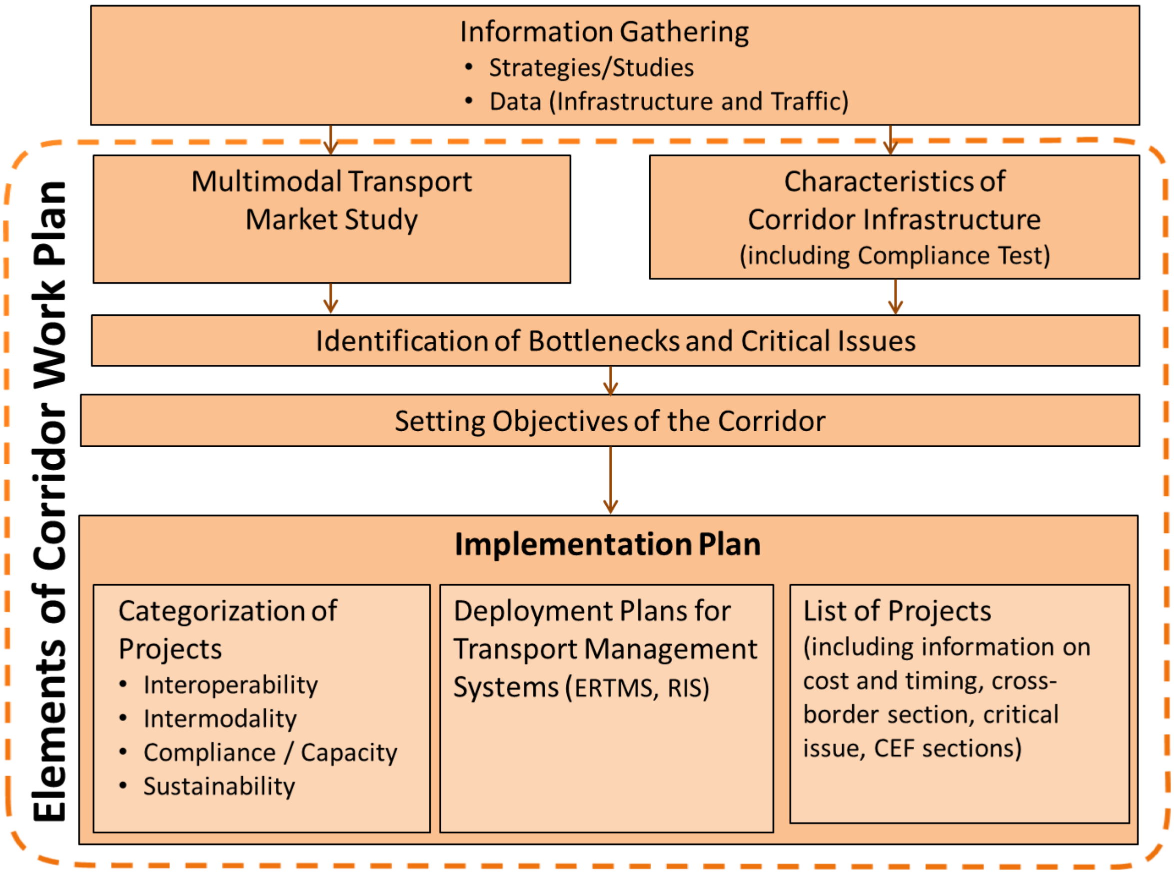
- IDENTIFICATION OF STAKEHOLDERS; identified to be relevant to the Corridor, not limited to the participants of the Corridor Forum.

- REVIEW OF STUDIES; with overall conclusions, in addition to the analysis/summary of the individual studies

- ELEMENTS OF THE WORK PLAN;
  - Description of the characteristics of the corridor:
    - a description of the technical parameters of the infrastructure for each transport mode;
    - the Multimodal transport market study (MTMS);
    - the identification of critical issues along the corridor (cross border sections, bottlenecks, interoperability, intermodality, operational and administrative barriers).
  - Objectives of the Core Network Corridor; in line with TEN-T regulation No.1315/2013 Article 4. Key Performance Indicators (KPI) were identified, which are measurable and based on existing statistics.
  - Implementation:
    - A list of projects (with an annex containing detailed standardised information per project) with the investment cost required and the envisaged sources of financing;
    - A deployment plan for traffic management systems (in particular ERTMS and RIS);
    - A plan for the removal of physical, technical, operational and administrative barriers between and within transport modes and for the enhancement of efficient multimodal transport and services:
    - Other elements as referred to in Art 47 paragraph 1.

[3] Common Structure for the third Progress Report; as requested by Stakeholders and Member States

Figure 1: Overall work flow of the Corridor Study



1.5 Data Collection

In parallel to the production of this study, the Consultants team was requested to update the TENtec information system[4] with technical infrastructure parameters and traffic flow data[5].

Table 1: Responsibility for TENtec Data Upload among Consortia (Selection OEM)

Core Network Corridor Study Team		Responsibility for TENtec Upload
1	Baltic-Adriatic	– Přerov node – Přerov – Břeclav – Wien (Rail) – Přerov – Brno – Wien (Road)
2	North Sea-Baltic	– Berlin node, Magdeburg node – Bremen Node – Bremen-Bremerhaven/Wilhelmshaven – Magdeburg – Hannover – Minden (IWW) – Hamburg – Berlin (Rail); Hamburg - Wittstock (Road)
4	Orient/East-Med	– Brno-Bratislava – Elbe and Vltava inland waterway – Magdeburg – Dresden – Berlin – Dresden – Border CZ (except Berlin Ring) – Border DE - Praha - (Česká Třebová) - Brno – Budapest-BG border (without Budapest node)
5	Scandinavian-Mediterranean	– Helsinki node – Hamburg/Bremen – Hannover – Hamburg Node, Hannover Node – Rostock node – Rostock – Berlin (Rail); Wittstock-Berlin – Leipzig Node
9	Rhine-Danube	– Česká Třebová - Přerov – Budapest node, Wien node, Bratislava node – Wien-Bratislava-Budapest – Danube ports and IWW

NB: "node" covers the relevant inland ports, seaports, airports and rail-road terminals. Links are to be considered multimodal, unless otherwise indicated.

For the transport modes and sections of the OEM Corridor that are within the responsibility of the Orient/East-Med Corridor Study Team the latest available data has been uploaded to the TENtec system. A remaining problematic issue is the update of traffic flow data for freight and passenger transport. In most cases this data is not collected for the parameters required in TENtec, or related data is considered as sensible information that cannot be published. In this regard, alternatives were discussed with the Stakeholders and these discussions are meant to be continued.

[4] TENtec is available under http://ec.europa.eu/transport/themes/infrastructure/tentec/

[5] In the overlapping sections (cf. section 5.1.5), the Consultants team has made additional agreements of sharing responsibility with other Consultants consortia in June 2014.

2 Identification of Stakeholders

2.1 Background / Methodology

The Regulation No.1315/2013 stipulates the role of the consulting Corridor Forum to assist the Corridor Coordinator in preparation and further implementation of the Work Plan. The Forum shall consist of all directly concerned stakeholders of the Corridor projects of common interest. These may be entities other than Member States, which may include regional and local authorities, managers and users of infrastructure as well as industry and civil society. The ToR is even more specific in listing the potential stakeholder, namely: infrastructure managers, ports, airports, rail-road terminals, users and other depending on the specific Corridor.

The Consultant identified stakeholders primarily based on:

- Geographical scope and Corridor alignment;
- Consultant's knowledge, networks and working experience in all countries along the OEM Corridor;
- Additional desktop research;
- Analysis of relevant studies and considering the current initiatives, such as:
  - PP7 and PP22;
  - ERTMS corridor E;
  - RFC 7.

The above exercise resulted in a data base of relevant stakeholder entities per country classified into the following main groups:

- Transport mode (rail, road, IWW, maritime, air, intermodal) further categorized as:
  - Infrastructure managers;
  - Independent regulatory bodies (where relevant);
  - Infrastructure users; due to the very large number only associations of users were included in the final list and clustered as "other", with exemption of successors of the former integrated national railway companies
  - "Other", which includes associations and/or unions of infrastructure managers and/or users.
- All modes or no mode specific:
  - National administration
  - Regional administration and bodies
  - Major cities and city agglomerations
  - Civil society, further divided into groups of:
    - Chambers of Commerce and Industry and/or similar organizations that represent the potential transport clients/ shippers, such as big industries
    - Environmental NGOs
    - Euro-regions and network of cities.

For each of the identified stakeholder entities, the Consultant collected a standardized set of data that includes:

- Institution/entity name (in local language and in English);
- Postal address;
- Website;
- Representative/s, for which the following information was collected:
  - Name and position/ department within the entity
  - E-mail address
  - Telephone and fax numbers.

All the above data were recorded in an Excel data file that provides for fast and easy review, selection and analysis of the information. The exercise resulted in a large number of stakeholders, whose involvement and relative importance for the OEM activities is different.

This is the reason why, based on its experience in similar assignments, the Consultant made a first estimation about the role of the stakeholders in the Study period, i.e. providing information, review and/or revision of Study reports and participation in the Corridor Forum meetings. Within the process of proposing to the Corridor Coordinator and to the Member States the draft lists of participants for the next CFs the stakeholders' data base was being continuously updated with the feedback received from the Ministries of Transport of the Member States.

As of the submission date of this Report the OEM Corridor stakeholders' list consists of 464 individuals and 351 entities, as summarised in the next table.

Table 2: Identified OEM relevant stakeholders per MS and relevant transport mode

MS	Total	Rail	IWW	Mari-time	Road	Air	Inter-modal	All modes
AT	**23**	6	3	-	1	1	1	11
BG	**50***	4	4	3	3	2	3	32
CY	**12**	-	-	4	1	2	1	4
CZ	**39**	5	7	-	2	3	1	21
DE	**50**	5	6	13	1	3	4	18
EL	**61**	5	-	15	5	4	4	28
HU	**38**	4	5	-	2	2	2	23
RO	**31**	5	4	-	4	2	1	15
SK	**23**	3	3	-	3	1	2	11
Trans-national	**20**	4	5	1	2	2	2	4
Projects	**4**	2	-	-	1	-	1	-
Total	**351**	**43**	**37**	**36**	**25**	**22**	**22**	**167**

* In Bulgaria one entity is responsible for both maritime and IWW ports

The process of elaboration of the Study on the OEM CNC, leading to the Coordinator's Work Plan, required an integrated approach to identify and to gradually involve the stakeholders in the Corridor Forum meetings. In this respect, the overall approach to the involvement of the stakeholders in the Forum activities was gradual and selective:

- 1st Corridor Forum Meeting: Member States
- 2nd Corridor Forum Meeting: Member States, rail, IWW and maritime infrastructure managers/ providers
- 3rd and 4th Corridor Forum Meetings: Member States, rail, IWW, maritime, road and air infrastructure managers/ providers and regional authorities.

According to the decision of the TEN-T Committee taken on June 18, 2014, consultation of civil society, user organisations and representative organisations will be done by the Coordinators outside the formal Forum meetings of 2014, possibly when being on mission in the different Member States and/or through other events along the corridor.

Based on the above long list of OEM Corridor stakeholders, the Consultant drafted shorter sub-sets of the relevant stakeholders to be gradually involved in the CFs. In advance of each Corridor Forum Meeting, the lists of stakeholders identified by the Consultant were submitted to the Corridor Coordinator and to the Member States for their approval. Annex 8 presents stakeholders per transport mode and country.

2.2 Rail Sector (incl. ERTMS)

Railway infrastructure and services are available in all OEM Corridor countries, except Cyprus. Typically the railway stakeholders include representatives of one national Infrastructure Manager (in Hungary there are two IMs), one or more freight operators or associations representing these, an independent regulatory and/or capacity allocation body and other interested parties.

In addition to the national stakeholders the Rail Freight Corridor 7 was identified as important transnational player.

The total number of identified rail stakeholders' representatives amounts to 73 individuals, which would make the group difficult to manage. For the second and the two following Corridor Forum meetings the Consultant proposed to limit the number of entities to 12, as presented in Annex 8. The proposal was agreed by both the Corridor Coordinator and the Member States.

2.3 Inland Waterway Sector and River ports

IWW transport is available in all OEM countries, except Greece and Cyprus. The group of IWW transport embraces the infrastructure managers of waterways and authorities of river ports, operators and associations thereof, national administration bodies and other associations and/or transnational organisations. The total number of IWW stakeholder entities is 37, as presented in Annex 8.

The total number of identified IWW stakeholders' representatives amounts 41 individuals. In line with the agreement reached during the first CF meeting, i.e. *the Danube and Danube ports to be mainly considered in the Rhine-Danube corridor instead of Orient/East-Med corridor*, the total number of both OEM IWW relevant stakeholder entities and individuals was limited to 13. The Consultant proposed eight stakeholder entities to be invited to attend the CFs. The list of these is presented in Annex 8.

2.4 Maritime Sector and Seaports ports

Four out of the nine OEM countries are landlocked (AT, CZ, HU and SK), Romania is a Black Sea country, but the Romanian seaport of Constanţa is part of the Rhine-Danube Corridor and not of the OEM Corridor. This is the reason why the Consultant identified maritime sector stakeholders only for Bulgaria, Cyprus, Germany and Greece only. The total number of maritime stakeholder entities is 36. The detailed list is presented in Annex 8.

The total number of maritime stakeholders' representatives amounts to 37 individuals. The Consultant proposed representatives of 13 stakeholders to be invited to attend the 2nd, 3rd and 4th CF meetings. The list of these is presented in Annex 8.

2.5 Road Sector

The group of road sector stakeholders includes national administrations/ authorities, infrastructure managers, associations of users and other national or transnational organisations. The total number of the identified road sector stakeholder entities is 25. The list is presented in Annex 8.

The total number of identified road stakeholders' representatives amounts to 35 individuals, which is significantly lower compared to rail and IWW groups. Representatives of the road national administrations and/or infrastructure managers were invited to attend the 3rd and 4th CF meetings. The list of the proposed invitees is presented in Annex 8.

In the case of Cyprus, Germany and Hungary the representatives of national (CY and HU) or federal (DE) administrations represent the road sector.

2.6 Road-Rail Terminals

Road-rail terminals are available in all countries along the OEM Corridor but Cyprus. The group of road-rail terminals consists of infrastructure managers only, the only exceptions being Hungary and Slovakia, where the RRTs are designated as infrastructure users. Due to the very large number of users, these were not identified in most of the OEM countries as a separate group but were covered by the rail and road infrastructure users. The total number of the identified RRT stakeholder entities is 16. The list is presented in Annex 8.

In addition other stakeholders different to those relating to RRTs were identified, as follows:

- In BG:
  - Bulgarian State Railways BDZ Freight EAD (IU);
  - Bulgarian Association for Freight Forwarding, Transport and Logistics (O);
  - Cluster Green Freight Transport (O);
- In EL:
  - Greek Company Logistics (IU)
- In RO:
  - National Railway Company "CFR" SA (IU)
- Transnational
  - European Intermodal Association (O);
  - Terminal Advisory Group of Rail Freight Corridor 7 (O);
  - TEMA Project (O).

The total number of identified stakeholders' representatives is 22.

2.7 Airports and air transport sector

The group of OEM Corridor air stakeholders consists mainly of airport managers or associations thereof, plus national authorities dealing with air transport infrastructure and services. The total number of the identified air stakeholder entities is 22, as presented in Annex 8.

The total number of identified air stakeholders' representatives amounts to 27 individuals. The list of the proposed air sector stakeholders invited to attend the CF meetings no. 3 and 4 was limited to 14 entities, which are presented in Annex 8.

2.8 Administrative sector (national, regional, local)

The list of administrative sector stakeholders consists of administration bodies at national, regional and major cities and agglomeration levels. The number of the identified stakeholder entities is 104, which makes it the largest group. The comprehensive list of identified stakeholders is presented Annex 8.

The total number of identified administrative sector stakeholders' representatives amounts to 160 individuals, which would make the group rather difficult to deal with. For the related Corridor Forum meetings the Consultant proposed to limit the number of entities to 37. The list is presented Annex 8.

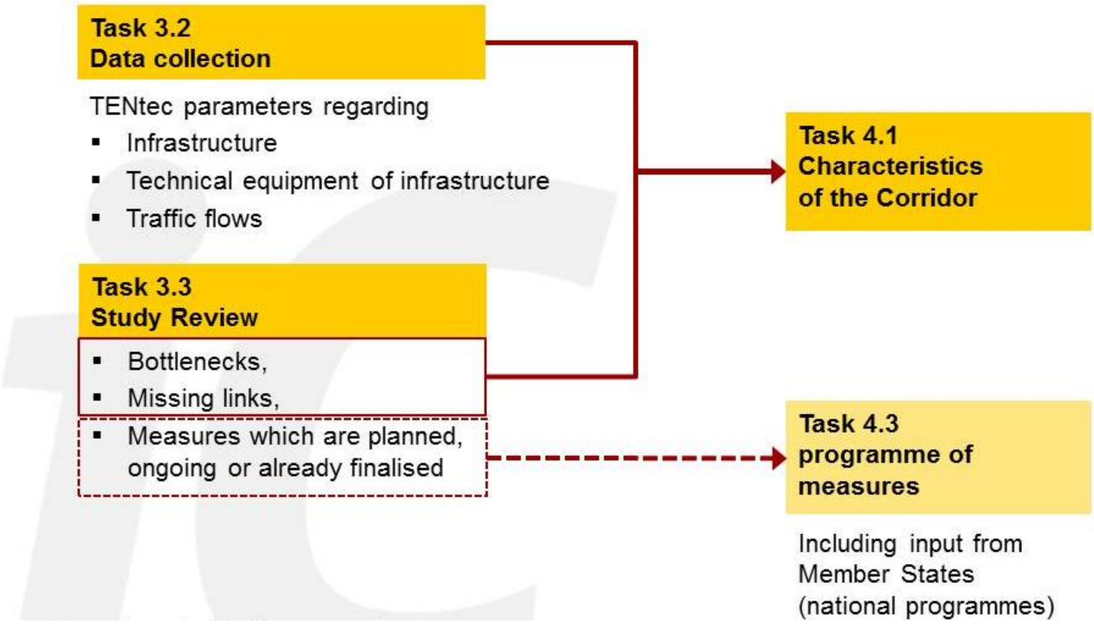
2.9 Civil Society

The list of civil society stakeholders includes other stakeholders, such as Chambers of commerce or similar, environmental NGOs, city networks, euro-regions, etc. The list of the identified stakeholder consisting of 63 entities is presented in Annex 8.

3 Review of Studies and relevant documents

The identification and review of studies and relevant documents on national and multinational level is, apart from the data collection, an essential pillar for the identification of the characteristics of the OEM Corridor. The objective is to describe the characteristics of the corridor, gather information on bottlenecks and missing links, as well as to collect information on projects and measures that are important for the Work plan preparation and for the subsequent development of the implementation plan. The interrelation between the tasks is illustrated in Figure 2.

Figure 2: Relevance of Study Review within overall work flow



Source: Consortium

3.1 Categorization of Studies and Documents

With the scope to analyse the characteristics of the OEM corridor and to identify bottlenecks, critical issues, ongoing/planned infrastructure measures and projects along the corridor, as well as to assess their relevance for the corridor, a number of relevant studies and documents were reviewed and analysed by the Consortium. These comprised both national and multinational studies. Special focus was put on studies/documents related to transport network (mono-modal, multimodal, intermodal), the preparation of projects (e.g. CBA, EIA, traffic forecasts), the feasibility of projects that are foreseen for future implementation and reports on ongoing projects. Only studies/documents directly related to the OEM Corridor or one of its segments were taken into account.

Given the large number of studies and documents that have been reviewed by the consortium and their heterogeneity, the documents were categorized in order to provide a clear and detailed overview on the identified information sources.

The studies and documents were grouped as follows:

- Feasibility studies
- Market/Research studies

- Master plans
- National strategy documents
- Technical reports / assistance

Table 3 provides an overview on the number of studies and documents reviewed per category and per Member State.

Table 3: Extent of OEM relevant studies and document per category and country

	AT	BG	CY	CZ	DE	EL	HU	RO	SK	Total
Feasibility Study		8	2	2	3	4	1	8		28
Market/Research Study		1	1		5	1	6	1		15
Master Plan	1	1	2	2	1	2	1	2	1	13
National Strategy Paper	6	14	1	3	6	1	4	2		37
Technical Report / Assistance	3	7	1	7	2		14	4	1	39
Total	**10**	**31**	**7**	**14**	**17**	**8**	**26**	**17**	**2**	**132**

Regarding the modal coverage of the studies, Table 4 provides an overview on the number of studies and documents per mode and per category.

Table 4: Extent of OEM relevant studies and document per mode and category

	Feasibility Study	Market/Research Study	Master Plan	National Strategy Paper	Technical Report / Assistance	Total
Air	1				1	2
Intermodal	1			1		2
IWW	1	3		3	1	8
Multimodal	3	8	11	19	1	42
Rail	12	3		11	22	48
Road	10	1	1	3	14	29
Sea			1			1
Total	**28**	**15**	**13**	**37**	**39**	**132**

Apart from the national studies, a number of multinational studies have also been reviewed. Table 5 presents the coverage per transport mode.

Table 5: Extent of OEM relevant multinational studies per mode

Mode	Multinational Studies
Air	1
Multimodal	13
Rail	9
Road	2
Sea	5
IWW	2
Total	**32**

3.2 Complete List of Studies and Documents reviewed

The complete list of reviewed studies and documents with more detailed information on their contexts and transport modes covered is provided in Annex 2a and 2c.

The following elements of the study analysis were collected for all relevant Member States for the defined comprehensive network:

- Project Basic data: Name of the project , Project website, type of study, Objective of the project, Planned project activities, Concerned section of the TEN-T network (modal and geographical coverage), timeframe;
- Study content: technical and financial data available, market relevant data, traffic management systems, etc.;
- Other relevant issues: Traffic forecasting, e.g. issues on environmental impact assessment, socio-economic evaluation.

The complete list of reviewed studies was prepared in two phases.

In the first phase, the study review concentrated on the “priority list” issued by the EC within the Tender Specifications and verified during the Kick-Off-Meeting. This list, covering all modes was continuously coordinated with the DG MOVE Advisory team, the Member States and the Infrastructure manager.

The list has been derived from the following sources:

- Annual reports of the EU Coordinator Gilles Savary (PP 22)
- Priority Projects 2010 – A detailed analysis
- CEF: Pre-identified projects for 19 OEM corridor sections (as given in section 3.2.2)
- TEN-T Priority Projects (as given in section 5.1.4)
- ERTMS Corridors (as given in section 7.2.1)
- REGIO funding: ISPA, ERDF, Cohesion Fund

In a second stage, this priority list was enriched by additional strategic documents and studies, e.g.:

- National transport master plans of the Member states (see section 3.2.3);
- Relevant national studies (e.g. feasibility studies of infrastructure projects).

3.2.1 Studies related to the TEN-T Priority Projects

Table 6 provides information on the reviewed TEN-T Priority Projects along the OEM corridor.

Table 6: Overview list of studies related to Priority Projects along the OEM corridor

PP#	Name of PP	Coincidence with the OEM corridor	Progress Report	Identified Project Fiches	Important Corridor Studies
PP07	**Motorway axis Igoumenitsa/Patras–Athina–Sofia–Budapest**	Entirely	Overall: ▪ TEN-T Priority Projects 2010 - A Detailed Analysis ▪ Progress Report 2012 Imple-mentation of the TEN-T Priority Projects	▪ 2007-EL-07040-S: Studies for the development of the motorway project of PP7 ▪ 2007-EL-07020-S: Studies for the vertical access Thessaloniki-Serres-Promahonas ▪ 2006-HU-92201-S: Studies for M8 Motorway, Section I Lepsény - Dunaújváros and Section II Dunavecse - Kecskemét ▪ 2005-HU-92203-S: Study for M43 motorway II. Phase Makó - Nagylak / Csanádpalota	▪ Strategic Action Plan for the Development of Igoumenitsa-Patras-Sofia-Budapest Priority Axis 7
PP17	**Railway axis Paris–Strasbourg–Stuttgart–Wien–Bratislava**	Wien area, Bratislava area	Annual Report of the Coordinator Péter Balázs	▪ 2012-AT-18070-P „Extension of the tri-modal inland port through land reclamation" ▪ 2012-AT-91099-S „Studies for extension of tri-modal port Wien Freudenau " ▪ 2010-AT-91136-S: Terminal Wien Inzersdorf – Planning, ▪ 2007-AT-17040-P: Works and studies for upgrading the Wien - Bratislava railway line	n.a. for Wien – Bratislava; see PP 22
PP21	**Motorways of the Sea**	East Med, Ionian, Aegean Sea	Annual Report of the Coordinator Luis Valente de Oliveira	▪ 2012-EU-21019-S: ANNA - Advanced National Networks for Administrations' ▪ 2011-EU-21007-S: COSTA ▪ 2011-EU-21001-M:ADRIAMOS-Adriatic Motorways of the Sea ▪ 2010-EU-21102-S: MOS4MOS-Monitoring and Operation Services for Motorways of the Sea ▪ 2010-EU-21105-S: MIELE- Multimodal Interoperability E-services for Logistics and Environment sustainability	n.a.

PP#	Name of PP	Coincidence with the OEM corridor	Progress Report	Relevant Project Fiches	Important Corridor Studies
PP22	**Railway axis Athina–Sofia–Budapest–Wien–Praha–Nürnberg/Dresden**	Entirely	Annual Report of the Coordinator Gilles Savary October 2013	▪ 2013-EU-22004-S: Preliminary Planning Services new high speed rail line Dresden-Praha ▪ 2012-EL-22023-S: Remaining studies for the underground construction and rail level realignment of the railway corridor from the Piraeus RS exit (km 1+488) to the Athina RS ▪ 2012-CZ-22117-P: Intermodal terminal MĚLNÍK ▪ 2011-EL-93020-S: Remaining studies to complete the in the section Athina RS (km 9+700) –SKA (Aharnes Attica) (km 22+300) ▪ 2007-HU-22020-S: Preparation of design for approval for the railway line section Biatorbágy - Tata ▪ 2007-EU-22070-S: Studies for the development of the Railway PP 22	▪ Final Report Carrying out a study on the completion of the Priority Project Nr. 22 (November 2012) ▪ Greek Rail Study on PP22 ▪ (OSE)
PP23	**Railway axis Gdansk–Warsaw–Brno/Bratislava–Wien**	Přerov; Brno – Wien		▪ 2007-CZ-90501-S: Reconstruction of the Railway Station Přerov	n.a.
PP25	**Motorway axis Gdansk–Brno/Bratislava–Wien**	Brno – Wien		none	n.a.
PP29	**Railway axis of the Ionian/Adriatic intermodal corridor**	Igoumenitsa - Kalambaka		none	n.a.
ER-TMS	**The European Rail Traffic Management System**	Entirely	Annual Report of the Coordinator Brussels, October 2013;	see section 0 of this document	European Commission: Staff Working Document on the state of play of the implementation of the ERTMS Deployment Plan, SWD (2014) 48, of 14.02.2014

3.2.2 The Connecting Europe Facility

The analysis of the infrastructure and nodes along 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 7 presents the studies and documents related to CEF pre-identified projects for the OEM corridor (as provided by Regulation 1316/2013), while Table 8 until Table 11 present additional CEF projects assigned to other Core Network Corridors in overlapping sections with the OEM corridor.

Table 7: List of CEF Pre-identified projects along the Orient / East-Med corridor

	Links/Nodes	Mode	Type of Projects
1	Dresden–Praha	Rail	Studies for high-speed rail
2	Praha	Rail	Upgrading, freight bypass; rail connection airport
3	Hamburg–Dresden–Praha–Pardubice	IWW	Elbe and Vltava studies, works for better navigability and upgrading
4	Děčín locks	IWW	Studies
5	Praha–Brno – Břeclav	Rail	Upgrading, including rail node Brno and multi-modal platform
6	Břeclav – Bratislava	Rail	Cross-border, upgrading
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
11	Vidin – Sofia – Burgas/TR border Sofia – Thessaloniki – Athina/Piraeus	Rail	Studies and works Vidin – Sofia – Thessaloniki - Athina; Upgrading Sofia – Burgas/TR border
12	Vidin – Craiova	Road	Cross-border upgrading
13	Thessaloniki, Igoumenitsa	Port	Infrastructure upgrading and development, multimodal interconnections
14	Athina/Piraeus/Heraklion – Lemesos	Port, MoS	Port capacity and multimodal interconnections
15	Lemesos – Lefkosia	Ports, multimodal platforms	Upgrading of modal interconnection, including Lefkosia South Orbital, studies and works, traffic management systems
16	Lefkosia – Larnaka	Multimodal platforms	Multimodal interconnections and telematics applications systems
17	Patras	Port	Port interconnections, (further) development of multimodal platforms
18	Athina - Patras	Rail	Studies and works, port interconnections

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

Additional projects assigned to other Core Network Corridors in overlapping sections are according to Regulation No. 1316/2013 Annex I:

Table 8: 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 9: List of CEF Pre-identified projects along the North Sea - Baltic corridor

	Links/Nodes	Mode	Type of Projects
1	PL Border – Berlin – Hannover – Amsterdam/Rotterdam	Rail	Studies and upgrading of several sections (Amsterdam – Utrecht – Arnhem; Hannover – Berlin)
2	Wilhelmshaven / Bremerhaven - Bremen	Rail	Studies and works
3	Berlin – Magdeburg – Hannover, Mittellandkanal, western German canals, Rhine, Waal, Noordzeekanaal, Ijssel, Twentekanaal	IWW	Studies, works for better navigability and upgrading waterways and locks

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

Table 10: List of CEF Pre-identified projects along the Scandinavian - Mediterranean corridor

	Links/Nodes	Mode	Type of Projects
1	Rostock	Ports, MoS	Interconnections ports with rail; low-emission ferries; ice-breaking capacity
2	Rostock - Berlin - Nürnberg	Rail	Studies and upgrading
3	Hamburg/Bremen - Hannover	Rail	Studies ongoing

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

Table 11: List of CEF Pre-identified projects along the Rhine - Danube corridor

	Links/Nodes	Mode	Type of Projects
1	Wien – Bratislava / Wien – Budapest / Bratislava - Budapest	Rail	Studies high-speed rail (including the alignment of the connections between the three cities)
2	Budapest - Arad	Rail	Studies for high-speed network between Budapest and Arad
3	Komárom – Komárno	IWW	Studies and works for cross-border bridge

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:

Table 12: Selected Horizontal Priorities

	Topic	Type of Projects
2	Innovative management & services	Telematics application systems for road, rail, inland waterways and vessels: ITS, ERTMS, RIS and VTMIS
3	Innovative management & services	Core network ports, motorways of the Sea (MoS) and airports, safe and secure infrastructure
4	New technologies and innovation	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

The studies/documents related to the above listed CEF pre-identified projects along the OEM corridor that have been reviewed are listed in Annex 2b.
These pre-identified sections on the Orient/East Med corridor are reflected in the Implementation plan (see section 7.1) and the List of projects (see Annex 5 of this study).

3.2.3 The National Transport Masterplans

Table 13 provides an overview on national strategic studies/documents taken into consideration, which are related to the medium and long term planning of the Member States on national transport infrastructure.

Table 13: List of National Master Plans and related national documents of OEM countries

	National Transport Master Plans	Issued by	Related investment documents	Related Transport Flow Models	Corridor relevant modes considered
DE	**Bundesverkehrswegeplan 2003 (Federal Transport Infrastructure Program), next update 2015**	German Ministry of Transport and Infrastructure (BMVI)	▪ Verkehrsinvestitionsbericht (VIB) 2012 (Transport Investment Report 2012) ▪ Investitionsrahmenplan (IRP) 2011-2015 (Investment framework plan 2011-2015)	▪ Prognose der deutschlandweiten Verkehrsverflechtung für 2025 (Forecast of the transport interrelations throughout Germany 2025),2007 ▪ Prognose der deutschlandweiten Verkehrsverflechtung für 2030 (Forecast of the transport interrelations throughout Germany 2030), 2013/2014.	▪ Road (Freight, PAX public/individual) ▪ Rail (Freight, PAX) ▪ IWT (Freight)
CZ	**Transport Sector Strategies, 2nd Phase** **The Medium-Term Plan of Transport Infrastructure Development with a Long-Term Outlook (2014)** **The Transport Policy of the Czech Republic for 2014 – 2020 with the prospect of 2050, June 2013**	Czech Ministry of Transport	▪ OPD / Operational Programme Transport 2007-2013 ▪ OPD / Operational Programme Transport 2014-2020	▪ Traffic forecast medium and long term	▪ Road (Freight, PAX public/individual) ▪ Rail (Freight, PAX, HSR) ▪ IWT (Freight) ▪ Air (Freight, PAX)
AT	**Gesamtverkehrsplan 2012 (General Transport Infrastructure Strategy 2012)**	Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT)	▪ ASFINAG Rahmenplan 2013-2018 (Road Investment Framework), revised annually ▪ ÖBB Rahmenplan 2013-2018 (Rail Investment Framework), revised annually ▪ Zielnetz 2025 (Long-term rail infrastructure program) ▪ Bundesstraßengesetz (Long-term road infrastructure program) ▪ IVS Action Plan 2011 (Intelligent Traffic Management)	Verkehrsprognose Österreich VPÖ2025+; (Traffic Forecast Austria 2025), 2009	▪ Road (Freight, PAX public/individual) ▪ Rail (Freight, PAX) ▪ IWT (Freight) ▪ Air (Freight, PAX) ▪ ITS

	National Transport Master Plans	Issued by	Related investment documents	Related Transport Flow Models	Corridor relevant modes considered
SK	**Strategic Development Plan of Transport Infrastructure of the Slovak Republic by 2020 - Master Plan, phase I**	Slovak Ministry of Transport, Construction and Regional Development	Sector Operational Programmes for Transport - Operational Programme Integrated Infrastructure 2014 - 2020	Forecast for the Development of Freight and Passenger Transport 2030), foreseen 2016	▪ Road ▪ Rail ▪ Intermodal ▪ Aviation ▪ IWT ▪ Others
HU	**National Transport Strategy – National Transport Policy Concept (Nemzeti Közlekedési Stratégia – Nemzeti Közlekedési Koncepció)** 2013/2014	Hungary – Ministry of National Development	Operative Programme of Integrated Transport Development (Integrált Közlekedésfejlesztési Operatív Program – IKOP 2014-2020)	Multimodal traffic model	▪ Road ▪ Rail ▪ IWT ▪ Aviation ▪ Others
RO	**Master Plan General de Transport 2014**	Ministry for Transport and Infrastructure	Operational Programme Transport 2007-2013 Operational Programme Transport 2014-2020	Not existing	▪ Road (Freight, PAX public/individual) ▪ Rail (Freight, PAX) ▪ IWT (Freight) ▪ Aviation (Freight, PAX)
BG	**General Transport Master Plan 2010**	Ministry of Transport, Information Technologies and Communications	Operational Program “Transport” 2007-2013 Draft Operational Program “Transport and Transport Infrastructure” 2014-2020	National Transport Model 2010 forecast for 2020 and 2030 Transport model updated in 2013, forecast for 2020 and 2030	▪ Road (Freight, PAX public/individual) ▪ Rail (Freight, PAX) ▪ IWT (Freight) ▪ Maritime (Freight, PAX) ▪ Air (Freight, PAX) ― ▪ Road (Freight, PAX public/individual) ▪ Rail (Freight, PAX)
EL	**Strategic Framework of Transport Investments for 2014 – 2020 (draft August 2014)**	NSRF, Ministry of Infrastructure, Transport and Network	Operational Programme 2007-2013 Operational Programme YMEPRAA 2014 – 2020	Not existing.	▪ Road ▪ Rail ▪ Aviation ▪ Maritime
CY	**Strategy on TEN-T ports and roads (ΣΤΡΑΤΗΓΙΚΗ ΒΙΩΣΙΜΗΣ ΑΝΑΠΤΥΞΗΣ ΧΕΡΣΑΙΩΝ ΜΕΤΑΦΟΡΩΝ**	Ministry of Communications and Works	Operational Programme 2014-2020	Traffic Model on Lefkosia South Orbital Motorway	▪ Road (Land Transport), ▪ Maritime

	National Transport Master Plans	Issued by	Related investment documents	Related Transport Flow Models	Corridor relevant modes considered
	ΚΑΙ ΘΑΛΑΣΣΙΩΝ ΜΕΤΑΦΟΡΩΝ; ΛΙΜΕΝΙΚΩΝ ΥΠΟΔΟΜΩΝ; May 2014)				

3.3 Description of most important corridor related studies

The section presents a review of the studies considered to be of the highest relevance to the OEM corridor, in terms of:

- Providing information on existing status including technical characteristics and on-going infrastructure projects of parts of the Corridor
- Dealing specifically with TEN-T Priority Projects and CEF pre-identified projects.
- Focusing on addressing and/or alleviating important bottlenecks and critical issues already identified for the corridor.
- Providing information on planned infrastructure projects, including infrastructure characteristics, financial data and time plan for execution of works.
- Focusing on issues that relate to the Corridor's objectives
- Providing information for the Multimodal Transport Market Study.

The following table provides an overview, while the detailed review of studies is presented in Annex 7.

Table 14: List of detailed described studies and program relation

Studies/documents	Related to Program
Completion of the Priority Project Nr. 22	TEN-T Priority Projects
Evaluation Study for the Upgrade of Railway Axis 22 and Technical Support to OSE SA: Feasibility Analysis- Action Plan	TEN-T Priority Projects
Adriatic Motorways of the Sea (ADRIAMOS)	TEN-T Priority Projects / Motorways of the Sea
Strategic Action Plan for the Development of Igoumenitsa-Patras-Sofia-Budapest Priority Axis 7	TEN-T Priority Projects
Master Plan Monitoring And Operation Services For Motorways Of The Sea (MOS4MOS)	Motorways of the Sea
East Mediterranean Motorways of the Sea Master Plan	Motorways of the Sea
Implementation plan of Rail Freight Corridor 7 "Orient Corridor"	Rail Freight Corridors
Studies for high-speed rail Dresden - Praha	CEF pre-identified project
Elbe studies, works for better navigability and upgrading	CEF pre-identified project
EIA and Feasibility study documents on the construction of the Elbe IWW Navigation step at Děčín (Czech Republic)	CEF pre-identified project
The Detailed Design Study of the Lefkosia South Orbital Motorway	CEF pre-identified project
ACROSSEE	INTERREG
FLAVIA	INTERREG
Sustrain Implement Corridor	INTERREG
UNECE TEM and TER Master Plan	n.a.
Study on Seaport Hinterland transport (Forecast of the transport interrelations throughout Germany 2025 - maritime forecast)	n.a.

3.4 Additional information sources

Apart from the review of the documents and studies interactions with PLATINA II, the European Coordination Action towards quality inland waterway transport, and Rail Freight Corridor 7 took place during the elaboration of the OEM Corridor study, both providing valuable information on Inland waterway and Rail freight transport along the corridor.

The following documents provided by PLATINA II and Rail Freight Corridor 7 were taken into account in this OEM corridor study:

PLATINA II:

- Information package on the State-of-Play of IWT, Vol. 1 of 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 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 reports TEN-T Corridor Consortia, November 2014.

Rail Freight Corridor 7:

- Implementation plan of Rail Freight Corridor 7 "Orient Corridor", November 2013

Additionally to the above document a joint working meeting with representatives from the OEM Corridor study team and the Rail Freight Corridor 7 team took place in Budapest in July 2014.

3.5 Findings of the Study Review

3.5.1 Procedure

Through the review of documents and the definition of their relevance, the consortium gathered comprehensive knowledge on the OEM corridor and valuable information on the characteristics of the corridor and the related bottlenecks, critical issues, as well as the implemented, ongoing or planned infrastructure measures and projects along the corridor.

The information collected is in particular essential for the "Work plan preparation", the major task within the study, and was used for:

- the further evaluation of the characteristics of the corridor together with identification of bottlenecks and missing links;
- the identification of the objectives of the Orient / East-Med corridor;
- the definition of the programme of measures and possible sources of funding;
- the elaboration of the Multimodal Transport Market Study, analysing the current situation for passenger and freight transport in the corridor in multimodal terms, traffic volumes and modal split;
- the development of the OEM corridor implementation plan.

3.5.2 Findings

With regard to the findings of the studies review, the level of geographical coverage is highly important. The predominant number of documents (132) addresses the Corridor related infrastructure and transport modes on a national level in the respective Member State, with a strong geographical focus on the south-eastern part of the corridor.

Overall, the national documents provide sufficient information on infrastructure, projects and transport modes, including in some cases also interrelations between different modes, for all Member States. A problematic issue, however, is that national planning focusses on improvements on the national networks only.

Cross-border issues are frequently neglected and approaches for cross-border planning rarely exist. First steps have been made in this regard, but these are still individual cases, such as the new Danube Rail/Road Bridge Calafat – Vidin and studies on the High Speed Rail Dresden - Praha. Thus, both the development of a cross-border approach for infrastructure planning as well as the continuation and deepening of existing approaches needs to be fostered.

The objective should be to establish a real Corridor approach covering transport infrastructure as a whole for all transport modes. At present, this approach exists only in a rudimentary state. National planning/projects should not focus only on the national benefits, but also on multi-/international benefits, particularly in cases of cross-border sections, along which infrastructure development has to be harmonized on both sides of the border. This is to avoid the creation of new bottlenecks, which is essential, as the overall objective of the Corridor-orientated approach should be to reduce bottlenecks, not to create new ones.

In this regard, national strategies have to be adjusted to address appropriately the Corridor and its bottlenecks and the projects addressing these. The Corridor Fora offered the possibility to discuss with the Member States this particular issue.

Apart from the large number of national documents, 32 multinational documents (i.e. documents covering at least two Member States along the Corridor) provide information on transport infrastructure and transport modes, especially on interoperability and cross-border issues.

Nevertheless, there were marginal differences regarding the quality of information comparing the different transport modes, as well as sufficient information provided for all modes. As the OEM Study team was in regular personal contact with the stakeholders from all Member States, the Consultant sought to clarify issues that were considered of importance bilaterally. Overall, based on the reviewed documents, the key critical issues and main bottlenecks along the corridor were identified and classified with regard to cross-border issues, interoperability, intermodality and compliance to requirements of TEN-T regulation (see Annex 1).

Critical issues, such as interoperability along the Corridor are addressed sufficiently but only on a technical level. Other issues which play an important, role such as seamless transport flows along the Corridor that require also coordination on an organisational and legislative level, are barely addressed. Finally, a number of infrastructure projects were obtained from both national and international documents, such as National Transport Master Plans or studies on Priority Projects. These projects cover measures implemented, ongoing and/or planned.

Projects derived from national strategies only focused on the national networks, so cross-border links are often neglected. In this regard, an overall coordination is required to stimulate Corridor related projects, which was discussed in the Corridor Fora.

For a detailed overview on the findings of the study overview, see Annex 2 and Annex 7.

4 Elements of the Work Plan - Summary

The sections of this Chapter summarize the content of the elements of the work plan as presented in Chapters 5, 6 and 7 of this final report, with each headline referring to the respective section.

4.1 The Orient/East Med Corridor Alignment (Summary of 5.1)

The outline of the Orient/East-Mediterranean Corridor is provided in Annex 1 of the CEF regulation 1316/2013. It is described as a corridor that will

"connect North/central Europe with the maritime interfaces of the North, Baltic, Black and Mediterranean seas, making the best of Motorways of the Sea ports, crossing 9 Member States. It will foster the development of those ports as major multimodal logistic platforms and will improve the multimodal connections of major economic centres in Central Europe to the coastline, using rivers such as the Elbe and the Danube.

The 9 Member States involved are (in alphabetical order): Austria, Bulgaria, Cyprus, Czech Republic, Germany, Greece, Hungary, Romania, and Slovak Republic.

In Cyprus, no rail infrastructure is deployed. Maritime infrastructure exists in 4 countries, namely Bulgaria, Cyprus, Germany and Greece.

Based on the decision made in the 1st Corridor Forum, in terms of IWW, the OEM Corridor Study will put emphasis on the Elbe-Vltava IWW system (Brunsbüttel – Mělník – Praha / – Pardubice; Germany and Czech Republic) and the IWW link from Magdeburg to Bremerhaven (in Germany). The Danube IWW (Austria, Hungary, Romania and Bulgaria) is mainly addressed in the Rhine-Danube Corridor Study. The Elbe-Havel IWW from Magdeburg to Berlin is being assessed by the North Sea / Baltic Corridor exclusively.

According to Regulation No. 1316/2013[6] and clarifications agreed with the Member States, the Orient / East-Med corridor (OEM corridor) consists of the following parts:

- Rostock - Berlin
- Brunsbüttel – Hamburg – Berlin – Dresden

Bremerhaven / Wilhelmshaven – Magdeburg – Leipzig / Falkenberg[7] – Dresden

- Dresden – Ústí nad Labem – Mělník/Praha – Kolín
- Kolín – Pardubice – Brno / Přerov – Wien/Bratislava – Győr – Budapest – Arad – Timişoara – Craiova – Calafat – Vidin – Sofia
- Sofia – Plovdiv – Burgas
- Plovdiv – Svilengrad - BG/TR border
- Sofia – Thessaloniki – Athina – Piraeus
- Athina – Patras / Igoumenitsa
- Thessaloniki / Palaiofarsalos – Igoumenitsa
- Piraeus – Heraklion – Lemesos – Lefkosia - Larnaka

[6] REGULATION (EU) No 1316/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013

[7] According to the Regulation, the alignment is via Falkenberg – Elsterwerda - Radebeul. Due to technical and operational reasons, the Consortium, the German Ministry of Transport and the rail infrastructure manager DB Netz agreed that the section Falkenberg - Elsterwerda is not part of the typical train routing, but Falkenberg – Röderau.

The length of the corridor infrastructure sums up to approximately 5.900 km (rail), 5.600 km (road) and 1.600 km (IWW excl. Danube). The number of core urban nodes along the Orient/East Med corridor is 15, with the majority located in Germany (5) and Greece (3), as well as one per other Member State. The same number applies for core airports, from which 6 are dedicated airports to be connected with high-ranking rail and road connections until 2050. Furthermore, 10 Inland ports and 12 Maritime ports are assigned to the corridor, as well as 25 Road-Rail terminals.

The Orient/East Med Core Network corridor includes sections of former TEN-T Priority Projects (PP 7, PP 22 and PP 21, PP 23, PP 25 partially) and of ERTMS Corridors (D and parts of B, E, and F). The Rail Freight Corridor RFC 7 "Orient / East Med" has been defined through Annex II of Regulation 1316/2013[8].

Several segments of the Orient/East Med Core Network Corridor are coinciding with other of the 9 Core network corridors, such as the Rhine-Danube Corridor (approx. 1000 km) and on shorter sections, the North Sea / Baltic corridor, the Scandinavian-Mediterranean corridor and the Baltic Adriatic corridor.

4.2 The OEM Railways Network and Rail Road Terminals (Summary of 5.2.1 and 5.2.2)

The infrastructure of the railway network along the OEM corridor is in considerable parts of the alignment not compliant with the technical characteristics thresholds set out by Regulation No. 1315/2013 regarding the key infrastructure parameters track gauge, operational speed (line speed), train length, axle load, electrification and signalling and telecommunication.

All OEM corridor lines have a gauge of 1435 mm. Most lines are at least double-tracked (approx. 73 %). Single line sections are the following:

- in Germany:
  - Rostock Hbf – Kavelstorf,
  - Rostock Seehafen – Kavelstorf,
  - Sande –Wilhelmshaven/ Jade Weser Port
- in Slovakia and Hungary:
  - Petržalka – SK/HU Border – Hegyeshalom,
  - Békéscsaba – Lökösháza - HU/RO Border,
- in Romania:
  - Border HU/RO - Curtici,
  - Arad – Strehaia
  - Craiova – Calafat, Border RO/BG,
- in Bulgaria:
  - RO/BG border – Vidin – Mezdra
  - Sofia – Kulata – BG/EL border,
  - Krumovo – Svilengrad – BG/TR border,
- in Greece:
  - BG/EL border – Promahonas – Thessaloniki
  - Lianokladi – Tithorea
  - Palaiofarsalos – Kalambaka.

Regarding operational speed, there are discrepancies in the Czech Republic (Děčín - Ústí nad Labem (freight link), Kralupy n.V. - Praha, Blansko - Brno), Slovakia (Petržalka - Border SK/HU) and Hungary (Kelenföld – Ferencváros within Budapest

[8] RFC 7 alignment: Praha – Wien/Bratislava – Budapest – București – Constanta/ – Vidin – Sofia – Thessaloniki – Athina

node), where line speed is 80 km/h. In Bulgaria, the operational speed is lower than 100km/h, specifically along the section Vidin - Sofia, reaching a speed of 70/80 km/h, while parts of the lines Sofia - Kulata and Sofia - Plovdiv - Burgas have speed limits of only 60 km/h: Pernik - Radomir, Septemvri - Plovdiv, and Tserkovski – Karnobat. Along the Bulgarian rail section Mihaylovo – Dimitrovgrad the operational speed is only 45 km/h. In total, approx. 15% of the OEM rail network is not compliant with the respective requirements of the Regulation.

The operation of 740 m trains is also not possible due to infrastructural, administrative or timetable-related/operational reasons, on several sections of the corridor, including all corridor sections in Czech Republic, Slovakia, Austria, Romania (except of the sections Timişoara – Caransebes and Filiaşi – Craiova) and Bulgaria (except of a number of sections between Plovdiv - Burgas and Svilengrad – Turkish Border), as well as one section (Hegyeshalom – Budapest) on the Hungarian Network (in total approx. 46% of the OEM rail network).

In contrast, most of the rail network along the OEM corridor is compliant with the minimum axle load threshold of 22.5 t. Exception in this regard are the entire rail network in Romania and a number of line sections in Greece (Promahonas – Thessaloniki, Domokos – Tithorea and Kiato – Patras) and Hungary (Budapest-Ferencváros – Cegléd and Békéscsaba – Lökösháza). Additionally, in Hungary, there is a special situation on the line Budapest-Kelenföld, where axle load of 22.5 t is permitted with speed restriction, while only 18.0 t are permitted without a speed limit. The non-compliant sections amount to approx. 15% of the OEM rail network.

Most of the OEM rail network is electrified (approx. 89%), having three different current systems in use: AC 15kV / 16.7 Hz (Germany and Austria), AC 25kV / 50 Hz (Czech Republic/South, Slovakia, Hungary, Romania, Bulgaria and Greece) and DC 3kV (Czech Republic/North). Diesel traction is required only on the sections Oldenburg – Wilhelmshaven in Germany, Craiova – Calafat in Romania, Dimitrovgrad – Svilengrad in Bulgaria and Promahonas – Thessaloniki, Domokos – Tithorea and Inoi – SKA – Piraeus, and Palaiofarsalos – Kalambaka in Greece.

Regarding signalling[9] and telecommunication systems, at present, for both ERTMS subsystems (ETCS and GSM-R), the national systems are still predominatingly used on the OEM rail network. There is a considerable lack of ERTMS implementation, with differences between Member States, as well as with regard to the two components GSM-R and ETCS. Regarding GSM-R, 51% of the OEM rail network is not compliant with the requirements of the Regulation, while regarding ETCS installation and operation, 86% and 90% of railways are not compliant, respectively.

By not meeting the requirements of the Regulation, there are cross-border and interoperability issues along the OEM rail network.

Capacity utilisation differs greatly between the northern and the southern part of the OEM rail network. Bottlenecks exist within nodes on some line segments (e.g. in Budapest / Czech Republic).

Regarding Rail Road terminals (RRT), there are in total 25 Core Rail Road terminals along the OEM corridor, most of which are located in Germany (8), Czech Republic (5), Austria (3) and Greece (3).

All RRTs on the OEM corridor are linked with the national road and rail networks, although there is in some cases a need to improve the quality of "last mile" connection or to solve capacity problems.

Regarding the state of development of RRT, there are differences between the northern and southern corridor parts, ranging from a lack of development to a dense

[9] i.e. Railway control systems

network of terminal locations, with limited capacities both in the terminals and the connecting rail and road network.

Based on this analysis, a train travelling from Athína (EL) to Hamburg (DE) would have to comply with the following standards:

- locomotive equipped with 7 different signalling systems; alternatively it would have to be changed 6 times
- even if the locomotive would be equipped with the 3 required different electrification systems, it would have to be replaced by diesel locomotives 4 times
- maximum length of 600 m, except on Bulgarian sections where the maximum train length is only 445 m,
- maximum axle load of 200 kN,
- it would run at 80 km/h or lower on approximately 510 km.

4.3 The OEM IWW Network and the Ports (Summary of 5.2.3 and 5.2.4)

The OEM inland waterway network comprises of the Elbe, the Elbe-Seitenkanal, the Elbe-Lübeck-Kanal, the Mittellandkanal, the Weser, the Vltava and the Danube. This study focuses on the waterways located in the northern part of the corridor (i.e. Elbe, Elbe-Seitenkanal, Mittellandkanal, Weser and Vltava), while the Danube is mainly addressed in the Rhine-Danube Corridor Study.

With regard to the requirement of Regulation No.1315/2013, the key infrastructure parameters examined within this study are the length of vessels, maximum beam, minimum draught, tonnage and compliance with the requirements of CEMT class IV, particularly regarding bridges and locks. Due to the importance of the Elbe within the Orient/East-Med Corridor and the fact that the main problematic areas are concentrated on the Elbe, the compliance check focuses mainly on this waterway.

The basic characteristic of the Elbe are the persisting unstable water levels, as they are subject to natural fluctuations, resulting in extremely low fairway depths, especially in dry seasons. The latter has significant impact on inland shipping regarding navigability and transportable tonnage, making also the respective sections commercially non-navigable. All-season stable navigation conditions cannot be guaranteed. For this reason, the possible loading depth is along long sections dependent on the water level, notably between Geesthacht (near Lauenburg) up to the German/Czech border and in the Czech Republic. Additional problems in the Czech Republic are the sections Mělník - Pardubice and Mělník – Praha, which have non-compliant structures (bridges). Insufficient draught and bridge clearance are also issues on the Elbe-Lübeck-Kanal.

Apart from the insufficient navigability, the problem of flooding is another important issue along the Elbe, which has also considerable large economic, social and ecological impacts. There are various environmentally sensitive areas located along the Elbe (alluvial forests and floodplains), which are partly listed as NATURA 2000 protected areas. To this end, measures for better navigability and upgrading along the Elbe must always be considered nowadays against the background of the sometimes conflicting criteria of economy and environment.

Another problem on the Elbe, at least and more specifically on certain sections in the Czech Republic, is the low bridge clearance, which reduces the potential container capacity per vessel. The Vltava waterway is also characterized by low height under bridges (4.50 metres), locks problems, limited fairway sections, as well as flooding.

Regarding the availability of Traffic Management Systems, the deployment of River Information Services (RIS) is advanced on the OEM inland waterway network. Basic RIS applications have been implemented in both Germany and the Czech Republic.

Regarding ship length on the Elbe, barges with dimensions of 110 m length and 11.45 m width can operate between Geesthacht and Mělník, while in the section Mělník – Přelouč the admitted length is 84 m and the width 11.45 m. On Vltava it is possible to navigate with barges of 110 m length and a width of 10.5 m width. However, due to the inconsistency of the adequate fairway depth, the maximum loading capacity can temporarily be reduced due to draught limitations.

On the Elbe-Seitenkanal, barges with 110 m length, 11.40 m width and 2.80 m draught and pushed convoys of 185 m length, 11.40 m width and 2.80 m draught can be used in principle. However, due to length limitations regarding the length of the chambers of the ship lift Lüneburg near Scharnebeck (maximum length of 100 m), the former are not approved for a continuous ride. For this reason, only barges that correspond to these dimensions can pass, while pushed convoys have to be decoupled for the passage and lifted or lowered individually.

On the Mittellandkanal, barges with the dimensions 110 m length, 11.45 m width and 2.8 m draught, as well as pushed convoys of 185 m length, 11.40 m width and 2.80 m draught can operate, while on the Mittelweser, barges with dimensions 85 m length, 11.45 m width and 2.5 m draught can be used. However, the section between Minden and Bremen is currently upgraded in order to allow the operation of ships with a length of 110 m and a width of 11.45 m.

On the Elbe-Lübeck-Kanal, barges up to 80 m length, 9.50 m width and 2.00 m draught can navigate. The limitations result from the dimensions of the locks.

Goods transported and transhipped in the inland ports are heterogeneous including all types of general cargo, dry and liquid bulk cargo, containers and heavy cargo. Most of the inland ports offer trimodal services and have sufficient capacity to handle all transport volumes.

Regarding the supply of alternative fuels, at present, no infrastructure is yet available along the Elbe and Vltava. Given that Liquefied Natural Gas (LNG) is considered as the forward-looking alternative fuel in matters of inland waterway transport, future implementation is likely, if there is enough demand from the market side and if economic viability is guaranteed.

4.4 The OEM Maritime Infrastructure and the MoS (Summary of 5.2.5)

The maritime infrastructure of the Orient / East-Med corridor includes 12 Core ports in total, as well as the Motorway of the Sea (MoS) linking the hinterlands of the Greek port of Piraeus with the Island of Crete at the port of Heraklion, and the seaport of Lemesos in Cyprus. The OEM ports include the key German Ports of Hamburg, Bremerhaven, Wilhelmshaven, Bremen and Rostock, the Port of Burgas in Bulgaria, the Port of Lemesos in Cyprus and the Greek Ports of Piraeus, Heraklion, Thessaloniki, Igoumenitsa and Patras. All the above constitute maritime ports, apart from the Ports of Bremerhaven, Bremen and Hamburg, which also constitute core inland ports according to the Regulation. In addition, all ports have transhipment facilities and related equipment facilitating intermodal transport. Further port related traffic information is given in Annex 4.

A key requirement of the Regulation No.1315/2013 is a maritime port connection with the road and rail network. Accordingly, two OEM seaports do not comply with the above requirement, namely the Ports of Igoumenitsa and Patras in Greece, which are currently lacking connections to the country's railway network. The latter constitutes a substantial interoperability bottleneck, hindering the seamless intermodal transportation with the use of road/rail and maritime modes along the supply chain of the OEM corridor. These missing rail connections have been taken into consideration by the country, but only the one in Patras is being addressed by a project study. No specific project is currently planned until 2020 for the connection of the Port of Igoumenitsa to the country's rail network.

Other interoperability and organisational bottlenecks are created by the lack of Traffic Management System (TMS) deployment in the port of Patras in Greece. The remaining ports are either successfully deploying certain types of Port Community Systems (i.e. German Ports) and Vessel Management Information Systems (Greek ports of Piraeus and Thessaloniki), or plan to deploy these in the near future (Burgas, Heraklion and Igoumenitsa).

With regard to handling capacity and utilisation, the threshold of minimum 500.000 tons of annual freight transhipment stipulated by the Regulation is exceeded by all OEM Corridor seaports. Capacity bottlenecks have been identified in Hamburg and Lemesos. These are being addressed by upgrading projects for both ports. Similarly, on-going and/or planned investment projects are expected to increase significantly the handling capacity of several OEM ports (Burgas, Lemesos, Igoumenitsa, Heraklion and Patras).

An additional requirement of the Regulation is the provision of publicly accessible Liquefied Natural Gas (LNG) refuelling points for maritime transport by all maritime core ports until 2030. Such facilities are planned for all German Ports, Piraeus in Greece and Lemesos in Cyprus. The provision of LNG facilities is not included in the plans of the other Greek ports or the Port of Burgas in Bulgaria.

Although northern ports face different problems when compared to the southern ones, a dialogue among them is also required to create a high quality integrated land-transport 'bridge' among these. The general conclusion is that bottlenecks are related mainly to their rail hinterland connections (whether existing or missing), not to the ports themselves. Nevertheless, they do require modern technologies to improve port performance.

The above issues have been highlighted in the Seaports Working Group meeting of the Orient/East Med Corridor that took place on the 29th of September 2014 in Brussels, which also stressed the importance of MoS development. The latter is particularly relevant to the OEM seaports in Greece and Cyprus, in order for these to become MoS port nodes along potential viable MoS connections by complying with the MoS quality criteria and the key priorities set for 2014-2020 in terms of maritime integration with ports' hinterland connections and TMS deployment.

4.5 The OEM Road Infrastructure (Summary of 5.2.6)

The road infrastructure covers all the nine OEM countries with a total distance between Wilhelmshaven and Lefkosia of 4682 km on average and a total length of road network of approximately 5644 km. The majority of the road sections are of Motorways / Express roads class (82%). The main bottlenecks identified along the OEM Road network are those related to non-compliant road classes, namely roads without level-free junctions (mainly single lane). These include small sections in the Czech Republic, Slovakia and Austria, whereas the issue is particularly prominent in Romania, Bulgaria, and to a lesser extent in Greece. It should be noted that there are several sections, where construction works are under way and part of the identified bottlenecks that will be alleviated in the 2014-2015 period.

The average weighted daily number of trucks per OEM corridor road section is approx. 3,150 and the respective number of cars is 19,000. The most freight traffic intensive sections are located in the German and Hungarian territory. Road sections near urban agglomerations that carry high number of passengers are located in Greece, Germany, Czech Republic and Hungary. The overall average capacity utilisation ratio for the OEM corridor sections, for which data are available, is approx. 44.5%. As a general characteristic of the entire road corridor, there is a high level of utilisation of the existing road capacity in and around the large cities.

The Regulation No.1315/2013 sets up a list of alternative fuels that substitute (at least partly) the fossil oil sources in the supply of energy to transport. LPG and LNG are widely available in all OEM countries except Cyprus (where the development is underway), although the density of the stations along the Corridor differs from country to country, as presented in the next table. Infrastructure systems of publically accessible charging stations and battery swap stations to recharge electric vehicles are generally available in the cities in Germany, Czech Republic, and Austria. In Slovakia, Hungary and Bulgaria, the number of stations is low and these are concentrated in one or two urban areas.

Table 15: Availability of alternative fuels' along the Corridor

MS	LPG stations	CNG stations	Locations with electrical charging points
DE	66	38	6
CZ	55	5	6
AT	5	3	2
SK	6	1	1
HU	39	2	1
RO	48	-	-
BG	53	18	2
EL	52	3	-
CY	0	0	n.a.

The Regulation No.1315/2013 sets also a specific requirement with regard to the provision of sufficient parking areas (at least every 100 km) with an appropriate level of safety. The analysis showed reasonable supply of parking facilities in Germany, Czech Republic, Slovakia, Austria and Hungary. Although the average figures of parking areas per 100 km of OEM roads in Romania, Bulgaria and Greece meet the minimum threshold set in the Regulation, there are still long road sections without any suitable facility in the above three countries.

The Regulation No.1315/2013 also sets up requirements for interoperability of the electronic toll collections systems. Road user charging systems are in force in all OEM countries but Cyprus, five of which are electronic (in Germany, Czech Republic, Slovakia, Austria and Hungary). These systems meet the requirements of Directive 2010/40/EU on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport. Nevertheless, for the moment, all these systems do not provide for seamless trans-border traffic, with the exception of partial cooperation between Germany and Austria, whereby the heavy goods vehicles only need one in-vehicle unit –the TollCollect OBU – to pay toll charges in both countries.

4.6 The OEM Air Transport Infrastructure (Summary of 5.2.7)

The Air transport infrastructure of the Orient / East-Med corridor includes 15 Core airports, 5 of which are located in Germany and 3 in Greece, as well as one per other Member State.
A key condition to ensure interoperability of the OEM corridor airports is their connection to the railway network. 7 out of 15 Airports have currently no direct railway connection: Bremen, Praha, Bratislava, Budapest, Timişoara, Sofia and Thessaloniki. However, in most cases the next existing rail line is located in a short distance. The islands of Crete (Heraklion Airport) and Cyprus (Larnaka Airport) do not have a railway network.

Based on the Regulation No.1315/2013 Article 41, par 3, there are dedicated main airports that are to be connected with the trans-European rail network by 2050, and wherever possible with the high-speed rail network. These dedicated main airports along the OEM corridor are: Hamburg, Berlin, Praha, Wien, Budapest and Athína.

According to Article 42 of the TEN-T regulation, dedicated Main Airports are to be also connected to the TEN-T road network by 2050. To date, the only airport without a high-ranking road connection is the Timişoara airport.

Concerning availability of alternative clean fuels, currently no fixed storage tank facilities for aviation biofuel are reported to be in use in the OEM airports.

Regarding the availability of alternative clean fuels for airport ground services (e-mobility, hydrogen, CNG, LPG); some airports have recently introduced charging or fuelling stations. Natural gas (CNG) and liquid gas (LPG) are already being used at Hamburg Airport as low-emission fuels, while a Hydrogen Project was introduced earlier. In 2013, 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 envisaged to be implemented at airports committed to become ecologically friendly in their operation (e.g. Budapest airport by 2020), however, no specific projects are known to present.

4.7 Overview on non-compliant infrastructure on OEM corridor

Summarizing the various information on the multimodal infrastructure of the Orient/East Med Core Network Corridor given above, the following tables shows the recent non-compliance values of the most important technical parameters set out for the TEN-T core network corridors for 2030. Together with the KPI Benchmark values presented under section 6.3 this overview might allow a status of Corridor development.

Table 16: Overview of length and percentage of non-compliant sections (2014)

Mode	Parameter	Calculation method	Non-Compliance (absolute)	Non-Compliance (relative)
Rail	Electrification	Length of non-electrified sections	645 km	11%
Rail	Freight trains with 22.5 t axle load at 100 km/h	Length of non-compliant sections	1700 km	29%
Rail	Operational speed	Length of non-compliant sections vmax <100 km/h	908 km	15%
Rail	Axle load	Length of non-compliant sections with <22.5 t	910 km	15%
Rail	Train length	Length of non-compliant sections with <740m	2734 km	46%
Rail	Number of tracks[10]	Length of sections with single track	1616 km	27%
Rail	Signalling systems (ETCS)	Length of sections ETCS not installed/ not operated	5074km/ 5325 km	86%/ 90%[11]
Rail	Telecommunication system (GSM-R)	Length of sections GSM-R not installed	3002 km	51%
IWW	Draught compliance	Sections with insufficient draught (2.50m)	966 km	59%
IWW	RIS deployment	RIS services not deployed (see 7.2.2.3)	9-10 of 20 RIS elements	45-50%
IWW	Bridge clearance	Sections with insufficient bridge clearance (5.25m)	269 km	16%
IWW	Connection to railway: IWW	Ports lacking of rail network integration	1 of 10 ports (Pardubice)	10%
IWW	Alternative fuels (AF)	Ports lacking of AF supply	10 of 10 ports	100%
Road	Express roads/motorway	Length of ordinary roads without grade separated junctions	1015 km	18%
Road	ITS Deployment	Core Network Urban Nodes lacking ITS deployment	0 of 15 Core Network Urban nodes	0%
Road	Electronic Tolling On-Board Equipment	Compatible national systems	2 of 5 countries[12]	40%
Road	Safe and Secure Parking	Length of road with safe parking facilities	189 km	3%
Road	Alternative fuels (AF)	Countries lacking AF supply	1 out of 9 countries	11%
Maritime	Maritime TMS Deployment	Seaports lacking of VTMIS, PCS, etc.	4 of 12 Core Network Maritime ports	33%
Maritime	Connection to railway: Maritime	Seaports lacking of rail network integration	2 of 10 Core Network Maritime ports (continental)	20%
Maritime	Alternative fuels (AF)	Seaports lacking AF supply	12 of 12 Core Network Maritime ports	100%
Airport	Connection to railway: Airports	Airports lacking of heavy rail network integration	3 of 6 Core network Major Airports	50%
Airport	Alternative fuels (AF)	Airports lacking AF supply	0 of 15 airports	100%

10 Double Track is not a technical requirement set out in the TEN-T Regulation 1315/2013.
11 i.e. 86% regarding ETCS installation and 90% regarding ETCS under operation.
12 Counted are only the countries, in which such electronic tolling systems exist.

4.8 The Multimodal Transport Market Study (Summary of 5.3)

MTMS process

The MTMS (Multimodal Transport Market Study) describes the transport market characteristics of the OEM corridor in its present condition and in the future. It essentially intends to analyse the OEM Corridor-related transport system and assess the capacity and traffic flows on the respective parts of the infrastructure, covering the time period from 2010 to 2030. The time horizon of 2030 was selected as it represents a major milestone for European policy and at the same time, provides a reliable basis for future results.

The MTMS concept was developed for the present 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 and regional studies as well as European sources such as the EU Reference scenario and the ETISplus databases.

In the 2nd Progress report of this study, the base year 2010 of freight and passenger traffic was presented. In the present final report, this is extended with the flows related to international freight traffic in the Corridor, such as passenger flows or domestic freight flows as well as traffic entering and exiting the Corridor. Regarding the domestic freight and passenger values, these will be aggregated figures as their main purpose is to identify the network capacity needs. For the traffic entering and exiting the Corridor, the study relies on input from the EU databases and input from the Second Corridor Forum.

The MTMS provides information on the macroeconomic framework as well as the Corridor-related demand flows. The analysis of the demand flows was enriched based on the conclusions from the Second Corridor Forum as well as from the final analysis from the consortium’s work.

With regard to the data used, for Task 1 (the macroeconomic indicators) the study presents national and in some cases regional information for GDP, population and other macroeconomic indicators and trends.

Figure 3 presents a schematic diagram of the Multimodal Transport Market Study Methodology. The elaboration of the activities identified under MTMS methodology has led to the MTMS outcomes.

The following three key activities were carried out.

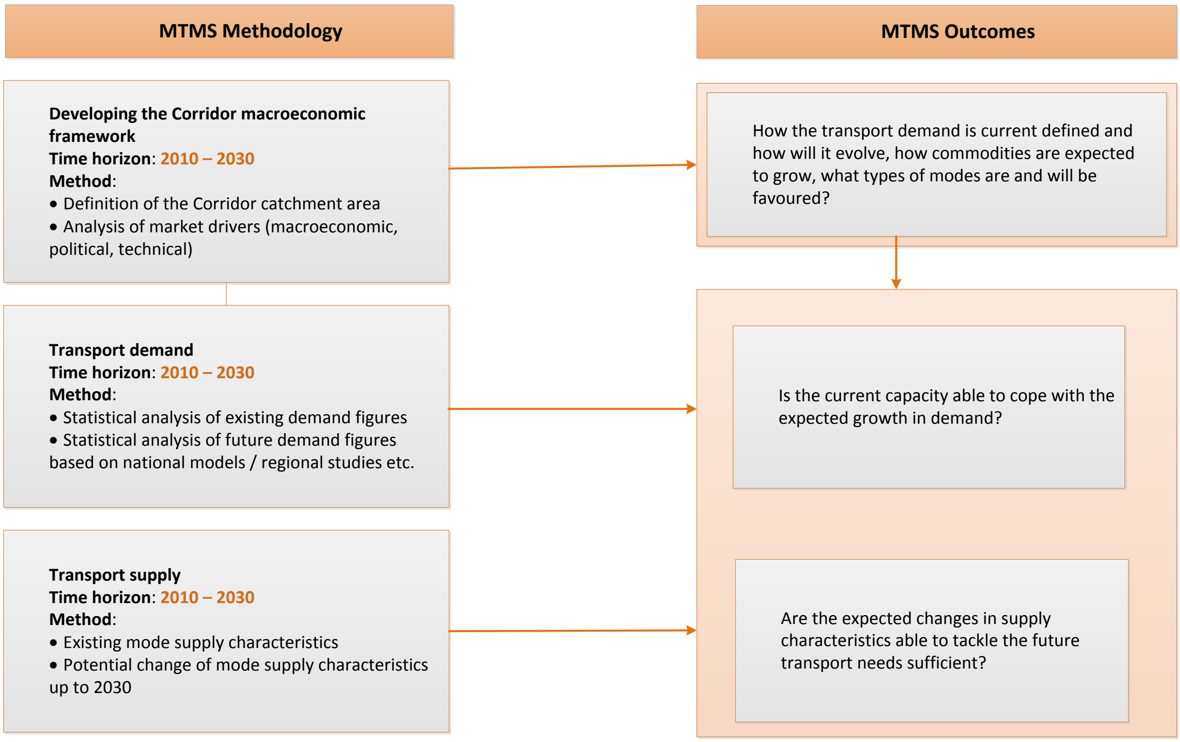
Step 1: Analysis of the Macroeconomic framework of the OEM corridor for the period 2010 – 2030.

This activity concerns:

- Definition of the catchment area. The NUTS 2 regions that are crossed by any infrastructure of the OEM corridor were selected for further analysis for the purpose of the MTMS.

- Analysis of the market drivers. This analysis describes a number of socio economic characteristics of the OEM corridor countries and OEM regions, in particular Gross Domestic Product (GDP), population and urbanisation. Also, a preliminary forecast for the GDP and population was given on the basis of an EU encompassing study. Besides the source Eurostat, national figures on GDP and population were presented. The purpose of this exercise is to examine whether the national forecasts are in line with the official EC studies.

Figure 3: Scheme of the Multimodal Transport Market Study Methodology



Source: Consortium

Step 2: Analysis of the transport demand for the period 2010 – 2030.

This activity concerns:

- On the basis of national sources the analysis of the current volumes and future demand scenarios developed by national models for each of the Corridor countries are presented. These scenarios describe the prospect of transport demand for a certain time horizon (e.g. 2030) based on a set of macroeconomic and policy assumptions. This analysis has been carried out for each country in the OEM corridor.
- Transport description of the OEM corridor in 2010covering both the passenger and freight transport using the ETISbase as source. It can be stated that ETISbase covers comprehensive data for passenger and freight that is derived from Eurostat and national sources. This analysis describes the transport for the catchment area on the corridor, i.e. on the first level, with origins and destinations inside the catchment area.
- Integrated freight transport demand scenarios. In this analysis the second level (origin and destination in the corridor) and third level (transit) of corridor traffic for rail and road transport has been considered. For both road and rail freight transport the base year 2010 is presented, as well as the forecast for year 2030. These forecasts are based on the PP22 study. In that study, the European reference scenario as presented in the socio economic section is used. Also, the forecasts for inland waterways and maritime transport are presented for year 2030, based on 2010. These forecasts are, just as for rail and road, based on the European reference scenario. The advantage of this approach is that all countries are treated in a comparable way with a similar base year 2010.
- Integrated passenger transport demand scenarios. In this analysis the long distance passenger rail transport in million passenger kilometres in 2010 and 2030 on the OEM corridor has been considered.

Step 3: Analysis of transport supply.

On the basis of the review in which key bottlenecks and critical issues in the infrastructure were identified, an outlook to the future (2030) is presented for rail and inland waterway. This outlook is based on the forecasts for the demand side and the identified bottlenecks and critical issues. Where possible, future projects were assessed for their impact on the elimination of these bottlenecks.

The outcomes of the above three activities led to the following results:

Gross Domestic Product (GDP) and population

The development of GDP in the period 2010 – 2030 shows that for all countries in the OEM corridor a positive growth is expected. In population forecasts, there are mixed results, since a decline is expected for certain Member States. The figures below depict the (maximal) average annual growth rates for population and GDP. For four Member States, a decrease of the population is expected in the period 2010 - 2030, while all countries expect an increase in GDP for this period.

Figure 4: Average annual population growth (2010 – 2030)

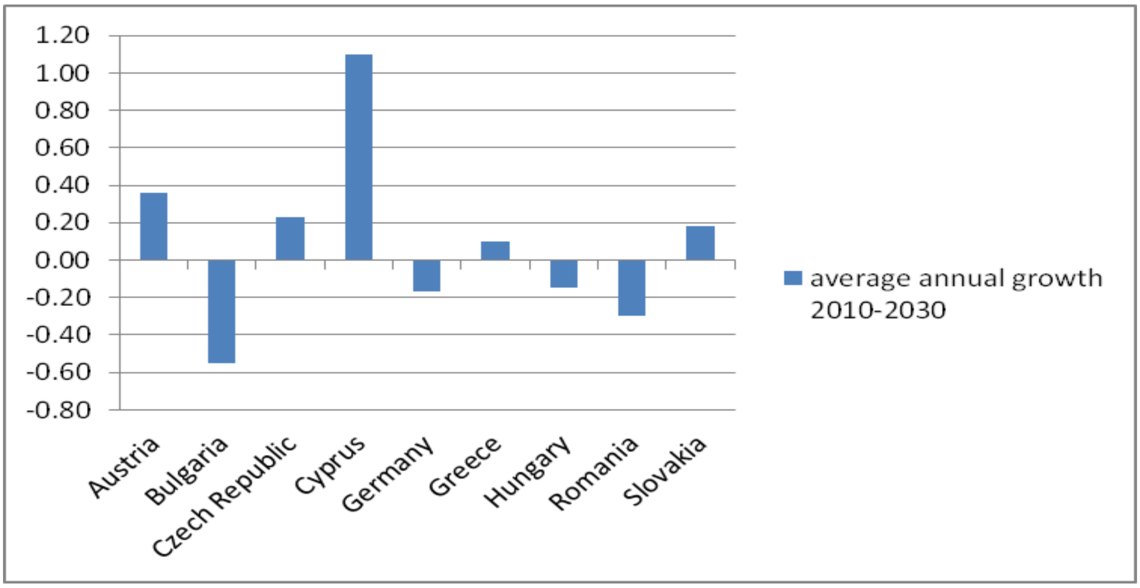
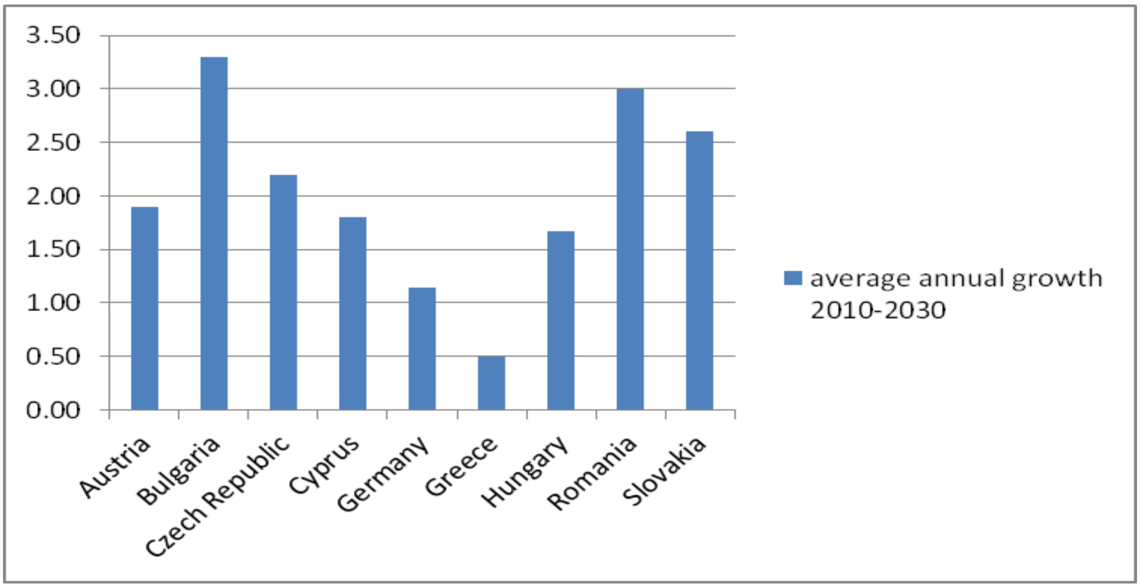


Figure 5: Average annual GDP growth (2010 – 2030)



The national transport volumes and demand scenarios

National forecasts and national transport figures have been described, as these were available through the project sources, as well as official national sources from the corridor countries. One of the main conclusions is that forecasts, if available, are on a regional level within the country considered (for example Austria, Germany, Bulgaria), but lack the regional detail in other countries. If forecasts are available, then in most cases no detail is available on a regional level, at best a differentiation is obtained between domestic, import/export and transit traffic. This means that on the basis of this information, the OEM corridor cannot be isolated from other corridors.

Also, it should be considered that there is no uniform scenario used in case of forecasts being available. At best, the scenarios of the German "Bundesverkehrswegeplan" are taken into account in the Austrian "Verkehrsprognose Österreich 2025+". Nevertheless, the timing is different; the Austrian plan is developed in 2009, while the German plans originate in 2007 and 2010, respectively[13], and will be updated in 2015. For a number of countries, forecasts are either not available or are given in qualitative figures.

Transport description of the OEM corridor in 2010

The first level of corridor traffic, that is, transport within the Corridor catchment area, has been described for the base year 2010. For freight transport, the domestic transport has been included. Notably for road transport the domestic transport is carried out on short distances. This is one of the reasons why the volumes for road are relatively high. The short distance transport by road is explained by a high share of building materials, foodstuffs, agricultural products and final products.

This also concerns the last or first mile transport related to long distance transport by rail or inland waterways, for example container transport. In the description and analysis the short distance transport has been separated from long distance transport. On the longer distance, there is more competition between road versus rail and inland waterways.

[13] Revision of Transport Infrastructure Demand Plan (Überprüfung Bedarfsplan 2010) and Traffic Interconnection Forecast 2025 (Verkehrsverflechtungsprognose für 2025), issued in 2007.

Integrated freight transport demand scenarios

The second level (origin and destination in the corridor) and the third level (transit) of corridor traffic for rail and road transport have been considered in this analysis, in both, tonnes and tonne-kilometres. The results are presented per country in the OEM corridor. For rail, the first level traffic is subdivided in domestic and international traffic, and the second level in imports and exports. For road, the first level domestic traffic has been further split into domestic short distance and domestic long distance. The short distance transport is in general applicable for distances shorter than 80 kilometres.

The modal split for rail and road (domestic short distance traffic is excluded) has been analysed for the horizons of 2010 and 2030. There is a modest increase expected for the rail share in this period, whereby in Germany and Austria the increase in the share of rail is the highest on the corridor.

Also for inland waterways and maritime transport, forecasts for 2030 have been presented for land-land flows in the OEM corridor. For inland waterways, in total a growth of 25% is expected in the period 2010-2030, and for maritime transport of 14%.

The table below summarises the results of the forecast volumes.

Table 17: Freight transport volume between the OEM regions for 2010, 2030 reference scenario; in 1,000 tonnes

	2010	2030 reference
Road	415,483	746,158
Rail	189,711	379,966
Inland waterway	18,694	23,361
Maritime	74,995	85,578
Total	**698,884**	**1,235,063**
Rail share	27.1%	30.8%
IWW share	2.7%	1.9%

In the European reference scenario, the share for rail is expected to grow from 27.1% in 2010 to 30.8% in 2030, whilst the share of inland waterways is expected to decrease from 2.7% in 2010 to 1.9% in 2030. When full compliance with TEN-T standards by 2030 is considered, the share of rail and inland waterways is expected to increase, as presented in section 5.3.9.

Integrated passenger transport demand scenarios

The passenger demand for the period of 2010 to 2030 remains almost stable with a growth rate of 0.05% per year.

Most of the countries demonstrate slightly positive growth rates with the exception of the Czech Republic and Hungary. These two countries have negative growth rates of 0.58% and 0.39% annually.

Analysis of transport supply

For rail and inland waterway, the identified bottlenecks and critical issues have been analysed using the forecast of the demand side. Where possible, future projects were assessed on their impact for the elimination of these bottlenecks.

For rail, the most important bottlenecks identified are listed below. Because of uncertainties (e.g. no data for short distance passenger traffic) in the identification process (see section 5.3.10), some of the bottlenecks are mentioned in terms of probability.

- The section Dresden – Czech border. Mainly because of growth in freight transport there is high probability that this section will be a bottleneck in 2030;
- The Hinterland traffic from/to Hamburg and according to German Rail (DB NETZ AG) also the Hinterland traffic from/to Wilhelmshaven and Bremerhaven/Bremen are expected to be bottlenecks;
- The Praha – Česká Třebová line is at full capacity in the base year, and for the year 2030, a doubling of the freight transport is expected, which confirms that this section is really a bottleneck;
- For the rail sections to/from Budapest, a doubling of freight transport is expected. According to the Hungarian railways, the improvements that will be made, will be sufficient;
- The cross-border section Békéscsaba – Thessaloniki. This section is rather long (1.168 km, or about 20% of the total OEM Corridor length) and runs on the territories of Hungary, Romania, Bulgaria and Greece. Currently, the characteristics of the railway lines are rather heterogeneous and many sections do not meet the requirements set by the Regulation No.1315/2013. According to the reference scenario for this section, growths for subsections are expected in 2030 between 70% and 160%. The biggest growth is expected for the section Filiaşi – Arad in Romania. For the subsections in Bulgaria and Greece, a more modest growth (70%) is forecasted.

For inland waterways, the following locks were identified as possible bottlenecks:

- Ship lift Lüneburg: It is expected that this bottleneck will be eliminated in 2030.
- The locks at Anderten (DE) and Geesthacht (DE) for which capacity utilizations are expected to increase to 70%.

Apart from expected demand, there are other factors that influence the future availability of capacity on rail or inland waterway infrastructure. A number of these other factors have been discussed. For rail, these are:

- Infrastructure charges in rail freight transport. Access charges have to be paid to access the rail networks;
- Average border waiting times in rail freight transport. The users of rail freight services are still confronted with considerable waiting times at various border crossing points along the corridor;
- The issue of capacity on mixed traffic lines and practices to resolve conflicts between trains is a subject for extensive research and development. This concerns the implementation of ERTMS level 3, introducing a system of gradual timetabling and computer assisted train operation systems.

For inland waterways these other factors are:

- The deployment of River Information Services (RIS). In both Germany and the Czech Republic, basic RIS applications have been implemented. The RIS could lead to a reduction waiting times before locks, bridges and ports.
- At present no infrastructure for the supply with alternative fuels is available along the Elbe and Vltava. In general, Liquefied Natural Gas (LNG) is considered as the forward-looking alternative fuel in matters of inland waterway transport. The planning for the construction of supply infrastructure for LNG takes place along the Unterelbe, and more specifically, in the Port of Hamburg.

4.9 The Critical Issues (Summary of 5.4)

The key critical issues are identified by the study review, infrastructure compliance analysis and Multimodal Transport Market Study and constitute rail cross-border and capacity issues, horizontal issues in terms of interoperability and intermodality, IWW bottlenecks and, finally, seaports integration into the Corridor. The critical issues largely coincide with the objectives of the CEF pre-identified projects provided in Annex I of the Regulation. To this end, the European Coordinator might focus primarily on these issues and related projects during his activities.

River Elbe

The River Elbe is characterised in general by insufficient navigability conditions, as well as deficiencies of several sections along its length, in terms of unreliable draught conditions, incomplete network, limited underpass clearances, non-compliant lock chambers, capacity deficiencies, etc. Due to the involvement of two Member States, Germany and Czech Republic, this also constitutes a cross-border border issue.

Rail cross-border and capacity

The overview of the OEM railway corridor identified three critical cross-border sections. The existing **Dresden – Praha** rail line (DE-CZ) is already highly used, while the forecasted considerable growth in freight demand will most likely create a critical capacity bottleneck for this section.

The **Brno – Győr** (CZ-AT/SK-HU) line exhibits technical bottlenecks at border crossing points characterized by poor technical condition of railway border bridges near Břeclav and towards AT and SK borders. The railway node Brno is also considered an important bottleneck in the Czech Republic, showing considerable capacity deficits and poor condition regarding basic technical parameters. In the Bratislava area, capacity bottlenecks are evident at the Devínska Nová Ves station and all other relevant Bratislava stations including tunnels.

Finally, there are interoperability issues along the long section **Békéscsaba – Thessaloniki (HU-RO-BG-EL)**, which also exhibits rather heterogeneous technical characteristics, while many sections do not meet the requirements set by the Regulation.

Apart from the above, the capacity utilisation analysis in conjunction with the results of the MTMS identified potential critical capacity bottlenecks at the hinterland transport to/from the Port of Hamburg, along the Praha – Česká Třebová line and along the rail sections to/from Budapest.

Maritime Ports

Intermodality constitutes a key critical issue for ports in terms of providing the necessary connections to the land networks to ensure the seamless intermodal transport along the supply chain of the OEM corridor. The latter is particularly relevant in the case of the Greek ports of Igoumenitsa and Patras, which are currently lacking connections to the rail network. Another critical issue is interoperability in terms of deployment of e-maritime services and vessel traffic management systems, which are either existing or planned in all OEM seaports except from that of Patras in Greece. In Cyprus, this regards also the need for improved road connections to seaports.

Intermodality

Apart from ports, the issue of intermodality must also be addressed in both Rail-road terminals and airports. The present situation could be characterized in general by bottlenecks or missing links between airports and corridor infrastructure, as well as the need for improvements in the connections of IWW ports and Rail-Road terminals.

Operational rules, ERTMS, Traffic Management Systems

One critical issue regarding operational rules refers to organizational bottlenecks, as well as lack of ERTMS and other Traffic Management Systems deployment in the road and seaport/IWW network.

4.10 The Objectives of the Corridor (Summary of chapter 6)

In accordance with the TEN-T Regulation No.1315/2013, the OEM Corridor shall demonstrate European added value by contributing to a number of the four key objectives related to territorial and structural cohesion, efficiency between networks/modes sustainability and increased benefits for users. The Regulation's objectives together with the related goals set in the 2011 White Paper for Transport - Roadmap to a Single European Transport Area – towards a competitive and resource efficient transport system are used to define the corridor-specific objectives. A benchmarking methodology is also proposed in order to measure the corridor performance against the set objectives.

The methodology is based on the definition of a number of related Key Performance Indicators (KPIs) per strategic objective (SO), for the measurement of which data is readily available from the present study, as per the following:

- KPI_1 : Electrification
- KPI_2 : Freight trains with 22.5 t axle load at 100 km/h
- KPI_3 : Trains of 740 m length
- KPI_4 : Deployment of ETCS and GSM-R
- KPI_5 : CEMT class IV compliance (draught)
- KPI_6 : RIS deployment
- KPI_7 : Express roads / Motorways deployed
- KPI_8 : Implementation of Traffic Management Systems: Road
- KPI_9 : Implementation of Traffic Management Systems: Maritime
- KPI_{10} : Connection to railway: Maritime
- KPI_{11} : Connection to railway: IWW
- KPI_{12} : Connection to railway: Airports
- KPI_{13} : Availability of alternative fuels infrastructure: Maritime
- KPI_{14} : Availability of alternative fuels infrastructure: IWW
- KPI_{15} : Availability of alternative fuels infrastructure: Airports
- KPI_{16} : Availability of alternative fuels infrastructure: Road

Finally, the Benchmark values for each KPI have been calculated for year 2013. For the further study period, an extension of KPIs to market-related indicators based on standardized calculation methods is proposed, which among others might reflect the development of transport modal split, capacity issues and travel time.

4.11 The List of Projects and the Implementation Plan (Summary of chapter 7.1)

The OEM Corridor implementation plan includes primarily the recording of all on-going and planned projects (infrastructure works and studies) known to present (2014), as obtained by National Ministries, the Infrastructure Managers and Regional Authorities. The projects were classified primarily under five key categories reflecting the key objectives of the Corridor, namely technical compliance, intermodality, interoperability, capacity and sustainability, while a secondary classification was provided to account for critical issues, cross-border issues and urban areas location.

A selection of key projects was subsequently made, based on whether these address the identified critical issues, the cross-border sections and/or are projects listed in the

CEF Regulation 1316/2013, Annex I. This list of key projects, together with the unresolved bottlenecks, may be used by the European Coordinator to define the key projects that will be part of the Corridor's Work Plan.

In total, 280 projects are listed for all modes, out of which:

- 101 items address technical compliance bottlenecks
- 39 items address interoperability issues
- 38 items address intermodality issues
- 90 address further capacity issues
- 12 address sustainability issues

As a conclusion it can be stated:

- 142 of 280 projects are addressing the (partial) mitigation of critical issues.
- Approx. **25.6 of 47.4 billion EUR** must been spent as project costs on critical issues in the OEM corridor, as far as costs are known at all.
- Approx **15.8 billion EUR** of these costs for critical issues are still to be financed.

In addition, to the above, the comparison of the critical issues identified against the implementation plan's list of projects, lead to the identification of "persisting bottlenecks", as these constitute non-compliant parameters of corridor sections and core network nodes along the OEM Corridor. These are either not fully or insufficiently addressed by any project(s) known to present, and call for special attention on behalf of the European Coordinator, in order to achieve the desired complete compliance of the entire Corridor with the TEN-T regulations together with an efficient and seamless operation.

Rail & RRTs

The investment projects for Rail and Rail-Road Terminals are expected to address the majority of existing bottlenecks in the OEM rail network by 2020. Nevertheless, there are still certain critical ones that will not be alleviated before 2020, particularly with regard to the technical non-compliance of certain sections in Bulgaria, Czech Republic and Romania. The undefined timing for a large number of projects is also deemed problematic, as it would hinder an implementation in the short-term. To this end, the remaining "open issues" for the railway sector include the following:

- A significant part of the railway network in the Czech Republic, Slovakia, Austria, Romania and Bulgaria (2734 km) will only permit a train length lower than 740m.
- Infrastructural requirements to operate freight trains with 22.5 t axle load at 100 km/h will be lacking along 550 km of the OEM rail network.
- Although the deployment of ETCS is addressed by a large number of projects, ETCS will be lacking along 1943 km.
- Uncertainty on the status of core RRT development in Pardubice, Thessaloniki and Patras.

IWW

In the Czech Republic, the foreseen mitigation measures are expected to alleviate the main bottleneck of the non-compliance of River Elbe. In Germany, the mitigation measures are not defined yet and are expected as a result or follow-up of the German study "Gesamtkonzept Elbe". However, the implementation timing of various projects is still unspecified, suggesting that implementation will not be realised in the near future. A jointly coordinated schedule is expected with the German study "Gesamtkonzept Elbe". Additional open issues are the unspecified timing and projects for the deployment of further RIS services in both countries, as well as the lack of provision of alternative fuels in all inland ports.

Seaports

The investment projects are expected to address the majority of existing intermodality, interoperability and capacity bottlenecks in the OEM seaports by 2020. Nevertheless, there are still certain critical ones that will not be alleviated before 2020, such as the missing rail connections to the Greek port of Igoumenitsa (incl. a potential RRT), the deployment of TMS at the Port of Patras, as well as the provision of alternative fuels missing from the Ports of Burgas, Thessaloniki, Patras, Igoumenitsa and Heraklion.

Road

Most road projects entail the construction of new or upgrading of existing motorway sections, which are expected upon completion to increase the relative share of motorway/express road sections to 92% of the total Corridor length. In addition, 80% of the projects planned to be completed after 2020 will address capacity problems in urban areas. Other related projects will only partially contribute to achieving interoperability of ITS and tolling systems along the Corridor, while there are very few projects aiming at introducing or extending the supply of alternative fuels and improving the efficiency of energy use. Accordingly, the "open issues" for the road mode are:

- The two corridor sections Lugoj – Drobeta Turnu Severin (150 km, RO) and Montana – Vratsa (38 km, BG, E79) are recently not planned to become of express road/motorway standard.
- The three corridor sections Drobeta Turnu Severin – Border RO/BG (83 km, RO, RN 56A), Orizovo – Border BG/TR (65 km, BG, Road 8/E80) and Border BG/EL – Thessaloniki (41 km, EL, E79) might lack an adequate number of parking facilities.
- ITS services are still regionally and nationally fragmented and are lacking interoperability
- The electronic toll charging systems that are in operation in DE, CZ, AT, SK and HU are still hardly compatible (only for Germany and Austria).

Airports

Connection of main airports with rail network is fundamental to achieve multimodality and interoperability objectives set by the European commission. 50% (3 out of 6) of the Core network major airports, belonging to the Orient-East Med Corridor, are currently not connected with heavy rail. Accordingly for the corridor airports, the "open issues" are:

- Hamburg Airport might clarify, whether its existing light rail connection will be upgraded towards heavy rail until 2050.
- The progress to provide capacity for alternative fuels for aircrafts shall be monitored in all corridor airports, as no project is in place yet.

The complete list of projects is presented per mode in Annex 5.

4.12 The ERTMS deployment along the Orient/East Med (Summary of 7.2.1)

The Orient/East Med corridor is partly coinciding with the ERTMS corridors E and F (and shorter parts of D and B), and also with sections where ERTMS deployment is required by the European ERTMS Deployment Plan 2009 (EDP) as well as sections of additional voluntary national development.

According to EDP and Decision 2012/88/EU, the deployment target by 2015 is to have approximately 1.872 km (32% of rail network length) fully equipped with ERTMS

(ETCS plus GSM-R), which comprises of major sections of the northern part of the corridor (DE, CZ, SK, AT, HU, partly RO).

Until 2020, an additional 2.279 km (39% of corridor) needs to be deployed with any ETCS subsystem. 480 km (8%) is not part of any recent deployment plan (mainly port links in DE and EL).

As regards the current status of ERTMS deployment, ETCS L1/L2 has been installed along certain railway sections in Austria, Hungary, Bulgaria and Greece (14% of length), while less are under operation.

GSM-R is in operation in Germany, the Czech Republic, Austria and parts of Bulgaria and Greece (49% of length). Additional parts of the corridor are currently under construction. Other sections do not have a clear date of deployment.

According to the list of identified projects along the Orient/East Med corridor, 52 projects / measures directly or indirectly related to ERTMS deployment have been identified, covering roughly the half of the OEM corridor railway lines.

However, the majority of the ERTMS projects are 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 to present; partially, the implementation of ERTMS is coupled to the regular displacement of legacy train control systems.

In many cases, it can be assumed that the overall upgrade or new construction of railway lines, especially those of the High-speed network, includes the ERTMS deployment as requested in the Decision (para 7.3.3.1). Therefore, the full ERTMS deployment could also be expected by the Corridor implementation target year (2030).

Nearly all ERTMS projects in the northern part (DE, CZ, AT, HU) refer to the implementation of ETCS level 2, as GSM-R is already in operation or under construction, while the southern part (RO, BG, EL) deploys Level 1. In Germany and Austria, studies about the upgrade of the currently employed level 1 on testing lines are ongoing.

The severe deployment delays in most of the Member States have been pointed out in the EC document[14] of February 2014: For Corridor E (Dresden – Constanta), the delays varied among Member States from 0 to 5 years, for corridor F Germany had announced the finalization date of 2027, according to this EC document, while the German Rail IM cannot yet define a finalization date.

The coherence analysis at cross-border points demonstrates that recently none of the cross-border points show a fully operating ERTMS system on both sides of the border. GSM-R is operated on both sides of DE/CZ and CZ/AT and SK/HU border. Where installed (AT/HU, RO/BG), ETCS is not under operation yet. In the near future, on 5 out of 8 border crossing points, deployment time gaps of 2 to 10 years might occur, according to recent schedules.

It is assumed that the ERTMS Breakthrough Program 2015/2016, presented by the European Coordinator Mr Karel Vinck during the 4th Corridor Forum meeting, will be a suitable tool to accelerate the ETCS and GSM-R deployment along the Orient/East Med corridor.

[14] DWD (2014), 48 final: Commission Staff Working Document on the state of play of the implementation of the ERTMS Deployment Plan, p. 5

4.13 The RIS Deployment Plan (Summary of 7.2.2)

Germany has implemented a wide range of RIS applications (ELWIS), which in general are of high quality. In the Czech Republic, basic RIS applications have been implemented, but LAVDIS services, such as provision of Notices to skippers suffer from the lack of reliability of their operation.

In both countries, a barrier for RIS development is the funding. The progress with the implementation of a few applications or its roll-out to the complete waterway network will be delayed, as cost-benefit evaluations of certain applications regarding data collection, storage and use were considered and personnel resources are limited at the national IWW administrations responsible for RIS implementation.

Apart from RIS, other IWW related investments are required, which are regarded as more important. In addition, the vessel fleet operated at the Elbe have outdated equipment and low transport performances, which reduces potential RIS benefits.

While basic systems are almost fully in place (Notices to Skippers, Electronic Nautical Charts), the deployment of a majority of advanced RIS services is still on-going.

The international data exchange between the two riparian countries is planned but still hampered by different technological applications and legal problems, especially because of data privacy issues. The missing interconnection between Czech Republic and Germany is regarded as a barrier for the wider use of electronic reporting.

Another challenge is the RIS implementation in inland ports. A number of inland ports have still not set out the necessary steps for the RIS implementation. No specific information is available for the Orient/East Med Corridor core network ports in Germany (Hamburg, Bremerhaven, Bremen, Hannover, Braunschweig and Magdeburg). Finally, no further RIS development plans are known for the Czech core network ports (Děčín, Mělník and Praha).

4.14 Other Elements (Resilience, Environmental Issues – Summary of 7.3)

The practice established by the EC of continuously sharing with the Member States the state of project progress has proven to be very effective and thus should be maintained in the future. Furthermore, the various projects presented by the Member States could be accompanied by traffic forecasts, Cost Benefit Analysis (CBA), accompanying measures necessary to meet the traffic targets and alternative solutions to the proposed projects.

The definition of the investments required should take in proper consideration the freight-oriented nature of the Corridor.

In addition to the above elements, mitigation and adaptation measures should be taken in advance by Member States and local agencies to reduce impacts of climate change and extreme weather events in the long-term, since these may negatively affect transportation systems increasing the risk of damages, delays and failures on roadways, railways, air and marine transport infrastructures.

5 Characteristics of the Corridor

5.1 Alignment of the Orient/East-Med Corridor

5.1.1 Alignment

Through clarifications with Member States the corridor alignment has been consolidated to:

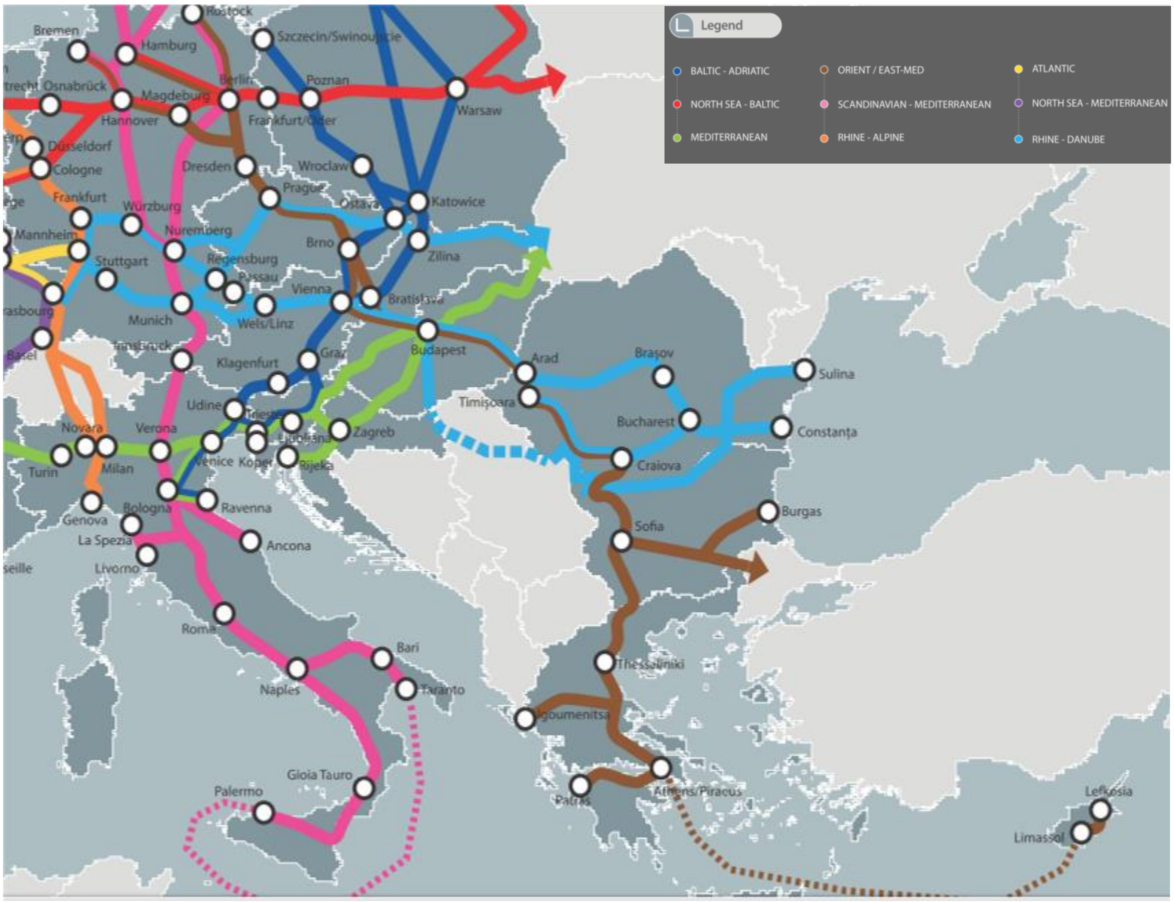
- Rostock - Berlin
- Brunsbüttel – Hamburg – Berlin – Dresden
- Bremerhaven / Wilhelmshaven – Magdeburg – Leipzig / Falkenberg[15]– Dresden
- Dresden – Ústí nad Labem – Mělník/Praha – Kolín
- Kolín – Pardubice – Brno / Přerov – Wien/Bratislava – Győr – Budapest – Arad – Timişoara – Craiova – Calafat – Vidin – Sofia
- Sofia – Plovdiv – Burgas
- Plovdiv – Svilengrad - BG/TR border
- Sofia – Thessaloniki – Athina – Piraeus
- Athina – Patras / Igoumenitsa
- Thessaloniki / Palaiofarsalos – Igoumenitsa
- Piraeus – Heraklion – Lemesos – Lefkosia - Larnaka

The specific corridor alignment as depicted in Figure 7 is a summary based on the findings of:

- the analysis of core network links and core networks nodes;
- the discussion of alignment since the 1st Corridor Forum with the Member States and coordination of DG MOVE.

[15] According to the Regulation the alignment is via Falkenberg – Elsterwerda - Radebeul. Due to technical and operational reasons, the section Falkenberg - Elsterwerda is not part of the typical train routing, but Falkenberg – Röderau. This change is in line with the request of the German Ministry of Transport and the rail infrastructure manager DB Netz.

Figure 6: Schematic overview map of the Orient / East-Med Corridor among TEN-T Core Network Corridors (brown colour)



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

Figure 7: Alignment of the Orient / East-Med Corridor

Source: Consortium

The alignment of the corridor is depicted in various maps as well as in the TENtec system. Country related corridor maps and comprehensive modal maps are provided in Annex 3 to this document.

5.1.2 Statistical Information on the Corridor

Table 18 shows the modal and country specific length of the corridor, summing all main and parallel lines identified as parts of the corridor. For IWW, this includes doubled river distances, as each national river bank is shown.

Table 18: Total length of Orient / East-Med Corridor by countries and modes

Orient/East-Med Corridor, infrastructure total length in [km]										
Mode	**DE**	**CZ**	**AT**	**SK**	**HU**	**RO**	**BG**	**EL**	**CY**	**Σ**
Rail	1650	840	160	114	412	506	1140	1068	---	**5890**
	28%	*14%*	*3%*	*2%*	*7%*	*9%*	*19%*	*18%*		*100%*
Road	1350	454	184	82	431	543	1004	1462	134	**5644**
	24%	*8%*	*3%*	*1%*	*8%*	*10%*	*18%*	*26%*	*2%*	*100%*
IWW	1321	317	---	---	---	---	---	---	---	**1638**
	81%	*19%*								*100%*

Source: Consortium, based on network statements

Table 19 shows modal and country specific average lengths, calculated from typical national routings, leading to shorter distances.

Table 19: Average Length of Orient/East-Med Corridor by countries and modes

Orient/East-Med Corridor, infrastructure average length in [km]										
Mode	**DE**	**CZ**	**AT**	**SK**	**HU**	**RO**	**BG**	**EL**	**CY**	**Σ**
Rail	685	472	150	114	403	506	1055	866	---	**4231**
	16%	*11%*	*4%*	*2%*	*10%*	*12%*	*25%*	*20%*		*100%*
Road	727	460	157	82	397	543	969[A]	1245	102	**4681**
	16%	*10%*	*3%*	*2%*	*8%*	*12%*	*21%*	*27%*	*2%*	*100%*
IWW	781[B]	159	---	---	---	---	---	---	---	**940**
	83%	*17%*								*100%*

Source: Consortium, based on network statements and other public sources

[A] along Trakija Motorway
[B] Bremerhaven – Praha Holešovice

As presented in Table 20, 9 countries are generally to be considered within the scope of this OEM corridor study, regarding line infrastructures, as follows:

- 2 countries include all infrastructure modes rail, road, IWW and sea shipping (DE, BG),
- 5 countries include rail, road, IWW (CZ, AT, SK, HU, RO),
- 1 country includes rail, road and sea shipping (EL), a
- 1 country includes by road and sea shipping only (CY).

Furthermore, all countries include at least one core network airport.

Table 20: Inclusion of countries to the Orient / East-Med corridor by infrastructure mode according to alignment

Country	Rail infrastructure	Road infrastructure	Inland waterway infrastructure	Maritime/port infrastructure	**Modes Total**
DE	✓	✓	✓	✓	**4**
CZ	✓	✓	✓		**3**
AT	✓	✓	(✓)		**3**
SK	✓	✓	(✓)		**3**
HU	✓	✓	(✓)		**3**
RO	✓	✓	(✓)		**3**
BG	✓	✓	(✓)	✓	**4**
EL	✓	✓		✓	**3**
CY		✓		✓	**2**
Total	**8**	**9**	**2 (6)**	**4**	**28**

Source: Consortium

(✓) For Inland Waterway see General Note under section 5.2.3

5.1.3 Core Network Nodes of the Orient/East Med Corridor

The urban/traffic/logistic core network nodes on the Orient/East Med corridor can be derived from the Regulation No.1315/2013, and are located on the corridor. These nodes represent agglomerations of population and economy on one side, and consolidation points for passenger and freight traffic on the other.

The results are summarised in Table 21, grouped per country and node type.

Table 21: Urban and traffic/logistic nodes of the core network belonging to the corridor alignment

	Urban nodes of the core network along corridor		Airports *		Maritime ports To be connected to TEN-T rail and road by 2030		Inland core network ports		Rail-road terminals		∑
DE	Hamburg Bremen Hannover Berlin Leipzig	5	*Hamburg *Berlin (BBI) Bremen Hannover Leipzig	5	Hamburg Bremerhaven Wilhelmshaven Bremen Rostock	5	Hamburg Bremerhaven Bremen Hannover Braunschweig Magdeburg Berlin	6	Hamburg; Bremerhaven; Bremen; Hannover (Nordhafen / Linden. Lehrte); Braunschweig Magdeburg Leipzig Rostock Berlin-Großbeeren	9	30
CZ	Praha	1	*Praha	1			Děčín Mělník Praha-Holešovice Pardubice	4	Děčín Mělník Praha-Uhříněves Pardubice Přerov	5	11
AT	Wien	1	*Wien	1			Wien		Wien (Freudenau / Nordwest)	2	4
SK	Bratislava	1	Bratislava	1			Bratislava Komárno		Bratislava	1	3
HU	Budapest	1	*Budapest	1			Komárom Budapest-Csepel		Budapest-Soroksár	1	3
RO	Timişoara	1	Timişoara	1			Drobeta-Turnu-Severin Calafat		Timişoara Craiova	2	4
BG	Sofia	1	Sofia	1	Burgas	1	Vidin		Sofia Plovdiv	2	5
EL	Thessaloniki Athína Heraklion	3	*Athína Thessaloniki Heraklion	3	Athína / Piraeus Heraklion Thessaloniki Igoumenitsa Patras	5			Thessaloniki Patras Athína/ Piraeus / Thriassio Pedio	3	14
CY	Lefkosía	1	Larnaka	1	Lemesos	1					3
∑	**15**		**15**		**12**		**10**		**25**		**77**

Source: Consortium, based on Annex 1 to Regulation No.1315/2013

**) Airports marked with * are to be connected to TEN-T heavy rail and road by 2050 according to Art. 42*

Inland core network ports with brown layer are connected to the inland waterway assigned to the Rhine-Danube Corridor or the North Sea-Baltic Corridor, see General Note under section 5.2.3

Figure 8 and Figure 9 show the assignment of the listed nodes to the corridor infrastructure and provide an indication of the spatial distribution of traffic/logistic core areas along the corridor.

Figure 8: Overview on core network urban and traffic/logistic nodes on the alignment of the Orient-East Med Corridor (Northern part)

Source: Consortium

Figure 9: Overview on core network urban and traffic/logistic nodes on the alignment of the Orient-East Med Corridor (Southern part)

Source: Consortium

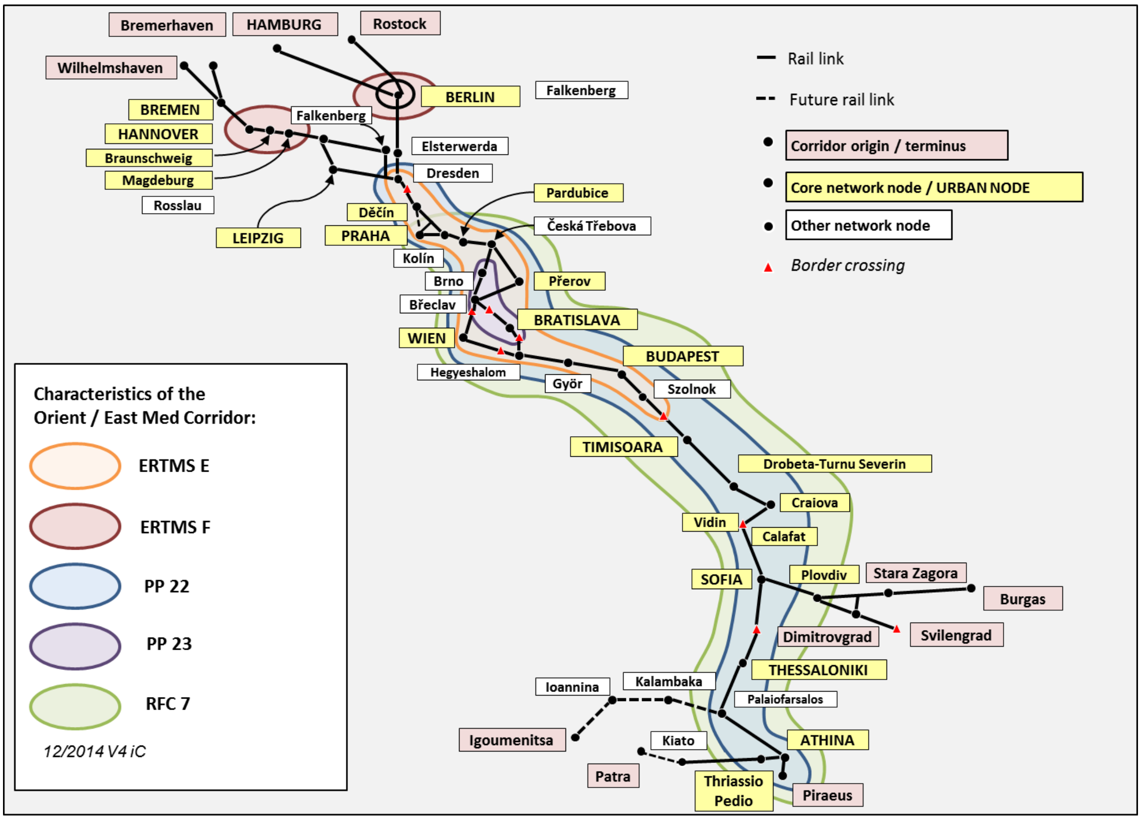
For the subsequent analysis, it has to be considered that the nodes representing inland ports and rail-road terminals in particular often consist of more than one facility. If applicable, in this study all single facilities of one node and of each mode were agglomerated for the purpose of the MTMS analysis, even if singular facilities would not meet the requirements of the regulation (e.g. regarding volume).

5.1.4 TEN-T Priority Projects and other initiatives along the Corridor

The Orient/East-Med corridor includes:

- sections of the earlier Priority Projects[16]:
  - PP 7 Motorway axis Igoumenitsa/Patras – Athina – Sofia – Budapest;
  - PP 21 Motorways of the Sea;
  - PP 22 Railway axis Athina – Sofia – Budapest – Wien – Praha – Nürnberg / Dresden;
  - PP 23 Railway axis Gdansk – Warszawa – Brno/Bratislava – Wien;
  - PP 25 Motorway axis Gdansk – Brno/Bratislava – Wien;
- sections of Rail Freight corridor No. 7 (Praha – Wien/Bratislava – Budapest – București – Constanta/ – Vidin – Sofia – Thessaloniki – Athina);
- sections of ERTMS Corridors[17]:
  - B (Hamburg Node)
  - D (Győr – Budapest)
  - E (Dresden – Praha – Budapest)
  - F (Hannover – Magdeburg – Berlin / Elsterwerda)

Figure 10: Schematic map of the Rail related initiatives coinciding the Orient / East-Med Corridor



Source: Consortium

[16] For Study Review related to TEN-T Priority Projects, see Section 3.2.1.

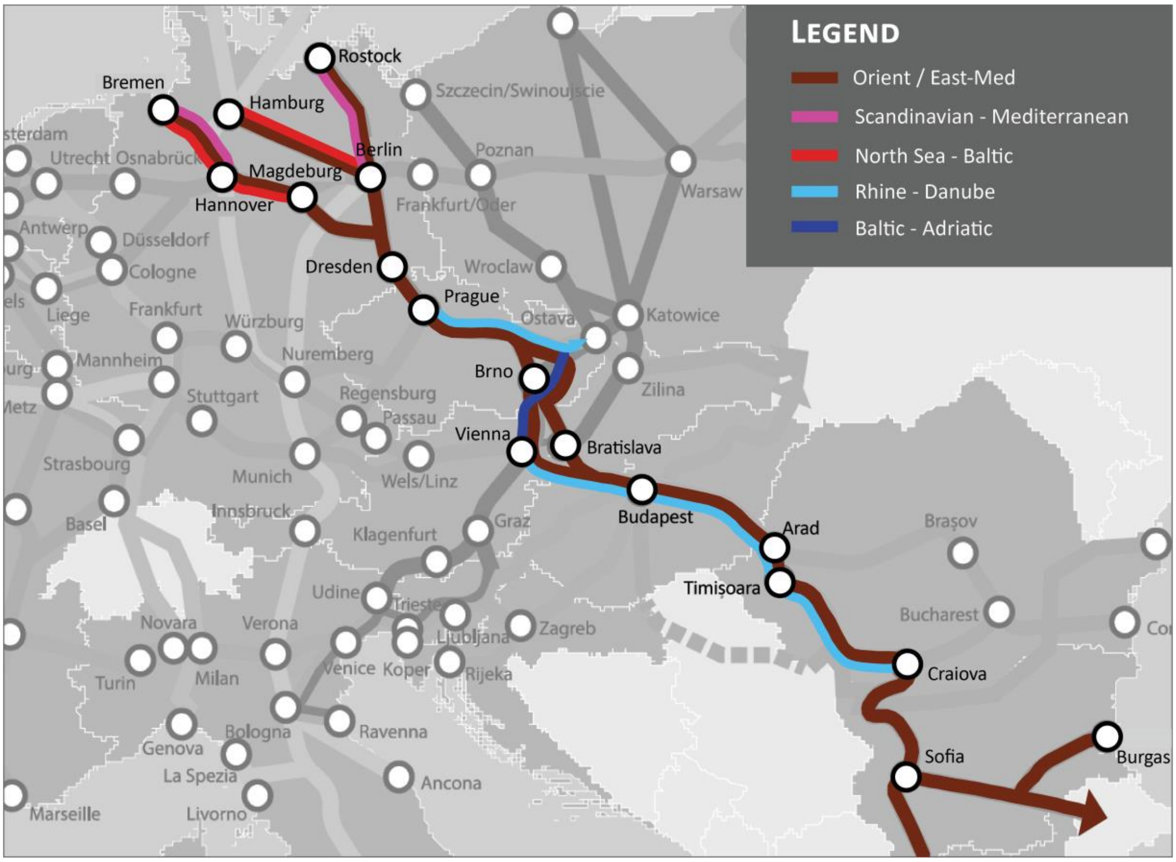
[17] For the Analysis of ERTMS Corridor Implementation, see Section 7.2.1

5.1.5 Corridor sections belonging to several corridor studies/consortia

Several segments of the Orient / East-Med corridor relate to many other corridors, as depicted below:

- The German "maritime" branch from Wilhelmshaven, Bremerhaven to Bremen to Hannover and Magdeburg (North Sea-Baltic corridor) incl. Bremen to Hannover (Scandinavian-Mediterranean corridor)
- The German "maritime" branch from Hamburg to Berlin (North Sea-Baltic corridor)
- The German "maritime" branch from Rostock to Berlin plus the node of Leipzig (Scandinavian-Mediterranean corridor)
- The main corridor section from Praha via Česká Třebová to Přerov (Rhine-Danube corridor)
- The Czech-Austrian branch from Přerov - (Brno) - Břeclav to Wien (Baltic-Adriatic corridor)
- The main corridor section between Wien and Vidin/Craiova (Rhine-Danube corridor, approx. 1.000 km).

Figure 11: Overlapping of the Orient / East-Med Corridor with other TEN-T corridors



Source: European Commission; Modified by Consortium

5.2 Description of the Technical Parameters of the Corridor Infrastructure

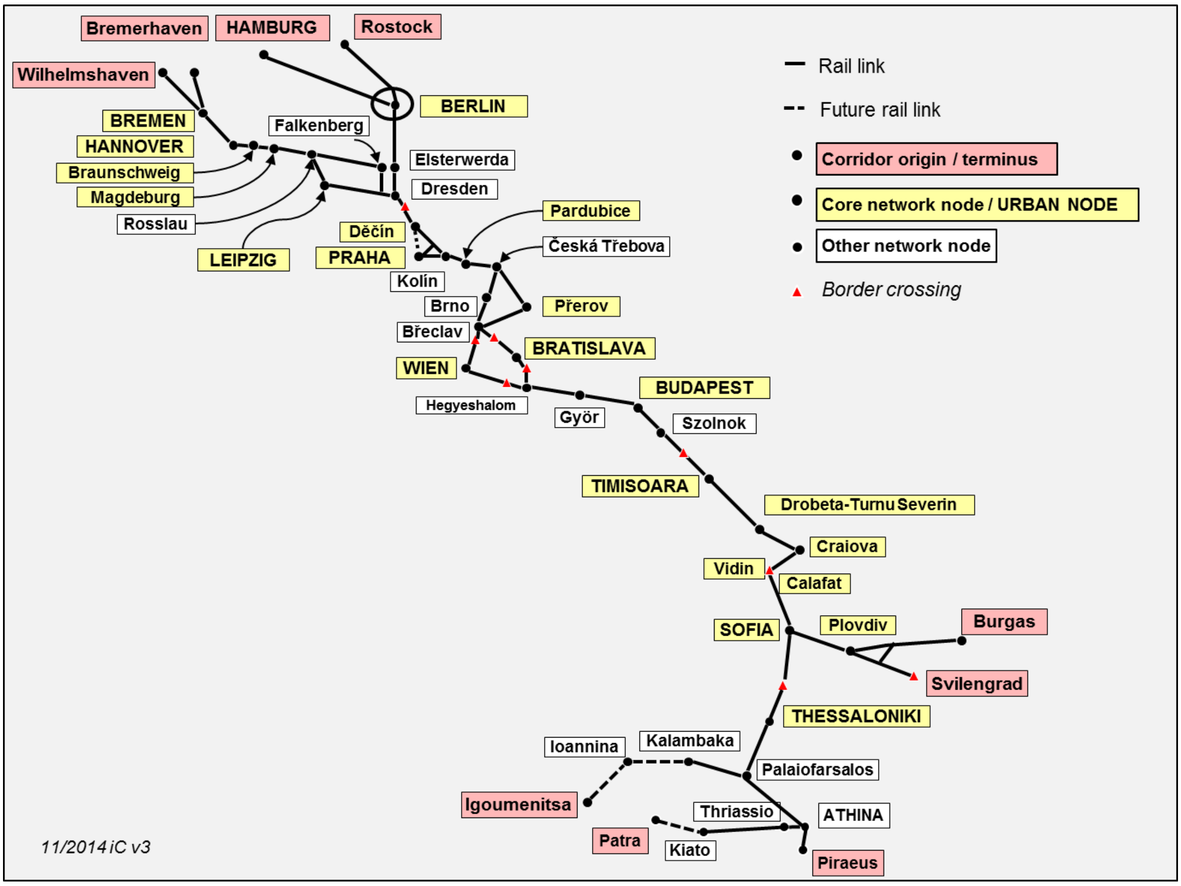
The objective of this chapter is the review of the compliance of the infrastructure of the OEM Corridor with the transport infrastructure requirements set out in the related EU Regulation (Regulation No. 1315/2013 of the European Parliament and of the Council of 11th December 2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No. 661/2010/EU), with the scope to identify the key bottlenecks and critical issues that need to be addressed. The exercise is carried out on a modal basis, with particular focus on the rail and inland waterway network of the Corridor.

5.2.1 Corridor rail infrastructure

5.2.1.1 Alignment

A schematic layout of the corridor rail infrastructure is displayed in Figure 12. The routing generally follows the overall alignment (see Figure 7).

Figure 12: Rail alignment of the Orient / East-Med Corridor



Source: Consortium (based on TEN-T Regulation), revised November 2014

The figure above also shows the assignment of the infrastructure, represented by dedicated railway lines. Routing variants on the respective main sections exist in Germany between Rosslau and Dresden (conventional freight rail routing via

Falkenberg[18] and future high speed passenger rail via Leipzig[19]), in the Czech Republic between Děčín and Kolín (left bank line via Lovosice and Praha [plus a planned high-speed line] and east bank freight line via Lysá nad Labem plus a freight rail link Praha – Lysá nad Labem) and between Česká Třebová and Břeclav (Freight mainly via Přerov and Passenger and Freight via Brno).

In addition, there are several planned new railway links, also shown in the above figure. Among these are:

- Heidenau - Ústí nad Labem (High-Speed rail) (Germany and Czech Republic);
- Lovosice - Praha (High-Speed rail) (Czech Republic);
- Kalambaka – Igoumenitsa (Greece);
- Kiato – Patras (Greece).

The corridor rail network covers eight countries (Germany, Czech Republic, Austria, Slovakia, Hungary, Romania, Bulgaria and Greece). Its total distance between Wilhelmshaven and Piraeus is on average 4231 km, depending on the routing in Germany and the Czech Republic. The biggest part of this entire distance is allotted to Bulgaria (1055 km = 25%), followed by Greece (866 km = 20%), Germany (685 km = 16%) and Romania (506 km = 12%), Czech Republic (472 km = 11%) and Hungary (403 km = 10%). Austria (150 km = 4%) and Slovakia (94 km = 2%) have only small shares of the average length. Cyprus has no railway infrastructure.

The total rail infrastructure length including all distinct sections is 5890 km, resulting from the relatively long German parallel branches.

5.2.1.2 Compliance of the Infrastructure with TEN-T requirements

Of particular relevance for the rail characteristics are the standards set by the Regulation No.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 (no speed requirement is set 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

The review of the railway network infrastructure status along the OEM corridor demonstrated that there are still considerable parts of the alignment, whose technical characteristics do not comply with the thresholds set out by Regulation No. 1315/2013. All key infrastructure parameters set by the EU regulation were examined, i.e. operational speed (line speed), train length, axle load, electrification

[18] According to the Regulation the alignment for rail freight is via Elsterwerda in order to include Core Network lines towards SW Poland. From the operational perspective a corridor train would have to run via Falkenberg and Röderau, due to a minor missing link at Elsterwerda rail junction.

[19] Instead of running via Rosslau, long-distance passenger trains use mainly the line Magdeburg – Halle – Leipzig, which is not part of the OEM corridor rail network.

and signalling and telecommunication. Additionally the number of tracks[20] was considered. Track gauge along the entire OEM corridor is 1435 mm.

Figure 13 presents a schematic layout of the Corridor Railway network, highlighting the areas of non-compliance along the Corridor in terms of line speed, axle load and train length. The complete mapping of the compliance test exercise is given in Annex 1a.

In addition, Table 22 provides for each parameter an overview on the percentage of non-compliant rail sections.

Operational speed:

With regard to line speed, on approximately 15% (908 km) of the corridor's rail network, the possible operational speed is lower than the 100 km/h threshold given by the TEN-T Regulation[21]. Only longer sections having a significant input on rail operations along the corridor were taken into consideration[22]. Among the sections with lines speeds lower than 100 km/h are sections in the Czech Republic (Děčín - Ústí n.L. freight link: 80 km/h), Kralupy n.V. - Praha, Blansko - Brno: 80 km/h; mainly due to challenging terrain conditions), within Budapest node (Kelenföld – Ferencváros: 80 km/h) and Slovakia (Petržalka - Border SK/HU: 80 km/h). The issue is, however, most prominent in Bulgaria, where the majority of the rail network is characterised by low maximum operational speeds. Along the OEM Corridor, this includes the entire section of Vidin – Sofia – Kulata: 60-90 km/h, i.e. from the Romanian to the Greek border.

Train length:

According to the Regulation lines of the core network should allow the operation of 740 m trains. Several sections of the corridor are not compliant with this requirement (approx. 46%, 2734 km). These line sections include the entire part of the Corridor in Czech Republic, Slovakia and Austria, and the entire section in Romania, apart from the sections Timişoara - Caransebes and Filiaşi – Craiova. In Bulgaria, the majority of the rail network is not compliant with the train length requirement of the regulation, with the exception of a number of sections between Plovdiv and Burgas and from Svilengrad to Turkish Border.

In general, it has to be stated that the possible operational train length is significantly influenced by the infrastructure parameters of the respective line, in particular with regard to the length of sidings of the operational programme applied. Additional factors are the traction power of the locomotive(s), the load hauled, braking power of the train and also related to these aspects, as well as to the respective operational programme, the inclination of the line either allowing, restricting or prohibiting operations for trains exceeding a dedicated length on certain lines. Further factors may be considered due to certain infrastructure parameters[23] on the respective railway lines. To determine all factors a detailed analysis is required[24].

[20] Regulation 1315/2013 on TEN-T requirements does not foresee any technical requirement regarding necessary number of rail tracks along the Core Network Corridor rail lines.

[21] Regulation 1315/2013 does only foresee a speed requirement for core freight lines (100 km/h), while there is no speed requirement for passenger lines. Anyhow this threshold is assumed valid also for passenger lines on the OEM Corridor in order to guarantee adequate services.

[22] Links or exchange tracks providing the connection between different railway lines often have lower maximum operational speeds than the main railway lines. As these sections are rather short the impact on travel time of a train is not as crucial as if the section is longer.

[23] Among these parameters are for example the location of strike-in contacts of levels crossing and their closing time.

[24] A detailed analysis of these factors for all routes and countries is very time-consuming and is beyond the scope of this study.

For example in Germany, the operation of 740 m trains is possible on main lines[25]; however, restrictions by the above mentioned factors are possible. In general, timetable-related and/or operational restrictions may influence the permitted train length. This applies to all rail networks along the OEM Corridor, not only to the one in Germany. In this regard, it is important to note that the length has to be determined individually for every train path[26].

Axle load:

Most of the OEM rail network is compliant with the minimum axle load threshold of 22.5 t; exceptions are the entire part in Romania, as well as line sections in Hungary (Budapest-Ferencváros – Cegléd and Békéscsaba – Lőkösháza) and Greece (Promahonas – Thessaloniki, Domokos – Tithorea and Kiato – Patras) making up approximately 15% (910 km) of the Corridor. For Hungary it has to be noted, that on the Hegyeshalom – Budapest-Kelenföld line an axle load of 22.5 t is permitted with speed restriction to 120 km/h, while without speed limit only 18.0 t are permitted[27]. This is in line with the requirements of the regulation, having no impact to freight trains, but potentially to passenger trains regarding travel time.

Electrification:

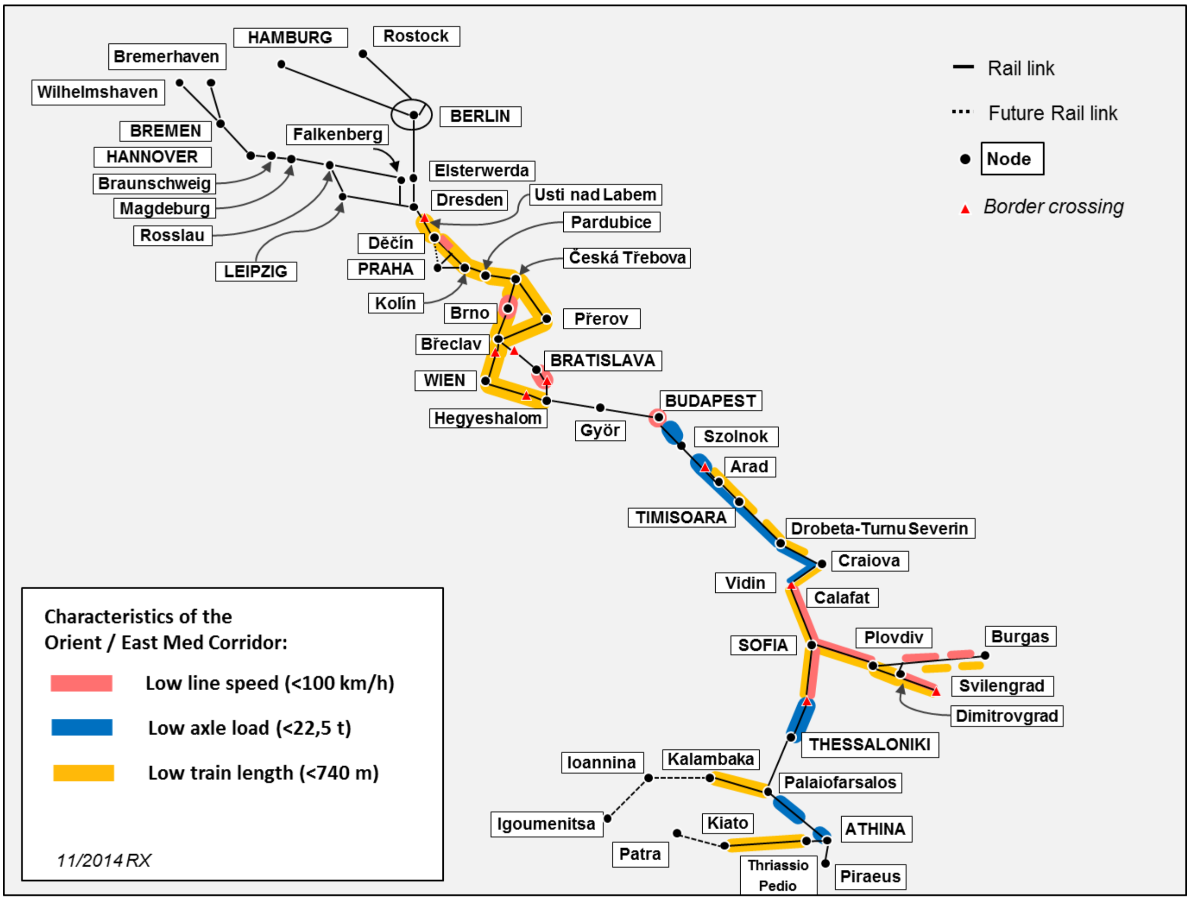
With regard to electrification as one key issue in the TEN-T requirements, the OEM railway network is for most of its part electrified apart from the sections Oldenburg – Wilhelmshaven in Germany, Craiova - Calafat in Romania, Dimitrovgrad – Svilengrad in Bulgaria (project ongoing) and sections Promahonas – Thessaloniki, Domokos – Tithorea and Inoi – Athina SKA - Piraeus, Palaiofarsalos – Kalambaka in Greece. Non-electrified sections make up approximately 11% (645 km) of the entire corridor.

Current systems used along the OEM Corridor include:

- AC 15kV, 16.7 Hz (Germany and Austria),
- AC 25kV, 50 Hz (Czech Republic - South, Slovakia, Hungary, Romania, Bulgaria and Greece) and
- DC 3kV (Czech Republic - North).

[25] Given the assumption that no stop of the train is foreseen e.g. for overhauling by another train.
[26] This task is not part of the OEM corridor study.
[27] For details see Hungarian Rail Network Statement 2014/2015, Annex 3.3.1.1.

Figure 13: Corridor Railway Network: Areas with unfavourable alignment



Source: Consortium

Number of tracks:

Most parts of the rail network within the OEM Corridor are at least double-track lines. The single-track lines[28], that occupy approximately 27% (1.616 km) of the entire OEM rail network, are located in:

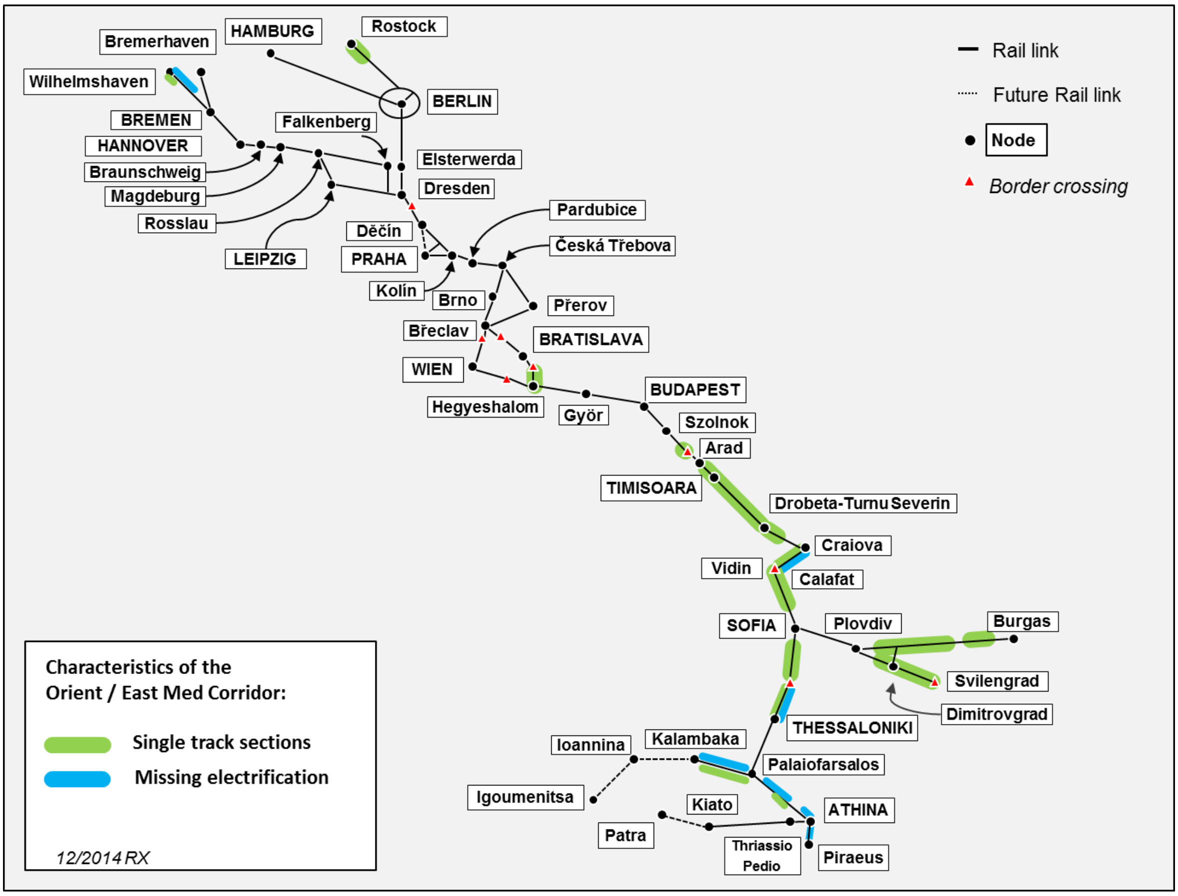
- Germany (Rostock Hbf – Kavelstorf and Rostock Seehafen – Kavelstorf, Sande – Wilhelmshaven Jade Weser Port)
- Slovakia (Bratislava and Border SK/HU near Rajka)
- Hungary (Border HU/SK near Rajka – Hegyeshalom, Békéscsaba – Border HU/RO near Lőköshája)
- Romania (Border RO/HU – Curtici, Arad - Strehaia and Craiova – Border RO/BG near Calafat)
- Bulgaria (Border BG/RO – Mezdra, Sofia – Border BG/EL and sections east of Plovdiv towards Burgas and Svilengrad)
- Greece (Border EL/BG – Thessaloniki and section on Palaiofarsalos - Athina line)

Figure 14 presents another schematic layout of the Corridor Railway network, highlighting the areas with insufficient line equipment, in terms of missing

[28] Short single-track links or exchange tracks providing the connection between different railway lines have not been considered.

electrification. However, any single track rail segment at the Corridor has always to be analysed based on multimodal traffic demand and line capacity, whether this is or might become a physical bottleneck or not for the Corridor traffic.

Figure 14: Corridor Railway Network: Areas with reduced line equipment



Source: Consortium

Signalling and telecommunication:

Regarding signalling system (to be understood as Railway control systems), at present, with some few exceptions, only national systems are used on the rail networks of the countries along the OEM Corridor. ETCS as interoperable Railway supervision system has been installed on few corridor sections so far. ETCS is not installed on 86% (5.079 km) of the Corridor and is not under operation on 90% (5.325 km).

Regarding rail telecommunication, national systems are dominating too. Along the OEM rail network GSM-R has currently been implemented in Germany, Austria, Czech Republic (partly) and Slovakia (partly) only. GSM-R is not installed on 51% (3.002 km) of the OEM rail network.

Thus, the status of implementation of ERTMS, consisting of the two technical components ETCS and GSM-R, differs greatly for the OEM rail network both per Member State and per technical component.

As the equipment of railway lines of the core network is an essential requirement of Regulation No.1315/2013, an overview on the deployment of ERTMS along the OEM corridor is of importance, taking into account the current state of play and measures foreseen in the future in order to foster the equipment of lines for each Member State. This analysis is presented in chapter 7.2.

Table 22: Status of Rail infrastructure compliance on Orient/East-Med corridor (2014)

Parameter	Length share of non-compliant sections
Operational speed	15%
Train length	46%
Axle load	15%
Electrification	11%
Number of tracks (at least double track[29])	27%
Signalling systems (ETCS)	86%/ 90%[30]
Telecommunication system (GSM-R)	51%

5.2.1.3 Technical Bottlenecks / Missing Links / Interoperability Issues

It is evident from the analysis presented in the previous sections that considerable parts of the OEM Corridor Railway network do not meet the requirements set by Regulation No.1315/2013. The major non-compliance is observed with regard to operational speed, train length and axle load. There are also certain network parts that are only single-track and others that require electrification. Finally, many national rail networks of the Corridor are still lagging behind in the deployment of ERTMS. It should be noted that the issue of non-compliance is particularly prevalent in the railway networks of Bulgaria and Romania. Several on-going and planned infrastructure projects in the countries aim at upgrading railway sections to meet the Regulation's requirements. These are described in section 7.1.

Apart from the issue of not meeting the Regulation's requirements, the discontinuities with regard to the technical characteristics are also the cause of technical bottlenecks and interoperability issues, which could hinder the achievement of one of the OEM corridor's key objectives, that is, a smooth and seamless passenger and freight rail transport along its entire length. Bottlenecks are created both within individual national networks, but also across cross-border sections, causing significant interoperability issues. These are analysed in detail in Chapter 6 of this report.

Regarding cross-border operation and interoperability, it has to be considered that not all of the parameters presented above have direct impact on rail interoperability along the OEM corridor (e.g. number of tracks, max. speed).

Relevant parameters are for example maximum train length, maximum axle load, change of traction/electrification system and signalling and communication systems. At present, there is no cross-border section without any change of relevant parameters.

One of the interoperability issues on the OEM Rail network is the difference in standards for maximum train length between the individual countries. Several of the relevant railway lines are at present not designed to allow the operation of trains with a length of 740 meters. The same applies for the differences regarding maximum axle loads.

Another issue in interoperability are the different voltage systems in place in the different countries along the corridor. However, these differences are becoming a

[29] Double-track rail lines are not explicitly required by TEN-T Regulation.

[30] i.e. 86% regarding ETCS installation and 90% regarding ETCS under operation.

minor problem in the context of interoperability if multisystem locomotives are used. The use of multisystem locomotive for cross-border traffic automatically implies that these locomotives are equipped with the railway control system required for the respective network[31].

This aspect together with the identified differences in control systems and the lack of ERTMS availability along the OEM corridor lead to another key interoperability issue. The introduction of ERTMS as interoperable safety and signalling systems in the countries along the OEM Corridor would solve one of the core technical bottlenecks.

5.2.1.4 Capacity Utilisation

The capacity utilisation along the OEM Corridor is highly relevant to the overall performance of train services and to the identification of bottlenecks. 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. These delays cannot often be reduced on short term, since operational flexibility on the line is not available. Furthermore, line congestions make it difficult or even impossible to attract additional rail traffic on the corridor, at least if no countermeasures are taken.

Freight transport

The capacity utilization of the OEM Corridor Railway network is very unequally balanced. The Northern part is heavily used, whereas the Southern part is less used with certain exceptions. Arad (in Romania) is a clear cut, dividing the northern and southern part of the corridor.

The PP22 study[32] showed that the rail lines of the OEM Corridor are mainly used for freight (if international traffic is only considered), except from the Dresden – Praha – Wien – Budapest route, which also sees many international passenger trains. In addition, the study showed that the current infrastructure can easily accommodate this international traffic. Capacity bottlenecks occur only when local traffic is dense, as is the case in the Czech Republic and around Budapest.

The Route Capacity is defined as the ratio of the maximum number of trains per track to the actual number of trains. Figure 16 depicts the percentile capacity utilization along the Corridor.

In general, the entire OEM Corridor railway network is well used for rail transport. The German ports are the key import ports for the Czech Republic, which explains why, especially in the section Dresden – Czech border, the line capacity is heavily used, but without any restrictions yet, i.e. there is still capacity available[33]. Due to expected growing transport volumes especially in the hinterland transport from/to the Ports of Hamburg, Bremen, Bremerhaven and Wilhelmshaven (especially in container and automotive transport), it is likely that this section can become a capacity bottleneck in future years. The same applies for the sections leading from/to the state border and for the nodes of Hamburg, Hannover and Bremen. Within the Czech Republic, the Praha – Česká Třebová line is at full capacity and has therefore to be considered as bottleneck.

[31] Multisystem locomotives are more expensive than single system locomotives. Additionally equipping locomotives with multiple signal control equipment implies significant additional costs, and operating them also requires undertaking the safety homologation process in all involved countries.

[32] Completion of the Priority Project Nr. 22 (PP22 study), PWC, Panteia, 2012

[33] According to information of the German Rail infrastructure manager DB Netz, the average utilization rate per day of this section is <85%.

The next capacity bottleneck is Budapest, an essential railway hub at the interface of PP6 and PP22. Here, the double-tracked southern Danube bridge is heavily used for (local) passenger and freight trains. As a result of increased traffic levels expected on the routes of the Priority Projects, Budapest could become a significant bottleneck in a few years' time. Past and on-going studies are conducted in order to solve this bottleneck, avoid serious congestion problems and develop different scenarios.

These scenarios include two main variants: the construction of a railway line bypassing Budapest in the South, dedicated for freight, allowing the existing Danube Bridge between Kelenföld and Ferencváros to be used mainly by passenger traffic or the reconstruction of the southern Danube Bridge. For the latter, a feasibility study is under preparation and about to start soon. It is expected that on the whole, the rail traffic crossing Budapest, which is at a critical point today will improve by the existing planning, so that it will not form a bottleneck in the future[34].

To the east of Budapest, traffic flows are decreasing, having a direct impact to the capacity. In Arad, the main freight traffic flow is heading east to Constanta, while only few passenger and freight trains are running south between Timişoara and Calafat. The newly built Danube Bridge between Calafat and Vidin has low traffic volumes, including very limited freight transport so far[35], which explains the very low capacity utilisation rate. Additionally, there is competition with the line via Serbia.

For the future, the possibility to operate trains only within EU offers an excellent opportunity because no time-consuming customs procedures are needed. In this regard, the improvement of the route via Calafat is required as soon as possible. From Sofia and to the Turkish border traffic is picking up, because of the freight trains taking the Balkan route to Turkey and Bulgarian passengers jointly using the Bulgarian rail infrastructure.

With respect to Turkey, the development of the railway links that crosses the Bosporus could result in an extra stimulus for rail transport in relation to Europe. It is expected that the trade in relation to Turkey will increase in the coming era. The majority of the trade flows is accommodated by maritime and road/ferry transport. Improved railway services will lead to a larger share of railway transport. Currently, specialised services are using the railway link, such as automotive, containers and other high valued goods. Between Sofia and Thessaloniki few trains are running (1 or 2 per day in each direction), which explains the low utilization rate. In Thessaloniki, traffic is picking up, mainly due to national traffic within Greece.

Passenger traffic

The PP22 study shows that the level of services offered along the northern part of the PP22 (Germany, Czech Republic, Austria, Slovakia and Hungary) is an important demand driving factor. In addition to the sections covered by the PP 22, there is an extensive level of services offered, especially between Hamburg and Berlin. Also, the section Berlin-Dresden is important for national and international services. Figure 15 depicts the long distance passenger rail demand for 2010, as data for short distance were not included in the PP22 study.

In the southern part of the PP22, the situation is different: in 2010, there were 2 pairs of passenger trains/day between Thessaloniki and Sofia running at commercial speed of 65 km/h. After this service was cancelled in early 2011 as part of measures taken

[34] Information received from the Hungarian Rail Infrastructure Manager MÁV.

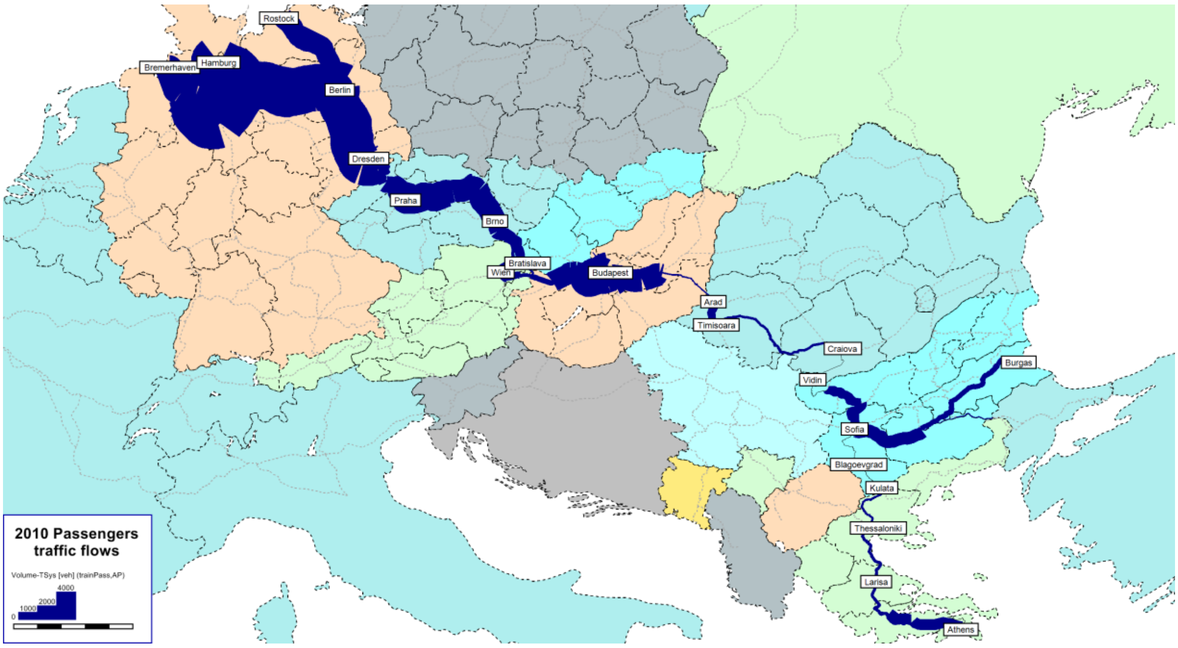
[35] Since May 10th, 2014 there is scheduled passenger service between Golenţi and Vidin, consisting of 1 pair of train per day; regarding freight services one train used the line so far, but low technical standards and missing electrification are the main obstacles hindering traffic.

for the financial stabilisation of the Greek railways, one pair of trains per day resumed operation in June 2014.

The supply is similar between Bulgaria and Romania. Currently, the main flows run via Ruse (Bulgaria) and Giurgiu (Romania) route, which is not part of the OEM corridor. Since May 10th, 2014, the first passenger service by rail (one pair of trains/day) was established between Vidin (Bulgaria) and Golenţi (Romania) along the new Vidin – Calafat Bridge.

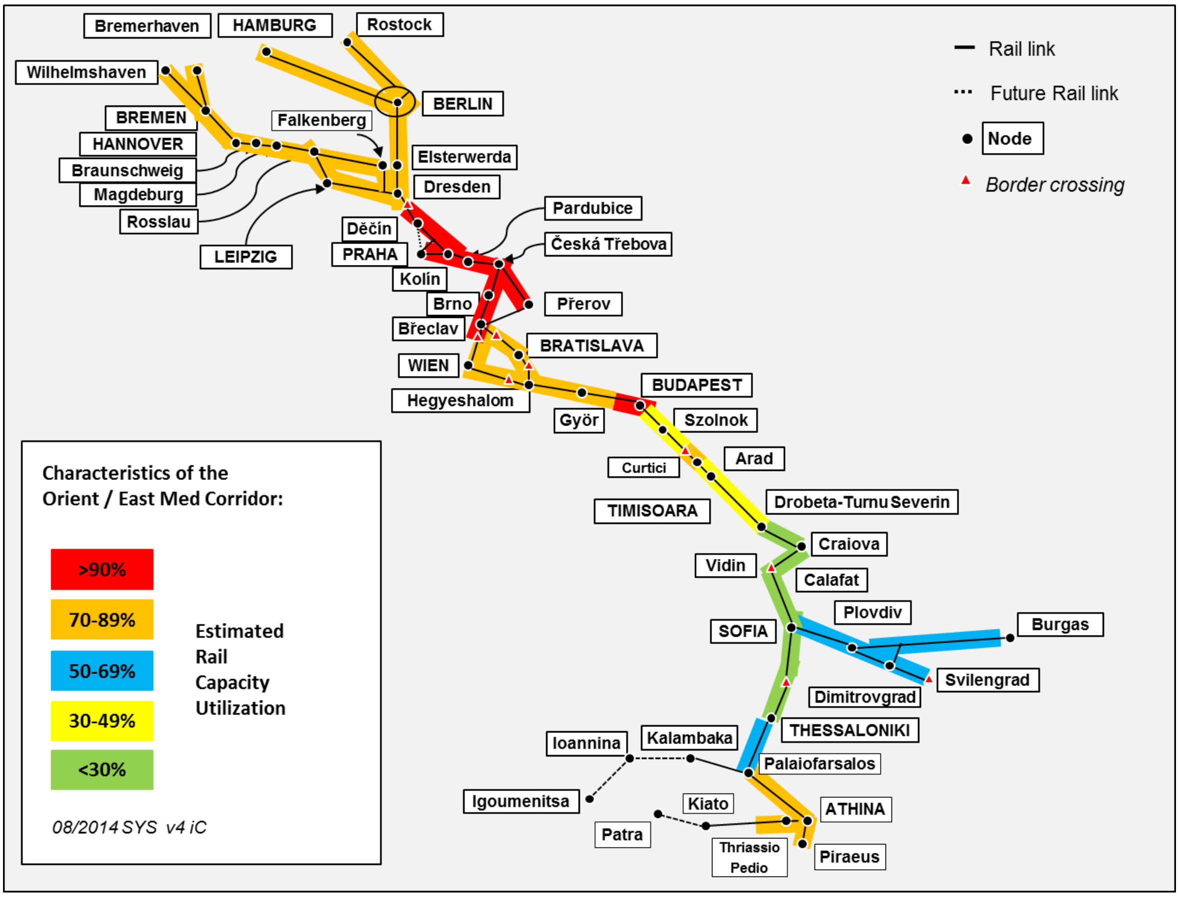
The number of trains crossing the border crossing point Curtici / Lökösháza between Romania and Hungary was higher: 6 train pairs to/from Budapest, 1 pair to Wien and 1 pair to Praha. In 2014, there are 5 train pairs crossing the Hungarian/Romanian border, mainly running between Budapest, Wien and București.

Figure 15: PP22 inter-zonal passenger traffic by rail (2010), in 1000 pax



Source: based on extended results of the PP22 Study

Figure 16: Corridor Railway Network: Capacity utilisation 2010



Source: Consortium / PP22 Study final report

Note to Figure 16:

For the analysis of rail capacity utilization on OEM Corridor, no dedicated capacity calculations have been performed by the Consultant. Instead, the depicted estimated rail capacity is based on expert judgement from a combination of the following sources: the Completion of the Priority Project Nr. 22 "Carrying out a study on the completion of the Priority Project Nr. 22"; interviews with the PP22 infrastructure managers, several related reports and presentations, e.g. RFC 7 Master Plan.

5.2.1.5 Integration of RRT, Airports, Seaports, Inland Waterway Ports

A key condition to ensure interoperability of the airports, seaports and RRTs along the OEM corridor is their connection to the railway network. The RRTs are naturally all in compliance (cf. 5.2.2, Table 24). Regarding seaports, all German seaports comply with the Regulation's requirement. In Greece, only the Port of Piraeus and Thessaloniki have existing railway connections, and so does the Port of Burgas in Bulgaria. The non-compliant ports are the Ports of Igoumenitsa and Patras in Greece (cf. 5.2.5, Table 31).

Table 23 lists the OEM airports with their related rail connection. The airports of Bremen, Praha, Bratislava, Timişoara, Sofia and Thessaloniki have currently no railway connection, while Heraklion and Larnaka are located on islands without any rail network. Thus, the Airports of Hamburg and Praha and Budapest (Terminal 2) are to be connected to heavy rail until 2050. A more detailed analysis of air traffic infrastructure and its multimodal interconnection is presented in section 5.2.7.

Table 23: Rail connection of Airports of the Orient/East Med Corridor

	Airport	Connection to Rail		
DE	*Hamburg		N	No heavy rail , Suburban trains only, electrified (1200 V DC)
	Bremen		N	No (2 km missing to next rail line) , Urban Light rail only
	*Berlin (BER)	Y		Heavy rail electrified, not in operation yet due to postponed opening of the airport
	Hannover	Y		Electrified, suburban trains only
	Leipzig/Halle	Y		heavy rail, electrified
CZ	*Praha		N	Metro line to connect with Central rail station, under construction
AT	*Wien	Y		heavy rail, electrified, no freight trains
SK	Bratislava		N	
HU	*Budapest		N	No heavy rail electrified to Terminal 2, Existing line to closed Terminal 1 only.
RO	Timişoara		N	
BG	Sofia		N	Metro line to connect with Central rail station, under construction
EL	*Athina	Y		
	Thessaloniki		N	
	Heraklion		*N*	*no rail network*
CY	Larnaka		*N*	*no rail network*

**) Airports marked with * are to be connected to TEN-T heavy rail and road by 2050 according to Art. 42 TEN-T regulation.*

5.2.1.6 Organizational Bottlenecks

The RFC7 Transport market study identifies as organisational weaknesses differences in performance regimes and language barriers. The latter can be overcome by using TCCcom[36], a tool supporting multilingual communication between traffic control centres and providing contact information to the dispatching centres. A specific bottleneck that must be pointed out is related to long-lasting border crossing procedures.

The duration of waiting times at borders ranges from 10 minutes to 48 hours. Apart from the pure technical issues, such as differences in the traction systems, signalling devices, etc. or the fact of crossing a Schengen border, the long waiting times are caused by internal procedures of the railway undertakings, mostly waiting for locomotive and/or staff of the cooperating railway undertaking, technical controls, etc. Practical evidence demonstrates that small undertakings have the longest waiting times at borders due to the lack of locomotives or staff.

Studies have highlighted the need to take into account issues related to infrastructure management, particularly at the level of interoperability, traffic management procedures or safety.

Commercialisation of services is another issue that deserves special attention. An indicative example is the new cross border passenger service established from May 2014 between Craiova and Vidin along the new Danube Bridge. The trip duration is over 3 hours for a distance of approximately 120 km, the passengers from Vidin need to transfer to reach both Calafat and Craiova and no round trip is possible from Vidin to Craiova within a day.

[36] i.e. Traffic Control Centres Communication

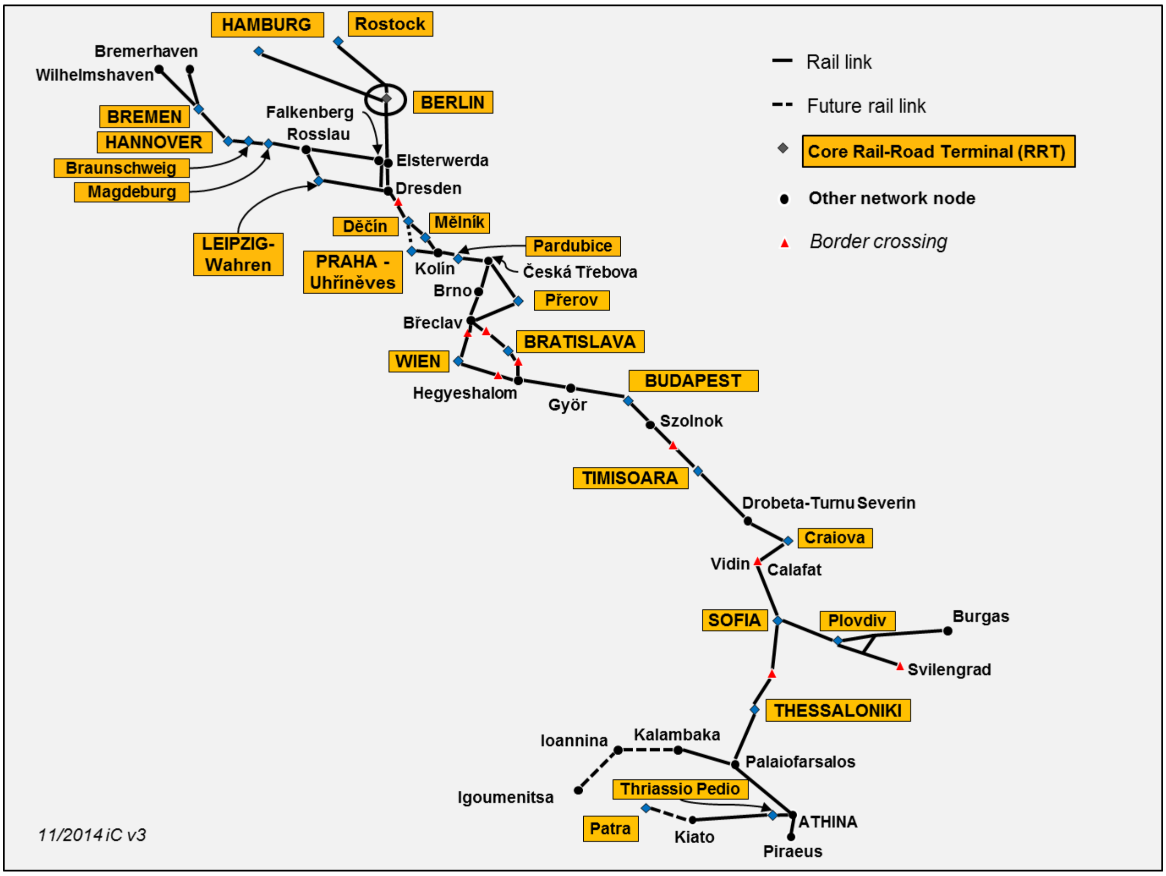
Gradually eliminating obstacles to interoperability issues at borders by focusing on harmonisation of procedures and simplification of formalities, while aiming for efficient controls and security levels, will be crucial for the efficient and sustainable operation of the OEM route. Countries should also focus on capacity building of human resources and supporting language skills training for staff at border crossings, although TCCcom provides help.

5.2.2 Rail Road Terminals

5.2.2.1 Location

Rail Road terminals (RRT) are intermodal connecting points allowing the transfer of goods between rail and road especially regarding combined transport. This chapter reflects only the bimodal relation rail-road and the respective terminals along the OEM corridor, while further trimodal terminals allowing intermodal transport between rail, road and waterways are located in inland and seaports.

Figure 17: Core Rail Road terminals of the Orient / East-Med Corridor



Source: Regulation No.1315/2013 Annex I

Based on the Regulation No.1315/2013 Article 41, para 1, the Rail Road terminals along the OEM corridor, assigned to Core network nodes, are defined in the Regulation Annex II. Taking additionally into account inputs from stakeholders, as well as discussions at the Corridor Fora in Brussels, the core OEM Rail Road terminals considered in this report are given in Table 24.

In total, there are 25 core RRTs along the OEM corridor, most of which are located in Germany (8), Czech Republic (5), Austria (3) and Greece (3), as well as one per other Member States.

5.2.2.2 Compliance of the Infrastructure with TEN-T requirements

The Rail Road terminals (RRTs) along the OEM corridor are key components of the intermodal transport chain, since they must ensure an efficient and safe interchange between road, rail and other transport modes, such as inland waterways. This applies also to article 12 of the Regulation No.1315/2013, which requires that the core RRTs of the core network shall be connected with the road infrastructure or, where possible, the inland waterway infrastructure of the comprehensive network.

With regard to road and rail connection, the table below depicts the existing situation among the OEM terminals:

Table 24: Accessibility of Core Rail-Road Terminals of the Orient/East Med Corridor

	Rail-road terminals	Rail Connection	Road Connection
DE	Berlin (Großbeeren)	Diesel/Electrified (connected to main line Berlin - Leipzig)	Federal road (Motorway A10 in 5 km)
	Braunschweig	Diesel (connection to local line at Braunschweig-Rühme)	Urban road (Motorway A2 in 2 km)
	Bremen	Diesel (electric traction possible from / to Bremen-Grolland, directly connected with electrified main line Oldenburg - Bremen)	Motorway A281 (0,5 km)
	Hamburg Billwerder	Diesel/Electrified (depending on transhipment track, direct connection to electrified main line Hamburg - Berlin)	Motorway A1 (0,5 km)
	Hamburg Altenwerder	Electrified (main line connection at Junction Hamburg Süderelbbrücke and Hamburg Hausbruch)	Urban road (Motorway A7 in 1,5 km)
	Hamburg Eurogate		
	Hamburg Burchardkai		Urban road (Motorway A7 in 2,5 km)
	Hamburg Tollerort	Electrified (main line connection at Junction Hamburg Abzw. Veddel)	Urban road (Motorway A7 in 6 km)
	Hannover	Diesel (main line connection at Hannover-Linden Hafen on electrified line Seelze - Lehrte)	Urban road (Federal road in 2 km)
	Lehrte (projected)	Electrified (connection to main line direction Hannover, Celle, Wolfsburg, Braunschweig, Hildesheim)	Urban road (Motorway A2 in 2 km)
	Magdeburg	Diesel (connection to main line at Magdeburg-Rothensee)	Urban road (Motorway A2 in 2 km)
	Leipzig-Wahren	Electrified (connected to main line Halle - Leipzig)	Federal road (Motorway A14 in 4 km)
	Rostock	Diesel (connection to main line at Rostock Seehafen)	Urban road (Motorway A19 in 7 km)
CZ	Česká Třebová	Electrified (connected to main line to Praha and Brno)	Federal road
	Děčín	Diesel (connected to electrified main line Děčín - Lysá n.L. respectively Děčín – Ústí n.L.)	Federal road only (Motorway D8 in 30 km)
	Mělník	Diesel (connected to electrified main line Děčín Lysá n.L.)	Federal road only (Motorway D8 in 30 km)
	Praha-Uhříněves	Diesel (connected to electrified main line via Praha Malesice and Praha Vysočany to Lysá n.L.)	Urban road (Expressway R1 in 10 km)
	Pardubice	*still under design*	*still under design*
	Přerov	connected to electrified main line Přerov -Břeclav	Federal road (I/47, I/55), (Motorway D1 in 5 km)
AT	Wien (Nordwestbahnhof)	Yes, electrified (to ZVBF Wien Kledering; approx. 20 km)	Urban Roads (Motorway A22 in 4 km)
	Wien (Freudenau Port)		Urban Roads (Motorway A4 in 3 km)
	Wien Inzersdorf	*under construction*	*under construction*
SK	Bratislava UNS	Diesel (connected to electrified main line Bratislava - Petržalka)	Urban road (Motorway D1 in 3 km)

	Rail-road terminals	Rail Connection	Road Connection
HU	Budapest-Soroksár (BILK)	Diesel (directly to Budapest -Kelebia electrified main railway line at Soroksár Station); 0,4 km	Motorway M0 (0,5 km)
RO	Timişoara	Diesel (connection to local line at Timişoara Sud)	Urban Road (Motorway A1 20 km)
	Craiova	Electrified (connection to main line at Craiova)	Urban Road
BG	Sofia	Yes; current terminal has very limited capacity	Urban Road (Motorway A2 in 3 km)
	Plovdiv	*under construction*	*under construction*
EL	Thessaloniki	Under design	Urban Road
	Patras	Under design	Motorway (under construction)
	Thriassio Pedio	Yes, electrified, under construction	Motorway A6 (5 km)

As specified in the table above, the Rail Road terminals on the OEM corridor are already connected to their respective national road and rail networks, although for several of them, there is a need to improve the quality of "last mile" access or to solve capacity problems.

The capacity of the Rail Road terminals along OEM corridor is determined by a couple of factors, which can only partly be influenced by the terminal operators. The primary ones are the position of the terminal within the rail and road network, the size and shape of the location area, the length of the handling tracks, and the number and capabilities of the handling equipment.

5.2.2.3 Capacity Utilisation

The performance of the terminals as the interface between rail and road is mandatory for the development of intermodal transport. Such performance is readable through adequate capacity utilisation and access to information regarding the actual operation of the existing Rail Road terminals along the corridor. As the market in this area is highly competitive, there is limited willingness for operators to provide detailed information, such as traffic volumes.

5.2.2.4 Technical Bottlenecks

Among the Rail Road terminals along the OEM corridor, there are serious issues in the southern countries, Romania, Bulgaria and Greece, where the intermodal transport is underdeveloped and for which the Member States are taking measures for building new facilities (on-going studies and development plans are included in the national transport strategies).

On the other hand, in the Austrian core network Rail Road terminal, no physical or technical bottlenecks are existing, while in the northern parts of the OEM corridor, e.g. in Germany, mainly due to the current and future growing importance of hinterland traffic to/from the seaports, terminal capacity is highly used, sometimes already facing its limits. Additionally, limited capacities on the rail and road networks can intensify problems, leading to a situation whereby terminal capacity is still available, but cannot be used due to constraints to access the Rail Road terminal. This issue is of particular importance in the surrounding areas of the seaports of Hamburg, Bremen and Bremerhaven.

5.2.3 Corridor inland waterway infrastructure

5.2.3.1 Alignment

The Inland Waterways (IWW) of the Orient / East-Med corridor are of more than 1.600 km length and comprise of:

- the River Elbe / Labe Inland Waterway from Hamburg Seaport to its hinterland, comprising of the nodal river ports Magdeburg and the Czech river ports (Děčín, Mělník, Praha-Holešovice, Pardubice). This includes the German section of the Elbe from Brunsbüttel to the Czech border near Děčín (River-km 726.6; Length: 638 km), the Czech navigable part of the same river called Labe from the German border to Pardubice (233 km; recently only navigable until Přelouč: 224 km),
- the northern part of the Vltava River from Třebenice (near Slapy dam) via Praha to the river mouth into River Labe near Mělník (91.5 km).
- the River Weser connects Bremerhaven via Bremen to Minden (221 km) and
- the Mittellandkanal from Minden via Hannover and Braunschweig to Magdeburg (223 km), whereas all ports named above are core network nodes, except of Minden.
- In Northern Germany, the Elbe system is linked through Mittellandkanal and River Weser with the North Sea seaports of Bremen and Bremerhaven.
- the Elbe-Seitenkanal (Elbe Lateral Canal) connects the Lower Elbe from Lauenburg with the Mittellandkanal until Edesbüttel (near Braunschweig) with a length of 115 km.
- the Elbe-Lübeck-Kanal[37] (61.5 km) provides together with the River Trave the connection between the Elbe and the Baltic Sea, linking also the seaport of Lübeck[38] with the inland waterway network.

Table 25: Analysed IWW sections of the Orient/East Med Corridor

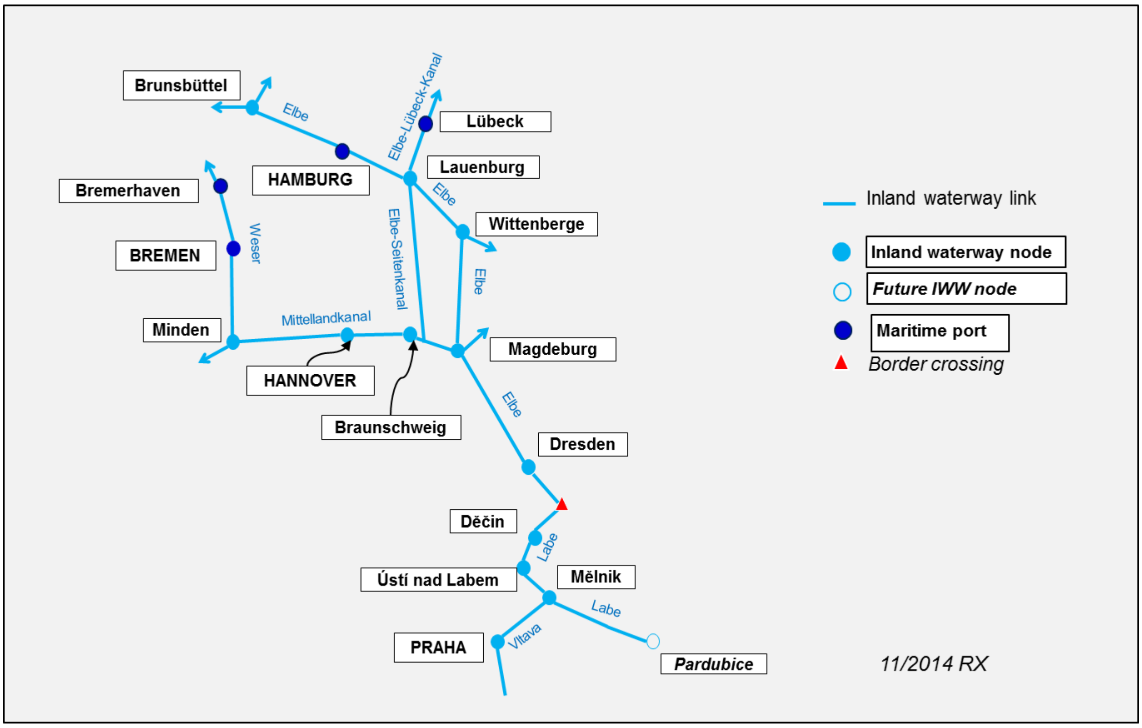
Member State	IWW name	Alignment (OEM-related)	CEMT class
DE	Elbe (Unterelbe)	Brunsbüttel - Hamburg	**Va** (Maritime waterway as well)
DE	Elbe (Unterelbe)	Hamburg - Wittenberge	**VIb**
DE	Elbe (Mittelelbe, Oberelbe)	Wittenberge – Magdeburg - Border DE/CZ	**Va**
DE	Mittellandkanal	Minden – Edesbüttel – Magdeburg	**Vb**, **IV**: east of Haldensleben km 298 to 318.4
DE	Weser (Mittelweser)	Bremen - Minden	**IV**

[37] A complete analysis of the Elbe-Lübeck-Kanal is not yet included in this report due to formal reasons and will be part of a future exercise.
[38] The seaport of Lübeck is part of the Scandinavian-Mediterranean Corridor and therefore not analysed in the Orient/East-Med corridor study.

Member State	IWW name	Alignment (OEM-related)	CEMT class
DE	Weser (Unterweser)	Bremerhaven - Bremen	**VIb** (Maritime waterway as well), **Vb**: km 366.7 to 360.7 (Bremen)
DE	Elbe-Seitenkanal	Edesbüttel – Lauenburg	**Vb**
DE	Elbe-Lübeck-Kanal	Lübeck – Lauenburg	**IV**
CZ	Elbe (Dolní Labe)	Border DE/CZ - Děčín – Mělník -	**Va**
CZ	Elbe (Střední Labe)	Mělník – Pardubice	**IV**
CZ	Vltava (Dolní Vltava)	Mělník – Praha – Třebenice	**IV**

Source: ELWIS, LAVDIS, 2014

Figure 18: Inland Waterways of Orient / East-Med Corridor



Source: Consortium (based on TEN-T Regulation)

General Note on IWW analysis in the OEM corridor study: Based on the decision made in the 1st Corridor Forum in April 2014, in terms of IWW, the OEM Corridor Study will put emphasis on the Elbe-Vltava IWW system (Brunsbüttel – Mělník – Praha / – Pardubice; DE/CZ) and the IWW link from Magdeburg to Bremerhaven (in DE). The Danube IWW (AT, SK, HU, RO, and BG) is mainly addressed in the Rhine-Danube Corridor Study. The Elbe-Havel IWW from Magdeburg to Berlin is being assessed in the North Sea/ Baltic Corridor exclusively.

5.2.3.2 Locks

Along the Orient/East med corridor, there are 55 existing ship lock locations, partly with parallel lock installation, which are as follows:

Czech Republic (34):

- Elbe (24): Pardubice, Srnojedy and Přelouč (out of service, R-km 951,2), Týnec nad Labem, Veletov, Kolín, Klavary, Velký Osek, Poděbrady, Nymburk, Kostomlátky, Hradištko, Lysá nad Labem, Čelákovice, Brandýs nad Labem, Kostelec nad Labem, Lobkovice, Obříství, Dolní Bečkovice, Štětí-Račice, Roudnice nad Labem, České Kopisty, Lovosice and Ústí nad Labem-Střekov.
- Vltava (10): Stěchovice, Vrané nad Vltavou, Praha-Modřany, Praha-Smíchov (Jiráskův bridge), Praha-Štvanice, Praha-Podbaba, Roztoky, Dolánky, Miřejovice, Hořín

Germany (21):

- Elbe (1): Geesthacht (R-km 585,9)
- Mittellandkanal (3): Hannover-Anderten, Wolfsburg-Sülfeld, Magdeburg IWW Jct.
- Weser (8): Minden Schachtschleuse (Weserschleuse under operation in 2015), Petershagen, Schlüsselburg, Landsbergen, Drakenburg, Dörverden, Langwedel, Hemelingen
- Elbe-Seitenkanal (2): Ship Lift Lüneburg, Uelzen I+II
- Elbe-Lübeck-Kanal (7): Büssau, Krummesse, Berkenthin, Behlendorf, Donnerschleuse, Witzeeze, Lauenburg

5.2.3.3 Compliance of the Infrastructure with TEN-T requirements

With regard to inland waterways, the key infrastructure parameters examined were the length of vessels, maximum beam, minimum draught, tonnage and compliance to CEMT class IV, particularly regarding bridges and locks. The general requirements of CEMT classes (class IV or higher) are presented in Table 26.

The complete mapping of the IWW compliance test is given in Annex 1b.

Figure 20 presents a schematic layout of the Corridor Inland Waterway network, highlighting the areas of non-compliance along the Corridor with minimum draught requirements and in terms of CEMT class IV.

Due to the importance of the Elbe as inland waterway within the Orient/East-Med Corridor and the fact that the main problematic areas are concentrated on it, the following description mainly focuses on the Elbe.

Water levels of the Elbe are subject to natural fluctuations. All-season stable conditions cannot be guaranteed. For this reason, it is evident that on the Elbe in Germany, between Geesthacht (near Lauenburg) up to the German/Czech border and in the Czech Republic, the possible loading depth depends on the water level. In addition, in the Czech Republic, the sections Mělník – Pardubice (Upper Elbe) and Mělník - Praha (Lower Vltava) have non-compliant structures (bridges, cf. Figure 19).

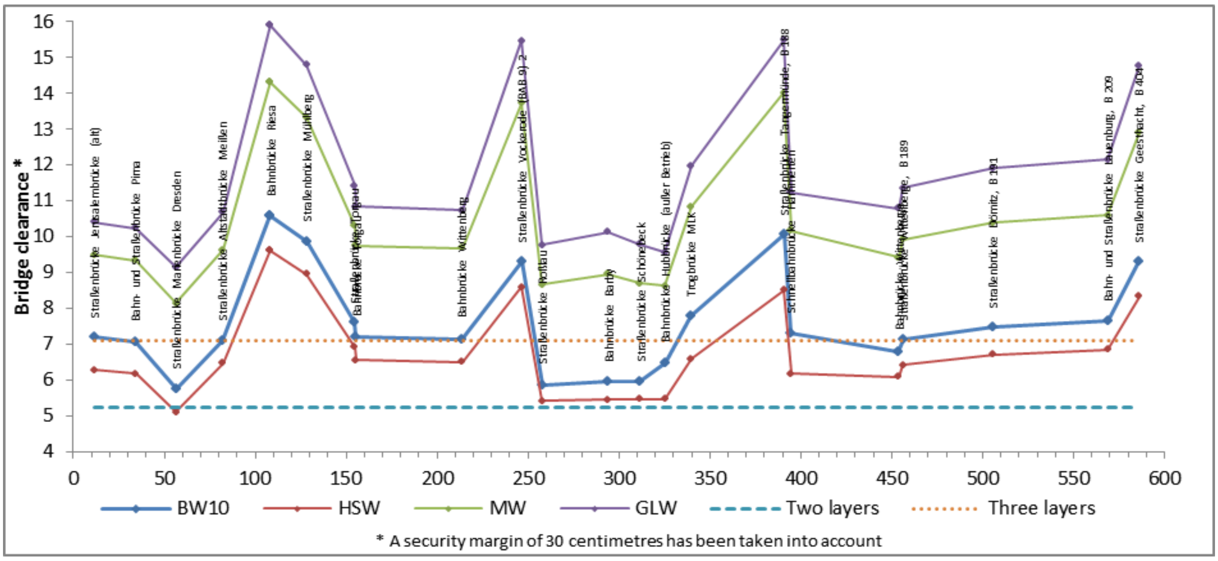
Persisting instability of water level is a basic characteristic of the Elbe and thereby a basic problem for inland shipping regarding navigability and transportable tonnage. In both Germany and Czech Republic some sections of the Elbe are characterised by extremely low fairway depths (1.4 m on German sections; 0.9 m - 2.0 m on Czech sections) especially in dry seasons, having a significant impact on the navigability and making the sections commercially non-navigable.

Table 26: General requirements of CEMT classes

	Barges				Convoys				both
CEMT class	Length (m)	Width (m)	Draught (m)	Ton-nage (t)	Length (m)	Width (m)	Draught (m)	Ton-nage (t)	Height for bridge clearance (m)[39]
IV	80 - 85	9.5	2.5	1000 - 1500	85	9.5	2.5 – 2.8	1250 - 1450	5.25 or 7.0
Va	95 – 110	11.4	2.5 – 2.8	1500 – 3000	95 – 110	11.4	2.5 – 4.5	1600 - 3000	5.25 or 7.0 or 9.1
Vb					172 – 185	11.4	2.5 – 4.5	3200 - 6000	5.25. or 7.0 or 9.1
VIa					95 – 110	22.8	2.5 – 4.5	3200 - 6000	7.0 or 9.1
VIb					185 - 195	22.8	2.5 – 4.5	6400 - 12000	7.0 or 9.1
VIc					270 – 280	22.8	2.5 – 4.5	9600 – 18000	9.1
					195 – 200	33.0 – 34.2	2.5 – 4.5		
VII					285	33.0 – 34.2	2.5 – 4.5	14500 - 27000	9.1

Source: CEMT Resolution No. 92/2 on new classification of inland waterways

Figure 19: Bridge Clearance on Elbe Inland Waterway



Source: Verkehrsbericht der WSD Mitte 2012, GDWS 2013.

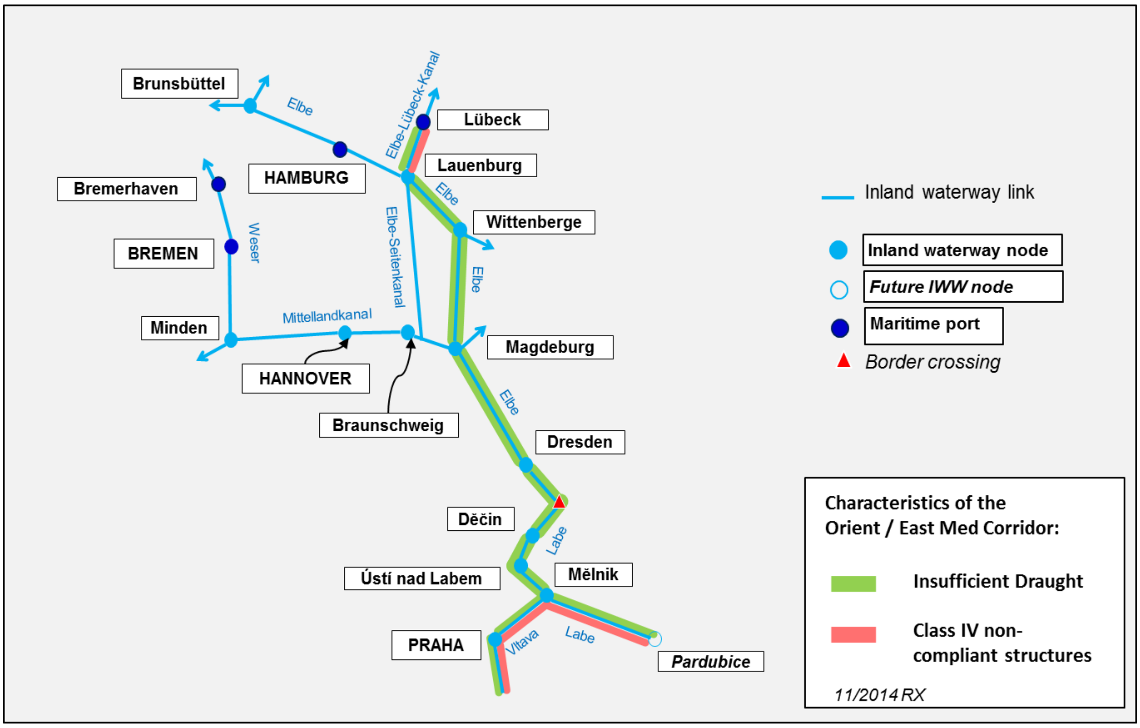
Legend:
BW10: water level that is exceeded on an average of ten days a year
HSW: Highest Navigable water level
MW: Average water level
GLW: Lowest Navigable water levels (giving a water depth of 1.60 metres downstream of Dresden and 1.50 metres upstream of Dresden)

[39] This value is particularly important for container transport. For double layer container transport a bridge clearance of 5.25 m is required, for triple layer transport 7.0 m and for quad layer transport 9.1 m.

On the entire German part of Elbe River, starting from Hamburg up to the German/Czech border at Schöna, there is enough bridge clearance to fulfil the requirements of the TEN-T guidelines for two layer stacks of containers. The most critical bridge is the Marienbrücke in Dresden, which has a bridge clearance of 5.11 metres at the highest navigable water levels. At BW10 (a level that is exceeded on an average of ten days a year), all bridges show bridge clearances higher than 5.25 metres. The Marienbrücke in Dresden has a bridge clearance of 5.76 metres at these water levels. At middle and low water levels, all bridges have enough clearance to even allow three stacks of containers. It might however be questionable whether these water levels allow the transport of three levels of containers.

One issue might be the arch bridges, especially in Dresden. For calculations, the 16 metres path between the arches has been used. However, the actual fairway width through the bridge is wider and thus the minimum bridge clearance can get lower. The issue of nautical difficulties at passing these bridges at high water levels should also be addressed: high currents make it difficult to manoeuvre through the arches, especially with high stacks of containers.
In this regard, better navigability on these sections could be achieved by upgrading/improvement measures, such as fairway deepening and construction of locks, for example with the construction of the lock of Děčín.

Figure 20: Corridor Inland Waterway Network – problematic areas



Source: Consortium

Apart from the problem of insufficient navigability conditions, which is mainly important from an economic point of view, another significant problem is the issue of flooding along the Elbe, which has also considerable large economic, social and ecological impacts. Nowadays, measures for better navigability and upgrading along the Elbe must always be considered against the background of the sometimes conflicting criteria of the economy and environment. On the one hand, conditions for shipping have to be improved or at least maintained as they are, while on the other hand, measures should not enhance the risk of floods. Given the impression of the floods of 2002 and 2013, the economic and social impacts were disastrous. Therefore, it is important to find a balance between both the above issues, as well as a coordinated approach between Germany and the Czech Republic on the future development in order to achieve the most optimal output for improving conditions for shipping, while and at the same time not endangering the resident local population.

Another problem on the Elbe and Vltava, at least on Czech sections between Mělník and Praha, as well as Mělník and Týnec nad Labem, is the low bridge clearance, which reduces the potential container capacity per vessel. The relevance of this limiting factor has to be analysed taking into account the issue, whether there is a need for three layer transport. Cost effectiveness of possible measures has to be ensured.

Additionally to the Elbe, also the Vltava waterway experiences low height under bridges (4.50 metres), locks problems, limited fairway sections, as well as flooding problems.

On the Elbe-Lübeck-Kanal is limited draught and low bridge clearance (4.50m) that reduces the potential capacity per vessel[40].

The following table provides an overview on deficiencies on the Elbe, Vltava and Elbe-Lübeck-Kanal.

Table 27: Deficiencies of IWW sections at Elbe and Vltava

Waterway	Section	Deficiency
Elbe	Geesthacht – Border DE/CZ	Unreliable draught conditions
Elbe	Border DE/CZ – Děčín - Ústí n.L. Střekov	Unreliable draught conditions, dropping below exploitable (defined) minimum
Elbe	Ústí n.L. Střekov – Lovosice - Mělník	▪ Draught conditions not up to class IV ▪ Standard underpass clearances of 6.5 m not achieved year-round ▪ Missing network of bridge labelling for navigation using radio locators
Elbe	Mělník – Týnec n.L. – Chvaletice - Přelouč	▪ Unstable draught conditions at Chvaletice port; ▪ Route draught conditions not up to class IV ▪ Missing emergency vessel protection; ▪ Insufficient reliability of lock operation (long downtimes)
Elbe	Přelouč - Pardubice	▪ Missing lock Přelouč II in the Chvaletice – Pardubice river segment; ▪ Insufficient draught conditions above Přelouč weir; ▪ Unreliable lock chamber at Srnojedy and impassable roadstead; ▪ Minimum underpass clearance of the Valy-Mělice bridge ▪ Waiting berths at some locks missing, especially for small vessels
Vltava	Mělník – Praha Holešovice - Praha/Jiráskův bridge	▪ Draught conditions not up to class IV (not urgent); ▪ Limited underpass clearances between Mělník and Praha-Holešovice; insufficient lock chamber widths (notably the pounds) prohibiting navigation by vessels 11.5 m wide; ▪ Insufficient capacity of Praha-Smíchov lock chamber ▪ Insufficient reliability of lock operation, long downtimes; ▪ Missing emergency vessel protection; ▪ Missing network of bridge labelling for navigation using radio locators

[40] Another important limiting factor in regard to container transport is the limited length of vessels (80 m) on the Elbe-Lübeck-Kanal (see also chapter 5.2.3.5)

Waterway	Section	Deficiency
Vltava	Praha/Jiráskův bridge – Praha Radotín - Třebenice	▪ Limited draught, navigation straits; dangerous entrance to upper roadstead of Praha-Modřany lock chamber; ▪ Limited underpass clearance ▪ Missing emergency vessel protection (Stěchovice)
Elbe-Lübeck-Kanal	Lübeck - Lauenburg	▪ Draught conditions not up to class IV ▪ Insufficient bridge clearance

Source: German Ministry of Transport; Czech Ministry of Transport, TSS 2, Book 6 (rev 2013)

In total, 966 km (59%) of the OEM inland waterway network are not compliant with the required draught conditions (2.50m). Sections with a total length of 269 km (16%) provide insufficient bridge clearance less than 5.25m.

5.2.3.4 Deployment of RIS

The deployment of River Information Services (RIS) is advanced. In both Germany and the Czech Republic, basic RIS applications have been implemented. The implementation of value-added services like e.g. Automated Identification System (AIS) is part of the IRIS Europe III project until 12/2014 in the Czech Republic (including two pilot AIS base stations on sections with navigation difficulties), while 90% of German fleet is equipped. However, landside AIS equipment is not installed. Besides this, the implementation of cross- border data exchange should be accelerated on the Elbe between Germany and the Czech Republic, which is currently hampered by differences in technological applications and the interpretation of data privacy regulations. Regarding the first, upgrades of the national RIS infrastructures are required in order to enable standardised cross-border data exchange. This is particularly important for the exchange of Notices to skippers, including also automatic translation of the most important content into both languages. The problem of interoperability is described in detail under section 7.2.2.

Additionally, it is recommended to make use of the traffic management functionality of RIS to introduce traffic and lock management on an international corridor level in order to reduce waiting times at locks, bridges and ports and to reduce fuel consumption. The basic characteristics and functionalities of the national RIS systems used in Germany and the Czech Republic are presented in the following. The RIS deployment plan is presented in section 7.2.2.

Germany: Elektronischer Wasserstraßen-Informationsservice (ELWIS)

The German RIS ELWIS is in operation on the entire inland waterway network in Germany. Operator of ELWIS is the German Federal Waterway and Shipping Administration. Provided services are Notices to Skippers including transport and traffic information for inland waterways, lock opening hours, leaflets and hydrological information (water levels, water level predictions, ice conditions reports on German waterways, etc.). In addition ELWIS provides facts and figures of inland waterways (overview maps, classification, usable locks and shipping channel dimensions), Inland Electronic Navigational Charts (Inland ENC), Inland Electronic Chart Display and Information Systems for Inland Navigation (Inland ECDIS), as well as statistics and contact details of departments of the German Federal Waterway and Shipping Administration and locks. All services are provided free of charge.

Czech Republic: Labsko-Vltavský Dopravní Informáční System (LAVDIS)

The Czech RIS LAVDIS is operated on the Elbe from Chvaletice (at km 939.84) to the border with Germany near Hřensko (at km 726.6). The River Vltava is part of the RIS from Třebenice (river km 91.5) to the confluence with the Elbe River near Mělník (river km 0), including the mouth of Berounka at the Port Praha Radotín. This includes information on actual water levels, notices to skippers, meteorological warnings, and webcam. The implementation was supported by IRIS Europe II and III. Electronic Navigable Charts (Inland ECDIS) are available for Elbe from km 726.6 – 949.2 (Border DE/CZ – Přelouč) free of charge and prepared by the State Navigation Authority (Státní Plavební Správa).

In addition to RIS, the Port of Hamburg has recently launched PRISE (Port River Information System Elbe). This IT platform brings together all information on ship arrivals and departures from all of parties involved in the handling process. The objective is to increase the flow of traffic on the Elbe. As the Port of Hamburg is the central gateway to the Elbe, both inland waterway transport and maritime transport profit from PRISE.

5.2.3.5 Capacity Utilisation

Freight transport

On the Elbe, barges with the dimensions 110 m length and 11.45 m width are approved to operate between Geesthacht and Geesthacht and Mělník. On the section Mělník – Přelouč, the admitted length of barges is 84 m and width 11.45 m. On Vltava River, it is possible to navigate with barges with a length of 110 m and a width of 10.50 m. However, an adequate fairway depth is not given consistently, having negative effects on the maximum loading capacity due to draught limitations.

An important adjacent waterway for the Elbe (or more exactly the Mittelelbe between the lock Geesthacht and Magdeburg) is the Elbe-Seitenkanal, allowing barges to circumnavigate this section via Elbe-Seitenkanal and Mittellandkanal, saving thus in comparison to the Elbe a distance of approximately 33 km. The majority of transport flows registered at the lock Geesthacht take the route on the Elbe-Seitenkanal or vice versa, while a comparatively small part of the transport flows remains on the Elbe.

On the Elbe, primarily large-volume goods and heavy goods from mechanical and plant engineering centres are transported, e.g. for Siemens in Berlin, Dresden, Görlitz and Erfurt, for Airbus industries in Dresden or the crane and steam boiler construction in Köthen. In addition, there is transport of agricultural products. The Elbe is also of great importance to the so-called downstream traffic to Hamburg. For example, the MUT tank farm in Magdeburg is supplied by the Elbe-Seitenkanal, while on the way back to Hamburg, i.e. the empty run, occurs on the Elbe.

Container shipping services, e.g. for container traffic to and from the ports of Magdeburg, Riesa and Dresden also use the Elbe almost all year, especially since on the Elbe - in contrast to the channel network - three-layer container transport is possible. In this regard, it is important to mention, that from the economic point of view Elbe and Elbe-Seitenkanal form a “communicating” Inland waterway network and need to be considered jointly not as opposed or competitive.

The capacity utilisation of inland waterways is limited for the locks and fairways in the Corridor, which is illustrated in the following table, valid for the last decade.

Table 28: Capacity use of selected locks on the OEM corridor

Lock	Fairway	Capacity [mln tonnes/yr.]	Capacity utilisation
Geesthacht (DE)	Elbe	17.0	57.7%
Lüneburg (DE)	Elbe-Seitenkanal	13.0	65.7%
Minden (DE)	Weser	8.5	46.1%
Anderten (DE)	Mittellandkanal	17.2	59.7%

Source: Planco (2007)

The Elbe-Seitenkanal is classified as an inland waterway of class Vb. That is, in principle, barges with 110 m length, 11.40 m width and 2.80 m draught and pushed convoys of 185 m length, 11.40 m width and 2.80 m draught can be used. The former, however, are not approved for a continuous ride. A hindering factor is the ship lift Lüneburg near Scharnebeck due to limitations of the two chambers, especially regarding length. Each chamber has a maximum length of 100 m and a width of 12 m. For this reason, only barges that correspond with these dimensions can pass, while pushed convoys have to be decoupled for the passage and lifted or lowered individually.

Built in 1974, many parts of the ship lift Lüneburg site - especially regarding mechanical engineering - have to be renewed or replaced. This has negative effects on the functionality and availability of the site. Limitations and even breakdowns, leading to interruption of traffic on the Elbe-Seitenkanal, occurred several times in the past years. The extension of the existing ship lift by building an additional lock with a length of 190 m and a width of 12.50 m could help to relief this bottleneck. A change in the dimensions of the existing troughs, e.g. an extension is not possible for structural and design reasons. The larger effective length represents the essential difference to the old building, enabling the passage of barges of 110 m length and coupled convoys to 185 m length, improving navigability and operations on the Elbe-Seitenkanal. Geographically, this new lock could be located immediately west of the current ship lift, where sufficient space is available. The land is already owned by the state and is considered as a reserve area for a possible expansion. As it is planned for the time being, in order to keep the existing ship lift in operation, in case of revision or construction works on the new lock, the risk of a bottleneck cannot be entirely excluded in the future.

For economic reasons the construction of the new lock is considered as the best solution, especially in comparison to rebuilding the ship lift. Planning is at an advanced stage, but financing is not secured yet[41]. Objective is to have the construction of the lock included in the Federal Transport Investment Plan (Bundesverkehrswegeplan BVWP) 2015.

Traffic on the Elbe-Seitenkanal is dominated by bulk transport. Main types of goods are petroleum products, solid fuels, as well as stones and earths, including building materials. Thus the three main types of goods represent approximately two-thirds of the total traffic. Container loads play, based on the tonnage, only a subordinate role.

On the Mittellandkanal barges with the dimensions 110 m length, 11.45 m width and 2.80 m draught and pushed convoys of 185 m length, 11.40 m width and 2.80 m draught can be used. Transport goods include all types of cargo.

[41] In 2010/2011 a technical and economic feasibility study was carried out by the Directorate General Waterways and Shipping (GDWS) stating that the new construction of a lock (with a required investment of EUR 250 million) is technically feasible and economically (even at today's traffic). At the end of 2011, the required preliminary analysis for the construction had been completed. In 2012, however, the further planning has not been enabled by the German Ministry of Transport with reference to lack of investment funds.

On the Mittelweser at present, barges with the dimensions 85 m length, 11.45 m width and 2.5 m draught can be used. The section between Minden and Bremen is currently upgraded so that a ship with a length of 110 m and a width of 11.45 m can operate in the future (planned from 2015 on). As on the Mittellandkanal Transport, goods include all types of cargo.

The Elbe-Lübeck-Kanal can be used by barges up to 80 m length, 9.50 m width and 2.00 m draught[42] only due to limited length of lock chambers. Traffic on the Elbe-Lübeck-Kanal is dominated by bulk transport. Transport volumes stagnated in the last years mainly due to insufficient infrastructural framework conditions that do not meet the requirements of present inland waterway transport. Main aspect in this regard is the limited length of vessels that can navigate on the canal excluding vessels of 110 m length, representing at present the vessel type mainly used in inland waterway transport. In addition, limited draught and bridge clearance have negative impacts on the transport volumes. However, inland waterway transport in the Elbe-Lübeck-Kanal has growth potential, if it is upgraded for vessels of 110 m including sufficient draught and bridge clearance[43]. This potential is generated by shifting transport flows from the road to inland waterways, the dynamic growth in the Baltic Sea region, secondary transports from and to the seaport of Lübeck and regional transport flows. A volume growth up to 2 – 3 million tonnes per year is possible[44], if the above mentioned upgrading measures are implemented.

Figure 21 and Figure 22 provide information on the freight traffic flows on Elbe, Elbe-Seitenkanal, Elbe-Lübeck-Kanal, Mittellandkanal and Mittelweser in 2012[45]. In 2013, the values were slightly higher for the Elbe and the Elbe-Lübeck-Kanal, Elbe-Seitenkanal, Mittellandkanal and Weser are important waterways especially in regard to hinterland traffic to and from the Ports of Hamburg, Bremen and Bremerhaven. In Annex 4, the share of inland waterways in the port traffic is analysed. For ports, the share of inland waterways is lower than 10% with the exception of Wilhelmshaven.

Capacity utilisation differs within the German OEM Inland Waterway Network. However, there is no capacity bottleneck.

In the Czech Republic, freight transport on inland waterway is characterized as follows: The export is dominated by cereals, oil crops, chemical fertilizers, mining products, built ships and whole engineering units, while import comprises mainly of animal feed and mineral resources. The manufactured goods in the Czech Republic are usually shipped straight from the producing facilities located on or near the Elbe River (chemical plants e.g. Lovochemie Lovosice, Spolana Neratovice, shipyards in Chvaletice and Děčín). On the contrary, production of cereals, oil crops, mining and engineering products comes from various parts of the Czech Republic, mostly from northern Moravia and western Bohemia regions. The imported goods come mostly from seaports where the goods are reloaded from other continents, e.g. feed from Latin America. Exports of chemical products formed about 5 to 6% of total exports. These products form a fifth of total exported volume transported by waterways by 2012.

In total 1.767.000 tonnes were transported on Czech inland waterways in 2012, of which approximately 77% were international and 23% national transport flows. This

[42] According to ELWIS a draught of 2.10 m is permitted for barges of 80 m length and 8.20 m width.

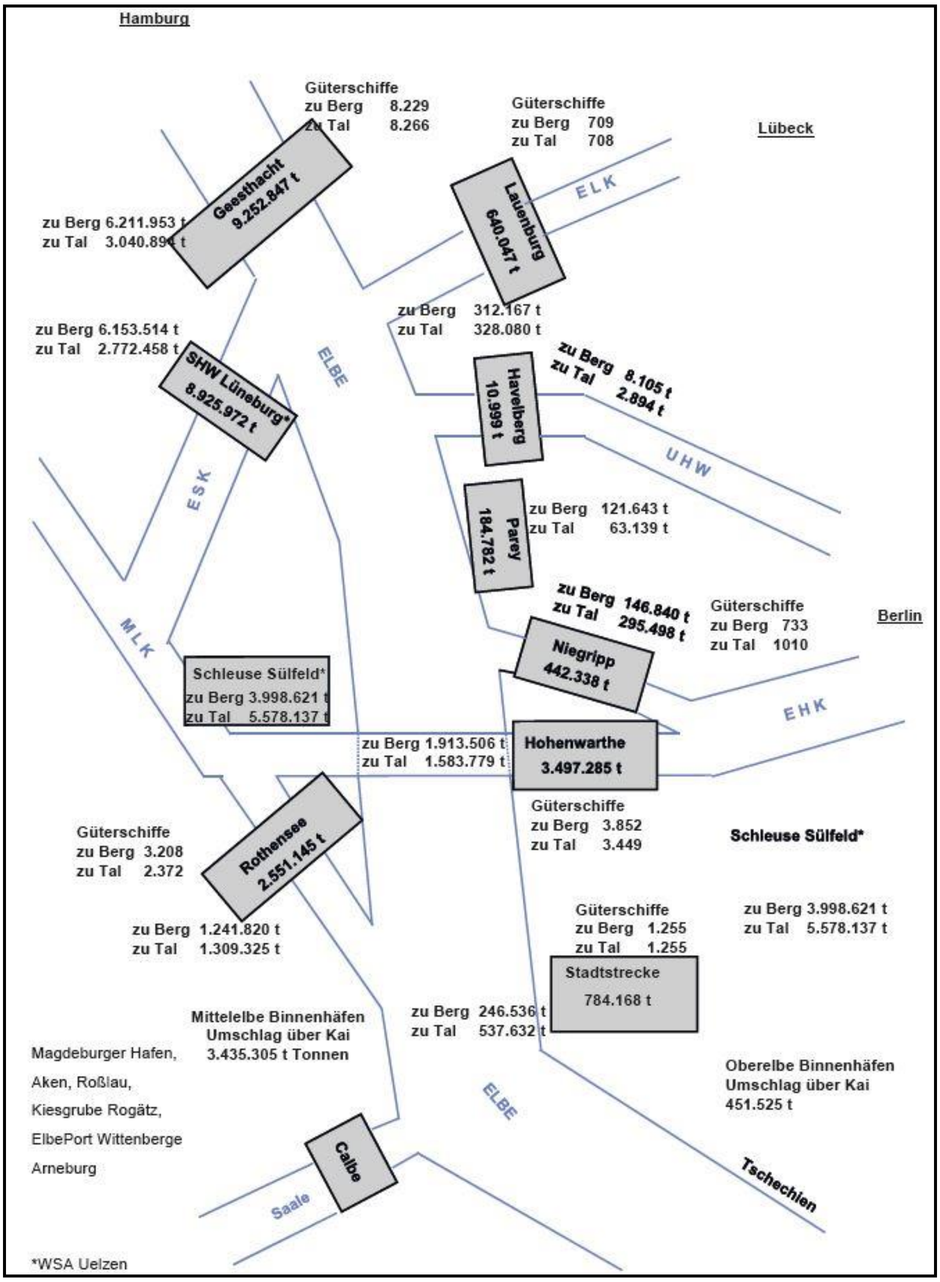
[43] According to information of IHK Lübeck based on a study of Hanseatic Transport Consultancy on the transport potential on the Elbe-Lübeck-Kanal performed in 2013. The study itself was not analysed in this report due to formal reasons.

[44] Neither the actual nor the forecasted transport volumes on the Elbe-Lübeck-Kanal are taken into account in the Transport Market Study due to formal reasons.

[45] The year 2012 was chosen to have the same base year for all inland waterways. For 2013 values are available for Elbe-Lübeck-Kanal and Elbe only.

illustrates the importance of the Elbe as gateway to the European and international market for the Czech Republic.

Figure 21: Scheme on IWT volume on Mittelelbe Section (Aken – Geesthacht)

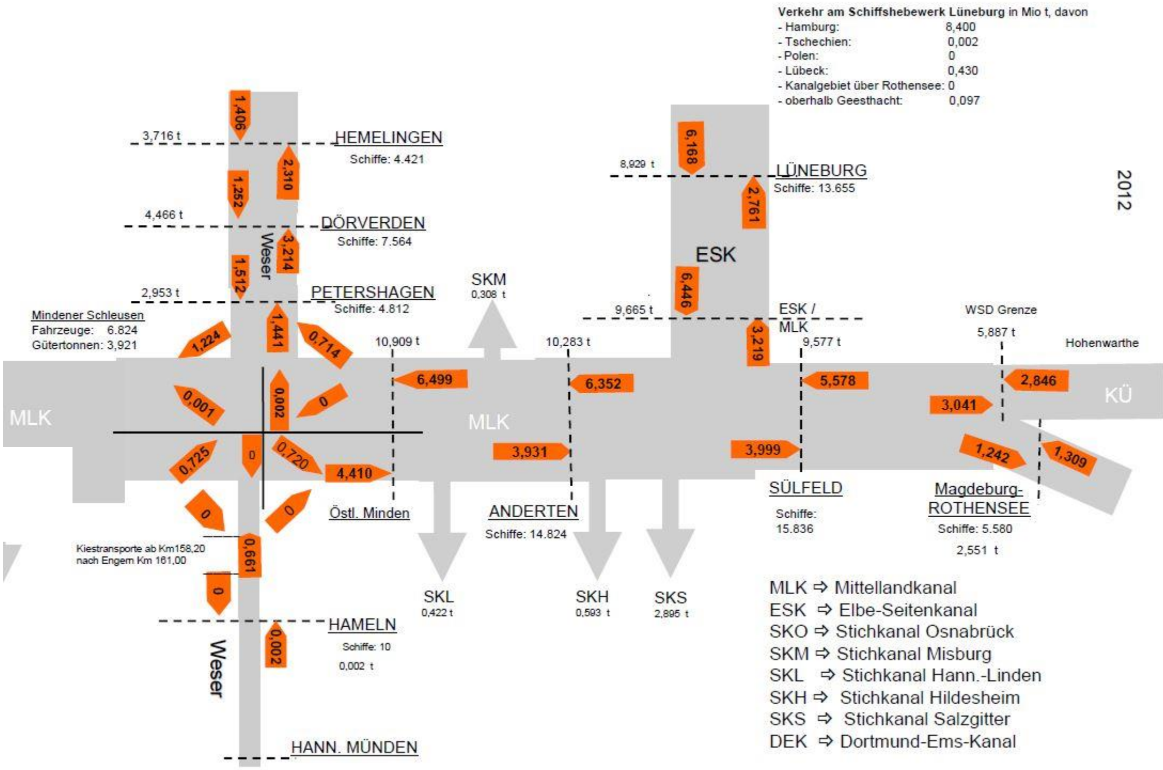


Source: Verkehrsbericht der WSD Ost 2012, GDWS 2013.

Legend:

MLK: Mittellandkanal
ESK: Elbe-Seitenkanal
UHW: Untere Havel-Wasserstraße
EHK: Elbe-Havel-Kanal
ELK: Elbe-Lübeck-Kanal

Figure 22: Scheme on IWT volume on Mittellandkanal section



Source: Verkehrsbericht der WSD Mitte 2012, GDWS 2013.

5.2.3.6 Relevance for Seaports

Inland waterways are important since they offer free capacity in contrast to congested road and rail networks. In this regard, the integration of inland waterways into a multimodal transport system should be fostered. For the OEM corridor, this is particularly important for the hinterland transport from/to the port of Hamburg in the case of the Elbe and Elbe-Seitenkanal, but also for the ports of Bremen and Bremerhaven that are connected to the Elbe via Mittellandkanal and Weser. Besides container transport, the transport of heavy goods and project cargo offers further potential due to infrastructural constraints (weight and dimensions), especially on road but also on rail. For the bigger part of these freight transport flows there is no alternative to Inland waterways. For both cases, the potential alternatives have to be identified and assessed. For effective transport, stable framework conditions along the inland waterways have to be ensured. Further port related traffic information is given in the Annex 4. The same applies in principle also for the Elbe-Lübeck-Kanal as connection to the seaport of Lübeck[46], but with limited capacity particularly regarding the container transport due to infrastructural deficits. Economic viability of respective transport alternatives was not given[47].

[46] Due to not being part of the OEM corridor, the seaport of Lübeck is not analysed in this report, but in the Scandinavian Mediterranean corridor study.

[47] Source: Information of IHK Lübeck on the basis of a study of Hanseatic Transport Consultancy on the transport potential on the Elbe-Lübeck-Kanal performed in 2013. The study itself was not analysed in this report due to formal reasons.

5.2.3.7 Technical Bottlenecks / Interoperability Issues

A substantial part of the OEM Inland Waterway Network is not compliant with the required minimum depth according to the TEN-T regulation, as well as CEMT Class IV. This endangers the seamless navigability of the Elbe. German economic associations criticize that on the River Elbe the maintenance objective of a guaranteed minimum fairway depth of 1.60 m between Hamburg and Dresden on 345 days per year and of 1.50 m between Dresden and the border to the Czech Republic, that has also been communicated to the Czech Government, is not fulfilled at present. The ongoing discussion and infrastructure projects foreseen for improvement addressing the above mentioned issues are described in Annex 7. Insufficient minimum draught is also an issue on the Elbe-Lübeck-Kanal.

Additionally, low bridge clearance hinders transport on Elbe and Vltava sections in the Czech Republic and the Elbe-Lübeck-Kanal in Germany. Besides the infrastructure projects, investments in new ship equipment and technologies must also be considered to adapt better to the navigation conditions of the Elbe. For example, the construction and use of ships with less draught could improve inland waterway transport on the Elbe. The financing of these investments has to be clarified.

5.2.3.8 Organizational Bottlenecks

Fostering the development of inland waterways as a transport mode along the OEM corridor does not only require maintenance at least of the current conditions and/or improvement infrastructure measures, but also a coordinated approach among all stakeholders involved. This relates in particular to a coordinated infrastructure development in Germany and the Czech Republic. In this regard, it is recommended that within the "Gesamtkonzept Elbe", which is at present under preparation by the German Ministry of Transport, the investments on the Czech sections of the Elbe are also appropriately taken into account, in order not be devalued. Within the framework of European Transport policy, a reliable statement regarding existing infrastructure and the additional maintenance measures to be taken have to be recorded on a cross-border basis. This is a core request of German trade associations, which are aiming at the same time to establish a fair balance between economic and ecologic requirements when using the Elbe.

Regarding navigation along the Elbe any time of day, limited daily operating hours of locks in the Czech Republic, not offering services in the night time[48], are hindering factors that restrict transport. On the other hand, lock operation must be economically viable. Thus, it has to be determined if there is enough potential regarding ship traffic that would jÚstífy a 24h-opening.

[48] For operating times of Locks at Elbe (Labe) and Vltava see http://www.lavdis.cz/en/waterways/water-locks

5.2.4 Inland Ports

5.2.4.1 Location

Based on Annex II of the Regulation No.1315/2013, the core inland ports of the OEM corridor are the following:

Table 29: Core Inland Ports and Further Inland ports

	Inland core network ports	Further Inland ports
DE	Hamburg Bremerhaven Bremen Hannover Braunschweig Magdeburg Berlin	Minden Haldensleben Lauenburg Wittenberge Aken Rosslau Torgau Riesa Dresden
CZ	Děčín Mělník Praha-Holešovice Pardubice (under design)	Ústí nad Labem Lovosice Kolín
AT	Wien	
SK	Bratislava Komárno	
HU	Komárom Budapest-Csepel	Győr-Gönyü Baja Dunaújváros Mohacs Páks
RO	Drobeta-Turnu-Severin Calafat	
BG	Vidin	
∑	**19**	**17**

In addition, other inland ports located along the Corridor, belonging to the comprehensive network, are listed in extracts[49] for information only. This shall not reduce their importance as transhipment points for goods between the different transport modes.

As for inland waterways, this report focuses on the northern part of the OEM corridor, i.e. inland ports located on the Elbe, Elbe-Seitenkanal, Mittellandkanal, Weser and Vltava. Inland ports located on the Danube (AT, SK, HU, RO and BG) are addressed in the Rhine-Danube Corridor Study.

All operational ports are equipped with sufficient road and rail connections and are thus trimodal. Nevertheless, only parts of Děčín and Praha ports are accessible by rail, while the Pardubice port is still under design.

[49] The extract is based on information given in the Annex II of the Regulation1315/2013, the TENtec information system and own research/knowledge. The consultant is aware that there are more inland ports along the OEM inland waterway network than listed. Anyhow considering all inland ports is beyond the scope of the study.

The following table shows the intermodal connection of the ports, evidencing the good quality.

Table 30: OEM River ports: Road and Rail Connections Status (2014)

	River port	Road Connection	Rail Connection
DE	Hamburg	Motorways A1, A7, A255, Federal roads B4, B5	Yes
	Bremerhaven	Extended Local road (Motorway in approx. 8 km)	Yes
	Bremen	Motorways A281, A27	Yes
	Hannover (Nordhafen)	Motorway A2 (in 2 km)	Yes
	Braunschweig	Motorway A2 (in 2 km)	Yes
	Magdeburg	Motorway A2 (in 2 km)	Yes
CZ	Děčín	Local road (Motorway in approx. 30 km)	Yes, partly
	Mělník	National road (Motorway in approx. 12 km)	Yes
	Praha Holešovice	Urban road (Motorway in approx. 6 km)	Yes, partly
	Pardubice	*port under design*	*port under design*

5.2.4.2 Characterization and Capacity

All core inland ports (except Vidin, Bulgaria) are trimodal ports, providing facilities for the transhipment of goods between the different transport modes. Goods transhipped in the OEM inland ports are heterogeneous including all types of:

- General cargo
- Bulk cargo (dry and liquid)
- Containers
- Heavy and project cargo

The latter is of particular importance along the Elbe. Regarding container transport, inland ports serve, as Rail Road terminals, as hubs for the hinterland distribution of seaports.

In general, the inland ports along the OEM corridor have sufficient capacity to handle all transport volumes. The trimodal positioning of the ports ensures that despite some adverse transport conditions of individual modes of transport, e.g. along the Elbe due to unstable water levels, all transport demand can be served.

For the OEM Inland ports presented in Table 30, the following short profiles summarize the most important information for each port. Additional port related traffic information, particularly on volumes, is given in the Annex 4.

Hamburg:

Hamburg is the largest port of Germany. Different types of cargo are handled in the port; apart from the dominance of containers, all types of general and dry and liquid bulk cargo. Hinterland transport plays a very important role as approximately 75% of the handled goods are further transported to other destinations. Several of them are located along the OEM corridor, including East and South-East Germany, Czech Republic, Slovakia, Austria and Hungary. With regard to Inland waterway transport, the share on modal split is with approximately a low 2%, at present, while the shares of road and rail are approximately 66% and 32%, respectively. According to the Port Development Plan, it is planned to increase the share up to 5% by 2025. This implies that a number of bottlenecks identified in the Inland waterway network (e.g. Ship lift Lüneburg on the Elbe-Seitenkanal) must be removed in order to reach this goal. The same applies to the other transport modes, particularly rail (e.g. upgrade of Hamburg node), and road (new motorway A26 – Port Motorway at Süderelbe).

Bremerhaven and Bremen:

Belonging to the same German Federal State and being represented by the same organization, Bremenports GmbH & Co. KG, the Ports of Bremerhaven and Bremen both ports are presented in a joint profile.
Bremerhaven, the larger one of both ports regarding the volumes, handles mostly general cargo, containers and automotive, while Bremen handles bulk and general cargo. Modal split of container hinterland transport of Bremerhaven comprises 50% road, 46.6% rail and 3.4% inland waterway transport. The high share of rail highlights the importance of solving bottlenecks within the rail network, and within nodes in particular (e.g. Bremen).

Hannover:

In Hanover, there are four inland ports, the Nordhafen and the Brinker Hafen directly located on the Mittellandkanal (km 155 and 161), as well as the Lindener Hafen on the branch canal Linden and the Misburger Hafen on branch canal Misburg. These ports appear uniformly as group of companies Port Hannover. In terms of accessibility all four ports are trimodal. Cargo volumes handled in Hannover include conventional (bulk/ general cargo), as well as containerized cargo.

Braunschweig:

Braunschweig Port is located at km 219 of the Mittellandkanal. Goods handled include bulk cargo, such as grain, petroleum, fossil fuels and goods from the recycling industry and containerized cargo. Due to its location on the Mittellandkanal, the Port of Braunschweig plans an important role in Container Inland Waterway Hinterland Transport for the German Seaports, particularly for Hamburg. For this reason, there are regular barge container transport services between Hamburg and Braunschweig. In addition, there is the option for linking also the Ports of Bremen, Bremerhaven and Wilhelmshaven, if required by the demand side.

Magdeburg:

The port of Magdeburg is located closely to an intersection of the Mittellandkanal, the Elbe-Havel-Kanal and the Elbe. In terms of cargo bulk, containerized and project cargo are transhipped. There are regular transport services in Hinterland transport to/from the Port of Hamburg.

Děčín:

Děčín Port is located on the Elbe and is a trimodal hub in the north of the Czech Republic close to the Czech/German border. With regard to the unstable water levels of the Elbe, that are natural underlying fluctuations, Děčín has at present the best navigation opportunity of all Czech inland ports. Types of cargo handled at Děčín Port include general cargo, dry and liquid bulk cargo and containers.

Mělník:

Like Děčín, the Port of Mělník is located on the Elbe and is a trimodal logistics terminal. Mělník serves daily container trains from/to the Northern European seaports (Rotterdam, Bremerhaven and Hamburg) and to Central European ports (Bratislava, Budapest and Koper). Transhipment goods include break bulk cargo, containers and heavy and oversized products.

Praha-Holešovice:

The Port of Praha-Holešovice is located on the Vltava. Main cargo handled includes bulk materials.

Pardubice:

The Port of Pardubice will be located on the Elbe, but is still under design.

5.2.4.3 Availability of Alternative Fuels

At present, no infrastructure for the supply of alternative fuels is available along the Elbe and Vltava. In general, Liquefied Natural Gas (LNG) is considered as the forward-looking alternative fuel in matters of inland waterway transport. This relates to emission standards that are expected to be tightened in the future, particularly for new construction of ships. The establishment of supply infrastructure for LNG is eligible and is promoted by the European Union. However the implementation of LNG along the inland waterway network requires the initiative of stakeholders, such as port operators. In addition, it is considered unlikely that LNG bunker stations can be operated cost-effectively for inland waterway transport only. The integration of other users, such as other transport modes or chemical industries can improve cost-effectiveness and economic viability due to synergy effects. Therefore, bunker stations for LNG at inland waterways should be constructed at central locations, where other users can also profit. This means that not every port has to hold available LNG. Planning for the construction of supply infrastructure for LNG exist along the Unterelbe, particularly in the Port of Hamburg.

5.2.5 Maritime Transport: Ports and Motorways of the Sea

5.2.5.1 Alignment

The maritime infrastructure of the Orient / East-Med corridor, presented in Figure 23, depicts the Motorways of the Sea and the maritime ports:

The links between Greece and Cyprus along with their seaport connections belong to the pre-identified Motorways of the Sea link of the OEM corridor:

- Piraeus – Heraklion: 190 nautical miles.
- Piraeus – Lemesos: 623 nautical miles (= 1153 km)
- Heraklion – Lemesos: 453 nautical miles (total: 1266 nm = 2345 km)

The Motorway of the Sea through the Eastern Mediterranean Sea is linking the hinterlands of the Greek seaport of Piraeus (in the Athina urban agglomeration) with the Island of Crete and the seaport of Heraklion, as well as with the Cyprus seaport of Lemesos.

Additional seaports being core network nodes, which are not connected with the IWW or pre-identified MoS of the OEM corridor, are:

- Rostock (Baltic Sea, DE)
- Wilhelmshaven (North Sea, DE)
- Burgas (Black Sea, BG)
- Thessaloniki (Aegean Sea, EL)
- Igoumenitsa and Patras (Adriatic/Ionian Sea, EL)

5.2.5.2 Compliance of the Infrastructure with TEN-T requirements

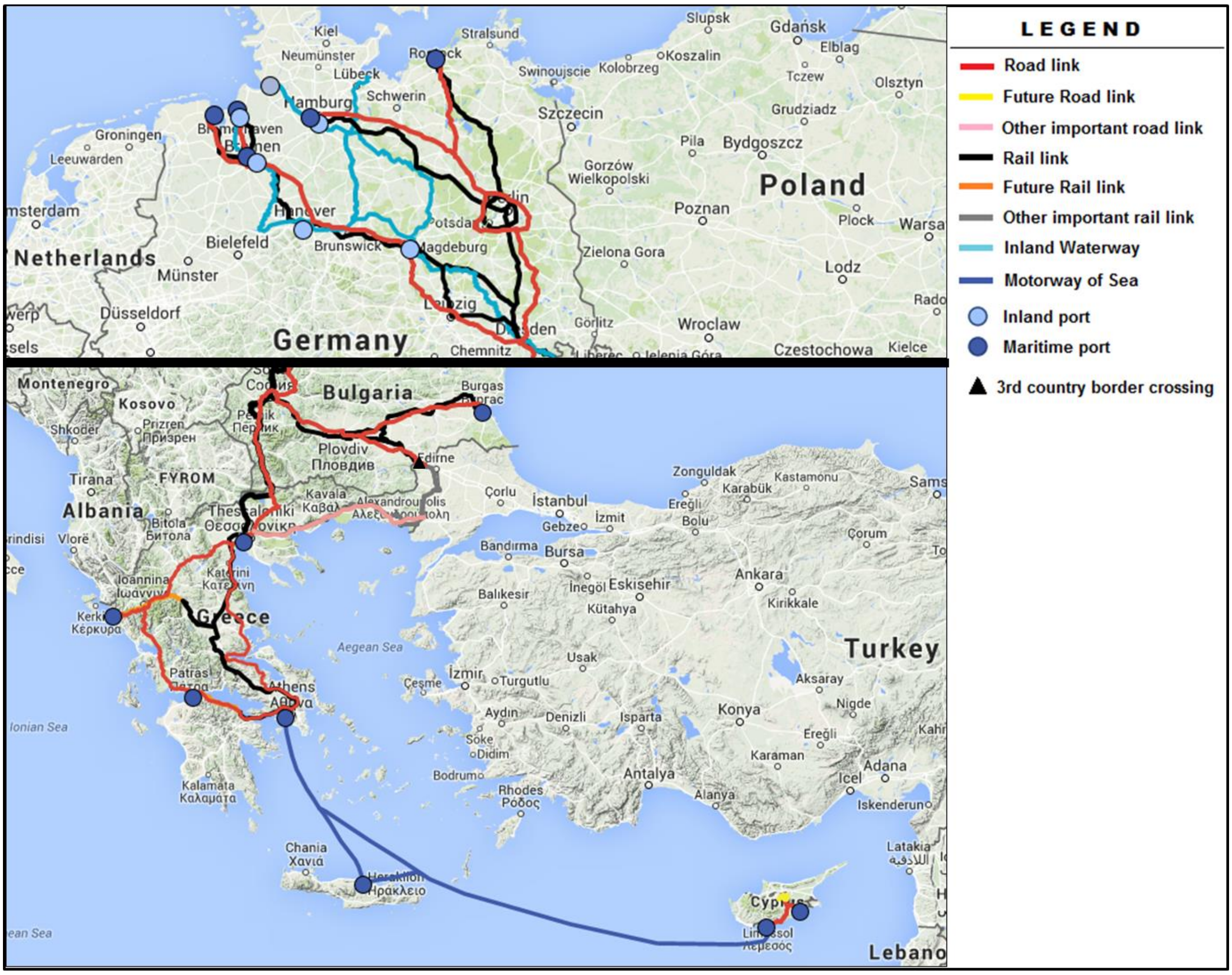
The characteristics of the ports belonging to the OEM Corridor were recorded mainly on the basis of the technical parameters included in TENtec, as well as the compliance with the following two Regulation No.1315/2013 requirements:

- Connection to rail network, inland waterways and road network; core ports are to be connected to rail by 2030
- Availability of alternative clean fuels by 2030.

Connection to road and railway networks

- Table 31 presents the list of OEM ports, as well as the availability and type of road and rail connections, as per the related Regulation requirement.
- Based on the above, the OEM seaports which do not comply with the Regulation are the ones with missing rail connections, namely Ports of Igoumenitsa and Patras in Greece.

Figure 23: Maritime Waterways of Orient / East-Med Corridor



Source: Consortium (revised Dec 2014); Note: MoS are not depicted in total.

Table 31: OEM Ports: Road and Rail Connections

	Maritime port	Road Connection	Rail Connection
DE	Hamburg	Federal road / Motorway	Yes, electrified
	Bremerhaven	Local road (Motorway in approx. 8 km)	Yes, electrified
	Wilhelmshaven	Local road (Motorway in approx. 8 km) / Motorway	Yes, diesel
	Bremen	Motorway	Yes, electrified
	Rostock	Motorway	Yes electrified
BG	Burgas	Motorway (last mile urban road)	Yes, electrified
EL	Athína / Piraeus	Motorway	Yes, electrified
	Heraklion	Two-lane carriageway	No (no railway network)
	Thessaloniki	Two-lane carriageway /urban road (Motorway at 2 km)	Yes (new under design)
	Igoumenitsa	Motorway	No
	Patras	Two-lane carriageway/urban road (Motorway under construction)	No (under design)
CY	Lemesos	Motorway	No (no railway network)

Source: Consortium

Availability of Alternative Fuels

The EU-Regulation No.1315/2013 and other related EC guidelines on sustainability, energy efficiency and CO_2 reduction are requiring publicly accessible Liquefied Natural Gas (LNG) refuelling points for maritime transport to be provided by all maritime core ports until 2030 with the scope to reduce CO_2 emissions from maritime bunker fuels by 40% by 2050.

German ports of Hamburg, Bremen and Bremerhaven plan to develop LNG bunkering facilities and start operating these by 2015, while neighbouring ports of Rostock and Wilhelmshaven will also provide access to LNG fuel. The general target is to provide ships in all German ports along the North and Baltic Sea with LNG as a clean fuel.

With regard to the port of Burgas, there are no specific plans or projects foreseen for the provision of alternative fuels facilities.

In Greece, the Port of Piraeus has been granted the status of ”Green Port” and there are plans for the provision of an LNG refuelling station to vessels calling, despite not been within a Special Emissions Control Area at the moment. With regard to the rest of Greece’s core ports, there are no immediate plans to provide LNG facilities.

Finally, the planned upgrading of the Lemesos port’s infrastructure and standards in relation to the works for exploiting hydrocarbons found in Cyprus’s Exclusive Economic Zone (EEZ) and neighbouring countries, is expected to assist to the development of relevant Liquefied Natural Gas (LNG) facilities. A relevant study is underway which is co-financed by TEN-T funds.

5.2.5.3 Deployment of Traffic Management Systems

In addition to the above requirements, the Regulation stipulates the necessity for ports to deploy e-Maritime services, including in particular Vessel Traffic Management Information Systems (VTMIS), single-window, Port Community Systems (PCS) and relevant customs information systems, as advanced and interoperable information technologies to simplify administrative procedures and to facilitate the throughput of cargo at sea and in port areas.

A VTMIS is a marine traffic monitoring system that only keeps track of vessel movements and provides navigational safety in a limited geographical area, whereas the PCS is the most advanced method for the exchange of information within a sea port infrastructure conglomerate. It is a neutral and open electronic platform enabling intelligent and secure exchange of information between public and private stakeholders, mainly optimising, managing and automating port and logistics processes through a single submission of data, connecting both transport and logistics supply chains.

With regard to Germany, the Ports of Hamburg, Bremen, Bremerhaven, Wilhelmshaven and Rostock, have implemented a Port Community System. Regarding the Port of Burgas, a project is underway for VTMIS implementation and will be completed in 2018 according to the tentative schedule. The project covers the whole Bulgarian Black sea shore, including the Port of Burgas. The implementation of a PCS is also planned by 2019.

In Greece, the Ports of Piraeus and Thessaloniki deploy Management and Information Systems and the Port of Igoumenitsa will implement a Port Community System, while the Port of Heraklion a VTMIS in the near future. The Ports of Patras does not have such a system in place. Finally, the Port of Lemesos has deployed the Cyprus Port Operation System (CYPOS), while the implementation of a PCS is also planned for 2017. Table 32 lists the different traffic management systems (TMS) deployed in each OEM port.

Table 32: Type of TMS per OEM port

	Maritime port	Type of Traffic Management System	Existing	Future
DE	Hamburg	PCS ("DAKOSY")	Y	
	Bremerhaven	PCS ("Bremer Hafentelematik")	Y	
	Wilhelmshaven	PCS ("Wilhelmshaven")	Y	
	Bremen	PCS ("Bremer Hafentelematik")	Y	
	Rostock	PCS (Verkehrsleitzentrale Warnemünde)	Y	
BG	Burgas	VTMIS and PCS		Y
EL	Athína / Piraeus	Port Management Information System (P-MIS) (also PCS in Cosco terminal)	Y	
	Heraklion	VTMIS		Y
	Thessaloniki	Port Management Information System	Y	
	Igoumenitsa	PCS		Y
	Patras	-		-
CY	Lemesos	Cyprus Port Operation System (CYPOS)	Y	
		PCS		Y

5.2.5.4 Capacity Utilisation

Table 33 presents the latest available annual passenger and freight flows of the OEM ports. Further port related traffic information is given in the Annex 4.

Table 33: OEM Ports: Passenger and Freight Flows

	Maritime port	Passenger Traffic Flow (pax p.a.) 2013	Freight Traffic Flow (tons p.a.) 2013
DE	Hamburg	-	128.568.000
	Bremerhaven	-	54.506.000
	Wilhelmshaven	-	24.694.000
	Bremen	-	12.553.000
	Rostock	-	18.085.000
BG	Burgas	5.670	15.851.000
EL	Athína / Piraeus	9.796.703 (2012 data)	23.563.000 (2012 data)
	Heraklion	2.499.199	2.974.000 (2011 data)
	Thessaloniki	47.841	14.515.326 (2012 data)
	Igoumenitsa	2.499.199	2.600.000
	Patras	723.991	2.654.000
CY	Lemesos	215.925	3.048.032

Source: TENtec (08/2014)

Germany

Recent figures for the Port of Hamburg, the largest seaport in Germany, provide evidence of rising throughput for container mega-ships, which has resulted in increased levels of fluctuation in capacity utilisation (peaks) at its container terminals. The port notes that container stores are fully productive at a level of capacity utilisation of up to 80%. With the current high levels of seaborne productivity, the port's container yard constitutes a bottleneck at the terminals. According to the latest port development plan for 2025, the projected container handling potential of 25.3m TEU in 2025 will require infrastructure investments to increase handling capacities. In addition, Hamburg is the EU port with the highest amount of rail volumes in hinterland transport; approximately 40% of its container hinterland traffic is carried by train. Bottlenecks are identified inside the port, therefore, its goal is to utilise the existing infrastructure more efficiently (e.g. by IT technology). Also, the insufficient navigability conditions of River Elbe limit the IWW share to 1%.

The Port of Bremerhaven, being the fourth biggest container port in Europe has the capacity to handle almost 10 million TEUs and 55 million tons of containerized cargo per year. The Bremerhaven Container Terminal exhibits a comparatively stable capacity utilisation. The OEM corridor connects Bremerhaven with the hinterland, where the modal share of railway is over 45%, and the connection is deemed a bottleneck for the port. Similarly to Bremerhaven, the Port of Bremen has an average throughput capacity of approximately 2.7 million TEU per annum. Based on the freight volumes recorded for year 2013, there are no capacity bottlenecks in either of the above mentioned two ports. The opening of a new terminal in the Port of Wilhelmshaven with a container handling capacity of 2.7 million TEU per annum resulted in a significant increase in capacity, whose utilisation rate, however, is at present low. Finally, the completion of the a new intermodal terminal in the Port of Rostock in 2014 doubled the port's handling capacity to more than 140,000 units per year and can amply accommodate the high throughput recorded for year 2013.

Bulgaria

The Port of Burgas is the biggest and busiest Bulgarian port. The Master Plan for the development of the Port of Burgas until 2015, foresees investments that will allow for the following:

- Terminal for general and liquid cargoes with handling annual capacity of 1.8 million tons
- Terminal for bulk cargos with handling annual capacity of 5.9 million tons
- Ro-Ro and Ferry Terminal with handling annual capacity of 1.3 million tons
- Container terminal with annual capacity of 150 000 TEU.

Based on the 5 million tons recorded for 2013, there are no capacity bottlenecks.

Greece

The Port of Piraeus is the largest Greek seaport and one of the largest container ports in the Mediterranean Sea basin. Its annual handling capacity is 3.6 million TEUs, while new investment in infrastructure is expected to increase its capacity by 60 %. At present, capacity utilisation is at approximately 80%. The port of Thessaloniki is the second largest Greek port, with an annual handling capacity of 0.41 million TEUs and utilisation rate of 70-75%. The ports of Patras and Igoumenitsa handle only Ro-Ro traffic, while planned expansion investment projects will increase their current handling capacity. The Port of Heraklion can serve container traffic but its handling capacity is somewhat limited, owing to the inadequate existing infrastructure. Nevertheless, the planned extension of the port and the construction of new facilities are expected to increase its capacity. In conclusion, no significant capacity bottlenecks are identified in the Greek seaports.

Cyprus

As a container port, Lemesos is the largest port in Cyprus with a total annual capacity of 600.000 TEUs. The port's storage capacity is currently inadequate for handling the overall volume of containers, while it is also unable to cope with the increasing traffic flow. The foreseen investment project for the port's upgrade is expected to substantially increase its handling capacity for containers to 1 million TEUs per annum once completed, meeting, thus future increasing demand.

5.2.5.5 Technical Bottlenecks / Interoperability Issues

The key bottlenecks and interoperability issues related to ports consist mainly of the necessary missing extensions of the railway networks to the ports in hand (as well as problematic IWW connections for northern ports) with the scope to provide a seamless intermodal transportation with the use of road/rail and maritime modes along the transportation supply chain of the OEM corridor, as well as the deployment of IT interoperable systems in the ports lacking such systems.

5.2.5.6 Organizational Bottlenecks

On the organizational aspect of ports, special focus should be placed on the need for these to become efficient intermodal "interfaces", alleviating related bottlenecks, such as different regulations between transport modes, linguistic difficulties with administrative documents, non-acceptance of electronic manifests and other documents, etc. The above hinder the effective and seamless operation of Motorways of the Sea by obstructing the full integration of the ports into the intermodal chain and resulting in long transit times within the port. The deployment of e-maritime and single-window systems would contribute considerably to the above objectives.

5.2.5.7 Motorways of the Sea

According to the EU White Paper on Transport 2001, the 'Motorways of the Sea' will be the maritime dimension of the TEN-T Core network, while related policies move positively in favour of maritime intermodal transportation solutions. The "Motorways of the Sea" (MoS), formally introduced through Decision 884/2004/EC of the European Parliament, currently constitutes an important EC policy initiative, aiming at shifting freight traffic from the highly congested European road network to more sustainable maritime links.

The overall objective is to establish a trans-European network of Motorways of the Sea that concentrates flows of freight on viable, regular, and reliable/quality sea-based transport services that are integrated in logistic chains covering all types of maritime freight operations. Based on the latter, specific quality criteria have been developed by the European Commission to characterize every single MoS scheme, in order for it to provide the required added value to an integrated intermodal transportation system:

1. Quality of port services (one-stop administrative services, services to ships, cost-based prices).
2. Quality of hinterland connections and services – good intermodal hinterland connections between the selected ports and the rest of the land network.
3. Overall information systems and monitoring in the transportation chain.

The priorities for the MoS policy 2014-2020 focus on three key target areas: (i) Environment, (ii) Integration of Maritime Transport in the Logistics Chain, and (iii) Safety, Traffic Management, Human Element/Training. These are directly related to certain objectives of the OEM Corridor, as well as critical issues identified, including the improvement of hinterland connections in ports and their integration with inland navigation and rail, the development of efficient Traffic and Transport Management Systems and the deployment of new technologies and systems.

Several Motorways of the Sea projects have been carried out from 2004, co-financed by the Commission's TEN-T programme (PP21). More specifically, the "East Mediterranean Motorways of the Sea – Master Plan" Project, elaborated during 2004-2009 by the Hellenic Ministry of Merchant Shipping and the General Secretary of Ports, identified several potential viable MoS connecting four of the OEM Seaports, namely Port of Piraeus, Igoumenitsa, Patras and Lemesos, with others in the Adriatic Sea, providing thus strong evidence of the benefit of these ports' infrastructure upgrade and modernization of services, as well as the quality of their hinterland connections.

Moreover, one of the identified key MoS corridors in the region related to the connection of the Ports of Igoumenitsa and Venice in Italy. To this end, within the framework of enhancing and financing this particular MoS, the Port Authorities of Igoumenitsa and Venice elaborate currently the project "Adriatic Motorways of the Sea (ADRIAMOS)" funded by the TEN-T Executive Agency, whose key objective is the necessary infrastructure investments (works and designs) for the two ports and their respective hinterlands, required to remove bottlenecks and improve efficiency of the logistics chain along the Adriatic-Ionian transport corridor. The ADRIAMOS project has also been identified in CEF Regulation, Annex I, while the Port of Venice belongs to both the Baltic-Adriatic Corridor and Mediterranean Corridor denoting also a potential connection to the OEM Corridor.

Figure 24 depicts the MoS corridor Venice-Igoumenitsa and their potential hinterlands.

The above highlights further the necessity for OEM seaports in Greece and Cyprus to become MoS port nodes along potential viable MoS connections. In this respect, they would be required to mitigate existing bottlenecks with regard to the quality of their hinterland connections and port infrastructure services, in order to comply with the MoS quality criteria and the key priorities set for 2014-2020 in terms of maritime integration with ports' hinterland connections and deployment of TMS. These are partly addressed by related infrastructure projects in the implementation plan.

Regarding the CEF pre-identified project MoS Piraeus – Heraklion – Lemesos, there are no studies yet analysing the feasibility and/or maturity of this potential MoS.[50]

To this end, the OEM study proposes a feasibility study to be carried out to include a business plan to demonstrate high level of understanding of critical success factors, the forecasting of demand traffic volumes and potential modal shift, as well as an advanced assessment of interventions required together with related costs. It should be noted that on a political level, a Memorandum of Understanding would be required between the Ports of Greece and Cyprus and respective letters of intent from potential users, displaying a high level of maturity.

[50] The private sector and the relevant maritime operators of Cyprus consider that a regular passenger service from Greece with Cyprus' Ports is not economically viable. However, the Government of Cyprus considers that emphasis should be placed in supporting maritime transport of passengers, especially for peripheral/ insular Member States, both as an alternative to air travel in general, but, more specifically, as an emergency service to maintain connectivity among Member States during incidents of air transport crises (e.g. natural disasters, terrorist activity).

Figure 24: Map of Motorway of the Sea Venezia - Igoumenitsa

Source: East Mediterranean Master Plan of the Motorways of the Sea, December 2009

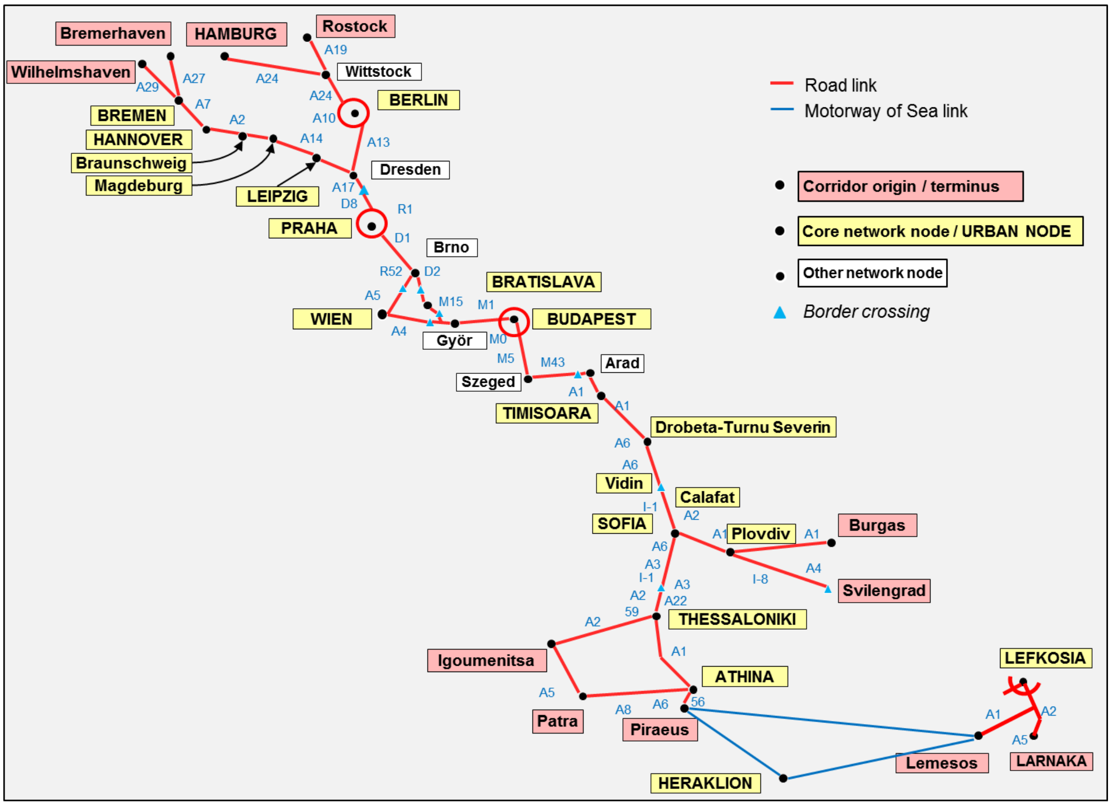
Finally, an additional MoS objective is the connection of the TEN-T Corridors to third countries and hence, the development of the OEM seaports is expected to play a significant role in the connection of their hinterland to third countries hinterland. Consequently, the development of MoS links should also be considered in parallel with related strategies and initiatives in the Corridor's wider region, such as the Adriatic-Ionian Macro-Region, Organisation of Black Sea Economic Cooperation (BSEC), European Neighbourhood Policy, the Union for the Mediterranean, etc.

5.2.6 Corridor road infrastructure

5.2.6.1 Alignment

The road alignment of the corridor, presented in Figure 25, shows an almost parallel routing to the rail alignment. Its total distance between Wilhelmshaven and Lefkosia is on average 4682 km.

Figure 25: Road alignment of the Orient / East-Med Corridor



Source: Consortium (based on TEN-T Regulation)

The road infrastructure covers all 9 countries. The biggest part of this total distance is allotted to Greece (1245 km = 26%), followed by Bulgaria (969 km = 21%), Germany (727 km = 15%) and Romania (543 km = 12%), Czech Republic (460 km = 10%) and Hungary (397 km = 8%). Austria (157 km = 3%), Cyprus (102 km = 2%) and Slovakia (82 km = 2%) have only small shares of the average length.

The total average distance of the road corridor is on average 4682 km, the total infrastructure length including all distinct sections is 5644 km.

5.2.6.2 Compliance of the Infrastructure with TEN-T requirements

The majority of the road sections are of Motorways / Express roads class (82%) with 2-4 lanes per direction with the exception of the sections presented in the next table.

Table 34: Ordinary corridor roads without grade separated junctions

MS	Road section	Ongoing construction/ upgrading works	Length (km)
CZ	D8 Ústí nad Labem/Trmice – Lovosice	Yes	16.4
CZ	R52 Pohorelice – Mikulov/Drasenhofen (CZ/AT)	No	23.1
AT	A5 Mikulov/Drasenhofen (CZ/AT) – Schrick	Yes; (7.5km section)	32
HU	M15: Rusovce/Rajka (SK/HU) – Hegyeshalom	No	14
HU	M0: Budapest Ring (missing part in Northwest)	No	26
HU	M43: Makó - Nagylak/Nadlac (HU/RO)	Yes	23
RO	A6 Lugoj – Calafat	No	278
BG	I-1 Vidin – Montana West	No	90
BG	I-1 Jct. I-1/BP Montana East - BP Vratsa (BP Vratsa West to BP Vratsa East)	No	29.9
BG	I-1 Jct. I-1/III-103 Mezdra – Jct. I-1/II-17 Botevgrad	No	30.3
BG	II-18 Jct. A2/II-18 Sofia – Jct. A6/II-18 Sofia	Yes (3.2 km section)	26.4
BG	I-1 Dupnitsa - Jct. I-1/III-106 Blagoevgrad	Yes	37
BG	Jct. I-1/Blagoevgrad IZ - Kulata (Border BG/EL)	Yes (14.7 km section)	79.7
BG	Orizovo – Harmanli	Yes	65.6
EL	A22 Strymoniko – Petritsi	Yes	41
EL	A1 Skotina – Evangelismos	Yes	32.5
EL	A1 Raches – Lamia	Yes	34
EL	A8 Korinthos – Patras	Yes	120
CY	A22 Lefkosia Southern Orbital Motorway		Missing link
	Total length , ***Out of which under construction/ upgrading***		**998.9** **459.9**

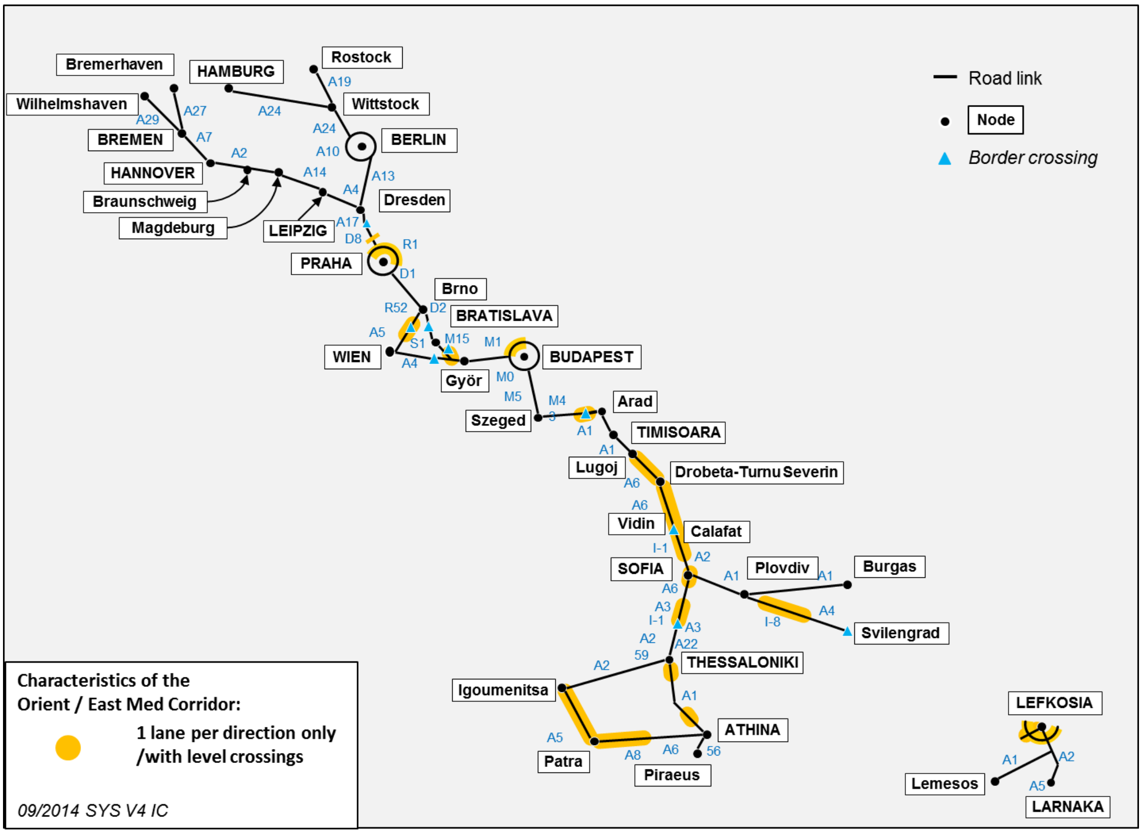
Source: TENtec, identified projects

Figure 26 depicts the schematic layout of the Corridor Road Network, highlighting the areas of 1 lane per direction roads. It appears clearly that most of the less developed parts are the cross border sections.

A specific issue to be considered in the case of Hungary (but not only) is the high average age (52 years) of bridges on secondary roads, limitations of vehicle weight and dimension, being, therefore, unsuitable for traffic deviation from motorways in case of emergency.

The complete mapping of the Road compliance test is given in Annex 1c.

Figure 26: OEM Corridor Road Network – problematic areas



Source: Consortium

With regard to the availability of safe parking and resting areas, this is an issue that must be brought to the attention of the relevant stakeholders, and most importantly, regarding the necessary level of safety and security for the parking along the corridor.

Similarly, there is limited information on the availability of clean fuels, as these are currently located within urban nodes in most countries and not along the OEM road network. This is also an issue that must be discussed with the stakeholders to investigate the possibility of implementing such services along the road network until 2030.

The issues of availability of safe parking, resting areas, and alternative fuels are presented in items 5.2.6.5 and 5.6.2.6 here under.

5.2.6.3 Capacity Utilisation

The current utilisation of the OEM road infrastructure capacity was based on data available in TENtec, except when more recent ones were available (as for instance for Hungary and Germany). This was at certain extent hampered by the missing data for technical characteristics of the roads and/or for the observed traffic. This is especially valid for Romania, for which no traffic and capacity data are available.

Very large variations were observed regarding the input infrastructure capacity (TENtec parameters no. 9 and 10: “Total hour capacity forward/backward”): from the unrealistic value of 26,000 to 900 cars per hour per line. Due the latter, the Consultant assumed average daily capacity for the different infrastructure types, as follows:

- Two lane roads[51] 20,000 vehicles/day/both dir.
- Two lane roads with separator[52] 30,000 vehicles/day/both dir.
- Motorways with 2 lanes per direction[53] 70,000 vehicles/day/both dir.
- Motorways with 3 lanes per direction[54] up to 100,000 vehicles/day/both directions.

The above average values were further adjusted, where 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, TENtec parameter no. 12) and passenger traffic flow (cars per year, parameter no. 15) related to calendar years that are available. The average weighted daily number of trucks per road section is about 3,150 and the respective number of cars is 19,000.

The most freight traffic intensive sections are located on German and Hungarian territory:

- A2 (DE) Kreuz Hannover-Ost - Kreuz Braunschweig-Nord - Kreuz Wolfsburg/Königslutter - Kreuz Magdeburg (DE) with 17,600 - 18,800 trucks per day,
- A1 (DE) Bremer Kreuz - Dreieck Stuhr (DE) with 17, 300 trucks per day,
- M0 (HU) Budapest (Jct. M0/M6) - Budapest (Jct. M0/M5) and Budapest (Jct. M0/M6) - Budapest (Jct. M0/M5) with over 200,000 tons and 16,500 – 17,000 trucks per day;
- A10 (DE) Schönefelder Kreuz - Ludwigsfelde-Ost 16,100 trucks per day,
- A4 (DE) Dreieck Nossen - Dreieck Dresden-West 15,600 trucks per day,
- M0 (HU) Budapest (Jct. M0/M1) - Budapest (Jct. M0/M7) with 175,000 tons and 13 000 trucks a day;
- M1 (HU) Tatabanya - Budapest (J. M0/M1) with some 150,000 tons and almost 11 000 trucks/day;
- M1 (HU) Győr - Tatabanya (HU) with 135,000 tons and
- Sofia Ring Road section (BG) with 135,000 tons.

Almost all border sections (for which data are available) show relatively high values regarding the share of heavy traffic, due to reduced cross-border local passenger car traffic:

- D2 (SK) Jct. Petržalka/Berg – Jct. Jarovce - Čunovo/Rajka (border SK/HU) with 53%
- M15 (HU) Čunovo/Rajka (SK/HU) - Hegyeshalom with 51%
- D2 (CZ) Břeclav - Brodske / Lanzhot (border CZ/SK) with 36%

[51] Roads without level-free crossings, assumed to correspond to the German RAS-Q standard with regular width RQ 10,5
[52] Roads without level-free crossings, assumed with regular width "RQ 20" according to Germany RAS-Q
[53] Assumed to correspond with RQ 29,50
[54] Assumed to correspond with RQ 29,50

- D2 (SK) Lanzhot/Brodske (border CZ/SK) - Stupava juh with 27%.
- A4 (BG) Svilengrad - Kapitan Andreevo with 25%.

Road sections near urban agglomerations that carry out high number of passengers are located in Greece, Germany, Czech Republic and Hungary:

- A22 (EL) Thessaloniki – Langadas and
- R1 (CZ) Praha Slivenec - Praha Vestec with about 90,000 cars/day
- A1 (DE) Bremer Kreuz - Dreieck Stuhr (DE) with 86,000 cars/day
- A10 (DE) Kreuz Oranienburg - Dreieck Pankow: 84,000 cars/day
- A4 (DE) Dreieck Dresden-West - Dreieck Dresden-Nord: 77,000 cars/day
- A8 (EL) Korinthos – Elefsina with 77,000 cars/day
- M0 (HU) Budapest Jct. M6 - Budapest Jct. M5
- A1 (EL) Metamorfosi - Schimatari with 68,000 cars per day.

Based on the above, the overall average capacity utilisation ratio calculated for the OEM corridor sections for which data are available is about 44.5%. In practice, the actual ratio should be higher due to other vehicles not considered in the calculations (buses and motorcycles as a minimum).

As a general characteristic of (all) the Corridor(s), there is a high level of utilisation of the existing road capacity in and around the large cities.

Germany

In Germany the weighted average capacity utilisation is about 66% due to a significant capacity overload (over 100%) on a couple of roads and a range between 30% (lowest) and more than 100% (highest). For 2/3 of the German sections, the weighted average capacity utilisation is above 50% and up to more than 100%.

The most congested sections are:

- A2 Dreieck Hannover-Nord - Kreuz Hannover/Kirchhorst - Kreuz Hannover-Ost - Kreuz Braunschweig-Nord - Kreuz Wolfsburg/Königslutter - Kreuz Magdeburg between 80-100%,
- A14 Kreuz Magdeburg - Dreieck Halle-Nord - Schkeuditzer Kreuz - Dreieck Parthenaue - Dreieck Nossen between 50-70%,
- A10 Dreieck Havelland - Kreuz Oranienburg - Dreieck Pankow - Dreieck Schwanebeck between 70-130%,
- A1 Bremer Kreuz - Dreieck Stuhr, around 100% ,
- A27 Dreieck Bremen-Industriehäfen - Bremer Kreuz around 97%,
- A4 Dreieck Nossen - Dreieck Dresden-West - Dreieck Dresden-Nord between 80-90% and
- A7 Dreieck Walsrode - Dreieck Hannover-Nord around 80%.

This list does not include any analysis of port-related road sections (e.g. Hamburg last miles), where relatively high capacity utilisation of road network is recorded.

Czech Republic

In the Czech Republic, the weighted average capacity utilisation is approximately 61% mainly due to high utilisation (over 80%) along the sections adjacent to Praha and Brno, as follows:

- R1 Praha Třebonice - Praha Slivenec;
- R1 Praha Řepy - Praha Březiněves;
- R1 Praha Slivenec - Vestec - Jesenice;
- D1 Brno - Brno jíh;
- D1 Brno-Ostopovice – Brno.

Austria

In Austria, traffic data are available for the following two sections:

- A4 Schwechat – Bruckneudorf with estimated capacity utilisation over 80% and
- A4 Bruckneudorf – Nickelsdorf with about 50% utilisation rates.

Slovak Republic

According to the analysis made in the Slovak Transport Masterplan, "*at present and in the near future, average daily traffic volumes exceed the capacity of the most important D1 Motorway, in particular in the Bratislava residential area section, and the section between Bratislava and Trnava*."[55]

Hungary

The weighted average road capacity utilisation on the Hungarian territory is about 44%. The most congested sections are:

- M0 Budapest (Jct. M0/M6) - Budapest (Jct. M0/M5)
- M1 Tatabanya - Budapest (Jct. M0/M1)
- M0 Budapest (Jct. M0/M7) - Budapest (Jct. M0/M6), all of which showing utilisation rate above 60%.

The rate of road capacity utilisation has drastically dropped following the gradual opening of the second carriageway in 2013 on the sections of M0 Ring Motorway around Budapest mentioned above.

Romania

According to the Romanian National Transport Model (2011), the capacity utilisation ratio was over 80% along A1 Timişoara – Lugoj section. No capacity problems are identified along the remaining part of the OEM Corridor in Romania.[56]

[55] Source: Slovakia Transport Masterplan, item 2.4.2.7, page 80
[56] Source: Romania Masterplan, page 153

Bulgaria

The average weighted capacity utilisation of the road infrastructure on Bulgarian territory is slightly less than 37%. Similar to other countries, the busiest sections are those of the northern part of the Sofia Ring Road. Besides these, above 50% are the utilisation rates of:

- I-1/E79 Dupnitsa – Kulata (BG/EL border) and
- I-8/E80 Orizovo – Novo selo (BG/TR border) sections.

The on-going motorway construction works will solve most of the current bottlenecks, except in the section Blagoevgrad – Kresna and along the road to Greece (I-1/E79), which shows a relatively high share of heavy trucks' traffic.

Greece

The estimated weighted average capacity utilisation ratio for the Greek part of the OEM Corridor is about 42%. The busiest sections with over 70% utilisation are:

- The two-lane road sections
  - 8A Korinthos - Patras K1 Jct
  - E75 /1 Skotina - Evaggelismos (Tembi)
- The motorway sections
  - A8 Korinthos - Elefsina
  - A22 Thessaloniki - Langadas
  - A1 Metamorfosi - Schimatari.

Cyprus

Cyprus shows the highest average capacity utilisation ratio among the six OEM countries for which capacity utilisation data were available, namely 72%. Particularly high are the estimated values for the following sections:

- A1 Lemesos (B8) – Lemesos Germasogeia
- A1 Alampra Jct – Kofinou Jct

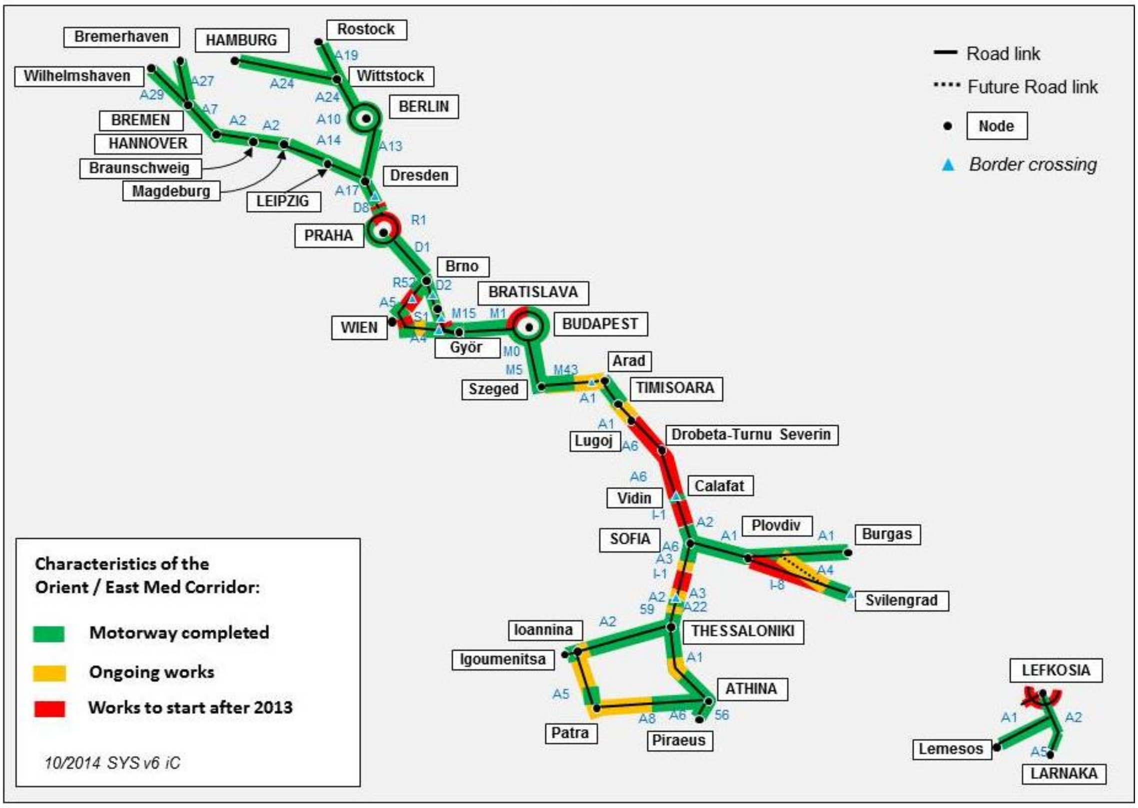
5.2.6.4 Technical Bottlenecks / Interoperability Issues

The main bottlenecks identified along the OEM Road network are those related to roads that are single lane per direction carriageways without level-free junctions. These are mainly small sections in the Czech Republic, Slovakia and Austria; whereas the issue is particularly prominent in Romania, Bulgaria, and to a lesser extent in Greece.

Figure 27 depicts the existing progress of implementation measures along the corridor related to construction and/or upgrading of links. It is evident that most bottlenecks identified would be relieved after the completion of the infrastructure projects. After the completion of the works in progress, the total length of sections that are not in conformity with the technical requirements will be about 540 km, i.e. 9.5% of the total OEM Corridor roads. More detailed information is presented in Annex 9 – Bottleneck Mitigation Analysis.

Road infrastructure in the areas of highly populated urban nodes is deemed a specific challenge, which should be analysed in detail outside of this study.

Figure 27: Corridor Road Network – implementation of measures



Source: Consortium

5.2.6.5 Availability of Alternative Fuels

The Regulation No.1315/2013 specifies the requirements to be complied with, related to the introduction of new technologies and innovation for the promotion of low carbon transport. The deployment of alternative fuels infrastructure is the subject of Directive 2014/94/EU. The Directive sets out minimum requirements for the building-up of alternative fuels infrastructure, common technical specifications for recharging and refuelling points, as well as user information requirements. The same document defines 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 bio methane) and liquefied petroleum gas (LPG).

Depending on the number of vehicles, using alternative fuels, Member States shall insure appropriate number of recharging/refuelling points accessible to the public at least on the TEN-T Core Network, in urban/suburban agglomerations and other densely populated areas. The worldwide commercial synthetic fuels production capacity is still rather limited and thus, has very limited practical importance. Among the OEM countries, Germany is the only one that has operational Biomass to Liquids (BTL) demonstration plant that produces 300 barrels of synthetic fuels per day.

Electrical Charging Points

The issue of electric vehicle networks, as infrastructure systems of publically accessible charging stations and possibly battery swap stations to recharge electric vehicles, is a matter of discussion for the time being. The establishment of such networks requires the setup of market-friendly framework conditions, which are corresponding to market needs. Along the OEM Corridor, public charging stations[57] are recently available in:

- Berlin, Hamburg, Hannover, Magdeburg, Leipzig, Dresden[58] (DE)
- Praha, D1 Mirošovice, D1 Hvězdonice, D1 Humpolec, Brno, R52 Mikulov (CZ)
- 3000 stations in various municipalities all over Austria including shopping centres and Wien airport, with Göttlesbrunn one station directly located at OEM corridor motorway A4.[59]
- Bratislava (SK)
- Budapest (HU) and
- Sofia, Stara Zagora (BG).

LPG and CNG

The other alternative fuels (LPG and CNG[60]) are more widely available in all OEM countries, although the density of the stations along the Corridor defers from country to country. It should be pointed that the Regulation No.1315/2013 does not set specific requirement in this respect. Art. 39 (2c) states alternative fuels shall be available along the core road infrastructure.

The availability of LPG and CNG stations per OEM country and/or along the corridor is as follows:

- In Germany, there are over 9 000 LPG[61] and 912 methane[62] stations all over the territory
- In Czech Republic, the total number of LPG stations is almost 1 200[63]. 55 of these are located at less than 1 km distance from the OEM Corridor route. At national level, there are also 63 CNG filling stations[64].
- In Austria, there are 52 LPG stations[65], out of which 4 are located at less than 5 km distance from the corridor route[66]. The total number of methane stations is 176. Moreover, CNG is available in 3 other stations along the corridor route, one of it directly at the motorway.
- Along the Slovak section of OEM road corridor, there are 5 LPG stations located at less than 1 km distance from the main route[67]; in total, there are 10 CNG stations in the country.
- In Hungary, there are 39 LPG stations in the immediate vicinity (less than 1 km) from the Corridor[68]. Nevertheless, it should be pointed that the National Transport

[57] European Map available under: www.lemnet.org
[58] Source: http://www.goelectricstations.com/stations-electric-cars.html
[59] A map and detailed information on plug-in stations for Austria are available from the Austrian e-mobility initiative "E-connected.at"
[60] Biodiesel availability is not further analysed due to different product definitions.
[61] Source: http://www.mylpg.eu/stations/germany/map
[62] Source: http://cngeurope.com/
[63] Source: http://www.mylpg.eu/stations/czech-republic/map
[64] Source: http://www.cng.cz/cs/stanice/
[65] Source: http://www.mylpg.eu/stations/austria/map
[66] Source: http://www.mylpg.eu/lpg-station-route-planner
[67] Source: http://www.mylpg.eu/stations/slovakia/map

Strategy from 2013 depicts the "general lack of alternative, clean fuel stations" as one of the deficiencies of the Hungarian transport system[69]. Probably one of the reason for this conclusion is the relatively low number of CNG facilities – 3 for the whole country

- The total number of LPG stations in Romania is about 540[70], out of which 48 are located along the corridor (less than 1 km distance); the first CNG station in Romania was opened in April 2014 in the city of Cluj, which is not located along the OEM corridor.
- On Bulgarian territory, there are over 370[71] LPG stations, 53 out of which are along the OEM Corridor (without considering the high number of facilities available in Sofia and Plovdiv); at national level the number of CNG stations is much lower, i.e. 18
- Along the Greek section of OEM road corridor, there are 52 LPG stations located at less than 1 km distance from the main route. The total number of LPG stations is over 510[72], while that of CNG stations is only 3.
- No LPG is available in Cyprus. The relative legislation that will allow the development of LPG as an alternative fuel in road transport is under way. The Legislative Proposal is examined in the Parliament in 2014.

5.2.6.6 Availability of Secure Parking

The Regulation No.1315/2013 sets specific requirement regarding the core road network as follows: to provide sufficient parking areas with an appropriated level of safety - at least every 100 km (art. 39 2 (c)).

The next table presents the estimated availability of parking areas for commercial vehicles with a 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 35: Number of Parking Facilities per road section

MS	Road section	Number of commercial vehicles parking areas
DE	A27/A7 Bremen – Hannover (DE)	1 + 2
DE	A2 Hannover – Magdeburg (DE)	6
DE	A14 Magdeburg – Leipzig (DE)	6
DE	A14 Leipzig – Dresden (DE)	4
DE	A24 Hamburg – Wittstock (DE)	4
DE	A19 Rostock – Wittstock	2
DE	A24 Wittstock – Berlin	3
DE	A10/A13 Berlin – Dresden	3 + 8
DE	A4/A17 Dresden – Border CZ	2

68 Source: http://www.mylpg.eu/stations/hungary/map
69 Source: National Transport Strategy, Status Quo, 2nd vol., (Nemzeti Közlekedési Stratégia), 2013
70 Source: http://www.mylpg.eu/stations/romania/map
71 http://www.mylpg.eu/stations/bulgaria/map
72 Source: http://www.mylpg.eu/stations/greece/map

MS	Road section		Number of commercial vehicles parking areas
CZ	D8	Border DE – Praha	2
CZ	D1	Praha – Brno	8
CZ	R52	Brno – Border AT	1
CZ	D2	Brno – Border SK	1
SK	D2	Border CZ – Bratislava	1
SK	D2	Bratislava– Border HU	2
AT	B7/A5/S1	Border CZ – Wien	1 + 1 + 1
AT	A4	Wien– Border HU	4
HU	M1/M15	Border SK/AT – Győr	2
HU	M1	Győr - Tatabánya	2
HU	M1	Tatabánya – Budapest	2
HU	M0	Budapest Ring road	2
HU	M5	Budapest – Szeged	4
HU	M43	Szeged – Border RO	1
RO	7/E68	Border HU – Arad	1
RO	A1	Arad – Timişoara	1
RO	6/E70	Timişoara – Drobeta T. S.	2
RO	56A	Drobeta T. S. – Calafat	0
BG	1/E79	Border RO – Botevgrad *	6
BG	A2	Botevgrad – Sofia	2
BG	18	Sofia ring road	3
BG	A6/1/E79	Sofia – Blagoevgrad *	1
BG	1/E79	Blagoevgrad – Border EL	4
BG	A1	Sofia – Plovdiv *	4
BG	A1	Plovdiv – Orizovo *	1
BG	A1	Orizovo – Burgas *	8
BG	8/E80	Orizovo – Border TR	0
EL	E79	Border BG – Thessaloniki	0
EL	A1	Thessaloniki – Skotina	2
EL	1/E75	Skotina – Evaggelismos	0
EL	A1	Evaggelismos – Raches	2
EL	A1	Raches - Lamia	1
EL	A1	Lamia – Schimatari	2
EL	A1	Schimatari – Elefsina	3
EL	A8	Elefsina – Korinthos	1
EL	8/E65	Korinthos – Patras	3

Source: Google Map and TransPark (IRU)[73]; Roads Executive Agency of Bulgaria[74]*

[73] Source: https://www.iru.org/transpark-search-route-action

[74] Source: http://www.api.bg/index.php/bg/karti/nalichni-parkingi-za-tezhkotovarni-avtomobili-po-napravleniyata-na-osnovnite-transportni-osi-v-republika-blgariya/

The above review shows reasonable supply of parking facilities in Germany, Czech Republic, Slovakia, Austria and in Hungary.

In Germany, the density of parking facilities has to be increased due to the high level of road utilization including heavy goods vehicles. Therefore the German motorways are equipped with one bigger sized resting facility (incl. fuel station) per each 50 km, while every 20 km a non-serviced parking facility shall be offered.

In Romania and Bulgaria, the number of parking areas per 100 km of OEM Corridor is lower (1.75 in RO and 3.0 in BG) compared to above mentioned countries, but the main problem is related to long sections that completely miss suitable facilities. Such section is Drobeta Turnu Severin – Calafat (98 km, RO), Orizovo – TR Border (132 km, BG).

The situation is similar in Greece: at OEM corridor level, there are 0.96 parking areas per 100 km. However, the consultant identified one section, namely Promahonas – Thessaloniki by-pass road (113 km) that lacks a secure parking area.

5.2.6.7 Compatibility of ITS and Road Tolling Systems

According to Article 18 of Regulation No.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[75]:

- 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[76]
- 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
- the harmonised provision for an interoperable EU-wide eCall[77]
- 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 set in many places throughout Europe, the use of regional and national ITS services are still fragmented. The general objective is national ITS to be compatible, which means 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 OEM Corridor.

Regulation No.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

[75] Art. 3, Directive 2010/40/EU
[76] Towards a roadmap for delivering EU-wide multimodal travel information, planning and ticketing services, Commission staff working document, SWD(2014) 194 final, June 2014
[77] http://ec.europa.eu/digital-agenda/en/ecall-time-saved-lives-saved

collection system/s are implemented these to be in line with relevant standards, so to provide for interoperability[78].

Distance or time based system for paying the use of certain roads exist in all OEM countries, but electronic fee collection systems are in place only in five of them:

Germany

LKW-Maut (Lorry 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 an body
- 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 OEM sections on Czech territory are covered by the tolling system

Slovakia

- travelling along OEM 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

There are three different kind of tolling systems in place:

- Toll Sticker for motorcycles, passenger cars and other vehicles below 3.5 tons, on the Austrian motorways and expressways
- Special additional toll sections refer to alpine road sections and thus, this system is not relevant to OEM 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”.

[78] 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 …

Hungary

The entire section of OEM corridor (except the 28 km long Southern Section of M0 Ring Motorway around Budapest) is included in the network that can only be used after payment of a road usage fee:

- for goods vehicles exceeding 3.5 tonnes permissible maximum weight distance related electronic toll system is in place since July 1, 2013
- vehicles of less than 3.5 tons and busses must procure e-Vignette that can be purchased online.

Romania and Bulgaria

Both countries apply time related sticker system for all roads along the OEM corridor and for all vehicle categories.

Greece

The toll motorway system in Greece follows the main Patras-Athina-Thessaloniki (PATHE) axis, i.e. the OEM route; there are 16 toll stations and thus, this is not an electronic system.

Cyprus

There are no toll roads in Cyprus to date.

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. Another TEN-T funded project[79] is the Regional European Electronic Toll Service (REETS TEN) for Trucks that focuses on the development of one single OBU that is compliant with multiple systems in AT, DK, FR, DE, IT, PL, ES. The study led by AETIS is in progress until 12/2015 and aims to deploy EETS compliant services fostering the interoperability of electronic road tolls.

In conclusion, as in 2014, electronic distance/ time related road user charging systems exist along the OEM Corridor in Germany, Czech Republic, Slovakia, Austria and Hungary. All these system meet the requirements of Directive 2010/40/EU. Nevertheless, for the moment, all these systems do not provide for seamless trans-border traffic, with the exception of partial cooperation between Germany and Austria.

[79] INEA Fiche No. 2012-EU-50009-S

5.2.7 Corridor airport infrastructure

5.2.7.1 Location

There are in total 15 airports along the Orient/East Med corridors that can be assigned to Core network nodes, with a majority in Germany (5) and Greece (3), as well as one per other Member State.

Based on the Regulation No.1315/2013 Article 41, par 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, and, wherever possible, with the high-speed rail network. These dedicated main airports along the OEM corridor are: Hamburg, Berlin, Praha, Wien, Budapest and Athina.

5.2.7.2 Compliance of the Infrastructure with TEN-T requirements

A key condition to ensure interoperability of the airports of the OEM corridor is their connection to the railway network. 7 out of 15 Airports have currently no direct railway connection: Bremen, Praha, Bratislava, Budapest, Timişoara, Sofia and Thessaloniki. However, in most cases the next existing rail line is in a short distance. The islands of Crete (Heraklion Airport) and Cyprus (Larnaka Airport) do not have a railway network.

Dedicated Main Airports (marked with *) are to be connected to TEN-T heavy rail (preferably the high-speed rail network) and road by 2050 according to Art. 42 TEN-T regulation. Dedicated Main Airports without heavy rail connections in 2013 are: Hamburg, Praha and Budapest.

The only airport without a high-ranking road connection is the Timişoara airport.

Table 36 lists the OEM airports (core) with their related high ranking rail and road connection.

The following airport rail projects are currently on-going or planned:

- Berlin (DE): Flughafenanbindung Schönefeld (Intercity Rail Connection of BER Airport at Schönefeld), 2006-2011, Finalization of remaining works depends on the date of issue for the construction permits and the opening of BER airport;
- Praha (CZ): Modernization of the heavy rail line Praha – Kladno, with the construction of a branch line to Vaclav Havel International Airport, including a new line to the airport (Status: Feasibility study);
- Praha (CZ): Extension of Metro Line A to the Airport. The first of three sections Dejvicka – Motol was financed by OPT-CZ 2007-2013 (Status: Construction ongoing);
- Wien (AT): Upgrade/Adaptation of existing Passenger Rail Station below Airport of Wien Schwechat (platform extension to 400 m length) safeguarding stop of long-distance passenger trains and separate stops of city-airport trains (Status: Construction partly finalized);
- Wien (AT): Variant study to integrate the Wien Airport Station into long distance passenger rail Wien – Bratislava / Budapest and to increase capacity of existing line Wien – Parndorf – Border AT/SK/HU (Status: Study planned);
- Budapest (HU): Construction Works of a new Rail Connection to Terminal 2, foreseen for 2019 – 2020;

- Sofia (BG): Extension of Metro system to Sofia Airport will be completed in 2015; the new line will provide for fast and reliable connection between the airport and Sofia central railway station.

For other main corridor airports, no projects are known.

Table 36: Rail and Road connection status of Airports of the OEM corridor (2014)

	Airports	Connection to Rail	Connection to Motorway/Expressway
DE	*Hamburg HAM	**No heavy rail , Suburban trains only, electrified (1200 V DC)**	Yes, Via B 433 to A7
	Bremen BRE	**No (2 km missing to next rail line) Light rail only**	Yes, A281
	*Berlin BER	Yes, heavy rail electrified, not in operation yet	Yes, A113
	Hannover HAJ	Yes, electrified, suburban trains only	Yes, A352
	Leipzig/Halle LEJ	Yes, heavy rail electrified	Yes, A14
CZ	*Praha PRA	**No (5 km distance to Praha – Kladno Heavy Rail Line)**	Yes, R1 (partly) and R7
AT	*Wien VIE	Yes, electrified, double track, PAX only	Yes, A4
SK	Bratislava BTS	**No (0,5 km distance to existing freight rail connection)**	Yes, D1 (500 m to exit Ivanka)
HU	*Budapest BUD	**No heavy rail electrified Existing line to closed Terminal 1 only.**	Yes, via Expressway 4 to M-0
RO	Timişoara TSR	**No (1km distance to existing heavy rail branch line)**	**No (missing expressway connection to A1; 15 km)**
BG	Sofia SOF	**No (1 km distance to existing corridor main rail line) Metro line under construction**	Yes, via level-free urban roads (Brussels Blvd, Zarigradsko Blvd) to Expressway No. 6
EL	*Athina ATH	Yes	Yes, A62
	Thessaloniki SKG	No	Yes, via Road 67to A25
	Heraklion HER	No (no rail network)	Yes, A90
CY	Larnaka LCA	No (no rail network)	Yes, A3 and B4

5.2.7.3 Availability of alternative fuels

Currently, no fixed storage tank facilities for aviation biofuel are reported to be in use in the airports of the Orient/East-Med Corridor. In general, the deployment of biofuels in the aviation sector is no longer constrained by technical factors, as a relevant number of flights tests have been successfully performed in this sense at both European and global level. Between 2008 and 2011, at least 10 airlines (including KLM, Lufthansa, Air France, Etihad, Qantas etc.) and several aircraft manufacturers have tested the use of various blends containing up to 50% bio jet fuels without requiring modifications to the engines.

A large-scale implementation of bio jet fuels in Europe is still far from being achieved. Until today, only four commercial flights have been performed in Europe using biofuels, not touching any corridor airport.

As far as bio jet fuels infrastructure facilities in airports are concerned, the situation in Europe is still at the embryonic stage, with a pioneering infrastructure facility recently developed in Sweden (June 2014, Karlstad Airport), where the first Bio Jet Fuel tank in Europe is able to supply on permanent basis sustainable jet fuel to all commercial flights departing from one single airport.

Regarding the availability of alternative clean fuels for airport ground services (e-mobility, hydrogen, CNG, LPG); some airports have recently introduced charging or fuelling stations. Natural gas (CNG) and liquid gas (LPG) are already being used at Hamburg Airport as low-emission fuels, while a Hydrogen Project was introduced. In Wien, 2013 a charging station for e-cars and a LPG fuelling station for the operation of 37 natural gas-powered vehicles were implemented. Similar actions are envisaged to be implemented at airports committed to become ecologically friendly in their operation (e.g. Budapest airport by 2020).

5.3 Multimodal Transport Market Study

5.3.1 Introduction

The MTMS describes the transport market characteristics of the OEM corridor in its present condition and in the future. It essentially intends to analyse the OEM Corridor-related transport system and "assess the capacity and traffic flows on the respective parts of the infrastructure", covering the time period from 2010 to 2030. The time horizon of 2030 was selected, as it represents a major milestone for European policy and at the same time, provides for the reliability of future results.

Three specific activities are defined under the MTMS:

- Task 1: At first, the MTMS will prepare the socio economic framework of analysis for Corridor transport activities. To this end, the MTMS will first identify which regions linked to the Corridor contribute to the international transport activities setting the "catchment area". Moreover, the study will identify the external socio-economic drivers, i.e. variables which affect the Corridor transport activities, such as the GDP and the population for the time period 2010-2030, in order to define the socioeconomic framework for the assessment of future transport activity.
- Task 2: Secondly, the MTMS will specifically analyse and evaluate the existing and future transport activities i.e. the demand, focusing on the international freight demand concerning the transported volume, commodities (type of cargo) and mode utilisation (modal split). Next to the existing demand structure, this assessment will highlight the mode performance, in order to identify the cases of low utilisation of modes. The time period of this task is also from 2010-2030.

  The report presents the results for the transport performance of different modes based on sources available. The results from the data collection were presented at the 3rd Corridor Forum meeting. The approach followed for the data collection is presented in Annex 4 to this report.
- Task 3: The third task of the MTMS will focus on the supply side of the market, presenting the main current and future characteristics of supply, such as capacity, with a view to assess whether the existing infrastructure, as a whole, is able to cope with the current and expected traffic flows.

For each of the above three tasks a specific methodology is adopted, that is described in the following sections. The MTMS main contribution to the Work Plan is to analyse the existing and future transport market trends from the supply and demand side for the OEM Corridor.

5.3.1.1 Definition of Catchment Area

The NUTS 2 regions that are crossed by any infrastructure of the OEM corridor are selected for further analysis for the purpose of the transport market study. The alignment of the catchment area consists of rail, road and inland waterways. However, for most Member States (the OEM countries), only a certain number of regions (the OEM regions) are selected that together make up the corridor catchment area.

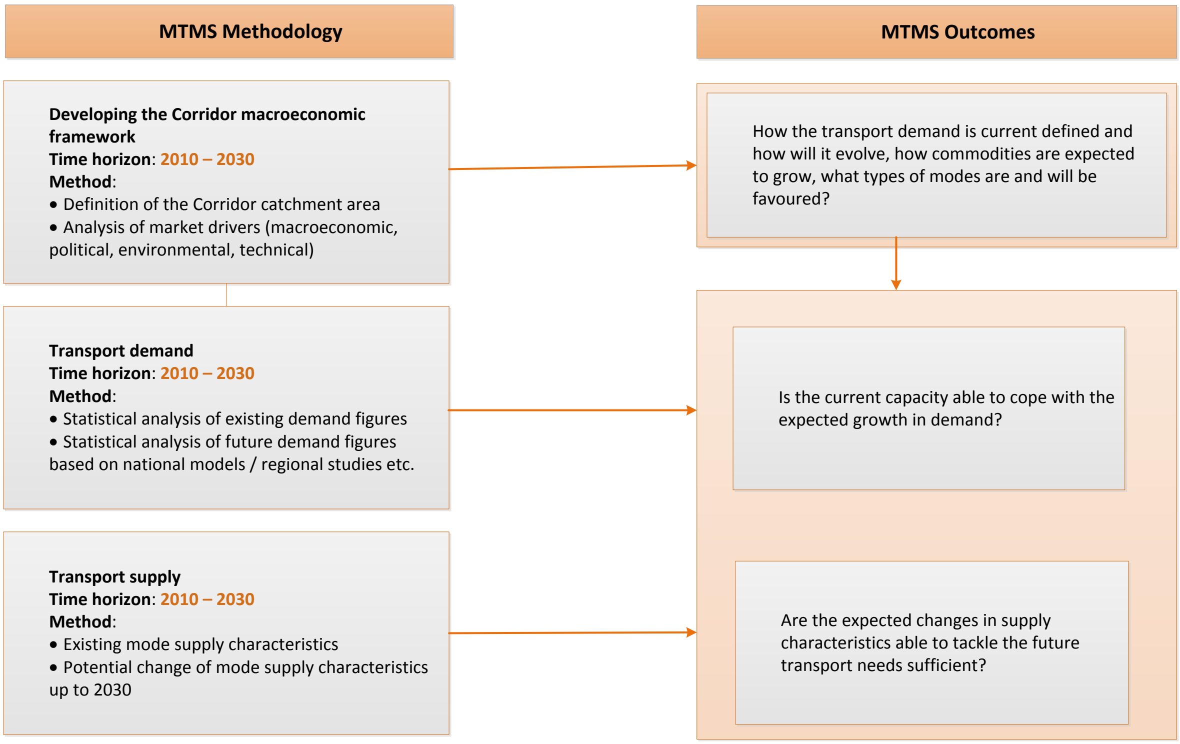
Figure 28: Map of Catchment area of the OEM corridor; NUTS 2

Source: Consortium

Concerning the transport demand, the MTMS will focus on the volumes, commodities and the modes performance along the OEM Corridor. Supply-wise, the study will examine whether the existing capacity and expected infrastructure changes will be able to cope with the future transport activities.

The following diagram presents the tasks of the MTMS linking them to the MTMS outcomes.

Figure 29: Scheme of the Multimodal Transport Market Study Methodology



Source: Consortium

5.3.2 MTMS process

The overall MTMS concept was developed for the present 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, while European sources, such as Eurostat, the EU Reference scenario and the TRANS-TOOLS/ETIS-BASE freight database were also used.

5.3.2.1 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) influencing the demand. For passenger demand, these are factors related to trips (generation and distribution), as well as modal split. Similarly, for freight demand, these are related to trade (generation and distribution) and modal split. Examples include, among 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 and costs for modal split. These parameters can be defined externally and, in case of scenarios, they can be modified in order to present a range of plausible future cases, for example, modelling the effect of decreasing transport times for a specific mode on the transport demand and the mode share.

The present report presents first the socioeconomic assumptions for the national scenarios, which are externally defined and shape the picture of the future passenger and freight demand. Whereas other parameters have an effect on the volumes, these two parameters are the most representative when presenting a scenario and hence, are described herein. Other parameters of interest, such as the fuel prices, motorisation and urbanisation rates, are not described in this report as they are internal model variables and not 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 and PP22 results[80]. These are the main source of information that can provide the scale of the demand reflecting only the Corridor-related flows for the OEM Corridor. MTMS 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 into 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 the case of changes simulated, these are developed through various scenarios.

Next to the national scenarios, there are several studies targeted at specific Corridor parts (e.g. port studies and related forecasts) or transport plans. These depict specific parts of the Corridor's catchment area and will be examined to draw conclusions on the effects of specific attributes on the transport demand, i.e. to perform a type of scenarios' analysis.

5.3.2.2 MTMS analysis and partner involvement

The overall MTMS concept was developed for the present report in order to have a clear integrated view of the analysis, as well as its expected outcomes. For each of the tasks all partners contributed with data from national sources, such as national forecasting models and regional studies, as well as European sources, such as Eurostat, the EU Reference scenario and the ETISplus database.

5.3.2.3 Data coverage of the MTMS

In this report, the MTMS provides information on the macroeconomic framework as well as the Corridor-related demand flows. These are complemented based on the conclusions from the Second Corridor Forum, as well as the final analysis from the consortium.

With regard to the data used for Task 1 (the macroeconomic indicators), the study presents national and in some cases regional information for GDP, population and other macroeconomic indicators and trends.

In the 2nd progress report, only the base year 2010 of freight and passenger traffic was presented. In the present report, the flows related to international freight traffic in the Corridor, such as passenger flows or domestic freight flows, as well as traffic entering and exiting the Corridor, are included. Regarding the domestic freight and passenger values, these will be aggregated figures as their main purpose is to identify the network capacity needs. For the traffic entering and exiting the Corridor, the study relies on input from the EU databases and that from the national stakeholders.

5.3.3 Socio-economic characteristics of the OEM corridor on the basis of GDP and Population

This section describes certain socio economic characteristics of the OEM corridor countries and OEM regions, in particular Gross Domestic Product (GDP), population and urbanisation. Also, a preliminary forecast for the GDP and population will be given on the basis of an EU study. The socio-economic characteristics of the OEM countries will be compared to related totals figures for EU-27 (until 2013; after which EU-28 will

[80] For the PP22 study ETISbase has been used and corrected with detailed information gathered in the PP22 study.

be considered); the characteristics of OEM regions will be compared to totals of OEM countries. The results from the countries will be presented in the last section.

The table below gives a first overview on the OEM regions (NUTS 2) level and their basic socio-economic status as of 2010.

Table 37: Overview on basic socio-economic data of NUTS2 Regions along the Corridor (2010)

NUTS2 ID	NUTS2 NAME	POP [1000p]	GDP M EUR	Pers/ km²	GVA* Agric.	GVA* Industr.	GVA* Servic.	GVA* Total
AT11	Burgenland (A)	283	6,240	72	231	1,587	3,845	5,663
AT12	Niederösterreich	1,608	44,918	84	1,187	13,403	26,174	40,764
AT13	Wien	1,689	75,292	4,073	132	11,021	57,178	68,331
BG31	Severozapaden	891	2,830	47	279	815	1,341	2,436
BG34	Yugoiztochen	1,086	4,391	55	227	1,568	1,983	3,778
BG41	Yugozapaden	2,043	16,673	101	255	3,733	10,360	14,347
BG42	Yuzhen tsentralen	1,489	5,084	67	408	1,611	2,356	4,375
CY00	Kypros/Kibris	806	17,465	87	365	2,584	12,801	15,750
CZ01	Praha	1,224	36,960	2,468	107	6,118	28,087	34,311
CZ02	Stredni Cechy	1,217	15,809	110	586	6,463	7,627	14,676
CZ04	Severozapad	1,143	12,440	132	257	5,400	5,892	11,548
CZ05	Severovychod	1,503	17,023	121	632	6,854	8,317	15,803
CZ06	Jihovychod	1,660	21,381	119	988	8,048	10,812	19,848
CZ07	Střední Morava	1,234	13,870	134	648	5,766	6,462	12,876
DE30	Berlin	3,407	88,691	3,823	77	13,253	63,965	77,295
DE41	Brandenburg - Nordost	1,138	22,553	73	468	4,777	14,410	19,655
DE42	Brandenburg - Südwest	1,378	31,882	99	432	6,507	20,845	27,784
DE50	Bremen	660	27,464	1,631	43	5,763	18,130	23,935
DE60	Hamburg	1,762	87,587	2,333	136	12,617	63,579	76,333
DE80	Mecklenburg-Vorpommern	1,664	35,739	72	868	5,743	24,535	31,146
DE91	Braunschweig	1,620	46,741	200	407	15,569	24,759	40,735
DE92	Hannover	2,143	62,920	237	527	13,488	40,821	54,835
DE93	Luneburg	1,690	37,527	109	822	7,227	24,656	32,706
DE94	Weser-Ems	2,467	66,161	165	1,261	16,928	39,469	57,659
DEA4	Detmold	2,045	59,944	314	440	17,705	34,095	52,241
DED1	Chemnitz	1,488	32,554	244	281	9,012	19,078	28,371
DED2	Dresden	1,634	37,525	206	338	9,277	23,088	32,702
DED3	Leipzig	1,065	24,959	243	214	5,288	16,250	21,752
DEE0	Sachsen-Anhalt	2,367	53,786	116	873	14,062	31,940	46,875
DEF0	Schleswig-Holstein	2,819	74,031	178	1,014	13,644	49,860	64,518
GR11	Anatoliki Makedonia, T	608	8,796	43	504	1,684	5,577	7,765
GR12	Kentriki Makedonia	1,943	34,449	103	1,373	5,966	23,073	30,412
GR13	Dytiki Makedonia	294	5,406	31	256	1,559	2,957	4,772
GR14	Thessalia	738	12,538	53	851	2,441	7,777	11,069
GR21	Ipeiros	355	5,660	39	273	807	3,918	4,998
GR23	Dytiki Ellada	743	11,777	65	766	1,797	7,834	10,397
GR24	Sterea Ellada	554	12,173	36	642	4,260	5,845	10,747
GR25	Peloponnisos	593	10,909	38	632	2,619	6,380	9,632
GR30	Attiki	8,166	200,785	1,072	606	24,077	152,571	177,255
GR43	Kriti	609	12,489	73	630	1,505	8,890	11,025
HU10	Kozep-Magyarorszag	2,952	51,910	427	286	8,916	30,964	40,165
HU21	Kozep-Dunantul	1,099	10,672	99	370	4,047	3,841	8,258
HU22	Nyugat-Dunantul	996	10,434	88	416	3,598	4,059	8,074

NUTS2 ID	NUTS2 NAME	POP [1000p]	GDP M EUR	Pers/ km²	GVA* Agric.	GVA* Industr.	GVA* Servic.	GVA* Total
HU32	Eszak-Alfold	1,493	10,072	84	671	2,377	4,745	7,794
HU33	Del-Alfold	1,318	9,560	72	818	2,154	4,426	7,397
RO41	Sud-Vest Oltenia	2,255	10,579	77	872	4,218	4,291	9,381
RO42	Vest	1,918	12,606	60	796	4,681	5,716	11,194
SK01	Bratislavsky kraj	617	16,621	300	185	3,547	11,452	15,184
SK02	Zapadne Slovensko	1,874	20,959	125	991	9,254	8,903	19,147

*in million Euro, Source: ETIS

5.3.3.1 GDP

The OEM corridor crosses nine countries included in Table 38, which presents the GDP in current market prices (EUR) for the years 2008 to 2012. The source of the data is Eurostat. The table clearly shows the effect of the global economic crisis in terms of the GDP decrease in all OEM countries in 2009.

The GDP share of OEM countries in the EU-27 total GDP has increased annually in the course of 2008-2012: from 27.2% of the EU-27 in 2008 to 28.6% in 2012.

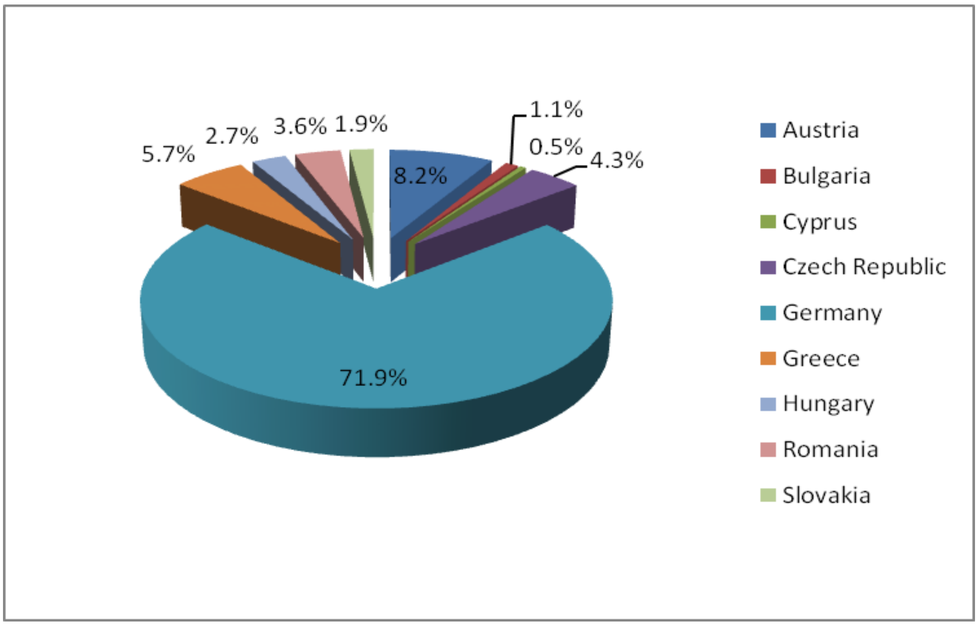
Of all the OEM countries, Germany has the highest GDP, accounting for higher GDP than the sum of GDPs of all other OEM countries combined; the total share of German GDP in 2012 equals approximately 72%. The GDP share is particularly small in Cyprus, Bulgaria and Slovakia.

Table 38: GDP in current prices in million Euros in OEM countries and EU-27 (2008-2012)

country/year	2008	2009	2010	2011	2012
Austria	274,020	282,744	276,228	285,165	299,240
Bulgaria	30,772	35,431	34,933	36,052	38,505
Cyprus	15,902	17,157	16,853	17,406	17,979
Czech Republic	131,909	154,270	142,197	149,932	155,486
Germany	2,428,500	2,473,800	2,374,200	2,495,000	2,609,900
Greece	223,160	233,198	231,081	222,152	208,532
Hungary	99,423	105,536	91,415	96,243	98,921
Romania	124,728	139,765	118,196	124,328	131,478
Slovakia	54,811	64,413	62,794	65,897	68,974
OEM	**3,383,225**	**3,506,314**	**3,347,897**	**3,492,175**	**3,629,015**
EU27	12,430,268	12,501,007	11,770,969	12,292,606	12,667,535
OEM as % of EU27	*27.2%*	*28.0%*	*28.4%*	*28.4%*	*28.6%*

Source: Eurostat

Figure 30: GDP share per entire OEM country (2012)



Source: Eurostat

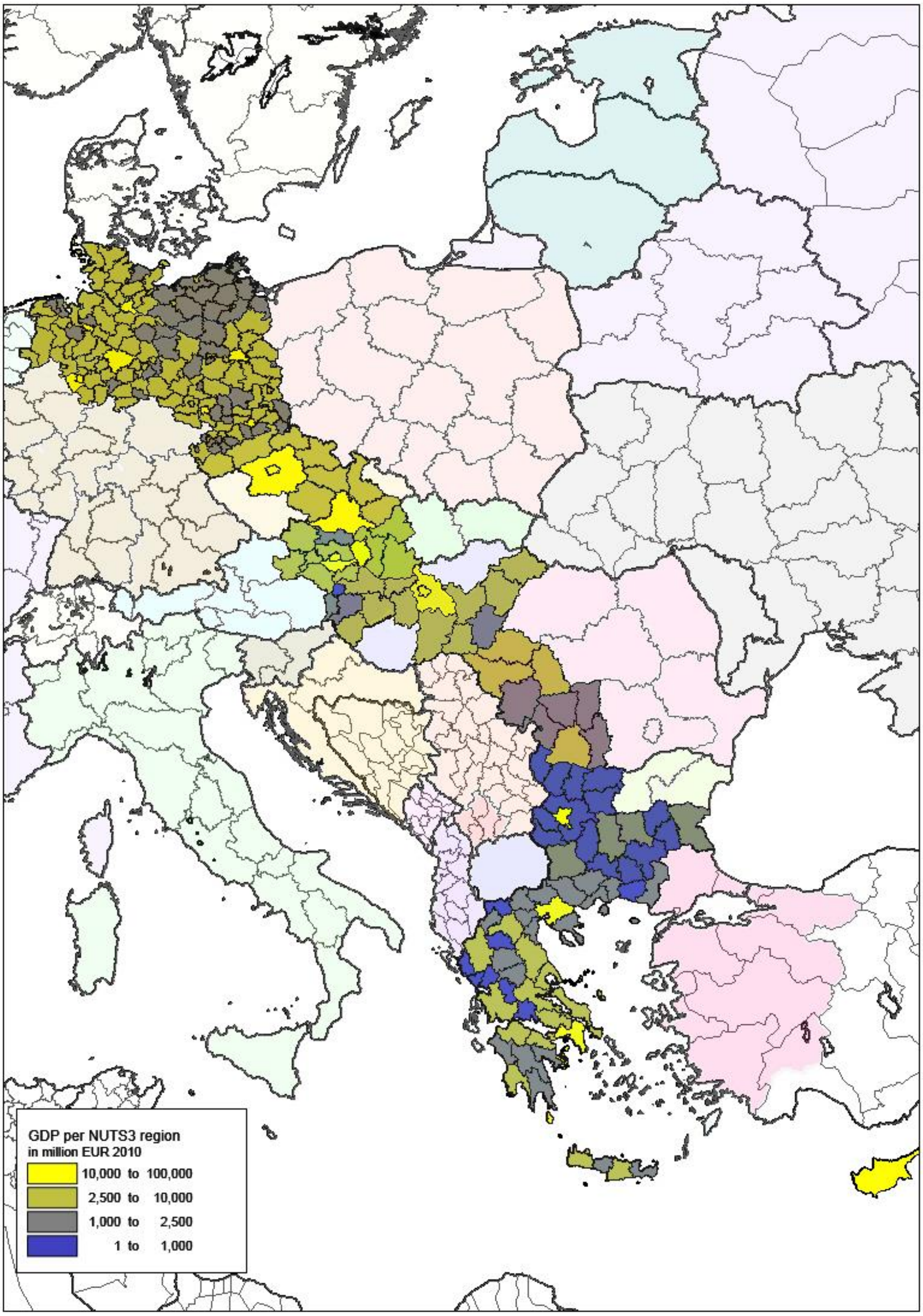
The regional GDP of the OEM corridor regions against the corresponding national GDP values is ranging between 38% and 40% in the period 2008-2012. Since 2010, the share of the corridor regions has marginally decreased.

OEM regions in Germany have the largest share of total GDP of all OEM regions: 53.6% in 2012. OEM regions in Greece account for 12.3% of total GDP of all OEM regions. GDP shares of OEM regions in Bulgaria, Romania and Cyprus are small.

The share of GDP of OEM regions in Cyprus and Greece in the total GDP of the country equals 100%, because the entire country falls within the OEM corridor region. Therefore, it holds for other socio economic characteristics as well. The GDP share of OEM regions in Hungary and Bulgaria exceeds 80% of the total GDP of these countries. GDP shares of German and especially Romanian OEM regions of these countries are small (29% and 17%).

Figure 31 shows the catchment area of the OEM corridor, together with the GDP value per region within the corridor, depicting essentially the distribution of welfare along the corridor. In absolute terms, the German regions are more detailed and smaller in terms of size, and that is the reason why Germany shows in the North East (Mecklenburg-Vorpommern) lower values for GDP compared to other regions. When looking at the aggregation over all regions per country (Table 38) one can observe that Germany in total has the highest share.

Figure 31: Map of GDP per OEM region (2012, NUTS3)



Source: ETISBASE-EUROSTAT

Table 39 lists the GDP per country. The share of the OEM regions in the total of all countries is stable at around 39% over the years 2008 – 2012. In comparison, the total of the OEM countries is listed in Table 38.

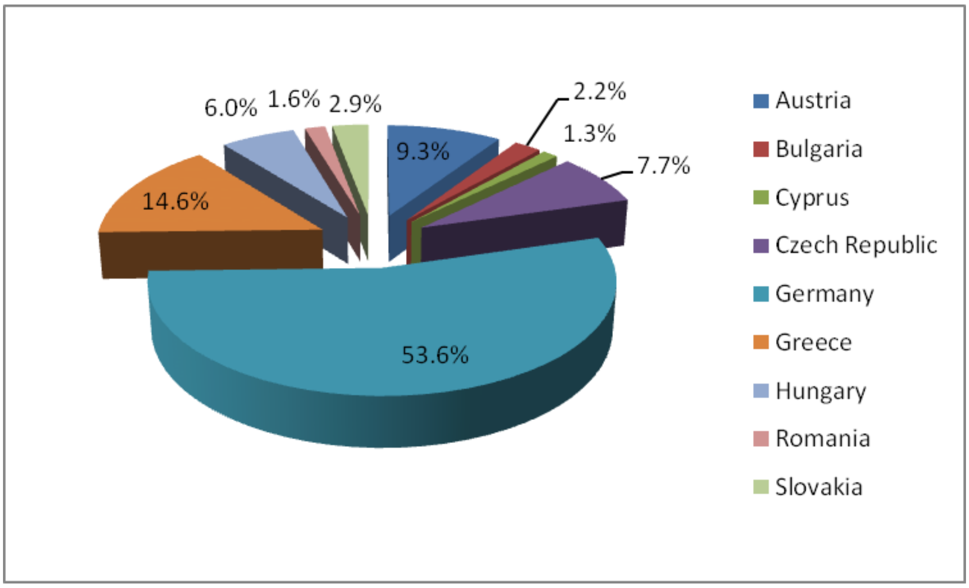
Table 39: GDP in current prices of OEM regions and OEM countries (2008-2012)

country/year	2008	2009	2010	2011	2012
Austria	120,861	125,011	122,484	126,772	132,099
Bulgaria	24,719	28,493	28,404	29,364	31,417
Cyprus	15,902	17,157	16,853	17,406	17,979
Czech Republic	92,770	108,985	100,708	105,999	109,322
Germany	708,621	728,449	705,374	737,604	765,099
Greece	223,160	233,198	231,081	222,152	208,532
Hungary	85,082	90,564	78,594	82,986	85,719
Romania	22,529	24,643	21,035	22,571	23,522
Slovakia	33,013	38,097	37,825	39,450	41,531
OEM regions	**1,326,657**	**1,394,597**	**1,342,358**	**1,384,304**	**1,415,220**
OEM total country	3,383,225	3,506,314	3,347,897	3,492,175	3,629,015
OEM regions as % of OEM total country	39.2%	39.8%	40.1%	39.6%	39.0%

Source: Eurostat

The analysis of the individual share per country (presented in Figure 32) shows, that entire Germany had a share of 72%, whereas the share of German OEM regions is 53.6%.

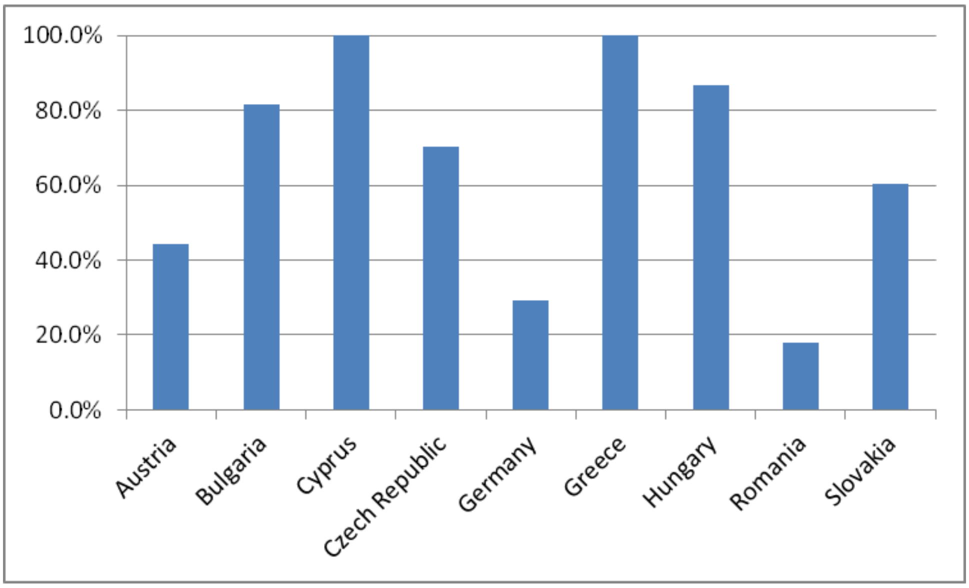
Figure 32: Share of total OEM regions GDP per OEM country (2012)



Source: Eurostat

Figure 33 depicts the share of the OEM region in the national economy measured in GDP for 2012. Cyprus and Greece are included as a country in their entirety in the OEM regions, having thus a share of 100%. The share of the OEM region is the lowest in Romania and Germany. In all other countries, the OEM regions contribute more than 60% to the national economy of the country.

Figure 33: GDP Share of OEM regions in total of OEM country (2012)



Source: Eurostat

As stated in the MTMS approach, a forecast is required for the socio-economic variables. These estimations have formed the input for forecasts presented below. The scenario, as included below, is derived from an official EU source[81]. The GDP for the OEM countries is given for the years 2010, 2020, 2030, 2040 and 2050. The information is not available at regional level. Also, the yearly growth in % per year is indicated in the last columns.

[81] *EU Energy, Transport and GHG Emissions Trends to 2050, Reference Scenario 2013*

Table 40: GDP (in 2010 prices) in OEM countries in bln Euro for the years 2010, 2020, 2030, 2040, 2050 and the average annual growth per decades

	Year					Annual growth in %			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**'10-'20**	**'20-'30**	**'30-'40**	**'40-'50**
Austria	276.2	337.7	385.4	442.5	507.4	1.7	1.3	1.4	1.4
Bulgaria	34.9	45.1	51.5	59.2	64.9	2.3	1.3	1.4	0.9
Cyprus	16.9	19.8	24.1	30.3	36.2	1.3	2	2.3	1.8
Czech Republic	142.2	184.3	218.8	255.9	290.0	2.1	1.7	1.6	1.3
Germany	2,374.2	2,801.8	2,997.7	3,185.2	3,465.8	1.2	0.7	0.6	0.8
Greece	231.1	227.1	256.6	289.3	322.1	0	1.2	1.2	1.1
Hungary	91.4	106.6	127.3	146.5	162.0	0.9	1.8	1.4	1
Romania	118.2	157.3	178.7	201.4	216.0	2.4	1.3	1.2	0.7
Slovakia	62.8	83.9	105.8	119.0	127.4	2.5	2.3	1.2	0.7
OEM	**3,347.9**	**3,963.6**	**4,345.9**	**4,729.3**	**5,191.8**	**1.3**	**0.9**	**0.9**	**0.9**
EU27	11,771.1	14,189.9	16,600.1	19,073.1	21,858.7	1.5	1.6	1.4	1.4
OEM as % of EU27	28.4%	27.9%	26.2%	24.8%	23.8%				

Source: EU Energy, Transport and GHG Emissions Trends to 2050, Reference Scenario 2013

5.3.3.2 Population

The total population of all OEM countries amounts to approximately 155 million in 2012. This accounts for almost 31% of the total population in EU-27 in 2012. This share has annually decreased in the course of 2008-2012; from 31.5% in 2008 to 30.8% in 2012.

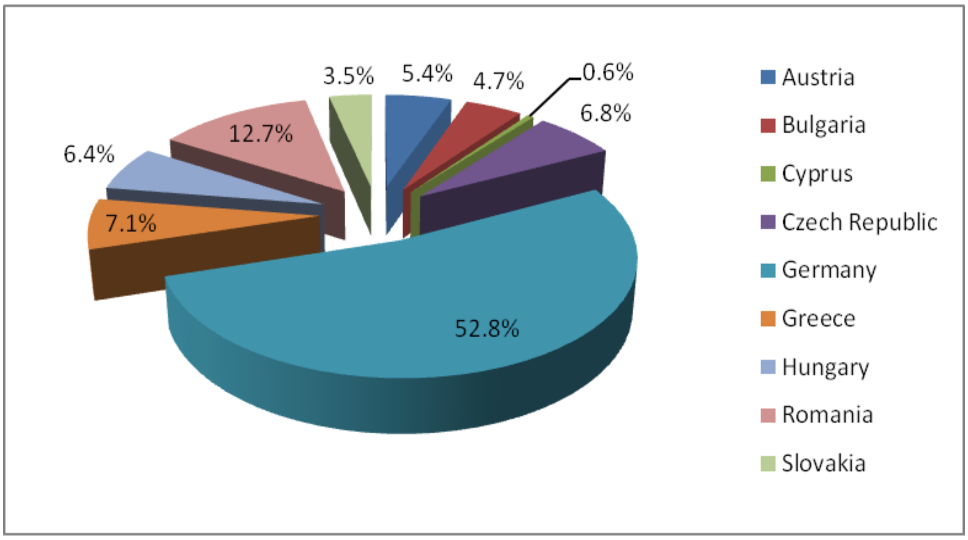
Of all the OEM countries, Germany has the largest population (just over 82 million in 2012). This equals to more than half of the total population of all OEM countries. The total population in EU-27 has increased annually in the course of 2008-2012, whereas the total population of OEM countries has decreased on an annual basis. This decrease is to a large extent caused by decreasing populations in Bulgaria and Romania.

Table 41: Population in OEM countries and EU-27 (years 2008-2012)

country/year	2008	2009	2010	2011	2012
Austria	8,355,260	8,375,290	8,404,252	8,408,121	8,451,860
Bulgaria	7,606,551	7,563,710	7,369,431	7,327,224	7,284,552
Cyprus	796,875	819,140	839,751	862,011	865,878
Czech Republic	10,467,542	10,506,813	10,486,731	10,505,445	10,516,125
Germany	82,002,356	81,802,257	81,751,602	81,843,743	82,020,578
Greece	11,260,402	11,305,118	11,309,885	11,123,034	11,062,508
Hungary	10,030,975	10,014,324	9,985,722	9,931,925	9,908,798
Romania	21,498,616	21,462,186	21,413,815	20,095,996	19,694,076
Slovakia	5,412,254	5,424,925	5,392,446	5,404,322	5,410,836
OEM	**157,430,831**	**157,273,763**	**156,953,635**	**155,501,821**	**155,215,211**
EU27	499,686,575	501,104,164	502,369,211	503,663,601	503,915,433
OEM as % of EU27	31.5%	31.4%	31.2%	30.9%	30.8%

Source: Eurostat

Figure 34: Population share per OEM country in total OEM population (2012)



Source: Eurostat

The total population in OEM regions has annually decreased from 2008 and onwards with the exception of 2010. In 2010, the population of all OEM regions increased by more than two millions and exceeded 70 million in total. This increase was caused by a population increase in Germany by approximately 2.5 million.

The total population share of OEM regions in OEM countries equals 45.9% in 2012 (see table 33). This share has annually increased from 2008 and onwards. This means that the population decrease in all OEM countries exceeded the decrease (increase in 2010) in all OEM regions.

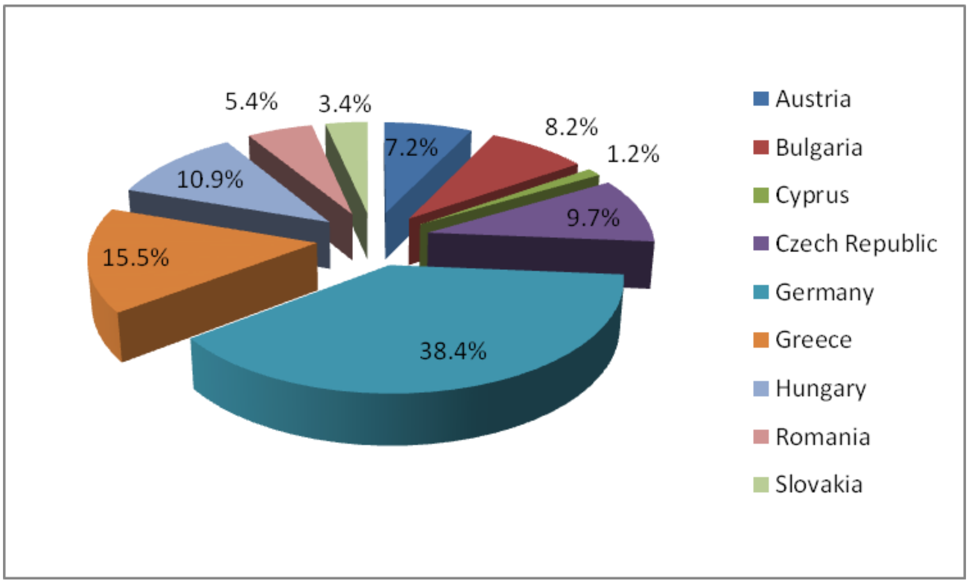
The German regions account for almost 38.4% of all population in OEM regions and 15.5% of all OEM regions population lives in Greece, and 10.9% Hungary (see figure 30). All other countries are lower than 10%. The population share of all OEM regions is the lowest for Cyprus (1.2%).

Table 42: Population of OEM regions per member states (2008-2012)

country/year	2008	2009	2010	2011	2012
Austria	5,060,477	5,074,485	5,095,008	5,096,262	5,126,282
Bulgaria	6,068,409	6,035,490	5,889,006	5,856,117	5,822,204
Cyprus	796,875	819,140	839,751	862,011	865,878
Czech Republic	6,839,782	6,866,580	6,885,737	6,901,977	6,914,253
Germany	24,853,977	24,789,903	27,290,514	27,293,852	27,329,534
Greece	11,260,402	11,305,118	11,309,885	11,123,034	11,062,508
Hungary	7,854,755	7,857,196	7,850,440	7,799,879	7,794,177
Romania	4,182,240	4,165,467	4,146,645	3,895,444	3,817,535
Slovakia	2,482,746	2,489,106	2,438,717	2,445,796	2,450,818
OEM regions	**69,399,663**	**69,402,485**	**71,745,703**	**71,274,372**	**71,183,189**
OEM total country	157,430,831	157,273,763	156,953,635	155,501,821	155,215,211
OEM regions as % of OEM total country	44.1%	44.1%	45.7%	45.8%	45.9%

Source: Eurostat

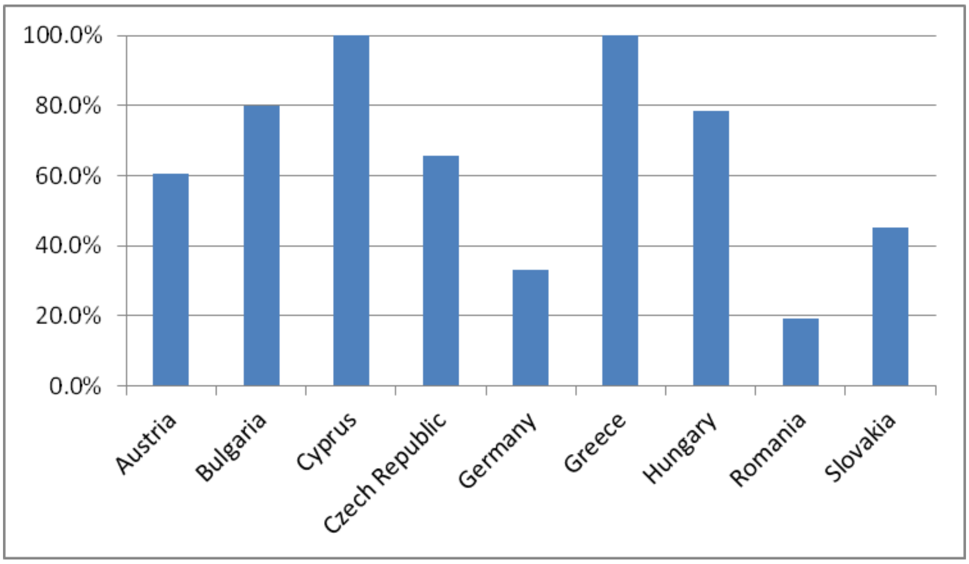
Figure 35: Share of total OEM regions population per OEM country (2012)



Source: Eurostat

Figure 36 presents the national shares of the OEM regions against the entire national population for year 2012. The population share of OEM regions in Cyprus and Greece equals 100%, because the entire country falls within the OEM corridor region. The population share of OEM regions in Hungary and Bulgaria reaches 80% of national population. Population shares of German and especially Romanian OEM regions in the total population of these countries are low (33% and 19%).

Figure 36: Population share of OEM regions in total of OEM country (2012)



Source: Eurostat

The demographic projections, listed in Table 43 are also derived from the study that comprised the GDP projections[82]. The population projections are listed below for years 2010, 2020, 2030, 2040 and 2050.

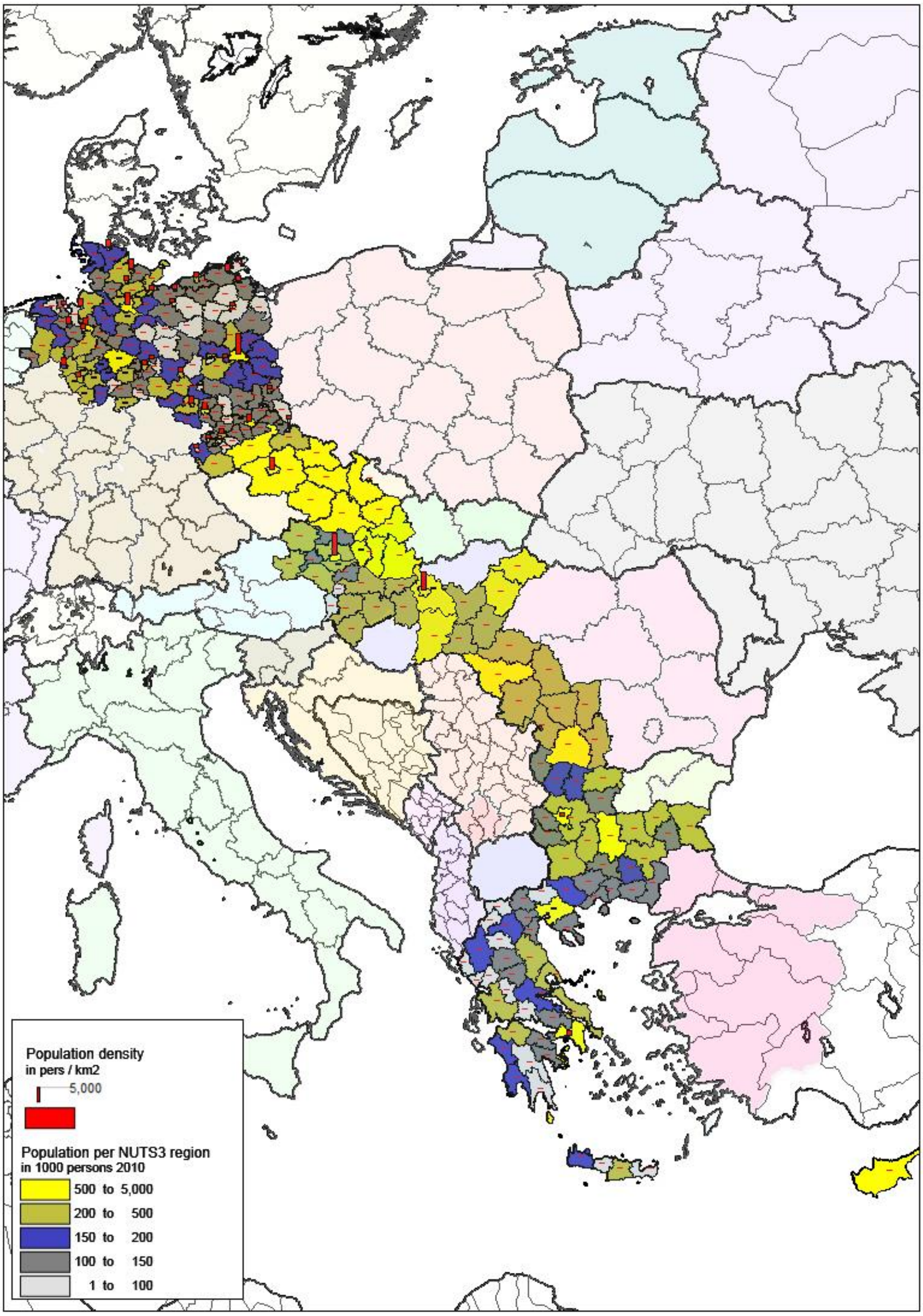
Table 43: Population forecasts for OEM countries 2010, 2020, 2030, 2040, 2050; in mln inhabitants; and annual population growth per decades

	Year					Yearly growth in %			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**'10-'20**	**'20-'30**	**'30-'40**	**'40-'50**
Austria	8.4	8.6	8.8	9.0	9.0	0.3	0.3	0.1	0.0
Bulgaria	7.6	7.1	6.6	6.2	5.9	-0.6	-0.7	-0.6	-0.6
Cyprus	0.8	0.9	1.0	1.0	1.1	1.0	1.0	0.6	0.5
Czech Republic	10.5	10.8	10.8	10.7	10.7	0.3	0.0	-0.1	-0.1
Germany	81.8	80.1	77.9	74.8	70.8	-0.2	-0.3	-0.4	-0.5
Greece	11.3	11.5	11.6	11.6	11.6	0.2	0.0	0.0	0.0
Hungary	10.0	9.9	9.7	9.4	9.2	-0.1	-0.2	-0.3	-0.3
Romania	21.5	21.0	20.3	19.4	18.5	-0.2	-0.4	-0.4	-0.5
Slovakia	5.4	5.6	5.6	5.5	5.3	0.3	0.0	-0.2	-0.3
OEM	157.3	155.5	152.3	147.6	142.1	-0.1	-0.2	-0.3	-0.4
EU27	502.4	517.0	524.9	528.2	526.5	0.3	0.2	0.1	0.0
OEM as % of EU27	31.3%	30.1%	29.0%	27.9%	27.0%				

Source: EU Energy, Transport and GHG Emissions Trends to 2050, Reference Scenario 2013

[82] EU Energy, Transport and GHG Emissions Trends to 2050, Reference Scenario 2013

Figure 37: Map of Population density per OEM region (2012, NUTS-3)



Source: ETISBASE-EUROSTAT

In Figure 37 the population per OEM region is indicated with the colour of the region.

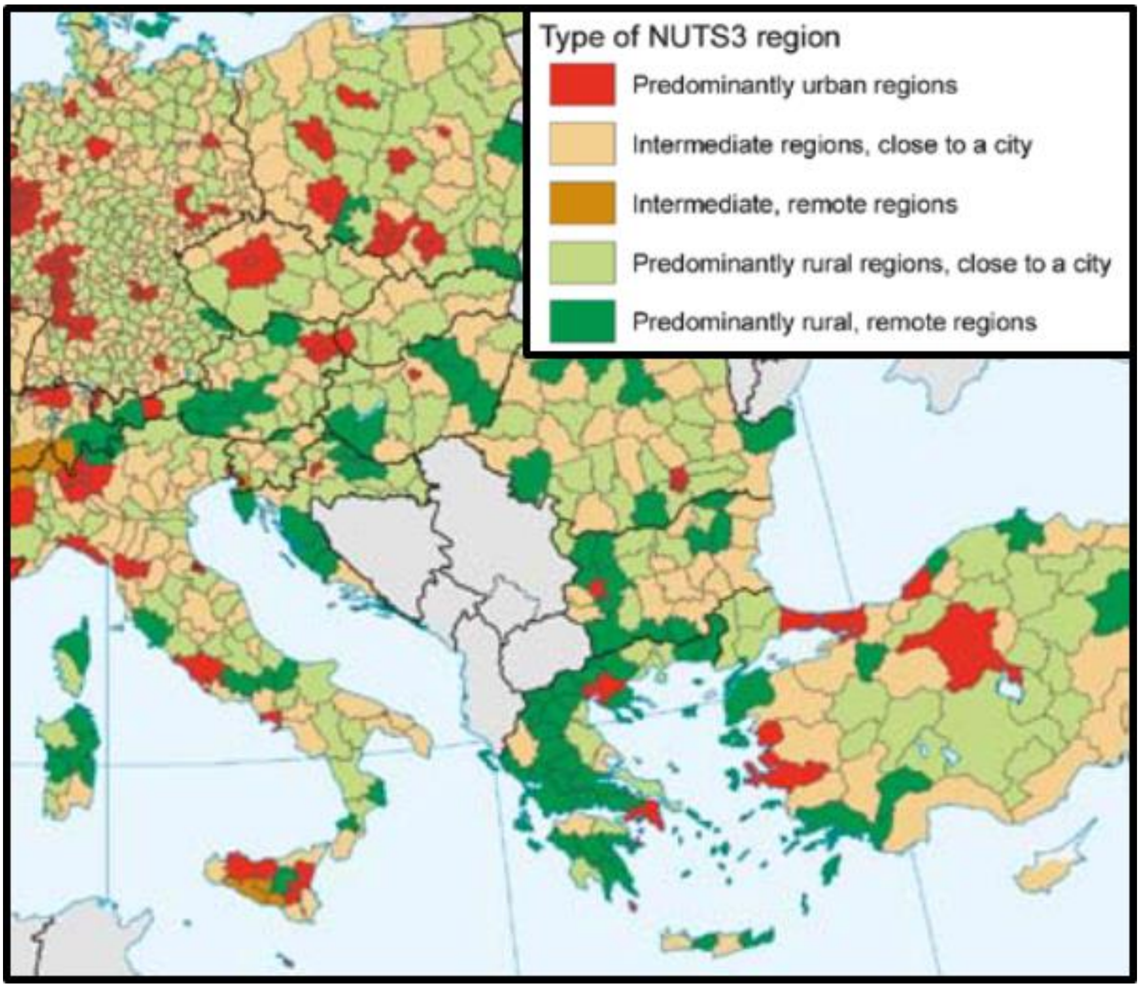
A second type of information is given in the map by the red coloured bar within the region, depicting the population density. In general, the population density in OEM regions is low with the exception of key urban areas such as Hamburg, Berlin, Praha, Wien and Budapest.

It should be noted that the GDP is listed in NUTS3 regions, but the selection of the catchment area is based on the NUTS2 regions for the purpose of the MTMS.

5.3.3.3 Urbanisation

An interesting feature is the urban-rural typology, including remoteness, which classifies all NUTS3 regions according to criteria based on population density and population distribution (urban-rural)[83]. This classification is combined with a distinction between areas located close to city centres and areas that are remote.

Figure 38: Map of Urban-rural typology including remoteness



Source: EC, Regional Focus, 2011

[83] 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

It creates five categories of NUTS3 regions:

- predominantly urban regions;
- intermediate regions, close to a city;
- intermediate, remote regions;
- predominantly rural regions, close to a city;
- predominantly rural, remote regions.

In general, it seems that of all OEM countries, Greece has a relative large share of predominantly rural, remote OEM regions. As depicted in Figure 38 the same holds for Bulgaria and Hungary. In the Czech Republic, regions surrounding Praha are predominantly urban. Most of the other OEM regions are intermediate regions, either close to a city or predominantly rural regions, close to a city.

5.3.4 Socio-economic characteristics of the corridor on the basis of GDP and Population as reported by the countries

In the previous section the European studies, referenced as official EC studies, have been used for describing the OEM countries. The available information allowed for the specific description of the corridor specifically, while this could be defined on the basis of the NUTS-3 regions. This section presents the national figures on GDP and population. The purpose is to check whether the national forecasts are in line with the official EC studies.

Furthermore, the section presents the forecasts coming from national models in order to give an impression on how the socioeconomic framework is expected to develop in the upcoming years. For projected national data, there are several European sources, including the EU Reference Scenario / European projections for 2013 (EU Reference Scenario, 2013). For regional data, the main data sources were national – for both existing and forecasted data - and the ETISplus database, for 2010 data. An overview of the data availability in the OEM countries is presented in the table below.

Table 44: Summary of national sources for GDP and Population Data

Country	Source(s)
Austria	Eurostat BVMIT
Bulgaria	Updated Master Plan (2013) National Statistical Institute of Bulgaria
Czech Republic	Eurostat OPD
Cyprus	Eurostat Eurostat
Germany	BVWP (2013)
Greece	Eurostat
Hungary	Eurostat Hungarian Transport Administration
Romania	Eurostat AECOM
Slovakia	Eurostat Strategic Development plan of Transport infrastructure

The historical and projected data on GDP and population is shortly discussed per corridor country in the following. Projected data means that forecasts are available for the specific country. For the projected data, a comparison between the European projections (from the previous section) and national sources (if present) is given at the end of the section.

Austria

The population of Austria grew over the last few years, and the GDP shows a significant growth. 68% of gross value added is generated by the services sector, 29% by the industry.

The Austrian MoT (BMVIT) commissioned a traffic forecast "Verkehrprognose Österreich 2025+". This study details socio-economic assumptions. The indicator GDP 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. According to European projections, until 2030 the yearly growth is expected to be 1.7%.

Population growth from the BVMIT study is taken from the national Austrian statistical bureau STATISTIK AUSTRIA. The most recent population forecast from 2012 is a growth of 0.36% per year until 2030, according to the main scenario. The European projections show an expected annual growth of 0.23%.

Aging of population is expected and Wien will remain the largest region with a growth of 0.74% per annum.

Bulgaria

In Bulgaria, there is a tendency for the number of inhabitants to decrease (annual growth more than -1%). Except for the year 2009 the international crisis did not hurt Bulgaria very much, since recently the annual growth in GDP is +1%. Almost 2/3 of the gross value added is earned in the services sector, and about 30% from the industry.

The annual growth rate of GDP for Bulgaria is expected to be almost 2% until 2030 according to European projections, and 3.3% according to the national source (updated Master Plan 2013). In the first edition of the Master Plan with base year 2008, the annual growth rate was over 4%

The population of Bulgaria is expected to decline according to the European projections in the years up to 2030 with an annual growth rate of about -0.7%. The national sources analysed included in the Master Plan and the National Statistical Institute. The National Institute reports forecasts for three variants:

- Variant 1 (target): The variant is defined as realistic and is prepared according to the EU regulations on the Member States demographic and social-economic development.
- Variant 2 (relative acceleration): The variant suggests that the country demographic development will be accompanied by the favourable social-economic processes.
- Variant 3 (relative delay): The prognosis on population development is done under the hypothesis for unfavourable social-economic processes in the country.

The annual growth rate according to the Master Plan is -0.55% until 2030, for variant 1 the annual growth rate is: -0.67%, for variant 2: -0.58% and for variant 3: -0.72%.

Czech Republic

After the long-term decrease, there is a very small population growth in the Czech Republic. The GDP growth was negative in 2012, but positive in 2010 and 2011, resulting in an overall GDP growth of 1%. 60% of gross value added comes from the services sector, and 37% from the industry.

Socio economic data for national forecasts is summarized in the following table. These are the drivers that are used as forecast for Czech transport demand. GDP is expected to grow by more than 2% annually.

Table 45: Czech socio economic forecast by source

Input	Change compared to 2010			
	2010	**2020**	**2035**	**2050**
GDP	1.00	1.27	1.74	1.88
Population	1.00	1.02	1.06	1.05
Share of economically inactive population	1.00	1.07	1.15	1.30
Motorization	1.00	1.14	1.19	1.20
Fuel prices	1.00	1.20	1.54	1.70
Coal and oil assumptions	1.00	0.91	0.75	0.63

Source: Transport sector strategies 2nd phase, OPD

For the Czech Republic the annual growth rate for GDP is expected to be 2.2% until 2030 for both the European projections and the national source.

The population of the Czech Republic is expected to increase in the years up to 2030 with an annual growth rate of about 0.14% (according to the European projections). According to the national source, the annual growth is expected to be 0.23%

Cyprus

The population of Cyprus shows a significant growth, but the GDP decreased on average. 80% of gross value added is generated by the tertiary sector (services) and only 17% by the industry.

For Cyprus, the annual growth rate for GDP is expected to increase by 1.8% in the years up to 2030, according to the European projections. The population of Cyprus is expected to increase according to the European projections in the years up to 2030 with an annual growth rate of about 1.1%.

Germany

The population growth of Germany is very low; the number of inhabitants is relatively stable over the recent years. Germany shows one of the highest growths of GDP in the EU, even in the recent years of the international crisis. 68% of gross value added is generated by the services sector, 30% by the industry.

The population in Germany is expected to demonstrate a slightly negative trend of 0.17% - 0.31% on average per year based on European sources, conforming to the national projections. At the same time, the employment rate is expected to increase by 4% in total based on the BVWP (2013) projections.

There are three main sources for the GDP growth in Germany, the European scenario, as well as two national (BVWP) sources dated in 2007 and 2013 respectively. The 2007 study indicated a 1.7% average annual growth, however without including the effects of the crisis. The follow-up study in 2013 projected the growth to be up to 2030 1.14% pa. This value is fairly consistent with the 1% pa growth from the European scenario.

Most of the sectors are expected to demonstrate a moderate growth by 2030. The industry (engineering, metals and chemicals) together with the market services anticipate the highest growths based on both the European, as well as the BVWP (2007) scenarios. These are within the range of 1.2% to 1.9% annually.

Greece

Greece was significantly impacted by the international economic crisis. In accordance with the 2011 Census results published by the Hellenic Statistical Authority, the number of inhabitants decreased by approximately 1.34% within the decade, while Eurostat data depict a continuous population decline for years 2012-2014. A highly negative annual growth in GDP (ranging 5-7%)was also recorded in the same period by both national sources and Eurostat database. 80% of gross value added is generated by the services sector, the industry sector is relatively small with a share of 16%.

For Greece the annual growth rate for GDP is expected to be 0.5% by 2030, while it is expected to increase in total by 1.4% by 2050 according to European projections. Similarly, the population of Greece is expected to grow in the years up to 2030 with an annual growth rate of approximately 0.1%.

Hungary

The population of Hungary shows a small negative growth, and the GDP showed positive figures for 2010 and 2011, but a negative growth in 2012. 65% of gross value added is generated by the services sector, while the industry has a considerable share of 31%.

Hungary's National Transport Strategy, responsibility of the Hungarian Transport Administration, summarizes the relative trends. The document uses global sources of EU reference scenario, NSO, and calculations of the consortium. GDP is expected to grow around 1% up to 2030. The 2020-2030 will see the highest growth. According to European projections, the annual growth rate is 1.67% until 2030.

The population of Hungary is expected to decline slowly in the years up to 2030 with an annual growth rate of about -0.15% (according to the European projection). Population is expected to decrease by 0.25 % per annum according to the national source.

Romania

The number of inhabitants of Romania decreased strongly over the last few years. GDP, however, shows a small growth. The services sector has a relatively small share of 50% of gross value added; the industry sector is large with a share of 43%.

For Romania, the annual growth rate for GDP is expected to be about 3% up to 2030 according to the national source. According to European projections, until 2030 the annual growth is expected to be 2.1%.

The population of Romania is according to European projections expected to decline in the years up to 2030 with an annual growth rate of about -0.3%. A similar reduction is reported by the national source.

Slovakia

Although the population of Slovakia shows a small decrease over the last few years, the GDP grew significantly. 60% of gross value added is generated by the services sector and 36% by the industry.

For Slovakia, the annual growth rate for GDP is expected to be about 2.6% until 2030 according to the European projections.

The population of Slovakia is expected to grow in the years up to 2030 with an annual growth rate of about 0.18% according to European projections. 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 statistical office 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 Slovak Republic.

Summary

The table below summarises the macroeconomic findings for the OEM Corridor countries for the different sources available.

Table 46: Population and GDP growth rates until 2030

Country	Average annual population growth (2010-2030)	Average annual GDP growth (2010-2030)
Austria	0.23% - 0.36%	1.7% – 1.9%
Bulgaria	(-0.72%) – (-0.55%)	2.0% - 3.3%
Czech Republic	0.14% - 0,23%	2.2%
Cyprus	1.1%	1.8%
Germany	(-0.31%) - (-0.17%)	1.0% - 1.14%
Greece	0.1%	0.5%
Hungary	(-0.25%) - (-0.15%)	1.0% - 1.67%
Romania	-0.3%	2.1% - 3.0%
Slovakia	0.18%	2.6%

In the figures below the (maximal) average annual growth rates from table 36 are visualized. For four countries a decrease of the population is expected in the period 2010 - 2030, all countries expect an increase in GDP for this period.

Figure 39: Average annual population growth (2010-2030)

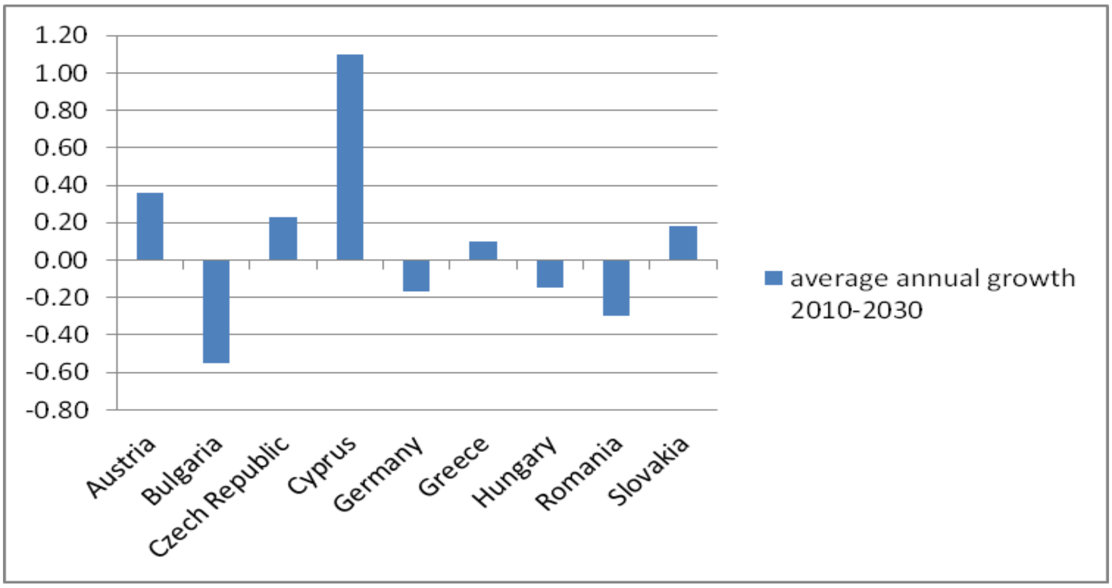
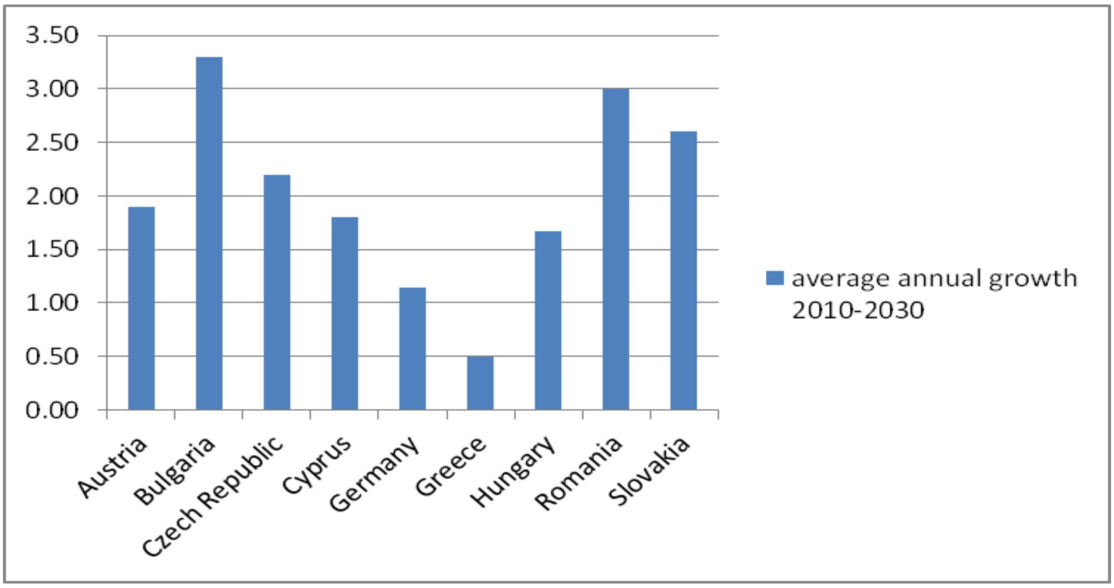


Figure 40: Average annual GDP growth (2010-2030)



5.3.5 The national transport volumes and demand scenarios

This section presents the present volumes and future demand scenarios developed by national models for each of the Corridor countries. These scenarios describe the prospect of transport demand for a certain time horizon (e.g. 2030), based on a set of macroeconomic and policy assumptions. The volumes of the latest base year, whereupon the forecasts are based, are also presented in this section. Each country is analysed separately in the following.

It should be noted that the total national transport volumes of the entire OEM countries are presented in this section. With these figures it is not possible to identify specifically the corridor, as this will be dealt with in the following section. In the figures presented in this section, there is neither a relation with other corridor countries, nor a specific subset of the corridor.

The purpose of this section is to present the national available transport figures and forecasts, if available, on a national level. These will serve as a benchmark for the detailed figures that will be presented for the OEM corridor in following sections.

5.3.5.1 Austria

The Austrian Ministry of Transport published a Traffic and Transport Forecast for the years up to 2025 in 2009. Two possible scenarios were analysed in this study. Scenario 1 assumes that general developments remain the same, whereas for scenario 2, there are assumptions that measures are taken in the field of infrastructure and development of traffic and transport, but that on the other hand the increases in traffic and transport are limited due to political measures, amongst others. The figures in this report are given for scenario 1.

Table 47 presents the forecasts for domestic freight movements, import/export freight movements and transit freight movements, for the years 2005 and 2025, and for road freight transport, rail and inland waterways, in tonnes. Notably, the transit transport is one of the faster growing segments in Austria.

Table 47: Forecast of freight movements in Austria (2005, 2025); in mln tonnes

Forecast of domestic freight movement (mln. Ton)			
	2005	**2025**	**2005 → 2025 in %**
Road	299.61	365.45	+22.0%
Rail	25.09	30.22	+20.4%
Inland waterway	0,56	0,67	+19.6%
Total	325,26	396.34	+21.9%
Forecast of import/export freight movement (mln. ton)			
	2005	2025	2005 → 2025 in %
Road	78.13	109.96	+40.7%
Rail	43.02	65.22	+51.6%
Inland waterway	9.54	14.39	+50.8%
Total	130.69	189.57	+45.1%
Forecast of transit freight movement (mln. ton)			
	2005	**2025**	**2005 → 2025 in %**
Road	56.49	108.30	+91.7%
Rail	22.70	46.89	+106.6%
Inland waterway	4.79	7.45	+55.6%
Total	83.98	162.64	+93.7%

5.3.5.2 Bulgaria

The Bulgarian General Transport Master Plan was commissioned by the Ministry of Transport in May 2008. The main objective of the Master Plan is the establishment of a strategic and coherent base of technical data, transport models and multimodal technical studies for long and medium term investment programming in the transport sector in Bulgaria.

On the basis of a number of assumptions and with 2008 as a base year, predictions are provided on a number of subjects for the period up to 2030. Table 48 gives the forecasts for domestic freight movements, import/export freight movements and trans freight movements, for the years 2008 and 2030, and for road freight transport, rail and inland waterways, in terms of 'lorry equivalents'.

Table 48: Forecast of freight movements in Bulgaria (2008; 2030); in lorry equivalents

Forecast of domestic freight movement (lorry equivalents)			
	2008	**2030**	**2008 → 2030 in %**
Road	21,423,333	38,266,625	+78.6%
Rail	2,103,905	3,508,798	+66.8%
Inland waterway	60,247	162,891	+170.4%
Total	23,587,485	41,938,314	+77.8%
Forecast of import/export freight movement (lorry equivalents)			
	2008	**2030**	**2008 → 2030 in %**
Road	1,915,226	3,315,112	+73.1%
Rail	806,907	1,794,614	+133.6%
Inland waterway	1,223,940	1,884,671	+54.0%
Total	3,946,073	6,994,397	+77.2%
Forecast of transit freight movement (lorry equivalents)			
	2008	**2030**	**2008 → 2030 in %**
Road	213,631	499,370	+133.8%
Rail	302,939	916,731	+202.6%
Inland waterway	5,130	6,732	+31.2%
Total	521,700	1,422,833	+172.7%

Recently, the Transport Master Plan was updated, with an intermediate year 2020 shown in the table. It can be seen that the period from 2011-2020 is a period that is anticipated to show a lower growth than that of the 2020-2030 period.

Table 49: Forecast of freight movements in Bulgaria (2011, 2020, 2030); in mln tonnes

mln tons	2011			2020			2030		
	Road	Rail	Rail share	Road	Rail	Rail share	Road	Rail	Rail share
Domestic	104.7	11.9	10.3%	127.3	13.9	9.8%	172.8	16.6	8.8%
International:	46.5	3.5	7.2%	56.2	4.8	7.8%	74.1	7.2	8.8%
Import	21.1	1.0	4.3%	25.9	1.3	4.8%	34.7	1.9	5.3%
Export	17.1	1.2	6.5%	21.9	1.6	6.7%	31.1	2.6	7.8%
Transit	8.3	1.4	14.8%	8.3	1.9	18.5%	8.3	2.6	24.3%

In both forecasts for Bulgaria, it can be noted that the rail freight transport is expected to grow in the international segment.

5.3.5.3 Czech Republic

The Czech Ministry of Transport published the National Transport Sector Strategy in 2013. This strategic document mainly dealt with the identification of transport infrastructure measures, but also contained freight transport forecasts for the years up to 2050. In this study, developments are given for railway, road transport and inland waterways for 3 scenarios ("high", "trend" and "low"), and for inland and international transport volumes together (excluding transit). No separate figures for inland and international transport are given. The percentages are based on tonne-km. The table below presents the figures for the scenario "trend".

Table 50: Czech Republic: Forecast of freight movements; in mln tonne-km

Transport Mode	2010	2010	2020	2035	2050
Railway	13,770	100%	123%	133%	146%
Road	51,832	100%	128%	166%	174%
IWT	679	100%	170%	215%	234%
Total	66,281	100%	127%	160%	169%

Source: Transport sector strategies 2nd phase, OPD

5.3.5.4 Cyprus

In Cyprus no figures on forecasts for freight transport are available. The Statistical Service of Cyprus delivers figures on road freight transport, which are presented in the tables below.

Table 51: Cyprus: Road transport according to load capacity of the vehicle and type of transport (2013)

Vehicle load capacity	Hire or reward		Own account		Total	
	mln ton	mln ton-km	mln ton	mln ton-km	mln ton	mln ton-km
Road tractor	4.7	259	2.7	158	7.4	418
Rigid 3.0 –9.9 t	0.1	5	2.5	69	2.6	75
Rigid 10-14.9 t	0.1	4	1.1	27	1.2	31
Rigid >15.0 t	2.2	46	2.7	47	4.9	92
Total	**7.1**	**315**	**8.9**	**303**	**16.0**	**618**

Table 52: Cyprus: International road transport according to gross vehicle weight and type of transport (2013)

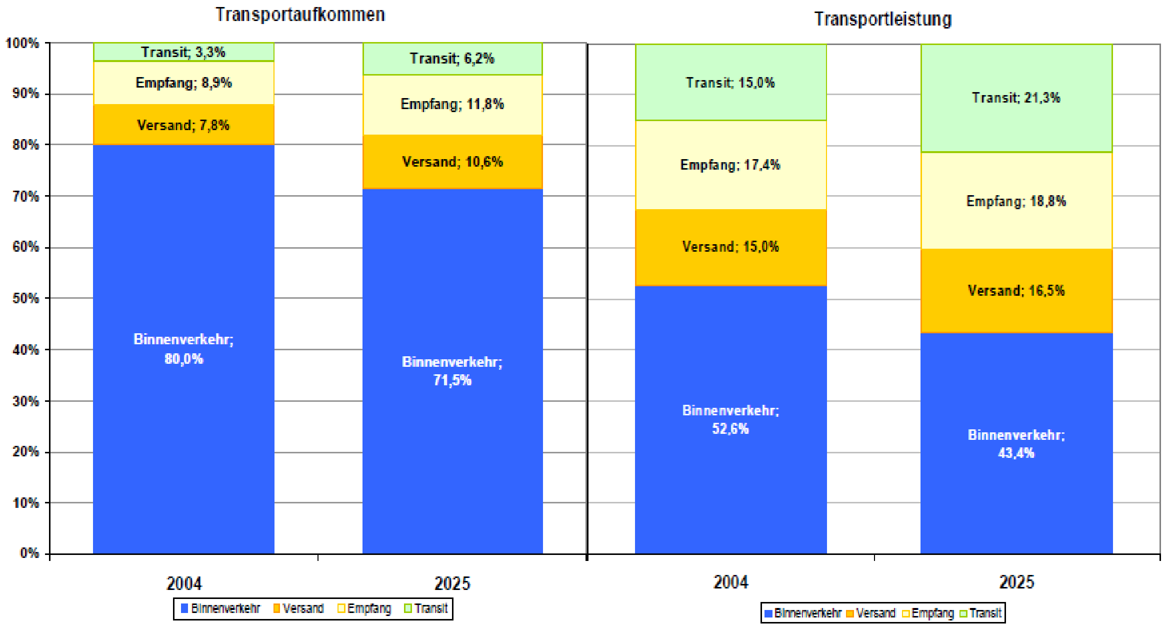
Gross vehicle weight	Hire or reward		Own account		Total	
	1000 ton	1000 ton-km	1000 ton	1000 ton-km	1000 ton	1000 ton-km
25 tonnes and over	22.5	16,349	0.0	0.0	22.5	16,349
Total	**22.5**	**16,349**	**0.0**	**0.0**	**22.5**	**16,349**

5.3.5.5 Germany

The ITP and BVU conducted in 2007 (BVWP, 2007) the study for the forecast of the transport flows up to 2025 on behalf of the Ministry of Transport and Infrastructure. This study provided detailed results for the projection of passenger and transport flows with 2004 as the base year, based on the socioeconomic assumptions presented in the previous section and a set of policies, including all expected infrastructural developments (as defined in the year of the study).

Based on the 2004 values, road is the dominant mode for freight transport with 1.45 billion tonnes (72.2% of the total transport), followed by rail with 0.32 billion tonnes (16%) and inland waterways with 0.24 billion tonnes (11.7%). By 2025, the national estimations expect the road share to increase by on average 2% annually, reaching a share of almost 76%. Rail follows a comparable trend, however, with a lower growth of 1.4% p.a. and 14.5% for modal split. Both road and rail in this forecasting draw demand from inland waterways, which grows by 0.9% p.a. and by 2025 will have a share of 9.5%. The same trend is also observed for freight performance measured in ton-km.

Figure 41: The market structure for Germany



Source: BVWP (2007)

The BVWP forecast also provides insight into the market characteristics (see Figure 41) in terms of tonnes (left-side) and ton-km (right-side). These graphs show that the domestic transport (in tonnes) occupies 80% of the total, leaving 16.6% for imports and exports and 3.3% in transit. By 2025, it is expected that the share of imports and exports, as well as transit will increase. In ton-km, domestic figures demonstrate much lower values due to the shorter distances. Nonetheless, it follows a decreasing trend.

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 period, reaching the 353 km, as well as for road, which is expected to reach the 300 km (increasing 19%).

In 2014, ITP and BVU conducted an updated version for the prognosis of the transport flows up to 2030 with 2010 as the base year. Based on the 2010 values, road is the dominant mode for freight transport with 3.12 billion tonnes (84.1% of the total transport), followed by rail with 0.36 billion tonnes (9.7%) and inland waterways with 0.23 billion tonnes (6.2%). By 2030, the national estimations expect the road to increase by on average 0.8% annually, reaching the share of 83.5%. Rail follows a comparable trend, however, with a higher growth of 1.1% annually and 10.2% of the modal split. Inland waterways grow by 0.9% annually and by 2030 have a share of 6.3%. The same trend is also observed for freight performance measured in ton-km.

The forecast also provides insight into the market characteristics in terms of tonnes and ton-km. Domestic transport (in tonnes) occupies 78.7% of the total, leaving 17.0% for imports and exports and 4.3% in transit. By 2030, it is expected that a larger share (20.5%) of the market will turn to imports and exports, as well as transit. In ton-km, domestic demonstrates much lower values due to the distance factor. Nonetheless, it also follows a decreasing trend.
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 15.6% within the 2010-2030 time period, reaching the 347 km. Road is also expected to increase strongly to reach 167 km (increasing by 18,9%). The increase for inland waterways is much less (increasing by 2.3% to 277 km). For general figures on freight transport, statistical information from the EU can be used (Statistical Pocketbook "EU Transport in Figures", version 2014). The table below presents performance figures (ton-km) up to 2012, which is the latest figure available.

Table 53: Germany: Freight movements in Germany; in bln ton-km

Performance of freight transport (in billion ton-km)				
Transport mode	**2010**	**2011**	**2012**	**Share in % (2012)**
Road – national	252.5	265.0	254.5	53.5%
Road – international	60.6	58.8	52.5	11.0%
Rail	107.3	113.3	110.1	23.2%
IWT	62.3	55.0	58.5	12.3%
Total	**482.7**	**492.1**	**475.6**	**100.0%**

5.3.5.6 Greece

In Greece, no figures on forecasts of freight transport demand are currently available. In this case, it is assumed that the freight demand volume growth would be equal to the country's GDP growth.
The Ministry of Infrastructure, Transport and Networks is, however, planning to issue a tender for the elaboration of an appropriate model to forecast freight demand. presents the latest statistical figures for road freight transport in thousand tonnes (source: Hellenic Statistical Authority). Additional figures are obtained from the Eurostat database with regard to rail and maritime transport, but for the years up to

2010. All available data provide evidence of the severe impact of the economic crisis in Greece.
The high volume of road transport observed is explained by own account transport and concerning the transport of building materials over short distances, which is of limited importance for the corridor traffic analysis. Hence, this type of transport flow will not be taken into consideration.

Table 54: Greece: Freight movements; in mln tonnes

Road (in mln ton)	**2009**	**2010**	**2011**	**2012**
professional				
national			89.6	107.2
international			3.9	6.3
own account				
national			411.8	286.5
Total	**n.a.**	**n.a.**	**505.3**	**400.1**

Maritime (in mln ton)	**2009**	**2010**	**2011**	**2012**
			123.53	129.81

Source: Hellenic Statistical Authority

Freight Movement (in mln ton)	**2009**	**2010**	**2011**	**2012**
Railway	5.5	3.9	**n.a.**	**n.a.**
Maritime	135.4	124.4	**n.a.**	**n.a.**

Source: EUROSTAT

5.3.5.7 Hungary

In Hungary, the National Technology Platform for Road Transport developed “Vision 2030” in 2009 with respect to the transport development. The main objective of the report was to look at the infrastructure of Hungary. The report provides volumes on freight transport by road, rail and inland waterways, but these figures are being reproduced from EU-reports, i.e. the report ‘Trends to 2030, update 2007’. The figures are given in the table below.

Table 55: Hungary: Estimated development of performances in goods transport towards 2030; in bln ton-km

in bln ton-km	**2010**	**2015**	**2020**	**2025**	**2030**
Road (public)	30.9	36.4	41.3	45.5	48.4
Rail	8.8	9.1	9.4	9.7	10.1
IWT	2.4	2.7	2.9	3.2	3.3
Total	**42.1**	**48.2**	**53.6**	**58.4**	**61.8**

For road transport, the division between national and international transport is: 86% is domestic transport, 14% is international transport. For rail transport, the share of international transport between inland, export, import and transit is higher than for road transport, as can be observed in the table below.

Table 56: Hungary: Shares of railway transport categories

Railway category	**%**
Inland	25%
Export	26%
Import	28%
Transit	21%
Total	**100%**

5.3.5.8 Romania

In 2014, the Romanian Ministry of Transport published a "General Master Plan for the Transport Sector in Romania". In this publication forecasts for freight transport are given for road, rail and inland waterways for the period 2011-2020, but no separate figures for inland, international and transit transport are foreseen. Table 57 below presents the figures.

Table 57: Romania: Estimated development of freight transport towards 2020; in mln tonnes

Transport mode (in mln ton)	**2010**	**2011**	**2020**	**2011 → 2020 in %**
Road	174.6	183.6	239.6	+30.5%
Rail	52.9	60.7	67.8	+11.6%
IWT	32.1	29.4	36.3	+23.4%
Total	**259.6**	**273.7**	**343.7**	**+25.6%**

For general figures on freight transport, statistical information, as supplied by the EC (Statistical Pocketbook "EU Transport in Figures", version 2014), can be used. Table 58 below presents performance figures (in bln ton-km) up to 2012, which are the latest figures available.

Table 58: Romania: Performance of freight transport; in bln ton-km

Freight Transport Performance (in bln ton-km)	**2010**	**2011**	**2012**	**Share in % (2012)**
Road – national	12.1	11.9	12.7	22.8%
Road – international	13.8	14.5	17.0	30.5%
Rail	12.4	14.7	13.5	24.2%
IWT	14.3	11.4	12.5	22.5%
Total	**52.6**	**52.5**	**55.7**	**100%**

5.3.5.9 Slovakia

Although a Strategic Development Plan of Transport Infrastructure of the Slovakian Republic by 2020 exists, no exact figures are published on forecasts for freight transport; only qualitative indications are given. For this report, statistical figures on freight transport by rail, road and inland waterways for the period 2010-2012 are presented. The figures for road transport exclude international cabotage.

Table 59: Slovakia: Domestic freight movements; in mln. Tonnes

Domestic freight movement (in mln ton)			
	2010	**2011**	**2012**
Road	112.205	98.983	94.713
Rail	6.409	7.010	6.356
IWT	0.071	0.058	0.038
Total	118.685	106.051	101.107
Import/export freight movement (in mln ton)			
	2010	**2011**	**2012**
Road	18.507	20.052	19.862
Rail	28.308	26.232	24.987
IWT	2.594	1.793	1.690
Total	49.409	48.077	46.539
Transit freight movement (in mln ton)			
	2010	**2011**	**2012**
Road	9.819	10.711	13.545
Rail	9.610	10.469	11.256
IWT	0.444	0.603	0.744
Total	19.873	21.783	25.545

For some general figures on freight transport, statistical information from the EU can be used (Statistical Pocketbook "EU Transport in Figures", version 2014). Table 60 below presents the performance figures up to 2012, which are the latest figures available.

Table 60: Slovakia: Performance of freight transport; in bln ton-km

in bln ton-km	2010	2011	2012	Share in %
Road – national	5.2	4.9	5.1	13.3%
Road –	22.4	24.3	24.6	64.2%
Rail	8.1	8.0	7.6	19.8%
Inland waterways	1.2	0.9	1.0	2.7%
Total	**36.9**	**38.1**	**38.3**	**100%**

5.3.5.10 Conclusion

Lack of regional forecasts

National forecasts and national transport figures have been described in this section, as these were available through the project sources, as well as official national sources from the corridor countries. One of the main conclusions is that forecasts, if available, are on a regional level within the country considered (for example Austria, Germany, Bulgaria), but lack the regional detail in other countries. If forecasts are available, then in most cases no regional detail is available, at best a differentiation is obtained between domestic, import/export and transit traffic. But again, on the basis of that information, the OEM corridor cannot be isolated from other corridors.

Scenarios

Also, it should be noted that there is no uniform scenario used in case of forecasts being available. At best, the scenarios of the German Bundesverkehrswegeplan in the Austrian Verkehrsprognose Österreich 2025+ are taken into account. But in this case the timing is different; the Austrian plan was developed in 2009. The German plan originates in 2007 and will be updated in the near future. For a number of countries, forecasts are either not available or given in qualitative figures.

Prerequisites for Corridor Forecasts

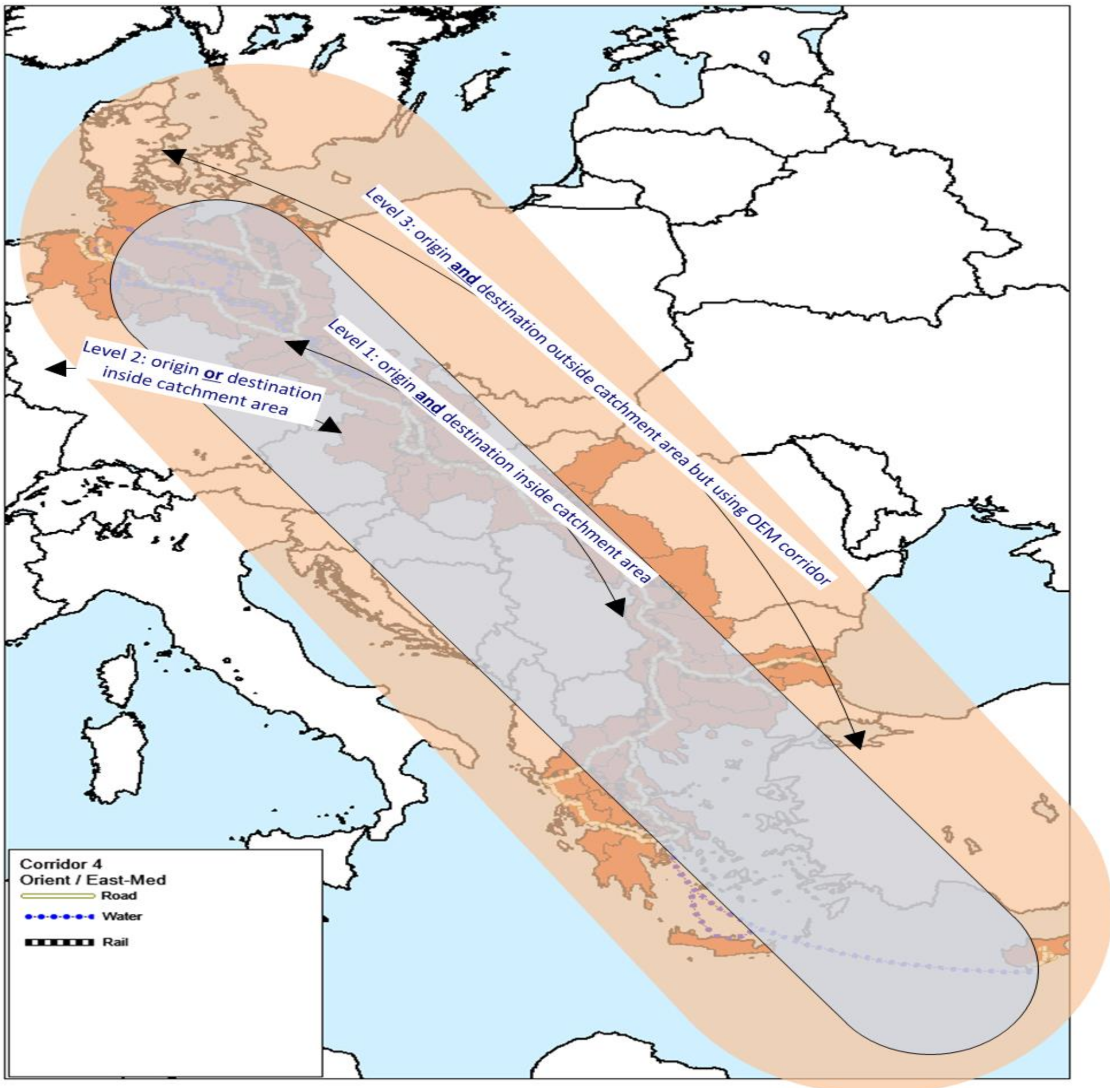
In order to address these shortcomings, integrated information is needed that refers to all the OEM corridor countries at the same level and preferably on a regional level. The regional level is an essential prerequisite in order to define the transport flows on the corridor. Taking the transport flows from country to country would mean for example that flows from Germany to Romania are analysed in total, so there would be overlap and "double counting" in the analysis for the OEM corridor. This double counting is in that particular case also valid for the Rhine-Danube corridor.

Levels of Corridor Traffic

It should also be mentioned that a distinction is to be made between domestic transport, import and export and transit transport. Domestic transport is transport within the corridor regions within an OEM country, import and export within the corridor is international transport between the regions of the different OEM countries. The total imports and exports within the corridor are similar, i.e. what is exported from one country is imported by the other, as it is a closed system. Consequently, imports will not be added to exports to avoid double counting. *For this traffic, the origin and destination are inside the corridor catchment area.* This is termed the **first level of corridor traffic**.

It is different when the transport flows with regions outside the corridor are considered, whereby the import and export to regions outside the corridor are necessarily a different item. For example, the road transport from the Czech Republic to Sweden, or from Holland to Romania, is using the corridor as well. In the present analysis, this is termed import and export to regions outside the corridor. *Either the origin or the destination has to be inside the corridor catchment area for this type of transport.* This is termed the **second level of corridor traffic**.

Figure 42: Schematic overview of the three levels of corridor transport flows



Source: Consortium

From a corridor perspective, the definition of transit is also important. The transit reported by a country is different from the corridor perspective. The transit for Hungary for example from the Czech Republic to Romania is passing through the corridor, but this is already accounted for in the first level of corridor traffic, if the catchment area of the corridor is considered. However, if it is outside the catchment area but using the corridor, it should be included. This is termed transit traffic, which is the **third level of corridor traffic**. *The origin and the destination are outside the catchment area, but traffic is using the corridor.*

Figure 42 presents schematically these three levels of corridor flows.

Use of existing data

The PP22 study results (as described under section 3.3), based on ETISplus and refined with country information collected in the PP22 project, are used as the basis for describing the corridor on the above these 3 levels. The advantage is that it covers the regions for the different transport modes and that it comprises different commodity groups.

The next section 5.3.6 describes the first level of transport for the base year, that is, the transport within the catchment area of the corridor.

5.3.6 Transport description of the OEM corridor in 2010

The transport description covers both the passenger and freight transport. For this report, the Consortium focused on data that were available from sources of previous studies. The data base year is 2010. For a detailed description it is referred to Annex 4, a description of the methodology and the use of databases is given there.

It can be stated that ETIS-BASE covers comprehensive data for passenger and freight that is derived from Eurostat and national sources. In this section the transport flows are described for 2010 which is the base year of the Priority Project 22.

Also, NUTS2 level is the lowest geographic level (giving the highest level of detail) for describing transport flows on regional level. As well as for freight and passenger description, the NUTS2 regions are used; the regional transport description is not available on NUTS3 level.

It should be stated that in this section the intra-corridor flows are described. That means that passenger and transport flows that are taking place within the catchment area of the corridor (see figure 20). In order to derive the transport flows in the catchment area a regional transport database is needed. If only on total country figures is relied, then, for example, the transport flows from the complete country of Germany towards Hungary is taken. If total country volumes of transport were taken for the analysis then an overlap with the Rhine-Danube Corridor would emerge. For that reason it is important that a definition of transport flows according to the catchment area is followed.

5.3.6.1 Freight transport description of intra-corridor transport flows

This section describes the freight transport performance of the OEM corridor, based on ETIS-BASE and, partly derived from the PP22 study (cf. Annex 7). In the PP22 study, the data for rail and road freight were already checked on consistency with national figures and other studies.

The following principles were applied:

- The transport volume is measured in tonnes.
- The flows will be first described for the year 2010. The year 2010 is well established as the effect of the crisis has faded out in 2008 and 2009 in most countries, thereby giving a more stable basis for forecasting.
- a strict definition of the corridor is used, i.e. any corridor infrastructure must physically pass through the NUTS 2 region ("OEM Region"). This is assigned as the first level of corridor traffic.

The following notes are added:

- Since only a part of Germany belongs to the OEM corridor, the German induced OEM-related traffic is considerably smaller than the national figure; the same applies to other countries accordingly.
- For inland waterways, the regions in Germany and the Czech Republic were included. In the OEM corridor this is covered by the rivers Elbe, Vltava, Weser and the Mittellandkanal.

The tables below present the transport volumes between the OEM regions per each OEM country.

Table 61: Road freight transport volume between the OEM regions grouped by states (2010); in 1,000 tonnes

in 1,000 ton	Austria	Bul-garia	Cyp-rus	Czech Rep.	Ger-many	Greece	Hun-gary	Ro-mania	Slo-vakia	Total
Austria	91,209	13	0	617	1,129	24	837	22	517	94,369
Bulgaria	45	77,103	0	18	87	644	100	59	5	78,062
Cyprus	0	0	32,216	0	0	13	0	0	0	32,229
Czech Rep.	888	49	0	189,362	3,089	18	590	36	2,864	196,897
Germany	1,541	26	0	2,639	605,510	65	830	78	390	611,080
Greece	32	778	7	44	18	507,714	34	60	30	508,719
Hungary	1,161	70	0	513	628	19	154,535	426	1,342	158,694
Romania	17	69	0	11	46	23	450	28,713	5	29,334
Slovakia	653	7	0	2,603	340	29	1,643	28	55,783	61,086
Total	95,546	78,115	32,223	195,806	610,848	508,538	159,021	29,422	60,937	1,770,455

Source: ETISBASE

Note for tables Table 61 and Table 62:
The tables are to be read as origin/destination tables, thus transport from corridor regions in one country to corridor regions in another country. The diagonal corresponds to the domestic transport among the corridor regions within a country.

For road transport, it should be noted that it includes also the short distance transport. A large fraction, about 60%, of road freight transport is on short distances. This is the transport flow within the region (intra-regional transport), that is dominated by transport of building materials and urban transport (final products and foodstuffs). These transport flows use the infrastructure, but are not in competition with the rail freight transport.

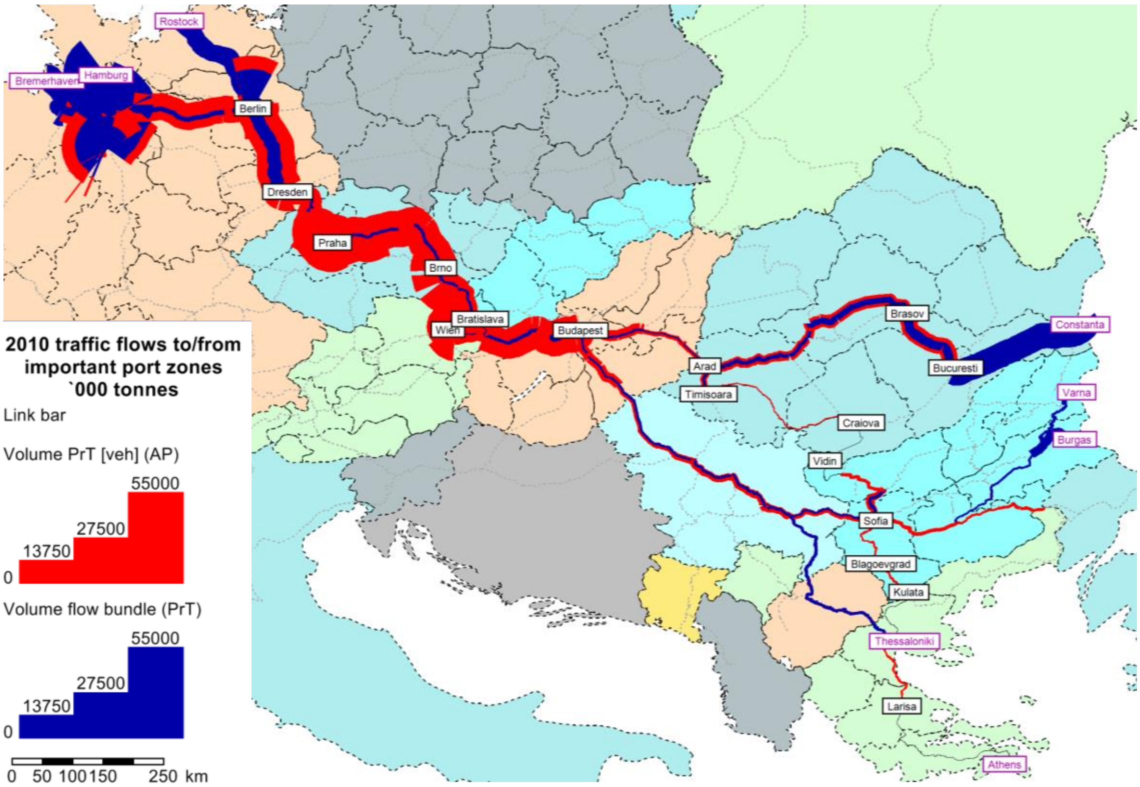
Table 62: Rail freight transport volume between the OEM regions grouped by states (2010); in 1,000 tonnes

in 1,000 ton	Austria	Bul-garia	Czech Rep.	Ger-many	Greece	Hun-gary	Ro-mania	Slo-vakia	Total
Austria	14,863	31	533	2,972	378	1,878	98	169	20,922
Bulgaria	2	12,505	4	3	291	5	113	2	12,926
Czech Rep.	3,870	39	26,981	5,326	3	2,042	136	3,050	41,448
Germany	2,876	19	4,519	53,488	67	1,870	13	530	63,382
Greece	4	109	10	46	252	262	6	13	702
Hungary	2,281	37	546	948	268	7,272	1,002	448	12,802
Romania	38	361	8	11	12	507	22,927	4	23,867
Slovakia	1,499	14	2,875	1,081	8	954	103	3,408	9,942
Total	25,433	13,115	35,477	63,874	1,280	14,791	24,398	7,623	185,991

Source: ETISBASE

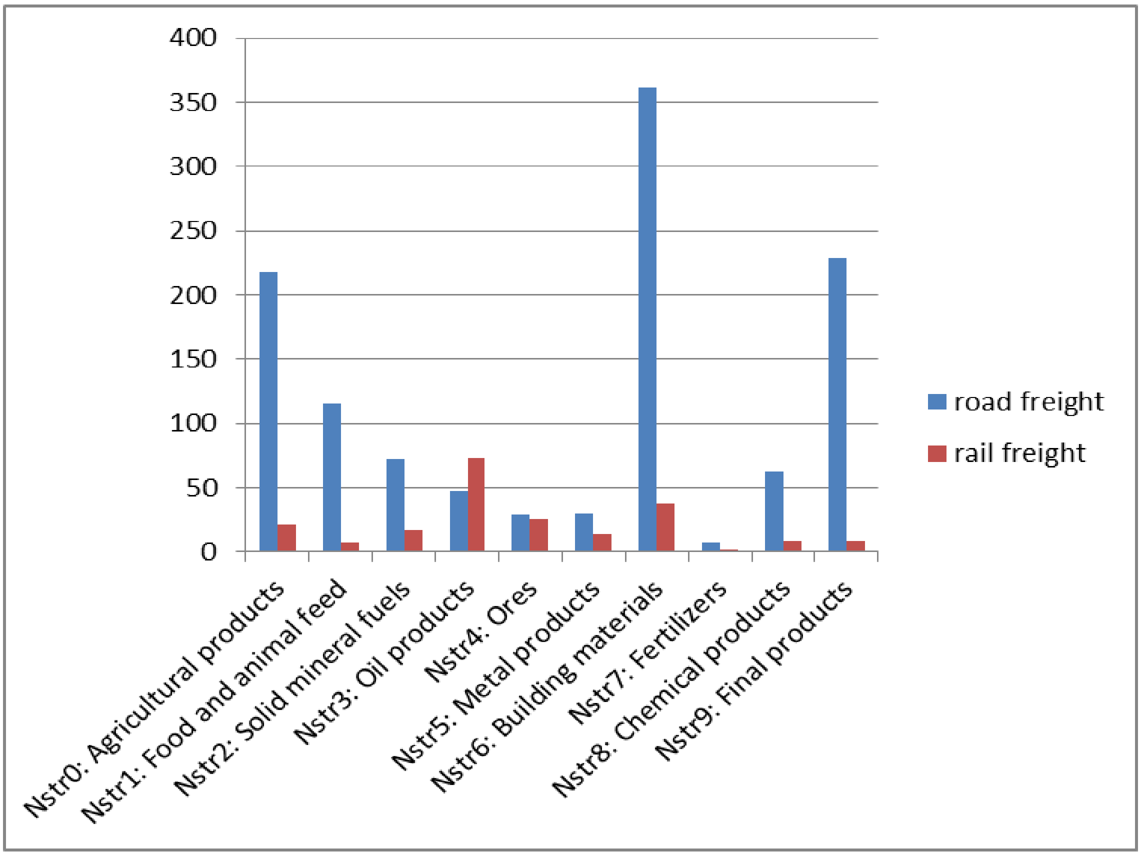
The rail traffic in the OEM corridor to and from the port zones in Northern Europe and the Black Sea is shown in the Figure 43 below, based on PP22 study results. The blue line indicates the share of the ports in total; the total rail freight traffic is indicated with the red line.

Figure 43: Rail freight transport on the OEM Corridor network with identification of port related railway traffic (2010); in 1.000 tonnes



Source: PP22 Study

Figure 44: Commodities transported within the corridor by rail and road freight transport (2010); in million tonnes



Source: ETISBASE

In addition to road and rail, inland waterway and maritime freight transport are also part of the OEM corridor, as shown in the following tables.

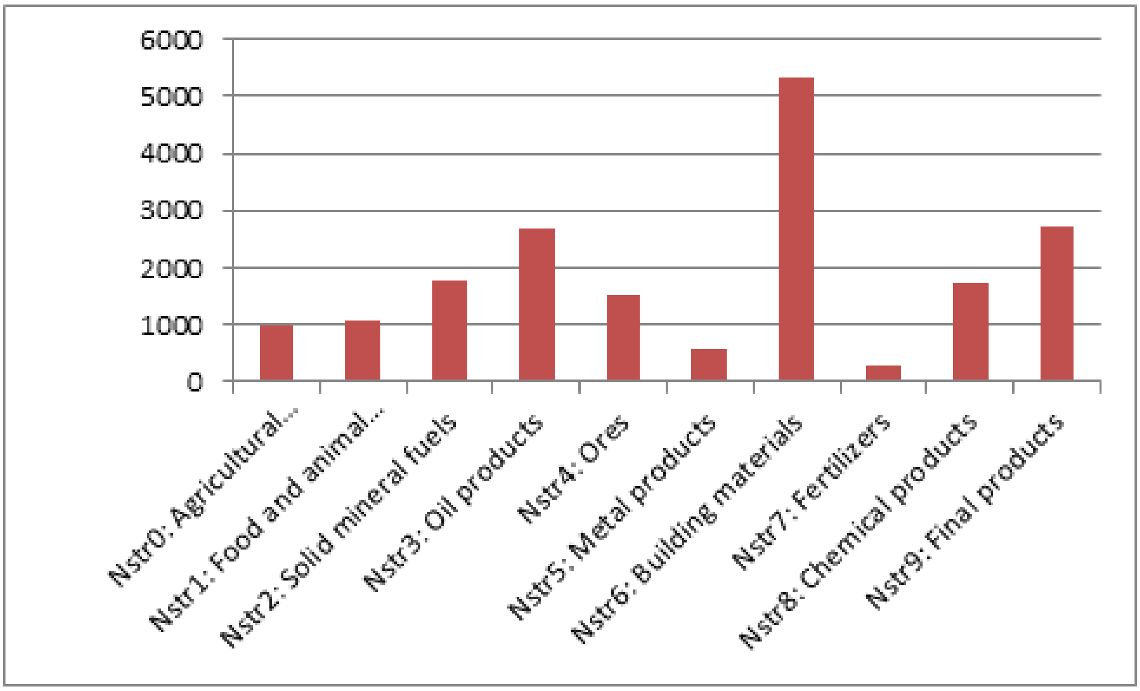
Table 63: IWW freight transport volume between the OEM regions grouped by states (2010); in 1,000 tonnes

in 1,000 ton	Czech Republic	Germany	Total
Czech Republic	370	212	582
Germany	64	18,048	18,112
Total	434	18,260	18,694

Source: ETIS-BASE

In Figure 45, the transported commodities by inland waterways are shown. With more than 5 million tonnes, building materials is the largest commodity.

Figure 45: Commodities transported within the corridor by inland waterways (2010); in 1,000 tonnes



Source: ETIS-BASE

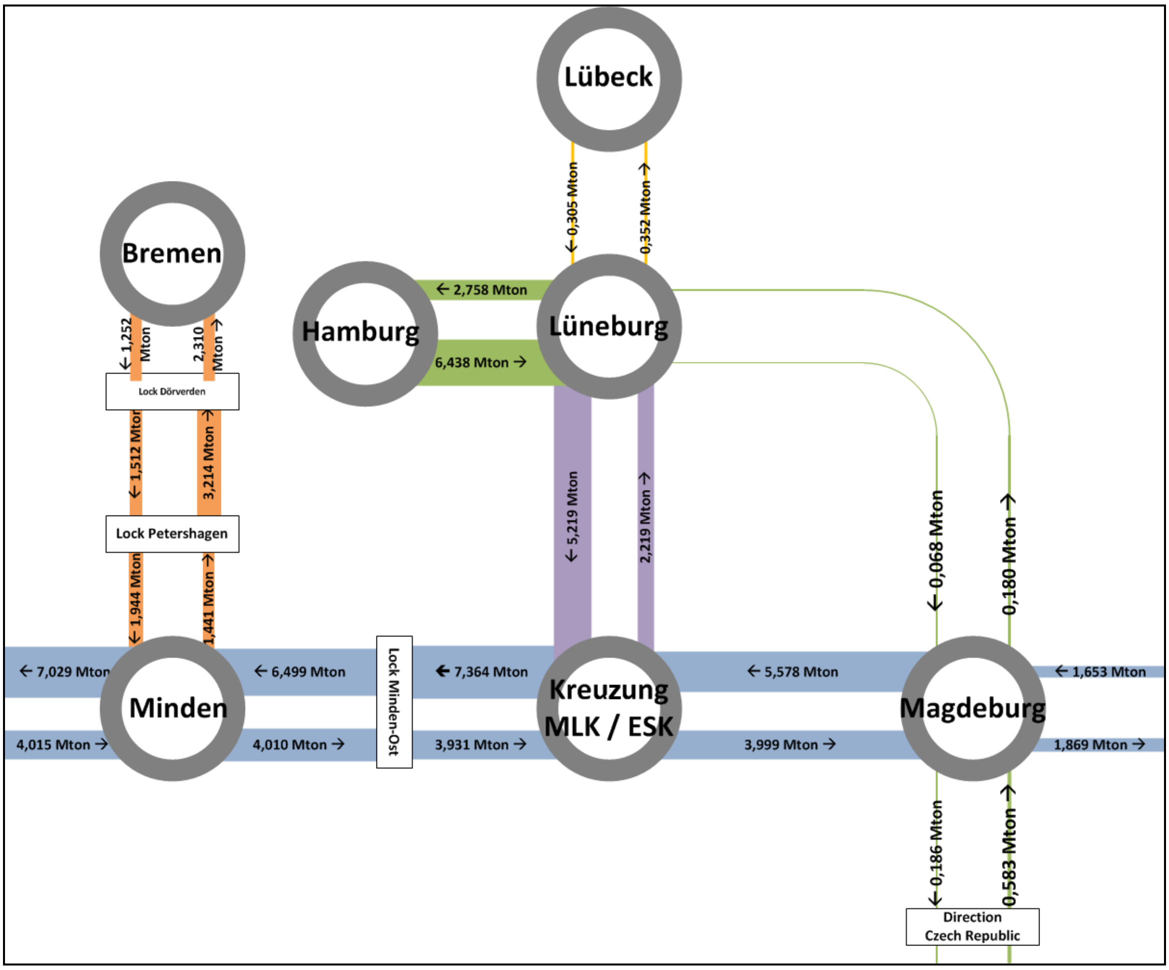
Figure 46 presents a schematic overview of the flows on the German / Czech inland waterway network. The inland waterway transport is shown in million tonnes for each stretch of the network linking the ports. The inland waterway transport flows of all levels of corridor transport are also presented.

The diagram shows the global transport flows on the IWW network of the corridor. It is clearly visible that the Mittellandkanal provides the backbone of the channel. The ports of Magdeburg, Bulstringen and Vahldorf provide high freight volumes in the direction of the Ruhr area. Furthermore, it should be noted that the port of Hamburg provides good IWW links with the urban areas of Hannover, Magdeburg and in the direction of Berlin. On contrary, the transport flows from Bremen are much smaller.
The busiest stretch on the Mittel-Weser IWW is in between the locks of Petershagen and Dörverden. Here, large sand and gravel pits provide cargo flows to the City of Bremen.

The Elbe IWW fails to provide high transport volumes in the Middle and upper stretch. Reasons for underutilization can be found in the low water levels on the Elbe River.

At numerous days of the year, the water levels on the Elbe drop below 1.65 metres, making commercial navigation nearly impossible. As a result, skippers prefer to sail over the parallel Elbe–Seitenkanal to service the industrial areas at Magdeburg and Berlin.

Figure 46: Transport on the inland waterway network on the OEM corridor in 2010; in million tonnes



Source: Consortium
Legend: MLK…Mittellandkanal, ESK … Elbe-Seitenkanal

The table below shows the maritime transport on the OEM corridor. As such, the strict definition is maintained. This means that maritime flows are given with origin and destination.

Table 64: Maritime freight transport volume between the OEM regions grouped by states (2010); in 1.000 tonnes

	Bulgaria	Cyprus	Germany	Greece	Total
Bulgaria	-	17	10	116	**142**
Cyprus	2	-	7	250	**259**
Germany	12	40	1,778	250	**2,079**
Greece	31	326	66	72,091	**72,514**
Total	**45**	**382**	**1,860**	**72,707**	**74,995**

Source: ETIS-BASE

5.3.6.2 Passenger transport description of intra-corridor flows

Information on passenger transport was derived from the PP22 study based on ETIS. It should be noted that only distances of more than 60 kilometres on average are included, except for the cases of border crossings. Therefore, the largest proportion related to commuter traffic is not included in for road and rail, respectively.

It should be noted that for road and rail transport we have used the strict corridor definition, the origin and destination of the trip are within the corridor "catchment area". For air transport we have selected the total passengers embarking and disembarking within the corridor "catchment area".

Table 65: Road passenger long distance transport volume between OEM regions grouped by states (2010); in 1,000 pax return trips

	Austria	Bul-garia	Czech Republic	Cyp-rus	Ger-many	Greece	Hun-gary	Ro-mania	Slo-vakia	Total
Austria	73,854	1	159	0	104	1	895	4	687	75,703
Bulgaria	12	49,734	9	0	12	228	49	176	10	50,229
Czech Republic	459	1	92,942	0	1,288	2	76	8	472	95,248
Cyprus	0	0	0	16,382	0	0	0	0	0	16,382
Germany	581	1	7,799	0	575,783	10	37	5	33	584,248
Greece	7	312	11	0	27	136,370	47	43	10	136,828
Hungary	701	4	63	0	74	3	82,787	443	449	84,524
Romania	14	76	15	0	25	11	296	25,213	13	25,665
Slovakia	2,503	3	347	0	59	1	229	6	27,872	31,020
Total	78,131	50,132	101,344	16,382	577,373	136,627	84,416	25,897	29,546	1,099,847

Source: ETIS-BASE

Table 66: Rail passenger long distance transport volume between the OEM regions grouped by states (2010); in 1,000 pax return trips

	Aus-tria	Bul-garia	Cyp-rus	Czech Republic	Ger-many	Greece	Hun-gary	Ro-mania	Slo-vakia	Total
Austria	3,470	2	0	16	25	1	179	1	18	3,713
Bulgaria	2	4,090	0	1	2	7	11	3	1	4,117
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	26	1	0	4,424	57	1	6	1	64	4,580
Germany	201	2	0	621	32,144	3	8	1	5	32,985
Greece	1	12	0	2	1	3,576	4	2	1	3,599
Hungary	95	1	0	8	11	2	13,918	42	36	14,112
Romania	2	1	0	1	1	3	30	1,586	1	1,625
Slovakia	49	3	0	11	5	1	14	1	1,941	2,026
Total	**3,847**	**4,111**	**0**	**5,083**	**32,247**	**3,594**	**14,170**	**1,636**	**2,068**	**66,757**

Source: ETIS-BASE

Table 67: Air passenger long distance transport volume in the OEM regions, grouped by Member States, 2008 - 2012; in 1.000 pax total embarked and disembarked

country/year	2008	2009	2010	2011	2012
Austria	19,687	18,045	19,617	21,106	22,196
Bulgaria	6,555	6,008	6,341	6,851	7,015
Cyprus	7,218	6,730	6,948	7,190	7,328
Czech Republic	13,118	12,098	11,997	12,404	11,497
Germany	54,822	52,253	54,898	57,648	58,912
Greece	49,694	48,169	46,501	47,140	45,046
Hungary	8429	8081	8175	8885	8430
Romania	693	860	1089	1005	928
Slovakia	2,789	2,049	1,922	1,841	1,592
Total	**136,763**	**130,240**	**131,530**	**136,113**	**133,733**

Source: Eurostat

Table 68: Maritime passenger long distance transport volume in the OEM regions grouped by states for the years 2008 till 2012; in 1.000 pax total embarked and disembarked

country/year	2008	2009	2010	2011	2012
Austria	-	-	-	-	-
Bulgaria	n.a.	n.a.	n.a.	n.a.	n.a.
Cyprus	n.a.	n.a.	n.a.	n.a.	n.a.
Czech Republic	-	-	-	-	-
Germany	11,810	11,449	11,734	11,133	10,965
Greece	45,222	43,867	42,130	39,140	20,418
Hungary	-	-	-	-	-
Romania	-	-	-	-	-
Slovakia	-	-	-	-	-
Total	**57,032**	**55,316**	**53,864**	**50,273**	**31,383**

Source: Eurostat (n.a. = not available)

5.3.6.3 Conclusion

The first level of corridor traffic, which represents transport flows within the catchment area, has been described for the base year 2010. For road freight transport, the short distance transport has been included in the tables above. This is one of the reasons why the volumes are relatively high. The short distance transport by road is jÚstífied by a high share of building materials, foodstuffs, agricultural products and final products. The latter concerns the last- or first mile transport related to long distance transport by rail or inland waterways, i.e. container transport.

While considering the modal split, it has to be carefully defined on which segments of transport are in the analysis. For example, on the short distance transport, there is limited competition of rail transport. For this reason, the long distance transport for road transport will be defined, i.e. the transport between regions (inter regional transport). In the next sections attention will be given which segments of transport are analysed.

5.3.7 Integrated freight transport demand scenarios

The previous section described the transport flows for the catchment area on the corridor, i.e. on the first level, with origin and destination inside the catchment. This section presents the second level and third level corridor flows. First, the rail freight transport is presented, followed by road freight transport. In section 5.3.7.5 the freight transport for inland waterways and maritime transport are presented.

For both road and rail freight transport the base year 2010 is presented and the forecast for 2030. These are based on the PP22 study. The PP22 uses the European reference scenario, as was presented in the socio economic section.
Also for inland waterways and maritime transport the forecasts are presented for 2030, based on 2010. These forecasts are, just as for rail and road, based on the European reference scenario. The advantage of this approach is that all countries are treated in a comparable way, having all the same base year 2010. The reference scenario does include the projects that are programmed and known to be finished by 2030. For the new projects an assessment is made whether the supply will be a bottleneck for the demand, this is carried out at the end of the MTMS analysis.

5.3.7.1 Rail transport corridor flows

Table 69 shows the rail transport related to the OEM corridor in 2010. The first 2 columns show the first level transport taking place within the catchment area of the corridor. The 3rd and 4th column show the second level: with origin or destination on the corridor.

Finally, the transit traffic on the corridor is shown in a separate row. This has origin and destination outside the catchment area. The total rail freight volume on the corridor is 244.485 million tonnes. The %-rows show that the share of this total for domestic transport is 59%, the share of international traffic within the corridor is 18%, the share of import and export to the outside corridor regions is in total 19%, while the share of transit transport is 3%.

Table 69: Rail transport volumes on OEM corridor (2010); in 1,000 tonnes

in 1,000 ton	**First level: corridor origin and destination within corridor**		**Second level: Origin or destination inside corridor**		
	Domestic	International	Import	Export	Total
Austria	14,863	10,570	1,843	1,917	29,193
Bulgaria	12,505	610	872	498	14,485
Czech Republic	26,981	8,495	4,076	3,405	42,958
Germany	53,488	10,376	10,724	13,211	87,798
Greece	3,982	1,028	63	392	5,464
Hungary	7,272	7,518	3,674	2,457	20,921
Romania	22,927	1,471	93	1,817	26,307
Slovakia	3,408	4,215	1,223	1,520	10,366
Total	**145,427**	**44,284**	**22,566**	**25,215**	**237,493**
%	59%	18%	9%	10%	97%
Third level: Transit					6,993
% transit					3%
Total (incl. transit)					**244,485**

In the Figure 46 below, the first level volumes for rail transport (see Table 69) are presented. In most countries domestic transport is dominant.

Figure 47: Rail volumes on first level OEM corridor traffic (2010); in million tonnes

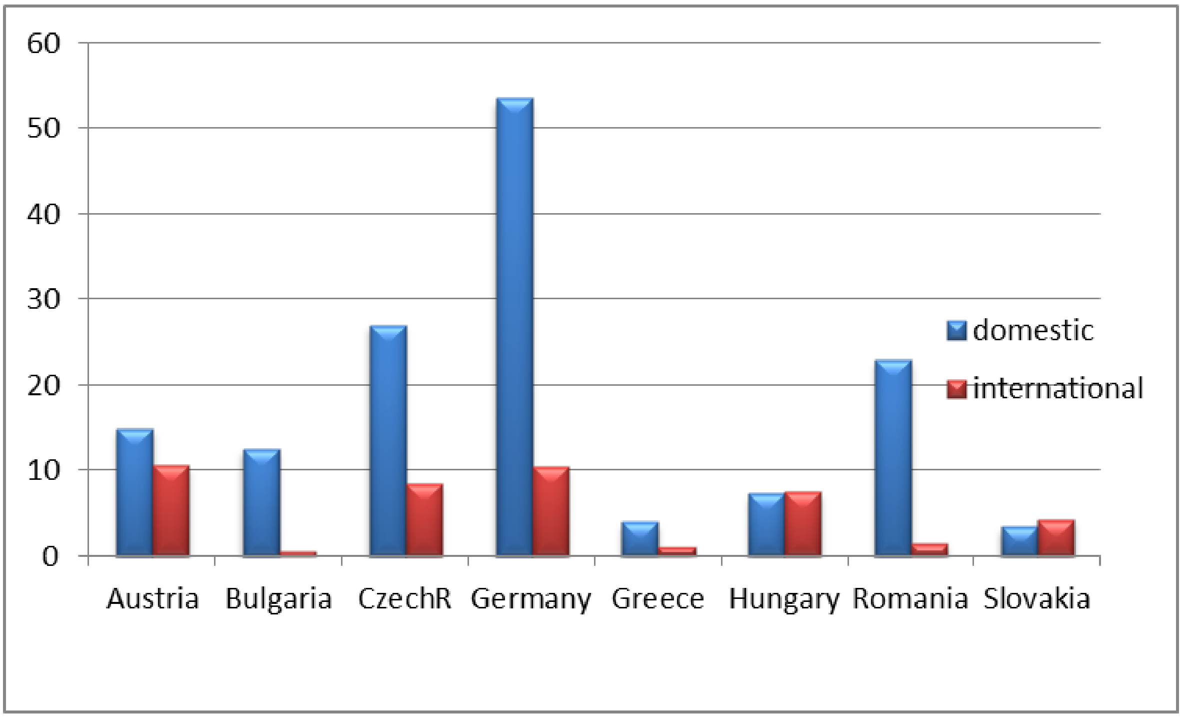


Table 70 shows the same figures for 2030. It is evident that the volume increases according to the reference scenario to 478.148 million tonnes. The share of domestic increases to 63%, the international traffic within the corridor decreases to 16%. The share of transport with outside regions (import, export and transit) decreases to 21%.

This is a result of policies aimed at promoting rail transport, which prove to be effective on a national level, especially in Germany and Austria. Some of the OEM countries have an orientation directed towards the corridor. Austrian OEM regions have a volume with other OEM regions of 14.970 mln tonnes.
The import and export of Austrian OEM regions to regions outside the corridor is 5.589 (=2.416+3.172) million tonnes. Along the same line of reasoning, the German OEM regions have a larger orientation towards regions outside the OEM corridor.

Table 70: Rail transport on OEM corridor (2030); in 1,000 tonnes

in 1,000 ton	**First level: corridor origin and destination within corridor**		**Second level: Origin or destination inside corridor**		
	Domestic	International	Import	Export	Total
Austria	20,683	14,970	2,416	3,172	41,242
Bulgaria	26,386	1,414	1,693	2,039	31,531
Czech Republic	57,587	17,351	9,346	7,906	92,190
Germany	106,969	15,098	16,160	20,927	159,154
Greece	7,705	1,160	103	647	9,614
Hungary	17,332	15,172	5,309	6,595	44,408
Romania	59,434	3,366	242	2,193	65,235
Slovakia	5,280	10,058	2,888	2,295	20,522
Total	**301,376**	**78,590**	**38,157**	**45,774**	**463,897**
%	63%	16%	8%	10%	97%
Third level: Transit				14,251	14,251
% transit					3%
Total (incl. transit)					**478,148**

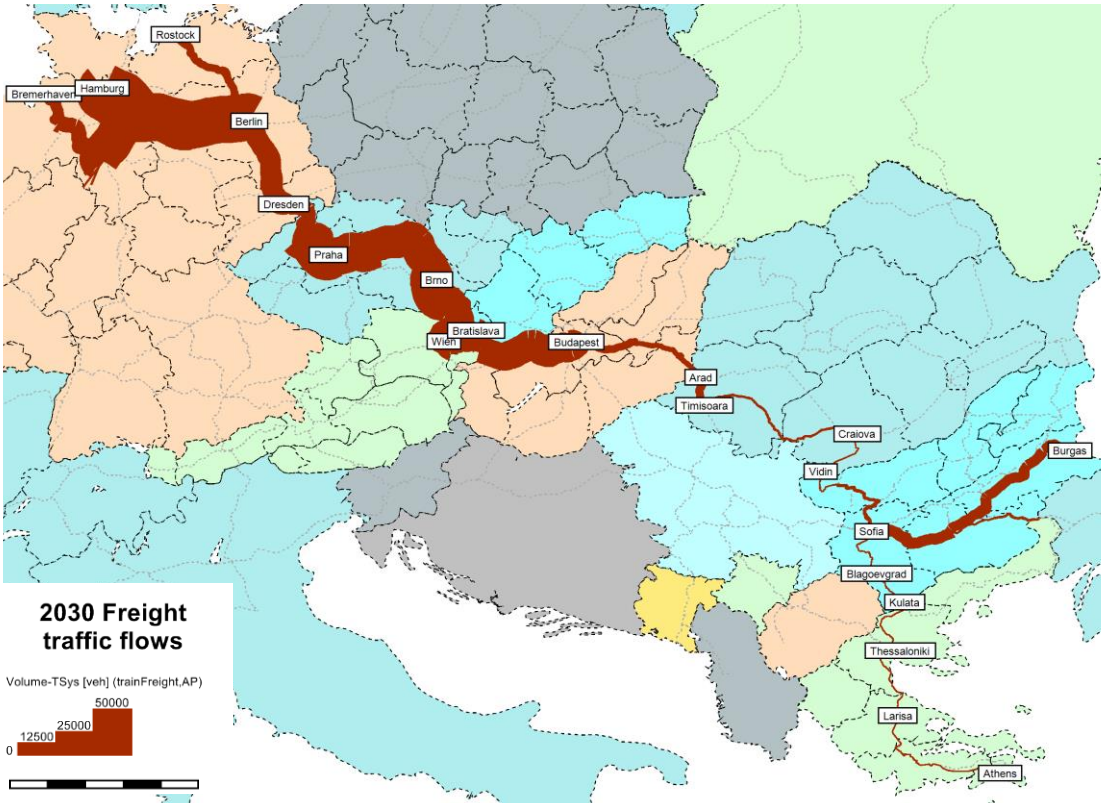
Table 71 shows the annual growth over the period 2010-2030. Austria and Germany witness a growth that is relatively higher in the domestic market for rail transport. The other countries of the OEM Corridor show a more comparable growth for both domestic and international markets. These economies are expected to grow at a higher rate, so all transport markets are likely to increase. In the following sections, the modal split will be analysed in order to examine how railways grow in the total transport market.

Table 71: Annual growth of rail transport on OEM corridor (2010–2030); in %

Growth in % (2010-2030)	**First level: Intra corridor origin and destination within corridor**		**Second level: Origin or destination inside corridor**		
	Domestic	International	Import	Export	Total
Austria	1.67%	1.76%	1.36%	2.55%	1.74%
Bulgaria	3.80%	4.29%	3.37%	7.30%	3.97%
Czech Republic	3.86%	3.64%	4.24%	4.30%	3.89%
Germany	3.53%	1.89%	2.07%	2.33%	3.02%
Greece	3.36%	0.61%	2.47%	2.53%	2.87%
Hungary	4.44%	3.57%	1.86%	5.06%	3.84%
Romania	4.88%	4.23%	4.90%	0.94%	4.65%
Slovakia	2.21%	4.44%	4.39%	2.08%	3.47%
Total	**3.71%**	**2.91%**	**2.66%**	**3.03%**	**3.40%**
Transit					3.62%
Total (incl. transit)					**3.41%**

The rail freight transport flows in the OEM corridor for the Reference scenario visualised on the rail network in Figure 48, showing that the largest flows are in Germany and the Czech Republic.

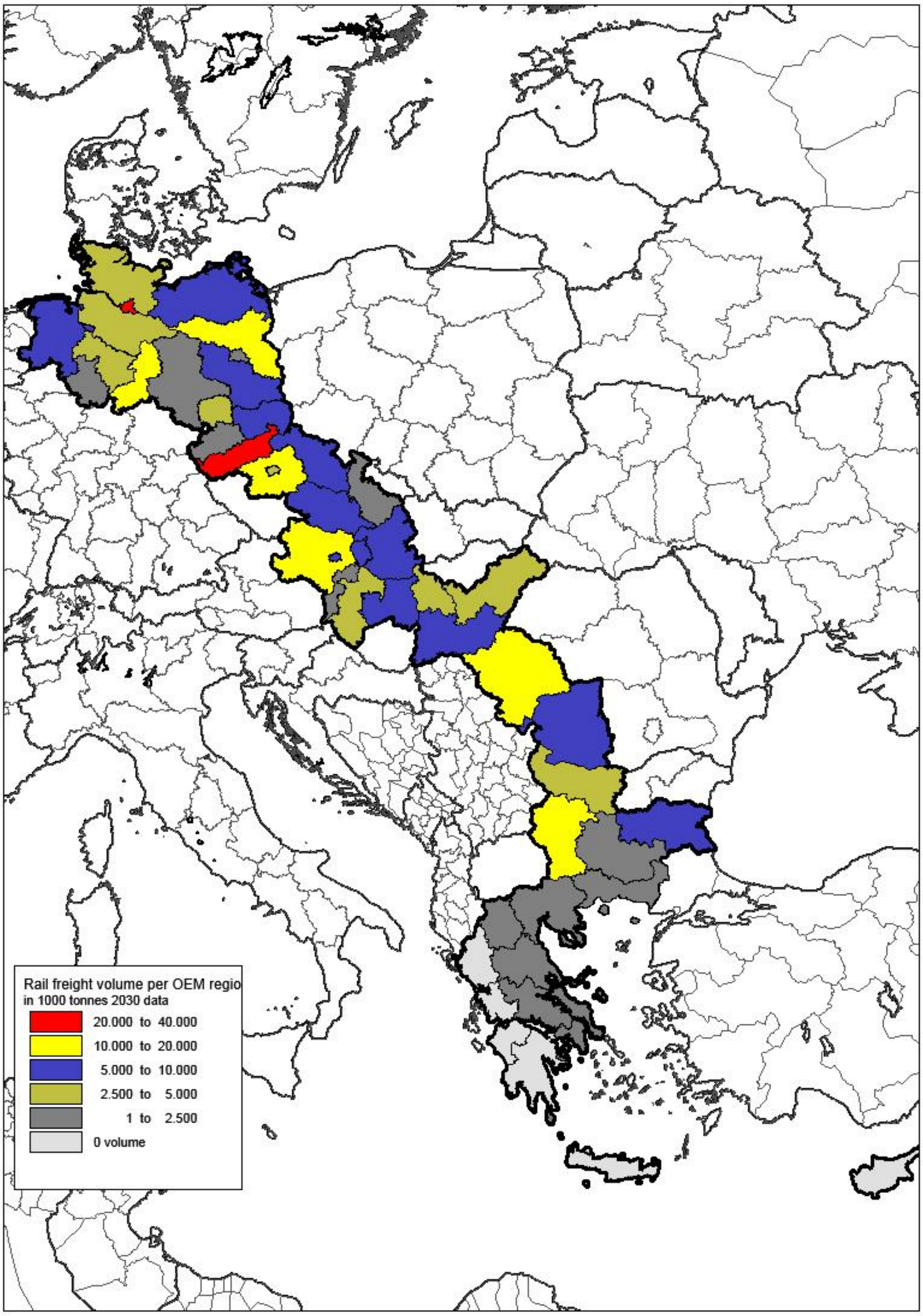
Figure 48: Rail freight transport flows on the network (2030); in 1,000 tonnes



Source: PP 22 Study Report

The figure below shows the regional transport flows for rail, it can be observed where the focal areas of railway transport are situated.

Figure 49: Volume of rail freight transport in OEM regions (2030); in 1,000 tonnes



5.3.7.2 Road transport corridor flows

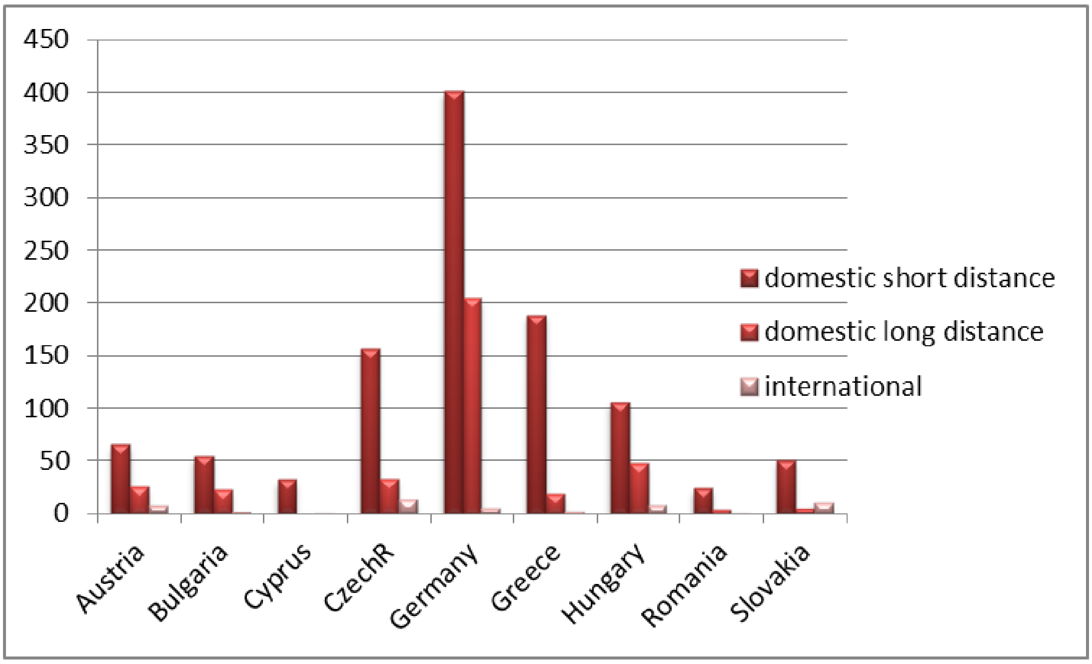
For road transport a distinction is made between domestic short and long distance transport. The short distance transport is considered in general for distances shorter than 80 kilometres. It can be observed that the short distance road transport has the highest share. The import and export to regions outside the catchment area have a higher share than the international road transport inside the corridor. It should be noted that the domestic road transport outside the corridor is not included in the analysis.

Table 72: Road transport on OEM corridor (2010) in 1,000 tonnes

in 1,000 ton	First level: Intra corridor origin and destination within corridor (Level 1)			Second level: Origin or destination inside corridor		
	domestic short distance	domestic long distance	international	Import	Export	Total
Austria	65,587	25,623	7,496	19,775	26,784	145,264
Bulgaria	54,371	22,732	1,970	2,968	2,008	84,049
Cyprus	32,216		20			32,236
Czech Republic	155,984	33,378	13,978	24,373	20,668	248,381
Germany	400,889	204,622	5,570	34,646	31,473	677,199
Greece	188,422	19,292	2,653	1,515	1,625	213,507
Hungary	106,316	48,219	8,644	9,645	10,299	183,123
Romania	24,269	4,444	1,329	3,494	4,437	37,973
Slovakia	50,726	5,058	10,456	14,980	13,934	95,153
Transit					64,062	64,062
Total	**1,078,780**	**363,367**	**52,116**	**111,395**	**175,288**	**1,780,947**
%	61%	20%	3%	6%	10%	100%

In the Figure 50, the first level road transport volumes (cf. Table 72) are visualised. For all countries domestic short distance transport is dominant.

Figure 50: Road transport volumes of first level OEM corridor traffic (2010); in million tonnes



According to the European reference scenario, the total road transport for the year 2030 increases with 75% relative to 2010 (see Table 73). The share of the five transport flows in 2030 differs only slightly from the shares in 2010.

Table 74 shows the growth over the period 2010-2030. The Czech Republic, Hungary and Romania witness a growth that is above 100% for all markets. For Austria, Cyprus, Germany and Greece, the total growth is below the overall growth of 75% of total road transport on the OEM corridor.

Table 73: Road transport on OEM corridor (2030); in 1,000 tonnes

in 1,000 ton	**First level: Intra corridor origin and destination within corridor**			**Second level: Origin or destination inside corridor**		
	domestic short distance	domestic long distance	international	Import	Export	Total
Austria	87,243	34,189	13,941	32,386	40,759	208,518
Bulgaria	126,169	52,895	2,855	6,385	5,117	193,422
Cyprus	54,767		213			54,980
Czech Republic	344,331	74,510	32,763	52,171	51,223	554,999
Germany	460,745	287,967	10,739	60,472	49,605	869,528
Greece	310,243	37,917	3,160	3,672	2,592	357,584
Hungary	262,535	118,993	22,498	24,593	25,634	454,252
Romania	71,724	12,551	3,681	10,095	11,818	109,868
Slovakia	84,126	8,425	28,861	37,289	40,002	198,704
Total	**1,801,884**	**627,448**	**118,710**	**227,063**	**226,750**	**3,001,856**
%	58%	20%	4%	7%	7%	96%
Transit						119,090
% transit						4%
Total (incl. transit)						**3,120,946**

Table 74: Growth of Road transport on OEM corridor (2010-2030); in %

in %	First level: Intra corridor origin and destination within corridor			Second level: Origin or destination inside corridor		
	domestic short distance	domestic long distance	international	Import	Export	Total
Austria	33%	33%	86%	64%	52%	44%
Bulgaria	132%	133%	45%	115%	155%	130%
Cyprus	70%		965%			71%
Czech Republic	121%	123%	134%	114%	148%	123%
Germany	15%	41%	93%	75%	58%	28%
Greece	65%	97%	19%	142%	60%	67%
Hungary	147%	147%	160%	155%	149%	148%
Romania	196%	182%	177%	189%	166%	189%
Slovakia	66%	67%	176%	149%	187%	109%
Total	**67%**	**73%**	**128%**	**104%**	**104%**	**75%**
Transit						86%
Total (incl. transit)						**75%**

5.3.7.3 Modal split corridor flows

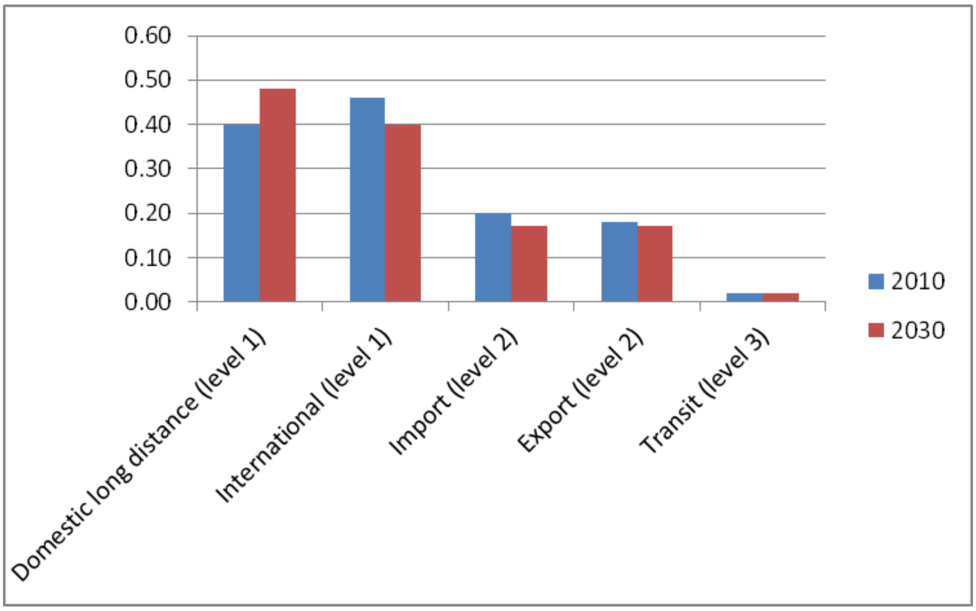
The modal split can be determined on the basis of the description of the road and rail markets. As stated before, the short distance road transport is not a competitive and captive market for rail transport. Instead, for some commodities short distance road transport is complementary as the first- and/or last mile transport. In order to determine the modal split, the long distance and international transport is taken into account.

Table 75: Share of Rail transport on OEM corridor in 2010 relative to road

Ratio	First level: Intra corridor origin and destination within corridor		Second level: Origin or destination inside corridor		
	domestic long distance	international	Import	Export	Total
Austria	0.37	0.59	0.09	0.07	0.17
Bulgaria	0.35	0.24	0.23	0.20	0.15
Cyprus					
Czech Republic	0.45	0.38	0.12	0.10	0.13
Germany	0.21	0.65	0.31	0.41	0.13
Greece	0.17	0.28	0.01	0.10	0.02
Hungary	0.13	0.47	0.38	0.20	0.10
Romania	0.84	0.53	0.02	0.30	0.54
Slovakia	0.40	0.29	0.08	0.07	0.10
Transit					0.02
Total	**0.40**	**0.46**	**0.20**	**0.18**	**0.14**

In the Figure 51 below, the modal shares for rail per level of transport are visualised. In 2030 the rail share increases for domestic long distance transport (level 1), and decreases for international (level 1), import (level 2) and export (level 2). The share for transit (level 3) is the same for both years.

Figure 51: Rail modal share per transport level (2010 and 2030), relative to road



The comparison of the rail shares presented in Table 76 above for 2010 with the rail shares for 2030 shows that the total share increases only slightly, from 0.14 in 2010 to 0.15 in 2030. For Germany, there is a significant increase from 0.13 in 2010 to 0.18 in 2030, whilst for Romania there is a decrease from 0.54 in 2010 to 0.50 in 2030. The rail share for domestic long distance transport increases in 2030, whilst the share for international (intra corridor) transport decreases.

Table 76: Share of Rail transport on OEM corridor in 2030 relative to road

Ratio	**First level: Intra corridor origin and destination within corridor**		**Second level: Origin or destination inside corridor**		
	domestic long distance	International	Import	Export	Total
Austria	0.38	0.52	0.07	0.07	0.17
Bulgaria	0.33	0.33	0.21	0.28	0.14
Cyprus					
Czech Republic	0.44	0.35	0.14	0.11	0.13
Germany	0.27	0.58	0.27	0.42	0.18
Greece	0.17	0.27	0.01	0.07	0.02
Hungary	0.13	0.40	0.21	0.24	0.09
Romania	0.83	0.48	0.02	0.16	0.50
Slovakia	0.39	0.26	0.08	0.04	0.10
Transit					0.02
Total	**0.48**	**0.40**	**0.17**	**0.17**	**0.15**

5.3.7.4 Tonne-kilometre analysis

The analysis for the tonne-kilometres is carried out in this section. With respect to some of the key performance indicators the evaluation can be carried out in ton-km. For example, CO_2-emissions can be related to the values in ton-km.

Table 77 presents the tonne-kilometres for rail on the OEM corridor in 2010. A comparison with the same table for tonnes in section 5.3.7.1 shows that the share for domestic transport is smaller in tonne-kilometres than in tonnes. This is caused by the fact that the transport distances for domestic transport are shorter than for the other three types of transport flows. For international transport (intra corridor) the opposite is witnessed, the share in tonne-kilometres being larger than its equivalent in tonnes.

Table 77: Rail transport on OEM corridor (2010); in million tonne-kilometres

in mln ton-km	First level: Intra corridor origin and destination within corridor		Second level: Origin or destination inside corridor		
	Domestic	International	Import	Export	Total
Austria	3,949	5,629	959	1,324	11,860
Bulgaria	3,686	429	109	73	4,297
Czech Republic	6,126	4,094	1,193	1,064	12,476
Germany	35,645	11,462	7,122	5,712	59,942
Greece	64	396	25	54	540
Hungary	1,403	4,332	1,193	1,130	8,059
Romania	6,557	759	15	98	7,429
Slovakia	723	2,750	473	301	4,247
Total	**58,153**	**29,852**	**11,088**	**9,757**	**108,850**
%	49%	25%	9%	8%	91%
Transit					10,489
% transit					9%
Total (incl. transit)					**119,339**

The figures in Table 78 in tonne-kilometre, compared to the ones in the same table in section 5.3.7.1 in tonnes, shows similar results for 2030, as the above for 2010. The share for domestic transport is smaller in tonne-kilometres than in tonnes, while for international transport (intra corridor); the share in tonne-kilometres is bigger than in tonnes.

Table 78: Rail transport on OEM corridor (2030); in million tonne-kilometres

in mln ton-km	First level: Intra corridor origin and destination within corridor		Second level: Origin or destination inside corridor		
	Domestic	International	Import	Export	Total
Austria	9,502	15,716	5,289	7,280	37,787
Bulgaria	8,055	737	0	159	8,951
Czech Republic	13,878	13,930	5,663	4,093	37,564
Germany	54,204	29,449	17,998	22,770	124,421
Greece	127	786	8	44	965
Hungary	5,421	7,729	1,562	2,686	17,398
Romania	37,666	2,658	134	1,276	41,733
Slovakia	1,525	11,146	3,065	2,386	18,122
Total	**130,378**	**82,151**	**33,719**	**40,694**	**286,942**
%	42%	27%	11%	13%	93%
Transit					22,802
% transit					7%
Total (incl. transit)					**309,744**

Table 79 and Table 80 present the road transport flows in tonne-kilometres in 2010 and 2030. Similar to rail, the share in tonne-kilometres for short distances is much smaller than in tonnes (see section 5.3.7.2). In both 2010 and 2030, the share in tonne-kilometres is less than half of the share in tonnes.

Table 79: Road transport on OEM corridor (2010); in million tonne-kilometres

in mln ton-km	First level: Intra corridor origin and destination within corridor			Second level: Origin or destination inside corridor		
	domestic short distance	domestic long distance	inter-national	Import	Export	total
Austria	3,935	3,271	1,675	9,253	6,975	25,109
Bulgaria	3,262	8,930	892	1,594	2,304	16,982
Cyprus	1,611	1				1,612
Czech Republic	9,359	5,301	3,606	9,477	10,996	38,739
Germany	24,053	55,639	4,573	15,955	17,567	117,786
Greece	8,731	1,826	799	1,724	1,376	14,455
Hungary	6,379	8,186	2,009	6,503	5,648	28,725
Romania	1,669	367	369	2,755	2,164	7,325
Slovakia	5,121	740	2,078	6,006	6,273	20,217
Total	**64,121**	**84,260**	**16,000**	**53,266**	**53,303**	**270,950**
%	18%	23%	4%	15%	15%	75%
Transit						88,913
% transit						25%
Total (incl. transit						**359,863**

Table 80: Road transport on OEM corridor (2030); in million tonne-kilometres

in mln ton-km	First level: Intra corridor origin and destination within corridor			Second level: Origin or destination inside corridor		
	domestic short distance	domestic long distance	inter-national	Import	Export	total
Austria	5,235	4,362	2,950	14,311	11,759	38,617
Bulgaria	7,570	20,780	1,727	3,902	4,466	38,444
Cyprus	2,738	11				2,749
Czech Republic	20,660	11,794	7,835	22,964	23,000	86,252
Germany	23,089	53,349	8,617	26,756	32,665	144,476
Greece	17,709	3,819	1,984	2,528	3,269	29,309
Hungary	15,752	20,184	4,862	15,075	13,297	69,171
Romania	4,906	1,037	1,053	7,050	6,226	20,271
Slovakia	10,321	1,233	5,274	17,160	14,980	48,968
Total	**107,980**	**116,569**	**34,301**	**109,746**	**109,661**	**478,257**
%	17%	18%	5%	17%	17%	73%
Transit						175,825
% transit						27%
Total (incl. transit						**654,082**

5.3.7.5 Inland waterways and maritime transport

In this section for inland waterways and maritime transport the forecasted tonnes for 2030 are presented. In the tables below the forecasts are presented in terms of tonnes for 2030 and growth rates between 2010 and 2030.

Table 81: IWW freight transport volume between the OEM regions grouped by states (2030 reference scenario); in 1,000 tonnes

	Czech Republic	Germany	Total
Czech Republic	490	291	780
Germany	93	22,487	22,581
Total	**583**	**22,778**	**23,361**

Table 82: Growth rates 2010-2030 inland waterways

	Czech Republic	Germany	Total
Czech Republic	32%	37%	35%
Germany	46%	25%	25%
Total	**35%**	**25%**	**25%**

For inland waterways the transport between Germany and Czech Republic is expected to grow the most (46%). For the other transport flows a more moderate growth is expected.

Table 83: Maritime freight transport volume between the OEM regions grouped by states (2030); in 1,000 tonnes

	Bulgaria	Cyprus	Germany	Greece	Total
Bulgaria	-	24	16	157	198
Cyprus	3	-	8	265	276
Germany	18	46	2,100	324	2,488
Greece	43	408	80	82,085	82,616
Total	**64**	**478**	**2,205**	**82,831**	**85,578**

Table 84: Maritime transport: Growth rates 2010-2030

	Bulgaria	Cyprus	Germany	Greece	Total
Bulgaria	-	42%	63%	36%	39%
Cyprus	53%	-	21%	6%	7%
Germany	53%	14%	18%	30%	20%
Greece	38%	25%	21%	14%	14%
Total	43%	25%	19%	14%	14%

Since the domestic Greece maritime transport is dominant, the growth of this transport flow determines the total growth of the maritime transport in the OEM corridor. Both the domestic Greece maritime transport and the total transport on the OEM corridor are expected to grow with 14% in the period 2010-2030.

The maritime flows that are related to the OEM corridor are a part of the total maritime throughput in the seaports on the corridor. In the table below the throughput of the ports is given for 2010 and 2030 reference scenario.

Table 85: Throughput of cargo and containers for the OEM Corridor core maritime ports in 2010 and 2030

	Goods; mln ton		Containers; mln TEU**	
OEM Seaports	2010	2030	2010	2030
Hamburg	104.5	194.6	7.91	16.39
Bremen	13.2	16.1	0.02	0.03
Bremerhaven	45.9	87.8	4.86	9.90
Wilhelmshaven	24.7	47.6	0.00	3.41
Rostock	19.5	24.8	0.00	0.00
Piraeus	14.0	16.5	0.57	2.87
Thessaloniki	13.1	15.3	0.30	2.10
Burgas	15.0	20.55	0.03	1.60
Lemesos	3.4	4.3	0.27	1.13

Sources: a) German Transport Interconnection Forecast 2030 (Verkehrsverflechtungsprognose 2030) incl. Traffic Network Assignment for Maritime Transport Chain (Lot 2 Sea Traffic Forecast), b) ETISbase, c) port statistics (see annex 4)
** 1 TEU is 15 tonnes gross

5.3.8 Integrated passenger transport demand scenarios

Table 86 and Table 87 show the long distance passenger rail transport in million passenger kilometres in 2010 and 2030 on the OEM corridor (the roundtrips have been added so that a symmetric matrix emerges, resulting in a matrix that is filled right above the diagonal). These are trips with origin and destination within the corridor without including the commuter traffic.

Table 86: Long distance passenger rail transport (2010); in million passenger kilometres

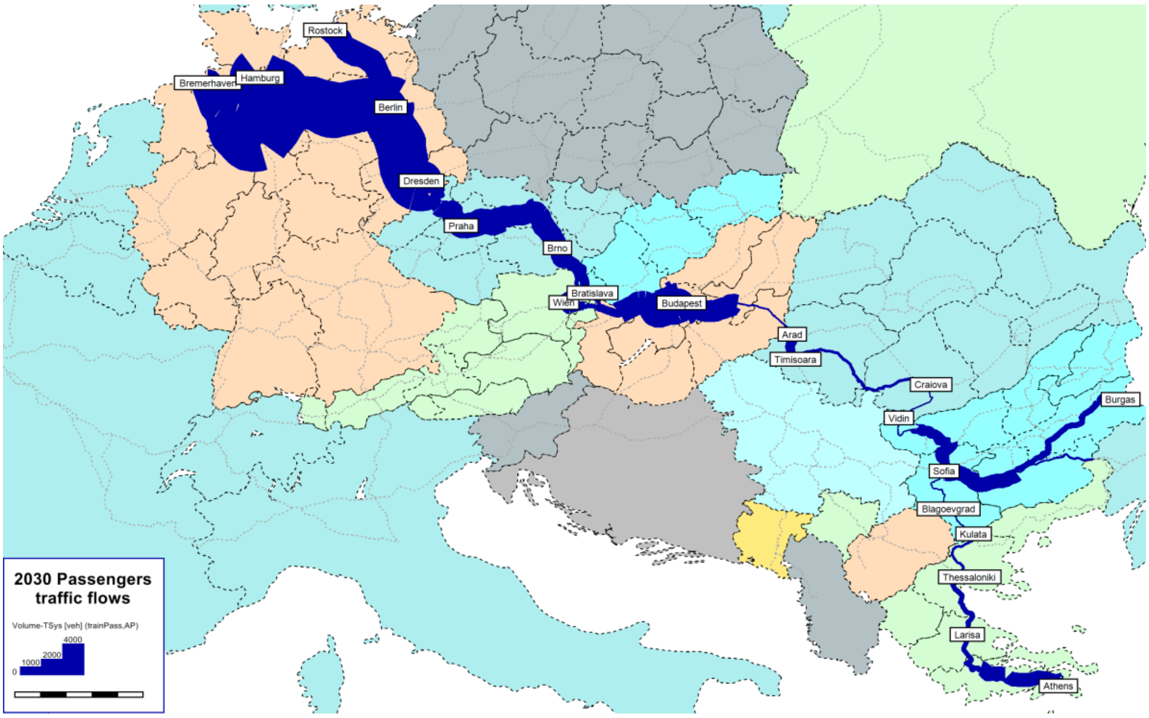
2010	Aus-tria	Bul-garia	Czech Rep.	Ger-many	Greece	Hun-gary	Ro-mania	Slo-vakia	Total
Austria	67	0	162	4	0	12	0	28	272
Bulgaria		237	0	0	3	0	0	0	240
Czech Rep.			1,518	137	0	0	0	0	1,656
Germany				504	0	0	0	0	504
Greece					468	0	0	0	468
Hungary						960	1	11	971
Romania							149	0	149
Slovakia								131	131
Total	**67**	**237**	**1,680**	**645**	**471**	**972**	**150**	**170**	**2,737**

Table 87: Long distance passenger rail transport (2030); in million passenger kilometres

2030	Aus-tria	Bul-garia	Czech Rep.	Ger-many	Greece	Hun-gary	Ro-mania	Slo-vakia	Total
Austria	79	0	165	5	0	15	0	28	290
Bulgaria		253	0	0	4	0	0	0	257
Czech Rep.			1,340	151	0	0	0	0	1,490
Germany				527	0	0	0	0	527
Greece					593	0	0	0	593
Hungary						888	1	17	905
Romania							159	0	159
Slovakia								129	129
Total	**79**	**253**	**1,504**	**682**	**597**	**902**	**160**	**173**	**2.861**

The passenger traffic demands for the period 2010-2030 remains almost the same with a growth rate of 0.05% per year. Most of the countries demonstrate slightly positive growth rates with the exception of the Czech Republic and Hungary. These two countries have negative growth rates of 0.58% and 0.39% annually. In addition to the population trends, these two countries have been showing negative growth trends in passenger-km from 2000 and onwards.

Figure 52: Map of 2030 passenger rail traffic in the OEM corridor; in 1,000 pax



Source: Consortium / PP 22 Study Report

5.3.9 Expected modal split effects of TEN-T compliance

In this section the expected effects of the technical compliance of infrastructure sections with the requirements listed in the TEN-T Regulation No.1315/2013 (in short: TEN-T compliance) are discussed for rail infrastructure and inland waterways. It is expected that the achievement of full compliance with TEN-T standards by 2030 will lead to a modal shift from road to rail and to inland waterways.

The reference scenario used assumptions based on the EU Energy, Transport and GHG Emissions "Trends to 2050", Reference Scenario 2013. The compliance to TEN-T standards scenarios was defined considering the additional to baseline assumptions:

- Seamless interoperable railway
  - Electrification of the whole network
  - Use of 740m trains
  - Operational speed >100 km
- ERTMS full deployment and double tracks[84]
- Road tolling[85]
- Increase in number of drivers' breaks
- Single Window for maritime transport,
- LNG fuel for ships

[84] Double rail track itself is not a TEN-T requirement, but is considered as logical part of the scenario.
[85] Road Tolling itself is not a TEN-T requirement, but is considered hereunder as logical part of the scenario.

Here it should be noted that the development of the scenarios was performed for the whole European network, and not solely for the OEM Corridor. In this way, it is possible to address the impact of various measures at EU-level and the effect on the OEM corridor simultaneously.

Table 88: Modelling assumptions of the "Compliance scenario" 2030 scenario

Measure	Modelling assumption/ Change in the modelling parameters	Geographical scope
(1) Seamless interoperable corridor	Improvement in efficiency and reliability of rail services (net effect is cost reduction per km and reduction of border crossing times)	Whole European network
740m trains	Rail cost reduction	OEM
ERTMS	Supply-side measure – additional paths in network, but no change in costs for operators	OEM
Single/ double track	Supply-side measure – additional paths in network, but no change in costs for operators	OEM
22.5 tonnes	No additional effect	OEM
(2) Road measures	Increase of operating costs and times	
Tolling	Increase in road costs per km on core network links	Whole European network
Increase in number of drivers' breaks	Increase in road journey time	OEM
(3) IWT measures	Various effects	
Single Window for maritime	Fixed cost reduction per ship arrival	Impact on MOS
LNG fuel for ships	Variable cost increase per tonne-km for maritime transport	OEM
Elbe upgrade to CEMT class V	Reduction in costs for IWT in Czech Republic and Germany	Impact on the whole European network
Elbe RIS implementation	Reduction in transport lead time	

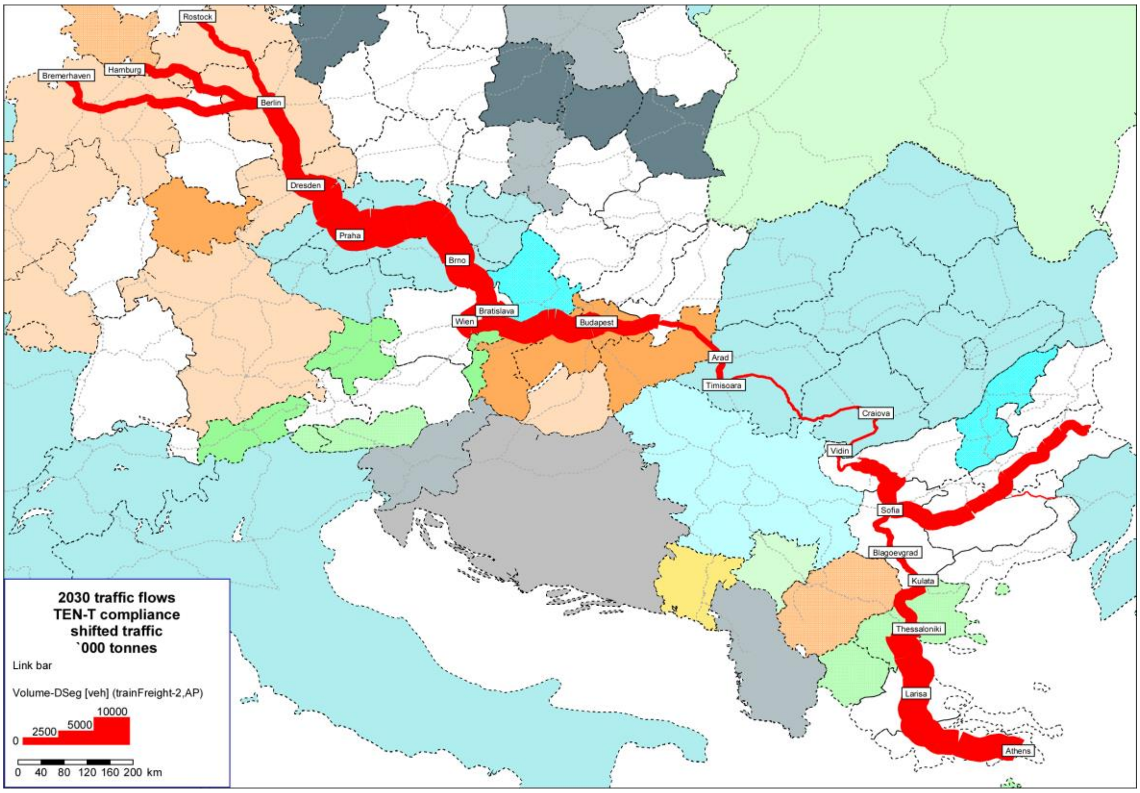
For rail transport, the shift from road to rail is derived from the PP22 study, where compliance to the TEN-T standards on the OEM corridor and accurate level of services has been evaluated. As this covers only part of the OEM corridor this exercise has been extended.

Table 89: Shifted rail freight transport volume between the OEM regions grouped by states (2030) after compliance with TEN-T Regulation; in 1,000 tonnes

in mln ton	Forecasted railway traffic reference scenario 2030		Shifted traffic from rail to road 2030	
	Domestic	International	Domestic	International
Austria	20,683	14,970	947	405
Bulgaria	26,386	1,414	4,135	179
Czech Republic	57,587	17,351	6,087	795
Germany	106,969	15,098	1,462	1,278
Greece	7,705	1,160	6,555	151
Hungary	17,332	15,172	3,446	550
Romania	59,434	3,366	600	169
Slovakia	5,280	10,058	251	561
Total	**301,376**	**78,590**	**23,482**	**4,088**

In the figure below it is indicated where the shifted tonnes from road to rail are located on the OEM rail network.

Figure 53: Shifted volumes from road to rail on the corridor (2030, compliance scenario); in 1,000 tonnes



Source: Consortium / PP 22 Study Report

For inland waterways the expected shift from road is mainly based on the PLATINA II study (Work Package 1: Market & Awareness). Although this study is done for containerized cargo, it is anticipated that the results can be used for other cargo types as well.

From the underlying data of this study the expected shift from road to inland waterways is determined for domestic traffic and for international traffic between Germany and Czech Republic. This shift is only expected for traffic over long distances.

For international transport this will be the case and for domestic transport "domestic long distance" (see section 5.3.6) will be used for Germany. For domestic transport in Czech Republic a separate analysis has been done, because of the short inland waterways distances in this country. On the basis of this analysis for domestic transport in the Czech Republic a growth by 10% is anticipated in 2030 from the modal shift from road transport.

From the PLATINA II study the expected shift from road to inland waterways is:

- For domestic transport in Germany: 5%;
- For transport between Germany and Czech Republic: 50%.

In section 5.3.6, the road transport for these relations on the OEM corridor has been presented:

- For long distance domestic transport in Germany in 2030: 288 million tonnes;
- For international transport from Germany to Czech Republic: 2.6 million tonnes;
- For international transport from Czech Republic to Germany: 3.1 million tonnes.

Using these inputs the transport of inland waterways after compliance with TEN-T technical requirements has been determined (see Table 90).

Table 90: IWW freight transport volume between the OEM regions grouped by states (2030) after compliance with TEN-T; in 1,000 tonnes

	Czech Republic	Germany	Total
Czech Republic	539	1,841	2,380
Germany	1,393	36,887	38,280
Total	1,932	38,728	40,660

In Table 91 only the modal shift is presented. This table shows that the largest modal shift is expected for domestic transport in Germany.

Table 91: IWW freight transport volume from modal shift between the OEM regions grouped by states (2030) after compliance with TENT; in 1,000 tonnes

	Czech Republic	Germany	Total
Czech Republic	49	1,550	1,599
Germany	1,300	14,400	15,700
Total	1,349	15,950	17,299

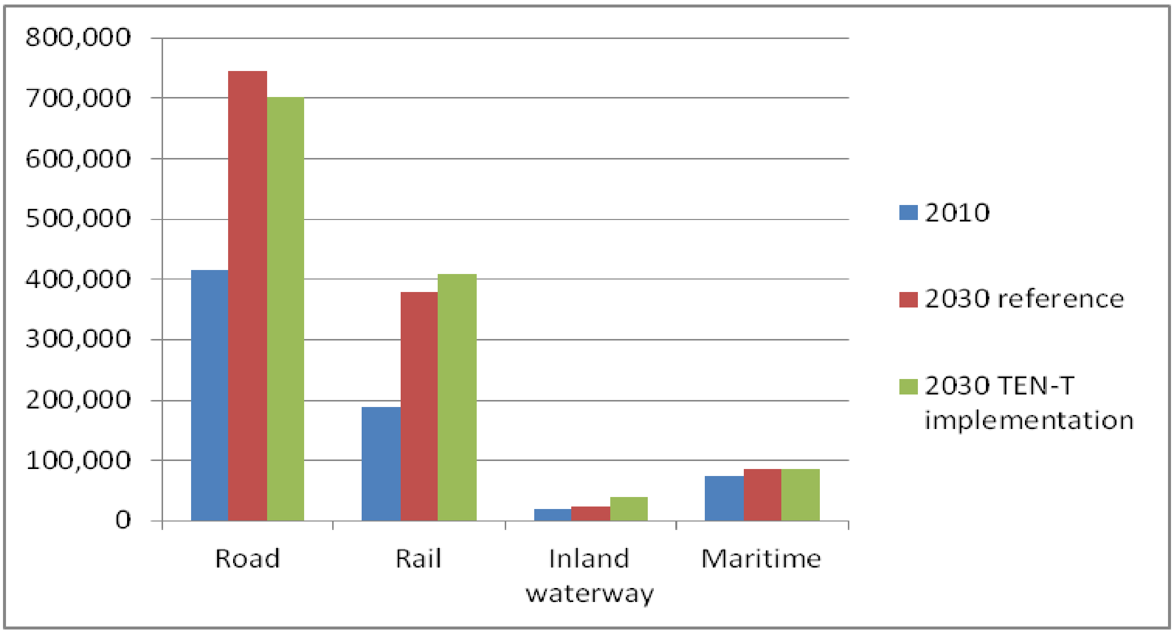
Based on the previous results, Table 92 shows the results for the reference scenario 2030 and the TEN-T compliance scenario. The analysis includes both domestic and international transport. It should be noted that road transport concerns long distance, inter-regional, transport. The strict definition of the corridor is used here, thus origin and destination of the freight flows are on the corridor. As the competition with maritime is limited on the corridor, there is no shift observed towards maritime flows. As the maritime flows presented here are strictly related to the corridors, as such these flows are only a limited part of the total throughput of the ports.

Table 92: Freight transport volume between the OEM regions for 2010, 2030 reference scenario and 2030 compliance with TENT; in 1,000 tonnes

	2010	2030 reference	2030 TEN-T implementation
Road	415,483	746,158	701,289
Rail	189,711	379,966	407,536
Inland waterway	18,694	23,361	40,660
Maritime	74,995	85,578	85,578
Total	**698,884**	**1,235,063**	**1,235,063**
Rail share	27.1%	30.8%	33.0%
IWW share	2.7%	1.9%	3.3%

In the figure below the freight transport volumes from Table 92 are visualised. Compared with the 2030 reference scenario, in the TEN-T compliance scenario the volumes for rail and inland waterway increase, whilst the volume for road decreases.

Figure 54: Freight transport volume between the OEM regions for all scenarios; in 1,000 tonnes



5.3.10 Supply side and capacity analysis

Section 5.2 presented the review of the compliance of the infrastructure of the OEM Corridor with the transport infrastructure requirements set out in the related EU, with the scope to identify the key bottlenecks and critical issues that need to be addressed. The exercise is carried out on a modal basis, with particular focus on the rail and inland waterway network of the Corridor.

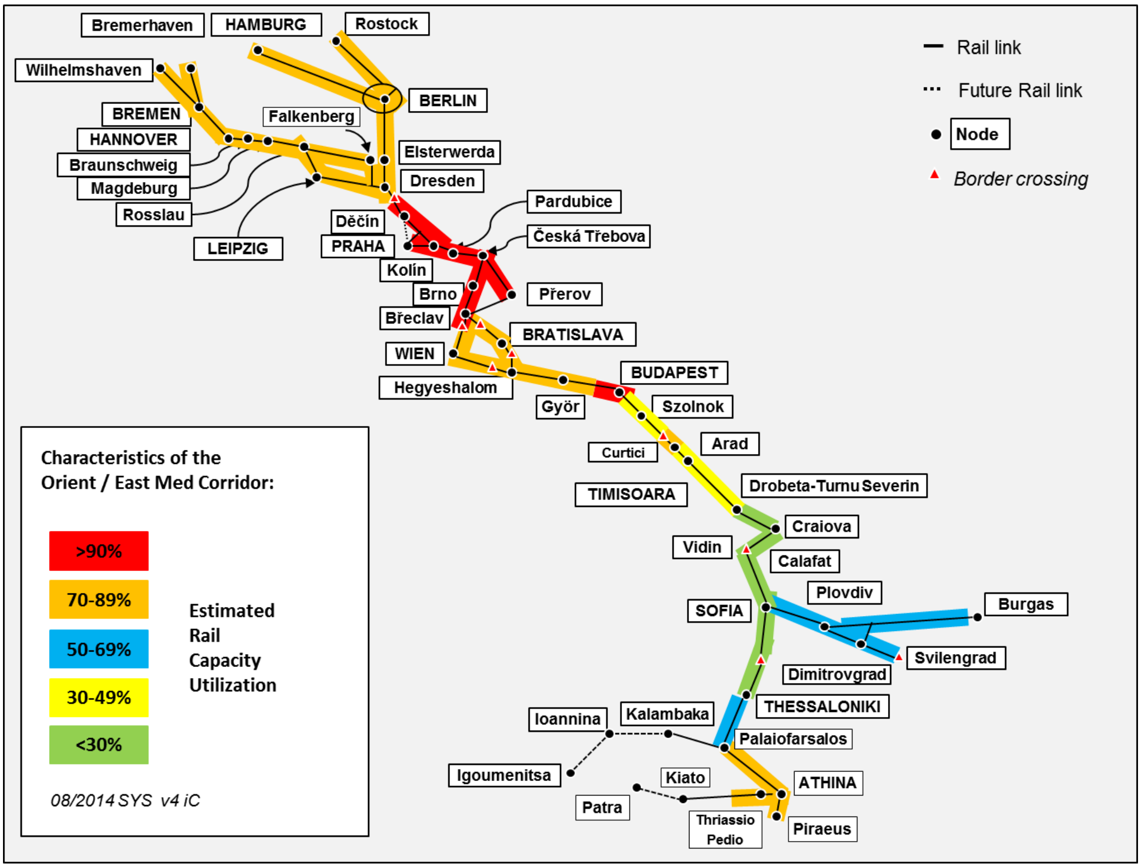
Based on this review, an outlook to the future (2030) is presented for rail and inland waterway in this section. This outlook is based on the forecasts for the demand side (see section 5.3.7.1 for rail) and the possible bottlenecks mentioned in section 5.2. Where applicable, possible future projects (see Annex 5) are assessed for their impact on the elimination of the bottlenecks.

5.3.10.1 Rail transport

Section 5.2.1.4 described the capacity utilization for the current situation. This (estimated) capacity utilization is visualized in Figure 55.

For the analysis of the rail capacity utilization on OEM Corridor, no dedicated capacity calculations have been performed by the study authors. Instead, the depicted estimated rail capacity is based on expert judgement from a combination of the following sources: the Completion of the Priority Project No. 22 "Carrying out a study on the completion of the Priority Project No. 22"; interviews with the PP22 infrastructure managers, and several reports and presentations, e.g. RFC 7 Master Plan (among others).

Figure 55: Corridor Railway Network: Capacity utilisation (2010)



Source: Consortium / PP22 Study Final report

Additionally, German Rail has provided in late 2014 their forecast for the OEM corridor railway lines, indicating potential bottlenecks in the Port hinterland connection.

In general, the northern part of the OEM-corridor is heavily used, whilst the southern part is less used with certain exceptions. Arad is a clear cut, dividing the northern and the southern part of the corridor. The PP22 study shows that the rail lines of the OEM Corridor are mainly used for freight (if international traffic is only considered), except from the Dresden – Praha – Wien – Budapest route, which also sees many international passenger trains.

In Section 5.2.1.4 the following possible bottlenecks for freight in the future were identified:

- The section Dresden - Czech border is heavily used, but there is still capacity available (DB)
- Hinterland transport from/to Ports of Hamburg, Bremen, Bremerhaven and Wilhelmshaven it is very likely this section can become a capacity bottleneck in future years (also see comment below).
- Within the Czech Republic, the Praha – Česká Třebová line is at full capacity and has therefore to be considered as bottleneck.
- Budapest. Due to new railway infrastructure it is expected that on the whole, the rail traffic crossing Budapest, which is a critical point today will improve by the existing planning, so that it will not form a bottleneck in the future (Hungarian railways).

In the PP22 project, data for short distances were not covered for passenger traffic. Due to the fact that not all German sections were in PP22 and data for short distances were not covered, no bottlenecks were identified in this study for this part of the network.
On the basis of the expected growth in demand in 2030, a check has been carried out to examine whether the above mentioned bottlenecks can be expected. Using the PP22 study for the relevant rail sections, forecasts have been made for freight transport as for the reference scenario.

For the section Dresden – Czech border, a growth of 80% is expected in 2030 according to the reference scenario. This section is also considerably used for passenger transport, for which almost no growth is expected (see par. 5.2.8). Because of the growth in freight transport, there is a high probability that there will be a bottleneck in this section in 2030. The high scenario, as evaluated in the PP22, leads to a higher growth of rail freight transport, as a result of a modal split change towards rail. This would lead to an increase in the probability of the occurrence of bottlenecks.

For the Hinterland transport from/to Hamburg, Bremen, Bremerhaven and Wilhelmshaven, no forecasts from the PP22 study were available. The growth for the hinterland transport is therefore linked to domestic transport in Germany and internationally in relation with the Czech Republic, for which German ports are the key import ports. For all these freight flows there is a significant growth in 2030, over 3.5% per year (see section 5.3.7.1). To this end, there is a high likelihood for this hinterland transport to become a bottleneck, in particular in nodes. German Rail (DB Netz AG) expects for the year 2025, besides for Hinterland transport from/to Hamburg, also bottlenecks in the Hinterland transport from/to Wilhelmshaven and Bremerhaven/Bremen. For both ports the capacity utilization is expected to be >90% in 2025.

For the node of Hamburg, works are partially completed concerning ‘upgrading measures to improve traffic flows and capacity for passenger and freight transport’. The expected finalisation date for these works is not available. Works for improving the node of Bremen have been completed.

The Praha – Česká Třebová line is at full capacity in the base year, and has therefore to be considered as a bottleneck already. For the year 2030, a doubling of the freight transport is expected, which confirms that this section is really a bottleneck.

For the rail sections to/from Budapest, a doubling of freight transport is expected. Because of dense local traffic, it is difficult to indicate whether the upgraded (e.g. Budapest Southern Rail Bridge) and new railway infrastructure (e.g. the construction of a Budapest Rail Bypass "V0") will be sufficient to accommodate the additional freight transport volumes. As already mentioned, according to the Hungarian railways the improvements will be sufficient.

Finally, attention is given to the cross-border section Békéscsaba – Thessaloniki. This section is rather long (1.168 km, or about 20% of the total OEM Corridor length) and runs on the territories of Hungary, Romania, Bulgaria and Greece. Currently the characteristics of the railway lines are rather heterogeneous and many sections do not meet the requirements set by the Regulation No.1315/2013.

According to the reference scenario for this section, growths for subsections are expected in 2030 between 70% and 160%. The biggest growth is expected for the section Filiaşi – Arad in Romania. For the subsections in Bulgaria and Greece, a more modest growth (70%) is forecasted.

Of course, not only expected demand has an influence on the future availability of rail infrastructure. There are other influencing factors, such as:

- 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.
- Average border waiting times in rail freight transport. The users of rail freight services are still confronted with considerable waiting times at various border crossing points along 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.). Other factors are also responsible, such as lack of interoperability of infrastructure (e.g. in 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).
- The issue of capacity on mixed traffic lines and practices to resolve conflicts between trains is a subject for extensive research and development. The implementation of ERTMS level 3 will release more capacity and create additional degrees of freedoms for a more flexible traffic management. Also, the feasibility of introducing a system of gradual timetabling is investigated, which would replace today's fixed timetable period and sharply reduce the lead time between a path request and the delivery of that request in a time table. Computer assisted train operation systems that integrate the train dispatcher and the train driver to enable "green wave" running of the train is being explored in the EU project ON-TIME and the Swedish CATO project. The concept releases capacity, improves punctuality, makes rail traffic more fluid and results in less ware on trains and tracks. These systems could provide an intelligent way of securing a "priority" green wave path between the terminals served by the train.

5.3.10.2 Inland waterways

In section 5.2.3.5, the capacity utilization for inland waterway was discussed. The following items were identified as hindering factors:

- On the Elbe barges with the dimensions of 110 m length and 11.45 m width are approved to operate between Geesthacht and the Czech / German border. However, an adequate fairway depth is not given consistently, having negative effects on the maximum loading capacity due to draught limitations.
- The shiplift Lüneburg near Scharnebeck due to limitations of the two chambers, especially regarding length. Each chamber has a maximum length of 100 m and a width of 12 m. For this reason, only barges that correspond with these dimensions can pass, while pushed convoys have to be decoupled for the passage and lifted or lowered individually.
- Some locks have a capacity utilization rate close to 60% (Anderten and Geesthacht); one lock (Lüneburg) has a capacity utilization of 65.7%. For the other locks in the OEM corridor the capacity utilization is lower.

The growth for inland waterway until 2030 is derived from the report "Verkehrsverflechtungsprognose 2030, Schlussbericht, 11 June 2014" which was commissioned by the German "Bundesministerium für Verkehr und digitale Infrastruktur". Between 2010 and 2030 a growth of 20% is expected for all inland waterway transport flows, according to the following breakdown:

- Domestic: 13.3%
- Export: 24.8%
- Import: 16.8%
- Transit: 40.1% (not applicable for the OEM Corridor)

The impact of this growth rates can be used only for the lock capacity utilization. For the inland waterways in the OEM corridor transit can be omitted. The growth for the other three types of flows is 17.9%. If this percentage is used for estimating the utilisation capacity for 2030, the Lüneburg lock capacity utilisation increases to approximately 77.5%. For the two other locks with close to 60% capacity utilisation, there is an increase to 70%. Because the Lüneburg lock is already under study for extension, this potential bottleneck will be eliminated.

Finally, apart from the expected demand, there are other factors that have an influence on the future availability of inland waterway infrastructure, such as:

- The deployment of River Information Services (RIS). In both Germany and the Czech Republic, basic RIS applications have been implemented. The RIS could lead to a reduction waiting times before locks, bridges and ports.

- At present no infrastructure for the supply with alternative fuels is available along the Elbe and Vltava. In general, Liquefied Natural Gas (LNG) is considered as the forward-looking alternative fuel in matters of inland waterway transport. The planning for the construction of supply infrastructure for LNG takes place along the Unterelbe, and more specifically, in the Port of Hamburg.

5.4 Critical Issues for the Core Network Corridor

5.4.1 Scope

This section presents an overview of the key critical issues that could hinder the OEM Corridor's functionality and/or coherent and timely development identified from the:

(i) Review of studies and databases
(ii) Analysis of infrastructure compliance and
(iii) Transport Market Study.

These are listed in Table 93 for all modes and corridor sections they apply to, and are described in detail in the following sections of this Chapter.

The critical issues identified herein are directly relevant to the principles of corridor development, and more specifically, coincide with the objectives of the CEF pre-identified projects provided in Annex I of the Regulation. To this end, the European Coordinator might focus primarily on these issues and related projects during his activities. These comprise of:

- rail cross-border and capacity issues,
- horizontal issues in terms of interoperability and intermodality,
- IWW bottlenecks and, finally,
- seaports integration into the Corridor.

For this reason, in Annex 5, the tables listing the infrastructure projects per mode provide in their last two columns an indication of whether each project addresses a critical issue and whether it constitutes one of the CEF pre-identified projects in Annex I of the Regulation.
The identification of critical issues will contribute to the definition of the Objectives of the Corridor and the subsequent set up of the Implementation Plan (Chapters 6 and 7, respectively).

Table 93: List of Critical issues

Mode	Section	Member States	Critical issue / Bottleneck
Rail	Dresden – Praha Rail line	DE, CZ	Capacity (New HSR line planned)
	Brno – Bratislava – Győr	CZ, SK, HU	Capacity (Brno, Bratislava area) Non-compliance
	Békéscsaba – Thessaloniki	HU, RO, BG, EL	Facilitate international rail transport Non-compliance
	Border Crossings	HU, RO, BG, EL	Improve operational rules and organization to reduce waiting times
	Various sections	all	ERTMS deployment
	Praha – Česká Třebová, Budapest Area	CZ, HU	Capacity
IWW	Elbe River	DE, CZ	Insufficient navigability, Non-compliance
	Vltava River	CZ	Insufficient locks, non-compliance
	Locks Lüneburg, Anderten, Geesthacht	DE	Potential capacity bottleneck
Seaport	Igoumenitsa and Patras	EL	No rail connection
	Patras	EL	VTMIS missing
	Hamburg Port hinterland lines	DE	Safeguard catchment area accessibility
	Lemesos	CY	Capacity Issues; Insufficient connection between hinterland and port
Airport	Hamburg, Praha, Budapest, Timişoara	DE, CZ, HU, RO	No Rail resp. Road link

5.4.2 Inland waterways

5.4.2.1 Elbe Inland waterway

Within the general scope of establishing multimodal transport corridors throughout the European Union, inland waterway transport is an integral part of the TEN-T network. To this end, the development of the River Elbe, connecting the North Sea, the Port of Hamburg and the Czech Republic along the OEM corridor, is highly important. The compliance check carried out in Section 5.2.3 highlighted the insufficient navigability conditions and listed in detail the existing deficiencies of IWW sections along the river, in terms of unreliable draught conditions, incomplete network, limited underpass clearances, non-compliant lock chambers, capacity deficiencies, etc.

One of the main issues is the improvement of navigation reliability through infrastructure upgrading measures to ensure an all-season navigability of the river[86]. Due to the involvement of two Member States, Germany and the Czech Republic,

[86] This might also include the navigability of the River Vltava as adjacent IWW from Mělník to Praha.

coordinated actions are required to ensure an efficient cross-border oriented development.

Studies focusing on options to upgrade the Elbe and to achieve better navigability on the river have been carried out regarding the fairway deepening and the construction of weirs and locks (e.g. in Děčín Weir). The challenge with regard to the Elbe IWW development is to find development solutions and make joint efforts, in order to take advantage of the River Elbe as a transport route, but also protect it against environmental and social externalities. A crucial point is the adherence of the infrastructure and services of the Elbe inland waterway transport route to the requirements of EU's environmental legislation.

At current stage, all earlier examined upgrading projects in Germany have been stopped. Future measures focus on maintaining the Elbe as Inland waterway transport route and ensuring stable and reliable conditions for shipping with minimal maintenance costs[87] and excluding a construction of weirs and locks. An expansion to improve the traffic conditions is not currently planned[88]. Regarding the lock-weir project in Děčín, further project implementation was suspended due to missing EIA documentation[89], to be expected in 2014. Assumed start of the project could be 2018/2019[90]. Further projects along the Elbe River in the Czech Republic are a similar lock-weir complex near Přelouč and some smaller upgrading projects (e.g. the Brandýs nad Labem lock upgrading).

The analysis of the capacity utilisation (in section 5.2.3.3) indicated that a number of locks, indicatively the Anderten and Geesthacht have a capacity utilization close to 60%, while the Lüneburg lock has a capacity utilization of 65.7%. For the other locks in the OEM inland waterway corridor, capacity utilization is lower. In accordance with the results of the MTMS, the growth for inland waterway demand between 2010 and 2030 is estimated at 20%.

Based on the above, a growth of 17.9% is assumed, which would increase the utilisation capacity of the Lüneburg lock to approximately 77.5% by 2030. Accordingly, the capacity of the Anderten and Geesthacht locks would increase to approximately 70%, indicating thus a potential capacity bottleneck. It should be noted that since an extension for the Lüneburg lock is already planned, it is assumed that this potential bottleneck would be eliminated.

Against this background, the further development of the Elbe inland waterway as part of the TEN-T network requires a balanced approach, taking into account the economic interests while ensuring compliance with environmental legislation as well as the respective legislation and policy in Germany and the Czech Republic. In this regard, both a dialogue between the involved Member States and the European Coordinator as well as joint coordinated actions are proposed to be found and discussed in the Corridor Forum.

5.4.3 Rail: cross border sections

The core TEN-T network is intended to constitute the backbone of the development of a sustainable multimodal transport network. Based on social and economic market priorities, the upgrade of the rail network is often focused on national sections, while cross-border sections are regularly facing low demand and require more coordination

[87] Maintenance works, aiming to restore and preserve the status quo of the navigation conditions before the flood of August 2002.
[88] Source: German Federal Ministry of Transport 2013
[89] Source: Czech Ministry of Environment, 2011
[90] Source: Czech Ministry of Transport, 2014

for their development. In fact, the cross-border sections are highly required for smooth international traffic and thus, have the highest European added value.

Considering the detailed analysis of the compliance of the technical characteristics of the OEM Corridor alignment carried out in Section 5.2.1, together with an analysis of current capacity utilisation, the following three critical cross-border sections have been identified:

5.4.3.1 Dresden – Praha high speed rail line (DE-CZ)

In accordance with the reference scenario of the MTMS, a growth of 80% is expected in 2030 for the already highly used conventional rail section Dresden – Czech border. This considerable growth in freight demand, will most likely create a critical capacity bottleneck for this section (this section is also considerably used for passenger transport; however, very low growth is expected).
Therefore, to increase capacity on this rail line and to relieve the German upper Elbe valley from transit freight trains (especially regarding noise problems) studies for a new section between Heidenau and Chabarovice (near Ústí nad Labem) with a length of 35 km were carried out. The design of the new rail line includes a base tunnel crossing the Erzgebirge Mountains (length 20 km), a maximum speed of 200 km/h and mixed traffic (i.e. passenger and freight). The costs for realization[91] come up to approx. EUR 1.9 bln.

The PP22 study (Completion of the Priority Project Nr 22) showed that the proposed passenger Dresden – Praha HSR line appears not to have a positive CBA, but the potential shift from passenger air traffic needs to be taken into account.

German Studies (BVU/ITP for Saxony 2009) showed at least for Dresden – Ústí a positive CBA of 1.3, assumed a further HSR connection to Praha.

Moreover, the Czech Republic and Germany have different viewpoints on the quality level of this line.

In the course of preparing the German Federal Transport Infrastructure Plan 2015 (BVWP 2015), the new rail line Dresden - Praha will be re-examined in the light of recent studies of the Czech Republic and the Free State of Saxony through the German MoT. As far as the CBA is positive, its inclusion in the BVWP 2015 is possible. In the subsequent legislative process the German Parliament could decide a recording of this action into the new development plan for federal railway infrastructure.

In addition, measures for upgrading the section from Ústí nad Labem to Praha are required as the existing rail line crosses complicated geographic areas. Designs foresee in this section also the construction of new high speed rail which is supposed for passenger transport. The project preparation has not started yet. The project implementation is foreseen after 2020[92].

5.4.3.2 Brno – Győr (CZ-AT/SK-HU)

This corridor sections is divided into two branches, a western one via Wien, and an eastern one via Bratislava. In particular, these are mainly cross-border related section within a more and more economically connected region (cf. CENTROPE region).

a) Section Brno – Břeclav (Czech Republic), 60 km
b) Section Břeclav – Bernhardsthal - Wien (Czech Republic / Austria), 90 km
c) Section Wien – Parndorf – Hegyeshalom (Austria / Hungary), 66 km
d) Section Břeclav – Lanžhot/Kúty – Devinská Nová Ves (Czech Republic / Slovak Republic), 70 km

[91] Source: Schüßler Plan, Saxon State Government of Economy, Labour and Transport, 2012
[92] Source: Czech Ministry of Transport, 2014

e) Section Devínska Nová Ves - Bratislava – Rajka - Hegyeshalom (Slovak Republic, Hungary), 45 km

Technical bottlenecks at border crossing points characterized by poor technical condition of railway border bridges near Břeclav towards AT and SK borders (project implementation until 2015 (CZ/AT) and after 2015 (SK)) are resulting in inconvenient track speeds.

The railway node Brno is deemed an important rail bottleneck in the Czech Republic, showing considerable capacity deficits and poor condition regarding basic technical parameters. In view of further traffic volumes, it is intended that both the Břeclav – Brno section and the Brno node will undergo a significant capacity upgrade during next years.[93]

In the Bratislava area, capacity bottlenecks have to be addressed at Devínska Nová Ves station (Requirement of new tracks[94]), as well as at all relevant Bratislava stations incl. tunnels.

To be discussed from a corridor point of view:
- The construction of a cross-border 2nd track between Bratislava Petržalka – Rusovce / Rajka – Hegyeshalom (incl. track speed and axle load increase)
- Further bypass projects to ensure transit capacity of Bratislava node (tunnels).

The future main issues on the OEM related Austrian rail lines are:
- The upgrade on the conventional rail line from Wien to Border AT/CZ near Břeclav to line speed 160 km/h and block densification, including Wien Simmering – Wien Erdberger Lände upgrade to three tracks
- the high-speed connection to Wien Airport within the CENTROPE Region (Brno / Bratislava / Győr)

For border crossing times, efforts are made to further minimize those[95].

5.4.3.3 Békéscsaba – Thessaloniki (HU-RO-BG-EL)

This section is rather long (1.168 km, or about 20% of the total OEM Corridor length) and runs on the territories of Hungary, Romania, Bulgaria and Greece. Currently the characteristics of the railway lines are rather heterogeneous[96] and many sections do not meet the requirements set by the Regulation No.1315/2013:

- Craiova – Calafat (RO) and Kulata (BG) – Thessaloniki (EL) sections are not electrified
- Max speed along Vidin – Sofia – Kulata (BG) – Mouries (EL) section is 70-80 km/h with permanent speed restrictions in many sub-sections; according to the 2013 annual report of PP22 Coordinator the speed between Arad and Craiova is 60 km/h and between Craiova and Calafat - 30 km/h
- Axle load of the track in Romania and from BG/EL border to Mouries/Thessaloniki is 20 tonnes, in Hungary between the HU/RO border and Békéscsaba it is 21 tonnes.
- Max train length along the line on Romanian, Bulgarian and Greek territories is below the threshold of 740 m (600m in Romania, 550-535 m in Bulgaria, 640 m in Greece).

[93] Source: Czech Ministry of Transport, 2014
[94] Source: RFC7 Implementation plan
[95] RFC7 Implementation plan p. 30: Břeclav (CZ/AT) recently: 3-60 min; Rajka: n/a.
[96] Source: Network statements, RFC7 Implementation plan

Loading gauge differs as well (GA in Hungary, GB/GC in Romania, GB/GA in Bulgaria)[97].

The PP22 study (Carrying out a study on the completion of the Priority Project No. 22) showed that upgrading the railway line between Hungary and Greece requires the use of adapted standards so that investment costs are jÚstífied by the related benefits.
The considerable investment expected, with all Romanian and Bulgarian sections upgraded to high standards, including the travel speed, will improve the travel time but is not expected generate significant additional modal shift. Given the investments and benefits, standards have to be applied to ensure interoperability while reducing costs.
Harmonisations of operational rules, as well as other horizontal measures for solving border-crossing problems are needed in order to achieve the expected benefits from the investment projects.

5.4.3.4 Capacity bottlenecks

In addition to the cross-border critical issues, the capacity utilisation analysis identified a potential critical capacity bottleneck at the hinterland transport to/from the Port of Hamburg and also to/from the Ports of Bremen, Bremerhaven and Wilhelmshaven. The new prognosis of the German Federal Ministry of Transport on Hinterland transport shows that the container volumes in Hamburg will increase almost as much as the aggregated volumes to/from Bremerhaven and Wilhelmshaven. Additionally, a high number of automobile trains are expected on the OEM Corridor on the link Bremerhaven – Falkenberg – Czech Republic/Slovakia/Hungary. The growth for this connection is linked to domestic transport demand figures in Germany, as well as international flows with the Czech Republic, which constitutes one of the key import country destinations for German ports. A significant growth in excess of 3.5% per year is estimated for these types of freight flows by 2030 (see par. 5.3.7.1), so there is a high likelihood for this hinterland connection to become a future bottleneck. Severe bottlenecks are expected in particular in Hamburg, Hannover and Bremen node.

The capacity analysis also demonstrated that the Praha – Česká Třebová line is currently operating at full capacity line in the base year, and is consequently considered as a bottleneck already. The results of the MTMS demonstrate a doubling of the freight transport expected by year 2030, which confirms that this section constitutes indeed a critical capacity bottleneck. The Czech Rail IM is addressing this section with studies on modernization (cf. Annex 9; Table 2, items no. 3, 4 and 5: Modernization of Rail Line Choceň – Ústí nad Orlicí and rail hubs in Česká Třebová and Pardubice).

On rail sections to/from Budapest a doubling of freight transport is expected. Because of dense local traffic, it is difficult to tell whether the new railway infrastructure will be sufficient to accommodate the extra freight transport. As already mentioned, according to the Hungarian railways the improvements will be sufficient.

5.4.4 Ports

As laid out in section 5.2.5, the OEM corridor connects the northern ports (DE: Bremerhaven, Wilhelmshaven, Bremen, Hamburg, Rostock) and the southern ports (BG: Burgas, EL: Igoumenitsa, Thriassio Pedio, Athina, Piraeus, Heraklion, Patra; CY: Lemesos).

[97] Dimensions of loading gauges (height x width either side of the track axle) are according to UIC for GA 3850 x 1280 mm , GB 4080 x 1280 mm and GC 4650 x 1455 mm.

At the same time, Motorways of the Sea (MoS) are an initiative aimed at creating intermodal freight transportation supply chains at ports with effective hinterland connections, rapid administrative procedures and a high level of service. The above calls for a dialogue between northern ports and the southern ports to create a high quality land-transport 'bridge' which were a topic of a Corridor Working Group meeting on September 29th, 2014.

With regard to intermodality, the necessary extensions of the land networks are required to provide a seamless intermodal transportation with the use of land and maritime modes along the transportation supply chain of the OEM corridor. In accordance with the analysis carried out in Section 5.2.5 this critical issue is particularly relevant in the case of the Greek ports of Igoumenitsa and Patras, which are lacking connections to the rail network. For Cyprus ports, a sufficient road connection is also deemed highly relevant for national development.

In addition, current practice indicates that the key factors for port competitiveness have shifted away from infrastructure towards interoperable IT systems, and hence OEM ports require developments such as single-window services and port community systems. This constitutes a critical issue for the Port of Patras. The remaining ports either have already implemented mainly either VTMIS or PCS, or plan their deployment in the short to medium-term horizon.

5.4.5 Horizontal issues

5.4.5.1 Operational rules, ERTMS, Traffic Management Systems

Efficient and reliable transport services by rail require a reasonable level of infrastructure quality, but in many cases an appropriate level of service in terms of operation rules and procedures is even more important. The 2013 annual report of PP22 Coordinator stresses the need to ensure that the infrastructure investments carried out should not have their effects limited by problems linked to operational issues, as for instance, border crossing procedures (Border crossing times range from 0:10 to 48:00 hrs.)[98].

In this context, the case of the Vidin (BG) – Calafat (RO) Bridge, which is open for road traffic since July 2013, but the first train ran on the Bridge on May 10th 2014 due to delay in the inter-governmental agreement on regulation of the border railway traffic, is emblematic. Other typical examples are issues related to procedures at the Schengen border between Hungary and Romania.

One critical issue regarding operational rules refers to organizational bottlenecks, such as the border crossing situation in rail transport, e.g. at the HU/RO border Lökösháza / Curtici. The Corridor Forum should discuss the implementation of further measures that support shorter train border passing times through improved cross-border scheduling of infrastructure, staff and rolling stock.

At present, the deployment level of ERTMS is very low along OEM corridor (cf. ERTMS deployment plan, section 7.2.1). Due to the importance of ERTMS in regard to seamless rail operation on the corridor the deployment of ERTMS infrastructure has high priority. There are various ongoing investment projects along the entire OEM corridor addressing this issue. A more synchronised and coordinated implementation should be ensured to maximise the benefits. However, considering the significant technical non-compliance of major parts of the OEM rail network to other parameters

[98] RFC7 Implementation plan, November 2013, p. 30

set out in Regulation No.1315/2013 the upgrade railway lines to these TEN-T standards is of first priority before implementing ERTMS on the respective sections.

5.4.5.2 Intermodality

Intermodality is a key critical issue of the OEM corridor that, apart from ports, must be also addressed in both rail-road terminals and airports.

Generally, the present situation could be characterized by:

- Various bottlenecks or missing links in the hinterland connections of seaports
- Bottlenecks or missing links between airports and corridor infrastructure
- Improvement potentials for IWW ports and Rail-road terminals

The above have been explicitly identified in the related sub-sections of Section 5.2. – Characteristics of the Corridor.

5.4.6 Projects addressing Critical issues / Open Issues

In section 7.1.9, an overview is given to highlight the projects addressing critical issues from the overall list of projects, while section 7.1.10 presents the open issues, providing the non-compliant sections and nodes not addressed by the known projects.

6 Objectives of the Core Network Corridor

6.1 Scope

This task entails the identification of the core objectives of the OEM corridor, which together with a proposed performance measurement framework will establish a sound basis for defining the programme of implementation measures, as will be presented in Chapter 7 of the present report. 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 OEM Corridor against these set objectives.

In general, the proposed corridor performance evaluation shall:

- Adopt an integrated approach, by taking into consideration subsequent tasks of the OEM study.
- Build on the overview of corridor characteristics, the corridor objectives and assessment of main critical issues (cf. Chapter 5).
- Take into consideration the input received from stakeholders and related findings obtained during the Corridor Forum meetings already realised.
- Be simple, not data intensive, robust and flexible in terms of being adjusted post any application/validation exercise.

6.2 General and specific objectives

In accordance with the TEN-T Regulation No.1315/2013, the network shall demonstrate European added value by contributing to the objectives listed in

Table 94.

The general objectives specified in the above were converted to specific objectives tailored to reflect the specificities of the OEM corridor, in accordance with the analysis of the corridor's infrastructure technical parameters' compliance with regulation standards and the identification of the main critical issues along its length, carried out in previous stages of the study and presented in Chapter 5 (in terms of cross border issues, bottlenecks and missing links, intermodality and interoperability issues of related corridor nodes and operational and administrative barriers).

These objectives are considered in conjunction with related goals set in the 2011 White Paper "*Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system*" for three types of trips, namely intercity travel, long-distance travel and intercontinental freight and urban transport. The goals relate mainly to optimising the performance of multimodal logistic chains, by also making greater use of more energy-efficient modes, increasing the efficiency of transport and infrastructure use with information systems and market-based incentives, and developing and deploying new and sustainable fuels and propulsion systems:

Table 94: TEN-T Objectives

Category	Objectives
Cohesion	**Accessibility** Accessibility and connectivity of all regions of the Union, including remote, outermost, insular, peripheral and mountainous regions, and sparsely populated areas.
	Infrastructure quality Reduction of infrastructure quality gaps between Member States.
	Interconnection of flows For both passenger and freight traffic, interconnection between transport infrastructure for, on the one hand, long-distance traffic and, on the other, regional and local traffic.
	Balanced infrastructure A transport infrastructure that reflects the specific situations in different parts of the Union and provides for a balanced coverage of all European regions.
Efficiency	**Continuity of long distance flows** Removal of bottlenecks and the bridging of missing links, both within the transport infrastructures and at connecting points between these, within Member States' territories and between them.
	Interoperability The interconnection and interoperability of national transport networks.
	Intermodality Optimal integration and interconnection of all transport modes.
	Economic efficiency The promotion of economically efficient, high-quality transport contributing to further economic growth and competitiveness; the efficient use of new and existing infrastructure.
	Innovation Cost-efficient application of innovative technological and operational concepts.
Sustainability	**Long term sustainability** Development of all transport modes in a manner consistent with ensuring transport that is sustainable and economically efficient in the long term.
	Clean transport Contribution to the objectives of low greenhouse gas emissions, low-carbon and clean transport, fuel security, reduction of external costs and environmental protection.
	Low-carbon transport Promotion of low-carbon transport with the aim of achieving by 2050 a significant reduction in CO_2 emissions, in line with the relevant Union CO 2 reduction targets
Increasing the users' benefits	**Meeting users' needs** Meeting mobility and transport needs of users within the Union and in relations with third countries.
	Safety and security Ensuring safe, secure and high-quality standards, for both passenger and freight transport.
	Risk resilience Supporting mobility even in the event of natural or man-made disasters, and ensuring accessibility to emergency and rescue services.
	Establishment of requirements The establishment of infrastructure requirements, in particular in the field of interoperability, safety and security, which will ensure quality, efficiency and sustainability of transport services.
	Accessibility PRM Accessibility for elderly people, persons of reduced mobility and disabled passengers.

Optimising performance of multimodal logistic chains

- 30% of road freight over 300 km should shift to other modes, such as rail or waterborne transport by 2030, and more than 50 % by 2050, facilitated by efficient and green freight corridors.
- By 2050, complete a European high-speed rail network. Triple the length of the existing high-speed rail network by 2030 and maintain a dense railway network in all Member States. By 2050 the majority of medium-distance passenger transport should go by rail.
- A fully functional and EU-wide multimodal TEN-T ‘Core network’ by 2030, with a high-quality and capacity network by 2050 and a corresponding set of information services.
- By 2050, connect all core network airports to the rail network and ensure that all core seaports are sufficiently connected to the rail freight and, where possible, inland waterway system.

Increasing efficiency of transport and infrastructure use with information systems and market-based incentives

- Deployment of the modernised air traffic management infrastructure SESAR in Europe by 2020 and completion of the European common aviation area.
- Deployment of equivalent land and waterborne transport management systems ERTMS, ITS, SSN and LRIT, RIS.
- By 2020, establish the framework for a European multimodal transport information, management and payment system.
- By 2050, move close to zero fatalities in road transport and ensure that the EU is a world leader in safety and security of transport in all modes of transport.
- Move towards full application of ‘user pays’ and ‘polluter pays’ principles and private sector engagement.

Developing and deploying new and sustainable fuels and propulsion systems

- Halve the use of ‘conventionally fuelled’ cars in urban transport by 2030 and phase them out in cities by 2050; achieve essentially CO_2-free city logistics in major urban centres by 2030.
- Low-carbon sustainable fuels in aviation to reach 40 % by 2050; by 2050 reduce EU CO_2 emissions from maritime bunker fuels by 40 % (if feasible 50 %).

The above general objectives of both the Regulation and the White Paper were converted to specific objectives tailored to reflect the specificities of the OEM corridor. To this end, the following **Specific Objectives** (**SO**) can be identified for the OEM Corridor under study:

With regard to cohesion:

SO 1 Upgrading of infrastructure quality level to comply with standards set out in the Regulation No.1315/2013 (particular focus on rail and road modes).

With regard to efficiency:

SO 2 Removal of infrastructure bottlenecks (missing links, non-compliant sections)
SO 3 Interoperability of national transport networks
SO 4 Optimal integration and improved interconnection of transport modes (ensuring/improving "last mile" connections to ports, airports and RRTs)
SO 5 Efficient use of infrastructure (new and existing)

With regard to sustainability:

SO 6 Contributing to the objectives of low-carbon and clean transport (reducing emissions, noise)

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

With regard to increasing user benefits:

SO 8 Reducing congestion

Based on the above and in accordance with the analysis of the corridor's infrastructure technical parameters' compliance with regulation standards and the identification of the main critical issues along its length, carried out in previous stages of the study, Table 75 summarises the key compliance objectives of the OEM Corridor per each individual mode.

Table 95: List of infrastructure compliance-related objectives with categories

Mode	Objective	Main Category
Rail	Full electrification	Cohesion
	Freight trains with 22.5 t axle load at 100 km/h	Cohesion
	Full deployment of ETCS and GSM-R	Efficiency
	Freight trains of 740 m length	Efficiency
	Fill in missing links (DE/CZ, EL)	Efficiency
IWW	CEMT class IV compliance (draught)	Cohesion
	RIS deployment / Cross-border data exchange	Efficiency
	Availability of alternative fuels	Sustainability
Road	Express roads with grade separated junctions	Efficiency
	Interoperability in use of tolling systems plus ITS deployment	Efficiency; User Benefit
	Availability of alternative fuels	Sustainability
Seaports	Connection to railway	Efficiency
	Availability of alternative fuels	Sustainability
	Full implementation of Traffic Management Systems (VTMIS)	Efficiency
Airports	Connection to rail network and road network	Efficiency, User Benefit
	Major airports connected to heavy rail by 2050	Efficiency
	Availability of alternative fuels (Capacity)	Sustainability

6.3 Key Performance Indicators (KPIs)

This task develops a framework for profiling the performance of any given section of the OEM Corridor through the establishment of appropriate Key Performance Indicators (KPIs) and related threshold values against a selected number of the above specific objectives, based on the availability of information for measuring the proposed KPI.

This section lists the KPIs selected to measure the OEM corridor's performance. In order to reduce the complexity and the volume of data that must be collected, some objectives will be combined into one single indicator potentially covering multiple dimensions or even goal categories.
In addition, where data for an indicator is not available, neither from EU nor Member State sources, a proxy indicator will be used, as an approximation to the original indicator, which provides sufficient information to allow the assessment of a relevant contextual aspect for the Corridor. More specifically, the KPIs defined in the present study are:

- specific
- relevant
- measureable with the tools, data and resources available from the present analysis (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

It should be noted that the use of results from recent Transport Market Studies is deemed problematic due to the non-comparability between different TEN-T core network corridors.

In light of the above, the following KPIs are introduced, together with their units of measurement.

The main sources for the above data requirements are the TENtec database and network statements.

- **KPI_1 : Electrification**
  - percentage or km of compliant railway
- **KPI_2 : Freight trains with 22.5 t axle load at 100 km/h**
  - percentage or km of compliant railway
- **KPI_3 : Trains of 740 m length**
  - percentage or km of compliant railway
- **KPI_4 : Deployment of ETCS and GSM-R**
  - percentage of line length with ETCS+GSM-R deployment
- **KPI_5 : CEMT class IV compliance (draught)**
  - percentage of compliant class IV sections with sufficient draught
- **KPI_6 : RIS deployment**
  - percentage of RIS services deployed (20 elements as given under 7.2.2.3)
- **KPI7 : Express roads/Motorways deployed**
  - percentage or km of Express roads and motorways with grade separated junctions
- **KPI_8 : Implementation of Traffic Management Systems: Road**
  - percentage of Core Network Urban Nodes with deployed ITS
- **KPI_9 : Implementation of Traffic Management Systems: Maritime**
  - percentage of ports (number of ports / total number of core ports) deploying VTMIS, PCS, etc.
- **KPI_{10} : Connection to railway: Maritime**
  - percentage of ports connected to existing rail network
- **KPI_{11} : Connection to railway: IWW**
  - percentage of inland waterway ports connected to existing rail network / maritime ports
- **KPI_{12} : Connection to railway: Main Airports**
  - percentage of all main airports connected to existing heavy rail network
- **KPI_{13} : Availability of alternative fuels infrastructure: Maritime**
  - percentage of ports offering alternative fuels
- **KPI_{14} : Availability of alternative fuels infrastructure: IWW**
  - percentage of ports offering alternative fuels
- **KPI_{15} : Availability of alternative fuels infrastructure: Airports**
  - percentage of airports offering alternative fuels
- **KPI_{16} : Availability of alternative fuels infrastructure: Road**
  - number of alternative clean fuels stations

Table 96 presents the benchmarking values for the identified KPIs as per the compliance analysis carried out for year 2013.

Table 96: KPI Benchmark Values (2013)

KPI	Description	Unit of measurement	Benchmark value
KPI_1	Electrification	percentage of compliant railway	89%
KPI_2	Freight trains with 22.5 t axle load at 100 km/h	percentage of compliant railway	71%
KPI_3	Trains of 740 m length	percentage of compliant railway	54%
KPI_4	Deployment of ETCS and GSM-R	percentage of line length with ETCS+GSM-R deployment	GSM-R: 49% ETCS: 10%
KPI_5	CEMT class IV/ draught compliance	percentage of compliant class IV sections with sufficient draught	41%
KPI_6	RIS deployment	percentage of RIS services deployed (20 elements as given under 7.2.2.3)	DE: 50% CZ: 55%
KPI_7	Express roads/motorway	length percentage Express roads and motorways with grade separated junctions	82%
KPI_8	Implementation of Traffic Management Systems: Road	percentage of Core Network Urban Nodes with deployed ITS	100%
KPI_9	Implementation of Traffic Management Systems: Maritime	percentage of ports deploying VTMIS, PCS, etc.	67%
KPI_{10}	Connection to railway: Maritime	percentage of ports connected to existing[99] rail network	80%
KPI_{11}	Connection to railway: IWW	percentage of inland waterway ports connected to existing rail network ports	90%
KPI_{12}	Connection to railway: Main Airports	percentage of all main airports connected to existing heavy rail network	50%
KPI_{13}	Availability of alternative fuels infrastructure: Maritime	percentage of ports offering alternative fuels	0%
KPI_{14}	Availability of alternative fuels infrastructure: IWW	percentage of ports offering alternative fuels	0%
KPI_{15}	Availability of alternative fuels infrastructure: Airports	percentage of airports offering alternative fuels	0%
KPI_{16}	Availability of alternative fuels infrastructure: Road	number of alternative clean fuels stations	n=412

For the follow-up study period, an extension of KPIs to market-related indicators based on standardized calculation methods is proposed, which among others might reflect the development of transport modal split, capacity issues and travel time.

[99] 10 out 12 seaports are located in countries with existing railway network, while Heraklion (EL) and Lemesos (CY) do not.

7 Implementation

7.1 Plan for the removal of barriers and to enhance efficient multimodality (Implementation Plan)

7.1.1 The Implementation Plan and the List of Projects

The implementation plan analysis includes initially the recording of all on-going and planned infrastructure projects known to date, as obtained from the National Ministries, the Infrastructure Managers and Regional Authorities. These are listed for each mode and for the entire OEM corridor (not only at a country level), together with key information, such as their status to present (i.e. 2014), envisaged time plan, budget and sources of funding. **The complete project list is presented in Annex 5 of this Report, divided into sub-tables for each different transport mode.**

The majority of the projects listed herein regard the new construction or substantial upgrade of the technical infrastructure, while others tackle organizational and administrative issues. However, projects which are related to maintenance without any extension of existing capacities are not listed as Corridor projects, with the exception of generic waterworks. Projects along parallel sections of the Comprehensive network are not regarded hereunder.

According to the agreement on overlapping IWW sections along River Danube (cf. section 5.2.3.1), projects related to the Corridor's IWW and riverports infrastructure in Austria, Slovakia, Hungary, Romania and Bulgaria are listed in the Implementation plan of the Rhine-Danube Core network corridor, only.

The complete project list also contains additional project ideas to the planned projects recommended by the Study authors (without cost and timing information), based on the analysis of the OEM Corridor carried out within the context of this study, including projects required as follow up to on-going projects, projects required to remove the identified bottlenecks, projects to enhance freight transport services, etc.

Further to the recording of projects, the analysis includes the categorisation of projects to mirror the Corridor Objectives, which leads to a selection of projects for each transport mode, as described in detail in the following sub-sections. **The selected projects essentially address either the identified critical issues, the cross-border sections and/or are projects listed in the CEF Regulation, Annex I.** This list of key projects, together with the unresolved bottlenecks, may be used by the European Coordinator to define the **key projects in the formulation of the Corridor's Work Plan**.

Finally, it should be noted that the analysis herein constitutes the recording of the identified on-going and planned projects. Any type of evaluation carried out for each individual project in order to examine its socio-economic and financial viability via widely applied tools, such as Cost-Benefit Analysis (CBA) and Multi-criteria Analysis (MCA), as well as any prioritization exercise/ranking of the projects fall beyond the scope of the present study. As stated by the European Coordinator during the 4th Corridor Forum, a more detailed analysis, including a Corridor CBA of infrastructure projects, will be part of the OEM Corridor follow-up study in the period 2015/2017.

7.1.2 Categorization of Projects

In accordance with the objectives of the corridor, as these were introduced by Article 4 and 8 of the TEN-T Regulation, and concretized in the Objectives of the Corridor in Chapter 6 of the present report, the development of the Orient/East Med Corridor may prevalently strive for the following key goals of the TEN-T Corridor Development:

a) Improving cross-border links,
b) Enhancing interoperability,
c) Ensuring intermodality,
d) Mitigating bottlenecks affecting the entire corridor functionality

The above goals are mirrored in the categorisation of the infrastructure projects that will make up the Corridor's implementation action plan.

Table 97 presents a description of the type of projects along the Orient/East Med corridor in accordance with the classification of primary categories.

Table 97: Project description per primary categories

Project category	Description
Technical Compliance of Lines Bottlenecks	Projects addressing the reduction or mitigation of non-compliant parameters (missing links / physical bottlenecks, technical bottlenecks) on linear infrastructures (e.g. axle load, train length, speed, CEMT-class, road type), except last-mile connections
Interoperability	Studies and works addressing compliance with TEN-T Reg. regarding ERTMS, RIS, ITS/Tolling, Port systems Upgrades of existing infrastructure/vehicles and systems with TMS systems
Intermodality	Measures for facilitating multimodal transport services for freight and passenger transport e.g. terminal capacity issues (expansion/upgrade/ construction), including last-mile connection
Capacity bottleneck	Capacity Upgrades based on Transport Market Study results (mainly inland): e.g. road congestion in urban nodes, IWW lock capacity, rail capacity.
Sustainability / Innovation	Measures regarding negative transport externalities e.g. noise, pollution, accidents; Innovation measures / pilot projects e.g. Alternative Fuels, LNG, e-freight, tracking and tracing

In order to distinguish between project categories "Technical Compliance/Bottlenecks" and "Capacity", projects have been analysed with regard to whether their full compliance with the technical requirement is still to be achieved (= category "Technical Compliance/Bottlenecks") or whether an upgrade is performed in order to further increase the line capacity, while all TEN-T requirements are already met.

In a broader sense, both actions will lead to improved capacity of infrastructure, however from different starting levels.

As a second level categorisation, additional information is provided per listed project, with regard to whether the project is located fully or partly in an Urban Area or a Cross-border section and whether it addresses a Critical Issue of the corridor, as identified in Chapter 5 of this Report.

Table 98: Project description per secondary categories

Project category	Description
Cross-border	Studies and works addressing cross-border sections according to TEN-T Reg. No.1315/2013 Art. 3 and Annex II, part 1 (entire section between urban nodes).
Core Urban node areas	Actions implementing/facilitating TEN-T transport infrastructure in "Urban nodes of the Core Network" according Reg. No.1315/2013, Annex II, part 1.
Critical issues	Actions addressing the defined Critical issues of the OEM corridor in accordance with chapter 5.4.

Moreover, an indication of whether a project has been identified in the CEF Regulation, Annex I project list is given.

This implementation plan follows a structure targeting on the implementation timing of the projects. This is to enable the monitoring of the timely coherence of adjacent sections with regard to similar issues. Thus, categorized projects are listed according to:

- Projects finalized in 2015
- Projects finalized between 2016 in 2015
- Planned projects with envisaged finalization after 2020 or without finalization date
- Either their assignment as a critical issue (as defined in Chapter 5.4), or being a cross-border section or a CEF pre-identified section.

7.1.3 Definition of Cross-border section in the List of Projects

With regard to the definition of a cross-border section, reference is made to the definition given in the Regulation No.1315/2013 Art 3, which essentially specifies the entire length of the corridor between two adjacent urban nodes[100], separated by a Member States' border. Given the multitude of the 8 state borders that the OEM corridor is crossing, a rather significant share of corridor length could consequently be defined as a cross-border section.

In a narrower sense, the definition of a cross-border section might not refer to links between Urban nodes, but to the line section linking the next operational transport nodes on both sides of state borders, such as the next motorway or railway junction, the next port or terminal after the border. In accordance with the latter definition, Table 99 lists the key cross-border sections of the OEM Corridor, which were used hereunder.

[100] Urban Nodes are defined in Annex II part I of the Regulation and are listed in Table 17 of this Report.

Table 99: Cross-border sections (after narrow definition)

	Rail line between	**Road** Motorways/express roads
DE/CZ	▪ High speed rail line between Dresden (DE) and Ústí nad Labem (CZ) ▪ Freight rail line between Dresden (DE) and Mělník (CZ)	Pirna (DE) – Ústí nad Labem (CZ)
CZ/AT	Brno (CZ) - Wien (AT)	Pohořelice (CZ) - Wilfersdorf (AT)
CZ/SK	Hodonín (CZ) - Bratislava (SK)	
AT/HU	Wien (AT) - Györ (HU)	
SK/HU	Bratislava (SK) - Hegyeshalom (HU)	Bratislava (SK) - Mosonmagyaróvár Jct. (HU)
HU/RO	Békéscsaba (HU) - Arad (RO)	Szeged (HU) - Arad (RO)
RO/BG	Craiova (RO) - Mezdra (BG)	Vidin (BG) - Calafat (RO)
BG/EL	Blagoevgrad (BG) - Thessaloniki (EL)	Sandanski (BG) - Strymoniko/Serres (EL)
CZ/DE: **Inland Waterway River Elbe, Dresden (DE) – Děčín**		

7.1.4 Implementation of Rail Infrastructure including Rail-Road Terminals

7.1.4.1 Background

Table 100 gives for each primary project category the typical objectives of projects assigned.

Table 100: Categories and objectives of Rail projects

Project category	Objectives of typical projects
Technical Compliance of Lines (Bottlenecks)	General Line Upgrades Electrification Axle Load / Speed Missing links in High-Speed Network
Interoperability	ERTMS deployment Simplified admin procedures
Intermodality	Construction or Upgrade of RRT and Pax Rail Stations, (Last mile connections)
Capacity bottleneck	Capacity upgrades (multiple track) at lines and junctions (urban nodes)
Sustainability	./.

The comprehensive analysis of projects and studies for Rail, which are either on-going or planned, identified in total 96 projects and studies, out of which:

- 43 address technical compliance/ bottlenecks
- 19 address interoperability
- 9 address intermodality
- 25 address capacity issues.

For Rail-Road Terminals (Multimodal logistic platforms) 8 projects have been identified in total, out of which:

- 1 addresses interoperability and
- 7 address intermodality.

The costs for the listed studies and works of this rail amount to EUR 28.266 billion (as far as costs are known).

7.1.4.2 Rail and Rail-Road Terminals: Technical compliance / bottlenecks projects

Rail sections non-compliant to the parameters set out in the Regulation are the main bottlenecks identified along the OEM Rail network.

In BG, CZ, DE, GR, HU, RO and SK there are in total 43 on-going projects, out of which:

- 13 studies and
- 30 construction works projects.

Most of these projects consist of the construction of new or upgrading of existing rail sections in order to achieve compliance with the technical requirements of the Regulation. However, there are differences in scheduling. Hence, the projects addressing critical technical compliance and bottleneck issues for rail along the OEM corridor are clustered according to their envisaged finalisation date.

The costs for the studies and works (49 items) of this category amount to EUR 15753 million (as far as costs are known). The total cost of those projects addressing critical issues (34 items) amounts to approximately EUR 12142.4 million.

In the following, the most important projects of this category are listed, which are either located at cross-border section, are critical issues or CEF-listed. For easier visualization tables are provided for finalization periods 2015, 2016-2020, after 2020 and without date.

Table 101: Rail projects addressing technical compliance/bottlenecks to be completed by 2015

No.	Location	Project name	Timing	Cost €M [101]	Financing sources	CB [102]	CI [103]	CEF[104]
				Studies				
EU001	DE, CZ Dresden - Ústí nad Labem	Planning of construction of a new High-Speed line (section Heidenau - Chabarovice)	2014 - 2015	n.a.	Financed State budget, TEN-T	Y	Y	Y
SK003	SK Bratislava Node	Development of Rail Node Bratislava -	2014 - 2015	0,6	Financed Cohesion Fund	Y	Y	Y
BG001	BG Border RO/BG - Sofia	Modernisation of the Vidin - Sofia - railway line	2013 - 2015	7,1	Financed Co-funded by Cohesion Fund; State budget	N	Y	Y
BG020	BG Sofia	Sofia railway node	2014 - 2015	2,1	Financed Co-funded by EU, State Budget	N	N	Y
BG005	BG Sofia - Border BG/EL	Modernisation of Sofia - Pernik Razpredelitelna - Radomir section	2013 - 2015	9,3	Financed Co-funded by EU, State Budget, Other (NRIC loan)	N	Y	Y
BG007	BG Sofia - Border BG/EL	Modernisation of Radomir - Kulata line	2012 - 2015	3,0	Financed Co-funded by EU, State Budget, Other (NRIC loan)	Y	Y	Y
BG009	BG Sofia - Plovdiv	Modernisation of Sofia - Plovdiv railway line, Sofia - Elin Pelin and Elin Pelin - Septemvri sections	2012 - 2015	30,2	Financed Co-funded by Cohesion Fund, State Budget, Other (NRIC loan)	N	N	Y
BG014	BG Plovdiv - Burgas	Rehabilitation of Plovdiv - Burgas railway line; Phase II	2012 - 2015	2,4	Financed Co-funded by Cohesion Fund 2007-13) State Budget, Other (NRIC loan)	N	N	Y
				Construction works				

[101] million Euro
[102] Cross-border issue based on Regulation 1315/2013
[103] Critical issue
[104] Included in the CEF pre-identified project list of Regulation No.1316/2013, Annex I

No.	Location	Project name	Timing	Cost €M 101	Financing sources	CB 102	CI 103	CEF[104]
CZ023	CZ Břeclav - Hohenau (AT)	Reconstruction of the bridge at km 80.930 railway Hohenau (ÖBB) - Břeclav	2015	16,9	Procured; Financing to be confirmed; Public funds and possible Co-funding CF - OPT1	Y	Y	N
HU003	HU Budapest - State Border HU/RO	Szolnok - Szajol: Line upgrade	2013 - 2015	9,4	Financed Co-financed by Cohesion Fund	N	N	Y
BG011	BG Sofia - Plovdiv	Modernisation of Septemvri - Plovdiv section	2012 - 2015	322,4	Financed Co-funded by Cohesion Fund, State Budget, Other (NRIC loan)	Y	Y	Y
BG012	BG Plovdiv - Border BG/TR	Reconstruction and electrification of Dimitrovgrad-Harmanli-Svilengrad section	2012 - 2015	200,3	Financed Co-funded by Cohesion Fund, State Budget, Other (NRIC loan)	N	Y	Y
BG013	BG Plovdiv - Burgas	Rehabilitation of Stara Zagora-Zimnitsa and Tserkovski-Burgas sections	2011 - 2015	244,4	Financed Co-funded by Cohesion Fund, State Budget, Other (NRIC loan)	N	N	Y

The total cost for the above listed 13 studies and works is EUR 848.1 million.

Table 102: Rail projects addressing technical compliance/bottlenecks to be completed between 2016 and 2020

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
				Studies				
SK004	SK Border CZ/SK - Bratislava	Study for Modernization of Kúty - Bratislava - Sturovo Railway Line	2014 - 2016	7,0	Financed ERDF	partly	Y	Y
SK005	SK Bratislava Node	Development of Rail Node Bratislava	2016 - 2018	25,0	Cohesion Fund	N	Y	Y
				Construction works				
HU005	HU Budapest - State Border HU/RO	Gyoma - Békéscsaba railway line rehabilitation	2012 - 2016	n.a.	Financed Co-financed by Cohesion Fund	N	N	Y
HU006	HU Budapest - State Border HU/RO	Békéscsaba - Lökösháza railway line rehabilitation	2017 - 2019	160,9	State budget, to be co-funded by CEF	Y	Y	Y

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
BG002	BG Border RO/BG - Sofia	Modernisation of Vidin - Medkovets section	2016 - 2020	451,3	Co-funded by EU (CEF) State Budget, Other (NRIC loan)	Y	Y	Y
BG010	BG Sofia - Plovdiv	Modernisation of Sofia - Plovdiv railway line, Sofia - Elin Pelin and Elin Pelin - Septemvri sections	2016 - 2020	974,9	Co-funded by EU (Cohesion Fund), State Budget, Other (NRIC loan)	N	Y	Y
BG015	BG Plovdiv - Burgas	Rehabilitation of Plovdiv - Burgas railway line; Phase II	2016 - 2020	299,8	Co-funded by EU (Cohesion Fund 2007-2013) State Budget Other (NRIC loan)	N	Y	Y
EL003	EL Thessaloniki - Athina	Construction of the New Double-Track High-Speed Railway Tithorea – Lianokladi – Domokos	1997 - 2017	1500,0	Financed Co-funded by NSRF 2007-2013	N	Y	Y
EL004	EL Athina - Patra	Construction of new double-track railway line Kiato - Aigio (Rododafni)	2006 - 2017	920,0	Financed Co-funded by Cohesion Fund, co-funded by NSRF 2007-2013; NSRF 2014-2020	N	Y	Y
EL005	EL Athina - Patra	Construction of new double-track railway line Rododafni – Rio	2012 - 2017	502,0	Financed NSRF 2007-2013	N	Y	Y

The total cost for the above listed 10 studies and works is EUR 4,841.1 million.

Table 103: Rail projects addressing technical compliance/bottlenecks to be completed after 2020

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
Construction works								
DE001	DE Oldenburg - Wilhelmshaven	ABS Oldenburg - Wilhelmshaven	2003 - 2022	690,0	Partially financed State budget	N	Y	Y
CZ015	CZ Litomerice - State Border DE/CZ	HSR Dresden - Praha (part border - Lovosice / Litomerice)	n.a. - after 2023	n.a.	TBD	Y	Y	Y
CZ016	CZ Litomerice - Praha	HSR Dresden - Praha (part Lovosice / Litomerice - Praha)	n.a. - after 2023	n.a.	TBD	N	Y	Y
CZ017	CZ Brno - Břeclav	Upgrade of Brno - Břeclav line as a High Speed Rail line	n.a. - after 2023	n.a.	TBD	Y	Y	Y

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
SK006	SK Bratislava Node	Development of Rail Node Bratislava - Works	2019 - 2021	900,0	TBD based on absorption capacity	Y	Y	Y
RO002	RO Craiova - Border RO/BG	Rehabilitation of Railway line Craiova - Calafat	2018 - 2025	n.a.	Co-funded by EU (Cohesion Fund-CEF)	Y	Y	Y
BG003	BG Border RO/BG - Sofia	Modernisation of Medkovets - Ruska Byala section	2019 - 2025	514,1	Co-funded by EU, State Budget, Other (NRIC loan)	Y	Y	Y
BG004	BG Border RO/BG - Sofia	Modernisation of Ruska Byala - Sofia section	2019 - 2025	987,4	Co-funded by EU, State Budget, Other (NRIC loan)	N	Y	Y
EL006	EL Athina - Patra	Construction of new double-track railway line Rio - Patra	2017 - 2022	168,0	Cohesion Fund	N	Y	Y

The total cost for the above listed 9 works project is EUR 3,259.6 million, as far as known.

Table 104: Rail projects addressing technical compliance/bottlenecks with non-scheduled implementation date

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
Studies								
RO003	RO State Border HU/RO - Timisoara - State Border RO/BG	Modernisation of the Arad-Timisoara - Caransebeş line for higher speeds	n.a.	n.a.	TBD	N	Y	Y
RO004	RO Timisoara - State Border RO/BG	Modernisation of the Caransebes-Drobeta Turnu Severin-Craiova line	n.a.	n.a.	TBD	N	Y	Y
BG023	BG Mihaylovo - Dimitrovgrad	Modernisation of Ruse - Dimitrovgrad railway line	n.a.	3,6	Co-funded by EU, State Budget	N	N	Y
Construction works								
DE006	DE Berlin Node	Nordkreuz – Birkenwerder Reconstruction	n.a.	268,0	State budget	N	N	Y
DE007	DE Berlin Node	Südkreuz – Blankenfelde Reconstruction	n.a.	558,0	State budget	N	N	Y
BG019	BG Burgas	Burgas railway node Infrastructure Works	n.a.	18,9	Co-funded by EU, State Budget, Other (NRIC loan)	N	N	Y
BG021	BG Sofia	Sofia railway node Modernisation	n.a.	220,7	Co-funded by EU, State Budget, Other (NRIC loan)	N	N	Y

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
BG006	BG Sofia - Border BG/EL	Modernisation of Sofia - Pernik Razpredelitelna - Radomir section	n.a.	431,5	Co-funded by EU, State Budget, Other (NRIC loan)	N	Y	Y
BG008	BG Sofia - Border BG/EL	Modernisation of Radomir - Kulata line	n.a.	1140,0	Co-funded by EU, State Budget, Other (NRIC loan)	Y	Y	Y
EL011	EL State Border BG/EL - Thessaloniki	Upgrade and electrification of Promahonas – Thessaloniki railway line	2017 - n.a.	80,0	Financed NSRF 2007-2013	Y	Y	Y
EL008	EL Thessaloniki - Athina Core network	Upgrade and electrification of Inoi - SKA (Aharnes) railway line	n.a.	88,0	Cohesion Fund	N	Y	Y
EL013	EL Athina - Igoumenitsa	Construction of Kalambaka-Ioannina-Igoumenitsa - Port of Igoumenitsa missing link	n.a.	1743,0	TBD	N	Y	Y

The total cost for the above listed 12 studies and works is EUR 4,551.7 million, as far as known.

The construction works planned by projects related to achieving technical compliance of railway lines with the standards set out in the Regulation No.1315/2013 will significantly alleviate the current non-compliance bottlenecks until 2020, especially in Bulgaria, Greece and Hungary. Other bottlenecks in Bulgaria and Slovakia will be addressed by 2025.

At a later stage, studies addressing additional sections of technical non-compliancy/bottlenecks would transfer the preliminary work into concrete construction projects. This applies to Romania in particular.

7.1.4.3 Rail and Rail-Road Terminals: Interoperability projects

The key interoperability issue along the OEM Corridor is the lack of ERTMS. An additional interoperability issue is related to organisational conditions for seamless transport flows along the OEM Corridor.

In all Member States along the Corridor, there are in total 19 on-going projects addressing mainly the ERTMS issue. Of these are:

- 5 studies and
- 14 construction works projects.

The costs for the listed studies and works of this category (23 items) amount to EUR 1,280.5 million (as far as costs are known). All projects addressing critical issues.

Table 105 lists the most important projects of this category, which are either located at cross-border sections, are critical issues and/or listed in CEF Regulation, Annex I. For easier visualization, tables are provided for finalization periods 2015, 2016-2020, after 2020 and without date.

Table 105: Rail projects addressing interoperability to be completed by 2015

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
Studies								
AT006	AT Wien - Border AT/HU	ETCS Upgrade: Wien - Gramatneusiedl - Border HU/AT near Nickelsdorf/Hegyeshalom	2014 - 2015	0,1	Financed State guaranteed loans, CEF	Y	Y	Y
EU002	HU, RO, BG, EL Athina - Sofia - Budapest - Hegyeshalom	Part of Priority Project 22 Assessment study to establish common standards	n.a. - 2015	13,0	Financed TEN-T Multi-Annual Programme	partly	Y	Y
Construction works								
CZ022	CZ Brno - Břeclav	CTC Břeclav - Brno	2014 - 2015	10,3	Financed TBD	Y	Y	Y
AT011	AT Entire network / ERTMS	ETCS retrofitting and testing AT, DE, HU, CZ, SI	2013 - 2015	3,1	Financed 2012-EU-60033-P;	partly	Y	Y
HU001	HU Budapest - State Border HU/RO	ERTMS on Budapest Ferencváros - Gyoma railway line	2013 - 2015	45,3	Financed Co-financed by Cohesion Fund	N	Y	Y
HU007	HU Border SK/HU - Budapest	ERTMS on Rajka Border SK/HU - Hegyeshalom railway line	2014 - 2015	2,1	Financed Co-financed by Cohesion Fund	Y	Y	Y
EL010	EL State Border EL/BG – Thessaloniki - Athina	Kiato – Athina – Thessaloniki – Promahonas – Idomeni Rail Corridor: Installation of GSM-R	2006-2015	63,0	Financed OP RAPT 2000-06, OP 2007-2013	partly	Y	Y

The total cost for the above listed 7 studies and works are EUR 136.9 million.

Table 106: Rail projects addressing interoperability to be completed between 2016 and 2020

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
Studies								
SK002	SK Border CZ/SK - Bratislava	ERTMS on corridor IV: Kúty-Bratislava (ETCS L2 + GSM-R)	2015 - 2016	3,5	Cohesion Fund	Y	Y	Y
Construction works								
DE015	DE Bitterfeld - Leipzig	Upgrade of the Berlin-Halle/Leipzig (VDE 8.3) track from ETCS Level 2, SRS 2.2.2+ to ETCS Level 2, SRS 2.3.0d	2018 - 2019	39,0	Financed State budget	N	Y	Y
CZ027	CZ State Border (DE) - Praha - Brno	ETCS on 1st rail transit corridor: State Border (DE) - Dolní Žleb - Praha-Libeň – Kolín	2015 - 2017	25,0	State Budget. Co funding by EU (CEF)	partly	Y	Y

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
CZ010	CZ Přerov - Česká Třebova - Břeclav	ETCS on railway line Česká Třebova - Přerov - Břeclav	2016 - 2018	222,0	State Budget. Co-funding by EU (CEF)	N	Y	Y
SK001	SK Border CZ/SK - Bratislava	ERTMS on corridor IV: Kúty-Bratislava (ETCS L2 + GSM-R)	2017 - 2019	116,3	Cohesion Fund	Y	Y	Y
HU008	HU Budapest - Border AT/HU	ERTMS on Budapest - Győr - Hegyeshalom Border AT/HU railway line	2015 - 2018	25,0	Financed To be co-funded by EU (Cohesion Fund-CEF)	partly	Y	Y
HU002	HU Budapest - State Border HU/RO	ERTMS on Gyoma - Lökösháza HU/RO Border railway line	2013 - 2016	51,3	Financed State budget, to be co-funded by CEF	partly	Y	Y
EL009	EL State Border EL/BG – Thessaloniki - Athina	Deployment of ETCS L1 on the PATHE / P axis	2007 - 2017	17,0	Financed OP RAPT 2000-06, OP 2007-2013	partly	Y	Y

The total cost for the above listed 8 studies and works is EUR 499.0 million, as far as known.

Table 107: Rail projects addressing interoperability to be completed after 2020

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
				Construction works				
CZ019	CZ Czech Republic	Equipment for traffic control on the railway infrastructure	2015 - 2023	614,5	State Budget	N	Y	Y

Table 108: Rail projects addressing interoperability with non-scheduled implementation date

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
				Studies				
AT009	AT CZ/AT border station Břeclav	Stopless Freight Trains AT/CZ	n.a.	n.a.	n.a.	Y	Y	N
AT010	AT HU/AT border station Hegyeshalom	Stopless Freight and Passenger Trains AT/HU	n.a.	n.a.	n.a.	Y	Y	N
				Construction works				
DE012	DE German Rail Network	Electronic Interlocking	n.a.	n.a.	State budget	partly	Y	Y

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
AT007	AT Wien - Border AT/HU	ETCS Upgrade: Wien - Gramatneusiedl - Border HU/AT near Nickelsdorf/Hegyeshalom (Works)	after 2019 – n.a.	n.a.	State guaranteed loans, CEF	Y	Y	Y

The above projects will improve the deployment of ERTMS along the OEM Corridor, including both preliminary studies for implementation and construction works for on-track installations. However, realisation will take place by 2020 or beyond and will not cover all sections of the OEM Corridor.

Rail-Road Terminals

For Rail-Road Terminals, the following project is addressing interoperability, focusing on improvements on an organisational level and fostering innovative technologies.

Table 109: Rail-Road Terminal projects addressing interoperability to be completed by 2020

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
				Study				
DE053	DE Berlin node	Berlin Interoperability Study	2014 - 2020	n.a.	Regional, Private, Local	N	Y	N

7.1.4.4 Rail and Rail-Road Terminals: Intermodality projects

Projects along the OEM Corridor related to intermodality focus on the construction or upgrade of Passenger Rail stations and Rail-Road Terminals, including last mile connections.

The 11 projects addressing intermodality issues for Rail are presented in the following tables. There are:

- 2 studies and
- 9 construction works projects.

The total cost for the listed studies and works of this category amounts to EUR 2,019.3 million (as far as costs are known), whereas 7 projects (EUR 2017.8 mln) address critical issues.

The following three tables list the most important projects of this category, which are either located at cross-border section, are critical issues or CEF-listed. For easier visualization, tables are provided for finalization periods 2015, 2016-2020, after 2020 and without date.

Table 110: Rail projects addressing intermodality to be completed in 2015

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
				Studies				
AT013	AT Wien - Bratislava - Györ	Study New Rail Line Wien Airport - Bratislava / Budapest	2013 - 2015	5,8	Financed State Rail Infrastructure Budget; part TEN-T 2007-AT-17040-P	Y	Y	Y
EL015	EL Athina Node	Realignment of the railway corridor Piraeus - Athina	n.a. - 2015	1,5	Financed Promoter budget, co-funded by EU	Y	N	Y
				Construction works				
AT001	AT Wien Node	New Wien Central Rail Station	2009 - 2015	1014,9	Financed City of Wien, State Rail Infrastructure Budget, Private (Real estate revenues); part of TEN-T 2007-AT-17040P	Y	Y	Y
BG016	BG Sofia	Reconstruction of Sofia station	2013 - 2015	n.a.	Financed Co-funded by EU (EFRD 2007-2013), State Budget, Other (NRIC loan)	N	N	Y

The total cost for the above listed 4 studies and works is EUR 1022.2 million, as far as known.

Table 111: Rail projects addressing intermodality to be completed between 2016 and 2020

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
				Construction works				
AT014	AT Wien Node	Wien Zvbf/ Kledering Rail Clip	n.a. - 2016	63,1	Financed State Rail Infrastructure Budget; part of funded TEN-T 2007-AT-17040-P	N	Y	Y
HU011	HU Budapest Node	Budapest Airport Rail Connection	2019 - 2020	145,1	State budget, to be co-funded by CEF	N	Y	N
BG018	BG Burgas	Reconstruction of Burgas station	2014 - 2016	n.a.	Financed Co-funded by EU (EFRD 2007-2013), State Budget, Other (NRIC loan)	N	N	Y

The total cost for the above listed 3 works projects is EUR 208.2 million, as far as known.

Table 112: Rail projects addressing intermodality to be completed after 2020

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
Construction works								
CZ014	CZ Praha Node	Modernization of the line Praha - Vaclav Havel International Airport	2019 - 2022	n.a.	TBD	N	Y	Y

Table 113: Rail projects addressing intermodality with non-scheduled implementation date

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
Construction works								
DE009	DE Berlin Node	Flughafenanbindung Schönefeld	2006 - n.a.[105]	670,0	Financed State budget	N	Y	Y

Rail-Road Terminals

For Rail-Road Terminals, 11 projects address intermodality issues, out of which are:

- 2 studies and
- 9 construction work projects.

The cost for the listed studies and works of this category amounts to EUR 1,039.3 million (as far as costs are known). The cost of the projects addressing critical issues is approximately EUR 842.3 million.

In the following three tables, the 7 most important projects of this category, which are either located at cross-border section, are critical issues or CEF-listed. For easier visualization tables are provided for finalization periods 2015, 2016-2020, after 2020 and without date.

Table 114: Rail-Road Terminal projects addressing intermodality to be completed in 2015

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
Construction works								
EL051	EL Athina Node	2nd Phase Thriassio Pedio RRT	1999 - 2015	252.0	**Financed** State Budget. Co funded: EU Regio OP 2007-13	N	Y	N

105 Works were almost completely finished in 2011. Finalization of remaining works depends on the date of issue for the construction permits and the opening of BER airport.

Table 115: Rail-Road Terminal projects addressing intermodality to be completed between 2016 and 2020

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
Construction works								
DE052	DE Berlin node	Rail connections to Terminal / Freight Villages and intermodal freight capacities	2014 - 2020	n.a.	State Budget, Regional, Private, Local	N	Y	Y
CZ051	CZ Czech Road Network	Development of transport terminals	2015 - 2020	43.6	State Budget, co-financed by CF /CEF	N	Y	N
SK051	SK Bratislava Node	ZSR Intermodal Terminal Bratislava - 1st phase	2018 - 2020	46.4	State Budget, co-financed by CF /CEF	N	Y	Y
AT051	AT Wien Node	Cargo Centre Wien (Inzersdorf)	- 2017	300.3	Financed EU TEN-T, State Rail IS Budget	N	Y	Y

The total cost for the above listed 4 works projects is EUR 390.3 million, as far as known.

Table 116: Rail-Road Terminal projects addressing intermodality with non-scheduled implementation date

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
Studies								
BG052	BG Sofia	Construction of new intermodal terminal in Sofia area	n.a.	n.a.	n.a.	N	partly	N
Construction works								
EL052	EL Igoumenitsa	Freight village in the Thesprotia region	n.a.	200.0	TBD	N	Y	Y

The total cost for the above listed projects is EUR 200 million, as far as known.

The above projects along the OEM Corridor will mainly be implemented in the short-term (until 2016) and in the medium-term (until 2020). These will improve the interrelations of the rail mode with other modes for both passenger and freight.

7.1.4.5 Rail and Rail-Road Terminals: Capacity projects

The main objective of projects addressing capacity bottlenecks is to increase the capacity of the existing rail sections in order to serve the expected future rail traffic demand.

The identified capacity bottlenecks are mainly located in nodes due to the overlay of international, regional and local traffic flows. This is particularly valid for certain rail network sections in AT, CZ, DE and HU.

In total, 37 projects are addressing capacity issues for Rail, out of which are:

- 4 studies and
- 33 construction works projects.

The total cost for those studies and works of this category amount to EUR 9,244.0 million (as far as costs are known), whereas 25 projects (EUR 7,100.2 mln) address critical issues.

The following tables list the most important projects of this category are, which are either located at cross-border section, are critical issues or CEF-listed. For easier visualization, tables are provided for finalization periods 2015, 2016-2020, after 2020 and without date.

Table 117: Rail projects addressing capacity to be completed by 2015

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
Construction works								
DE003	DE Hamburg node	Knoten Hamburg Upgrading measures	2008 - 2015 (Freight Station Maschen, partly undefined)	545.0	Partially financed State budget	N	Y	N
CZ028	CZ Ústí nad Orlicí	Passage through the railway junction Ústí nad Orlicí	2012 - 2015	40.0	Financed State Budget. Co funding by EU (OPD I)	N	Y	Y
CZ001	CZ Břeclav	Reconstruction of the railway junction Břeclav	2012 - 2015	45.5	Financed State Budget. Co-funding by EU (OPD I)	Y	Y	Y

The total cost for the 3 above listed projects is EUR 630.5 million.

Table 118: Rail projects addressing capacity to be completed between 2016 and 2020

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
Studies								
CZ006	CZ Pardubice	Passage through the railway junction Pardubice	- 2017	18.0	Financed State Budget. Co-funding by EU (OPD II)	N	Y	Y
CZ002	CZ Brno	Railway junction Brno	- 2017	11.0	Financed State Budget. Co-funding by EU (OPD II)	N	Y	Y
AT003	AT Wien - Border AT/CZ	Rail Line Upgrade Břeclav - Wien	2015 - 2018	20.5	State guaranteed loans, CEF	Y	Y	Y

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
Construction works								
DE005	DE Berlin - Rostock	ABS Berlin - Rostock	2005 - 2018 (ETCS undefined)	861.0	Financed State budget	N	Y	Y
CZ012	CZ Praha Node	Optimization of Praha Hostivar – Praha hl.n. 1st part (Praha Freight Bypass)	2014-2016	53.6	State Budget. Co-funding by EU (OPD I)	N	N	Y
CZ013	CZ Praha Node	Optimization of Praha Hostivar – Praha hl.n. 2ndt part (Praha Freight Bypass)	2015-2017	173.0	State Budget. Co-funding by EU (CEF)	N	N	Y
CZ024	CZ Praha Node	Increasing capacity of the Freight Line Praha Líbeň – Malešice – Hostivar/Vršovice (Praha Freight Bypass)	2016-2018	52.0	State Budget. Co-funding by EU (CEF)	N	N	Y
CZ025	CZ Praha - Brno	Modernization of the track section Praha Běchovice - Úvaly	2013 - 2016	65.0	Financed State Budget. Co-funding by EU (Opt. I(40), II(6,5))	N	Y	Y
HU004	HU Budapest – State border HU/RO	Szolnok Railway Node	2018-2020	131.3	State Budget, Co-funding by Cohesion Fund	N	N	Y
HU009	HU Budapest node	Budapest Southern Railway Bridge over Danube	2016-2018	112.9	State Budget. Co-funding by EU (CEF)	N	Y	N
HU012	HU State border HU/AT/SK -Budapest	Biatorbágy – Tata Railway Upgrade	2017-2020	378.1	State Budget. Co-funding by EU (CEF)	N	N	Y
RO001	RO Border HU/RO – Arad	Rehabilitation of Railway line Border HU/RO – Curtici – Arad – Deva – Simeria	2011 - 2017	364.0	Financed Co-funded by EU (Cohesion Fund-CEF)	partly	partly	Y

The total cost for the above 3 studies and 9 projects is EUR 2,240.3 million.

Table 119: Rail projects addressing capacity to be completed after 2020

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
Construction works								
DE008	DE Berlin Node	Nordkreuz-Karow	n.a. - 2021	153.5	Partially financed State budget	N	N	Y
CZ018	CZ Děčín - State border DE/CZ	Děčín tunnels	n.a. - 2022	n.a.	TBD	N	Y	N
CZ009	CZ Děčín - Kolin	Optimization of the line Děčín - Všetaty - Lysá nad Labem - Kolin	2017 - 2021	438.0	State Budget. Co-funding by EU (CEF, OPT II)	N	Y	N
CZ011	CZ Praha Node	Optimization of the line Praha Vysočany- Lysá nad Labem, 2nd construction phase (Praha Freight Bypass)	2016 - 2021	285.0	State Budget. Co-funding by EU (CEF)	N	N	Y
CZ008	CZ Pardubice - Kolin	Optimization of the line Pardubice - Kolín	after 2020	n.a.	n.a.	N	Y	Y
CZ007	CZ Pardubice	Passage through the railway junction Pardubice	2018 - 2022	n.a.	n.a.	N	Y	Y
CZ004	CZ Pardubice - Česká Třebova	Modernization of the line Ústí nad Orlici - Choceň	2021 - 2023	241.0	State Budget. Co-funding by EU (OPT II)	N	Y	Y
CZ005	CZ Česká Třebova	Passage through the railway junction Česká Třebova	- 2021	219.0	State Budget. Co-funding by EU (OPD II)	N	Y	Y
CZ021	CZ Přerov	Modernisation of the railway junction Přerov	2017 - 2021	112.8	State Budget and possible EU Co-financing (CEF, CF)	N	N	Y
CZ003	CZ Brno	Railway junction Brno	2018 - 2023	745.0	n.a.	N	Y	Y
AT008	AT Wien Node	Wien Zvbf Rail Freight Station - Alignment optimization of exit lines	after 2019 - 2027	n.a.	State guaranteed loans	N	Y	Y
AT004	AT Wien - Border AT/CZ	Upgrade Works Rail Line Břeclav - Wien	after 2019 - 2025	600.0	State guaranteed loans taken by OEBB Infra; OEBB considers to apply for EU co-funding (CEF)	Y	Y	Y

The total cost for the 12 above listed projects is EUR 2,794.3 million, as far as known.

Table 120: Rail projects addressing capacity with non-scheduled implementation date

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
Construction works								
DE004	DE Hamburg/Bremen - Hannover	ABS/NBS Hamburg/Bremen - Hannover	2020 - n.a.	1496.0	State Budget	N	Y	Y
CZ026	CZ State Border (DE) - Praha - Brno	Modernization of railway st. Nymburk hl. n.	after 2019 – n.a.	n.a.	OPT II	N	Y	Y
AT005	AT Wien Node Core Network	Extension Wien Erdberger Lände Rail Bridge (section Wien Simmering - Wien Praterkai)	2019 - n.a.	n.a.	State loan, EU-funding	N	N	Y
HU010	HU Budapest Node	Budapest Southern Railway Bypass ("V0")	n.a.	1160.9	Loan	N	Y	N

The total cost for the 12 above listed projects is EUR 2,656.9 million, as far as known.

The projects scheduled to be implemented by 2020 address the main capacity bottlenecks on the OEM rail network. No additional projects are recommended, but concrete implementation timing of various projects has to specified, to avoid long lasting implementation periods.

7.1.4.6 Conclusion

In conclusion, the investment projects for Rail and Rail-Road Terminal are expected to address the majority of existing technical compliance, interoperability, intermodality and capacity bottlenecks in the OEM rail network by 2020. Nevertheless, there are still certain critical ones that will not be alleviated before 2020, in particular regarding the technical non-compliance for certain sections in Bulgaria, Czech Republic and Romania. The undefined timing for a large number of projects is also deemed problematic, as it would hinder an implementation in the short-term. The latter applies to all categories.

7.1.5 Implementation of Inland Waterway Infrastructure including River ports

7.1.5.1 Background

In line with the alignment of the Inland Waterways of the Orient/East Med Corridor as presented in chapter 5.2.3, this part of the implementation reflects all known projects (works and studies) that are related to **the Inland Waterways and River ports of the Northern Corridor area,** comprising the German waterways (Mittellandkanal, Weser, Elbe-Seitenkanal) and the Elbe-Vltava Waterways in Germany and the Czech Republic.

The Danube River ports (Ports of overlapping Danube sections in Austria, Slovakia, Hungary, Romania, and Bulgaria) are only considered by the Rhine-Danube Core network corridor, and have not been listed hereunder.

Table 121 presents for each category the typical objectives of projects assigned. Generic waterworks are also included.

Table 121: Categories and objectives of IWW projects

Project category	Objectives of typical projects
Technical Compliance of Lines (Bottlenecks)	Compliance CEMT class4: e.g. fairways dredging, modernization of locks, securing underpass heights
Interoperability	RIS deployment along IWW, on board and in ports Simplified administration procedures
Intermodality	Project for the Upgrade / Extension of Ports
Capacity bottleneck	Measures that go beyond the requirements of CEMT Class 4 mainly due to capacity improvement
Sustainability	Provision of Alternative Fuels at Ports / LNG in Ports

The comprehensive analysis of IWW projects (works and studies), which are either on-going or planned, identified a total of 25 projects, presented in Annex 5, out of which:

- 15 address technical compliance bottlenecks
- 2 address interoperability issues
- 6 address capacity issues
- 2 address intermodality issues

4 projects are deemed to address non-critical issues.

This implementation plan follows a structure targeting on the implementation timing of the projects. This is to enable the monitoring of the timely coherence of adjacent sections with regard to similar issues. Thus, categorized projects are listed according to:

- Projects finalized until 2020
- Planned projects with envisaged finalization after 2020 or without finalization date
- Either their assignment as a critical issue (as defined in Chapter 5.4), or being a cross-border section or a CEF pre-identified section.

The overall cost of projects listed is a tentative EUR 935.6 million, excluding projects assigned to Maritime ports and to the German VDE Nr. 17 project, which solely amounts to EUR 2037 million for long-term rehabilitation of the Mittellandkanal / Elbe Havel Kanal sections Hannover – Magdeburg – Berlin, which is only partly inside the OEM corridor.

7.1.5.2 IWW and River Ports: Technical compliance projects

Along the Inland Waterway network, 15 studies and works are presented in the following table, which address existing technical bottlenecks and non-compliance with the CEMT class IV requirements, deemed as critical issues and CEF pre-identified projects (see Regulation 1316/2013, Annex 1), out of which 2 additionally refer to cross-border sections. The total cost of the below listed studies and works amount to a tentative EUR 302.4 million (based on known cost estimates), addressing critical issues.

Table 122: IWW projects addressing technical compliance/bottlenecks

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
	To be completed by 2020							
DE101	DE Elbe Geest-hacht - Border DE/CZ	Mittel- and Oberelbe Re-establishing navigation conditions as before 2002 flood (works partially completed)	TBD	69.0	State budget	Y	Y	Y
CZ102	CZ Elbe Mělník – Pardu-bice	Construction of new weir-lock Přelouč II (works - under constr.)	until 2017	111.7	State Budget. EU Co-fund.	N	Y	Y
CZ104		Modernization of the lock chamber Velký Osek (works - under constr.)	until 2016	5.6	State Budget. EU Co-fund.	N	Y	Y
CZ105		Modernization of the lock chamber Brandýs nad Labem (works - under constr.)	until 2016	7.1	State Budget. EU Co-fund.	N	Y	Y
CZ118	CZ Elbe Mělník – Pardu-bice	Study of projects for extension of waterway to Pardubice, works on enhancements of parameters and performance conditions (locks)	n.a. - 2019	n.a.	State budget	N	Y	Y
CZ109	CZ Vltava Mělník - Praha	Securing underpass heights on the Vltava waterway (study in progress)	n.a. - 2018	36.6	State Budget. EU Co-fund.	N	Y	Y
CZ110		Increasing draught levels on the Vltava waterway (study in progress)	n.a. - 2018	2.4	State Budget. EU Co-fund.	N	Y	Y
CZ111		Adaptation of chamber gates in Hořín (study in progress)	n.a. - 2018	8.4	State Budget. EU Co-fund.	N	Y	Y
CZ112		Modernization of the lock chamber Štvanice (study in progress)	n.a. - 2018	4.2	State Budget; EU Co-funding	N	Y	Y
CZ113		Modernization of the lock chamber Praha-Stare Mesto (study in progress)	n.a. - 2018	23.7	State Budget. EU Co-	N	Y	Y

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
					fund.			
CZ114		Adaptation of waterway Zbraslav & Stěchovice (study in progress)	n.a. - 2018	7.3	State Budget. EU Co-fund.	N	Y	Y
CZ106	CZ Elbe Mělník – Pardu-bice	Construction of a new road bridge over Elbe between Valy and Melice	n.a. - 2019	8.0	State Budget. EU Co-fund.	N	Y	Y
CZ107		Stabilization of shipway in the port of Chvaletice	n.a. - 2019	3.2	State Budget. EU Co-fund.	N	Y	Y
CZ103		Modernization of the lock chamber Srnojedy	n.a. - 2019	15.2	State Budget. EU Co-fund.	N	Y	Y
After 2020/unknown completion date								
CZ118	CZ Ústí n. L. –border CZ/DE	Study of projects for stabilisation of navigation depths	n.a. - 2022	n.a.	n.a.	Y	Y	Y

The above projects are mainly located in the Czech Republic. An increased number of German works projects is expected after the finalization of the Overall Study on Elbe IWW "Gesamtkonzept Elbe", which is foreseen in 2015.

7.1.5.3 IWW and River Ports: Capacity projects

The 5 selected capacity projects identified are meant to be successors of those addressing bottlenecks. Their overall cost amounts to EUR 615 million (based on known cost estimates). The cost for two of three projects addressing critical issues is EUR 410 million.

Table 123: IWW and river ports projects addressing capacity

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
	To be completed by 2020							
DE102	DE Elbe IWW: Hamburg - Border DE/CZ	Mittel- and Oberelbe Overall concept for future actions ("Gesamtkonzept Elbe") - study in progress	2013 - 2015+	n.a.	State budget	Y	Y	Y
DE103	DE Weser IWW: Bremen - Minden	Dredging to deepen the fairway, construction of lock Dörverden, construction of new lock Weserschleuse Minden (works under const.)	n.a. - n.a.	205.0	State budget	N	N	Y (NSB)
DE106	DE Mittellan dkanal Magde-burg – Braun-schweig	Mittellandkanal Upgrade (VDE No. 17); Magdeburg - Wolfsburg Upgrade of inland waterway to allow transport with vessels with a capacity up to 2000 tons and convoys up to 3500 tons (works partially	n.a. - 2016	n.a.	State budget	N	N	Y (NSB)

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
		completed); (EUR 2.037 bln for entire section Hannover - Magdeburg – Berlin)						
After 2020/unknown completion date								
CZ101	CZ Ústí nad Labem – border CZ/DE	Improvement of navigation conditions on the Czech Lower Elbe. (includes the DĚČÍN WEIR-LOCK COMPLEX option; study in progress)	n.a. - 2023	160.0	OPD II / CEF	Y	Y	Y
DE105	DE Elbe-Seiten-kanal	Extension of Ship lift Lüneburg Scharnebeck	n.a. - n.a.	250.0	State budget	N	Y	N

7.1.5.4 IWW and River Ports: Intermodality projects

The only project addressing a critical issue, and listed in CEF Regulation Annex 1, is the 1st part of the construction of the Pardubice Port amounting to EUR 8.2 million.

Table 124: River ports projects addressing intermodality

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
	To be completed by 2020							
CZ208	CZ Mělník – Pardu-bice	Construction of a new public port of Pardubice – Phase 1 (Study finalized)	n.a. - 2019	8.2	State Budget. EU Co-fund.	N	Y	Y

Intermodality projects related to German river ports are not known. Projects for the Sea Ports of Hamburg and Bremerhaven are described in section 7.1.5.6.

7.1.5.5 IWW and River Ports: Interoperability projects

Regarding the interoperability of Inland Waterway Transport, which mainly relates to River Information Services and Traffic control, there are 2 projects along the OEM corridor IWW and ports, which address critical issues with a total cost of EUR 10.5 million (based on known cost estimates).

Table 125: IWW and river ports projects addressing interoperability

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
	To be completed by 2020							
EU101	AT, CZ, SK, HU, RO, BG Danube, Elbe	IRIS Europe 3 on further RIS implementation	01/2012-12/2014	10.5	2011-EU-70001-S; TEN-T 50%	N	Y	N
After 2020								
CZ116	CZ	Traffic control of waterways (water transport management projects and equipment for increasing reliability of waterways)	2014 - 2023	n.a.	n.a.	N	Y	Y

7.1.5.6 IWW and River Ports: Relation to Maritime Projects

Additionally to the categories listed above, there are 4 projects listed as Maritime / Seaports Projects constituting interoperability and intermodality related studies and works for Bulgarian ports addressing critical issues. Their costs amount to EUR 7.7 million.
Additional projects related to the Bremerhaven (6 projects / EUR 36.5 mn known costs) and Hamburg Seaport (13 projects; EUR 862.5 mln) might have a significant impact to Inland Water Transport as well, are listed under Annex 5.

7.1.5.7 IWW Implementation Plan - Conclusion

Evaluation of Cross-border coherence

The Study on the Improvement of Navigability Conditions on Lower Elbe (incl. Děčín Lock-Weir complex project; see Capacity, 2020-2030) located close to the DE/CZ border, aims to guarantee sufficient draught in the Czech part of the Elbe, but due to its location, has a significant cross-border environmental impact and constitutes a major issue of recent stakeholder involvement. It is expected that the German study "Gesamtkonzept Elbe" sufficiently addresses all IWW development issues for the sustainable development of the entire Elbe Waterway.

In Germany, no specific RIS project for River Elbe is listed to present. RIS related interoperability projects are rather few on the entire corridor.

Evaluation of Bottleneck Mitigation

The main bottleneck is the non-compliance of River Elbe, comprising of a number of technical bottlenecks from the viewpoint of compliance in waterway infrastructure and the actual technical and operating conditions:

- Deficiencies due to non-compliant waterway parameters
- Incomplete network (CZ), network capacity deficiencies
- Port infrastructure capacity deficiencies
- Deficiency in terms of navigation fluency and safety

In the Czech Republic, the foreseen mitigation measures are deemed to alleviate the above mentioned bottlenecks. In Germany, the mitigation measures are not defined yet and are expected as a result or follow-up of the German study "Gesamtkonzept Elbe".

Evaluation of Implementation Timing

The implementation timing of various projects is still unspecified, suggesting that implementation will not be realised in the near future. A jointly coordinated schedule is expected with the German study "Gesamtkonzept Elbe".

In the Czech Republic, the Extension of Navigability from Mělník to Pardubice is scheduled in phases until 2019, while the project "Securing navigability of Dolní Vltava from Mělník until beyond Praha" until 2018.

Weser River fairway improvement measures in Germany are given without specific timing.

7.1.6 Implementation of Maritime Infrastructure including Seaports

7.1.6.1 Background

Table 126 presents for each category the typical objectives of projects assigned.

Table 126: Categories and objectives of maritime infrastructure and seaport projects

Project category	Objectives of typical projects
Intermodality/Technical Compliance of Lines	Construction of seaports connection to the rail network
Interoperability	Deployment of e-maritime and single-window services: i.e. VTMIS, PCS, etc.
Capacity bottleneck	Upgrade, extension of port infrastructure, i.e. terminals
Sustainability	Provision of Alternative Fuels at Ports / LNG in Ports, waste reception facilities, etc.

The comprehensive analysis of projects (works and studies), which are either on-going or planned, identified a total of 45 projects related to maritime infrastructure and seaports, out of which:

- 9 address intermodality/technical compliance bottlenecks
- 6 address interoperability issues
- 21 address capacity issues
- 9 address sustainability.

The costs of all listed studies and works for this mode amount to EUR 1.779 billion, out of which EUR 1.236 billion correspond to projects that address critical issues and/or are listed in CEF Regulation Annex I (based on known cost estimates).

7.1.6.2 Maritime: Intermodality

Table 127 presents the seaport and maritime projects related to intermodality addressing critical issues and/or listed in CEF Regulation, Annex I , under two categories, namely those that are expected to be completed by 2020 and those after 2020 or with unknown completion date. Total costs for the completion of these projects amounts to a tentative EUR 35.6 million (based on known cost estimates).

Table 127: Seaport and Maritime transport projects addressing intermodality

No.	Location	Project name	Timing	Cost €M	Financing sources	CI	CEF
To be completed by 2020							
BG208	BG Burgas	Multimodality works	2015-2019	2.6	State Budget Co-funded by EU	Y	Y
EL201	EL Thessaloniki	Rail connection to the Port of Thessaloniki	2014-2015	33.0		Y	Y
After 2020/unknown completion date							
BG207	BG Burgas	Multimodality Feasibility Study	n.a	n.a	State Budget Co-funded by EU	Y	N
EL203	EL Patras	Construction of rail connection to the Port of Patras	n.a.	n.a.	n.a.	Y	Y

The above projects include primarily the works to facilitate the multimodal transport in the Port of Burgas foreseen to be completed by 2019, and the upgrade of the rail connection at the Port of Thessaloniki envisaged to be completed by 2015, all mitigating existing bottlenecks.

There is an additional study planned for the multimodal transport in the Port of Burgas, for which no dates are yet known.

The missing rail connection at the Port of Patras has been taken into consideration in the Operational Programme "TRANSPORT INFRASTRUCTURES, ENVIRONMENT & SUSTAINABLE DEVELOPMENT 2014-2020" within the context of the completion of the Kiato-Patras section, and is currently at the study phase as the last mile connection of the Rio-Patras railway line through the city and to the Port of Patras. To this end, the project could be assumed that it would be realised after 2020.

It should be noted that the missing rail connections in the Greek ports of Patras and Igoumenitsa constitute the OEM Corridor's two key critical issues with regard to intermodality. With regard to the rail connection at the Port of Igoumenitsa, it is recommended by the Study authors to be considered within the missing link of the western extension of the railway network of Greece, Igoumenitsa-Ioannina-Kalambaka-Kozani.

7.1.6.3 Maritime: Interoperability

Table 128: Seaport and Maritime transport projects addressing interoperability

No	Location	Project name	Timing	Cost €M	Financing sources	CI	CEF
To be completed by 2020							
BG202	BG Burgas	Implementation of VTMIS-Phase VI	2015-2018	9.2	State Budget Co-funded by EU	Y	Y
BG205	BG Burgas	Feasibility study for Port Community system	n.a.	n.a.	State Budget Co-funded by EU	Y	Y
BG206	BG Burgas	Works for Port Community system implementation	2015-2019	5.1	State Budget Co-funded by EU	Y	Y
CY207	CY Lemesos	Implementation of Port Community system	-2017	n.a.	State Budget Co-funded by EU	Y	Y
After 2020/unknown completion date							
EL204	EL Heraklion	Deployment of VTMIS system	n.a.	1.5	n.a.	Y	Y

The implementation of VTMIS in the Port of Burgas will be fully completed by 2018, while a Port Community System (PSC) is also planned to be in place by 2019. A study for the implementation of VTMIS in the Port of Heraklion has been completed, however, the timing of related works is yet unknown. Finally, a PSC will be implemented in the Port of Lemesos by 2017. The above investments are expected to alleviate related interoperability bottlenecks for the OEM Seaports at a total tentative cost EUR 15.8 million (based on known cost estimates).

It should be noted that for the Port of Patras missing such a traffic management system, there is no related project planned for implementation. Consequently, this still constitutes a critical interoperability bottleneck and is recommended by the Study authors to be addressed by a related project.

7.1.6.4 Maritime: Capacity

The projects addressing critical capacity issues at the OEM Seaports, part of which are also listed in CEF Regulation, Annex I, are presented in Table 129.

Investment projects targeted at increasing critical seaport capacity issues are planned for the Port of Lemesos, Bremerhaven and Igoumenitsa, expected to be completed by 2020.

Additional capacity projects are planned, related to a further expansion of the Terminal 2-Vasiliko at the Port of Lemesos (together with new equipment and tug boat), fairway adjustments at the Port of Hamburg, and expansion and deepening works at the Port of Rostock, which are expected to be implemented after 2020. Also, the Port Authority of Heraklion has completed the study for the port expansion and construction of new port facilities; however, related works have not been scheduled yet. The tentative total cost of the above projects amounts to EUR 1.065 billion.

Table 129: Seaport and Maritime transport projects addressing critical capacity issues

No	Location	Project name	Timing	Cost €M	Financing sources	CI	CEF
To be completed by 2020							
DE201	DE Bremer-haven	Quality and capacity upgrade (Kaiserhafen)	2013-2015	8.0	Private sector	Y	Y
DE202	DE Bremer-haven	Quality and capacity upgrade (Imsumer Deich)	2014-2016	24.0	Private sector	Y	Y
EL202	EL Igoumenitsa	Phase B and Phase C of infrastructure development projects	-2018	139.6	EU funded	Y	Y
CY201	CY Lemesos	New passenger terminal	-2016	14.5	State Budget	Y	Y
CY202	CY Lemesos	Extension of the south container quay	-2016	25.0	State Budget Co-funded by EU	Y	Y
CY203	CY Lemesos	Expanding the cargo storage capacity	2017-2020	40.0	State Budget Co-funded by EU	Y	Y
After 2020/unknown completion date							
DE204	DE Hamburg	Fairway adjustments	n.a	250.0	State Budget	Y	N
DE207	DE Rostock	Expansion and deepening of the Warnow-Seekanal	n.a	n.a	State Budget	Y	N
EL205	EL Heraklion	Port expansion and construction of new facilities	n.a.	35.4	To be defined	Y	Y
CY204	CY Lemesos	3 Super Post-Panamax Gantry Cranes	2016-n.a	30.0	State Budget Co-funded by EU and Private Funds	N	Y
CY205	CY Lemesos	New Tug Boat	2016-n.a	7.5	State Budget Co-funded by EU and Private Funds	N	Y
CY206	CY Lemesos	Expansion of Terminal 2 Vasiliko	2018-n.a.	491.3	State Budget Co-funded by EU	Y	Y

7.1.6.5 Maritime: Sustainability

Table 130 lists the seaport projects related to sustainability, which do not address critical issues, but are listed in CEF Regulation, Annex I. The projects amount to a total tentative cost EUR 100.3 million.

It should be noted that there are no projects foreseen for the provision of alternative fuels in the OEM ports currently lacking such services, and, hence the consultant recommend that these are taken into consideration.

Table 130: Seaport and Maritime transport projects addressing sustainability

No	Location	Project name	Timing	Cost €M	Financing sources	CI	CEF
	After 2020/unknown completion date						
DE208	DE Rostock	Onshore power supply for vessels	-2030	n.a.	State budget	N	Y
DE218	DE Hamburg	Smart Port Energy	2015-n.a.	75.0	State Budget (Hamburg Port Authority)	N	Y
DE219	DE Hamburg	Smart Port Logistics	2015-n.a.	25.0	State Budget (Hamburg Port Authority)	N	Y
EL206	EL Heraklion	Maintenance works: dredging	n.a.	0.3	To be defined	N	Y

7.1.6.6 Conclusion

In conclusion, the investment projects are expected to address the majority of existing intermodality, interoperability and capacity bottlenecks in the OEM seaports by 2020. Nevertheless, there are still certain critical ones that will not be alleviated before 2020, such as the missing rail connections to the Greek ports of Igoumenitsa and Patras, the deployment of a Port Traffic Management System at the Port of Patras, as well as the provision of alternative fuels missing from the Port of Burgas and all Greek ports apart from Piraeus.

7.1.7 Implementation of Road Infrastructure

7.1.7.1 Background

Table 131 presents for each project primary category the typical objectives of road projects assigned.

Table 131: Categories and objectives of road infrastructure projects

Project category	Objectives of typical projects
Technical Compliance of Lines (Bottlenecks)	Missing links in expressway/ motorway network Provision of secure parking
Interoperability	Interoperable tolling systems (if relevant) ITS deployment
Capacity bottleneck	Capacity upgrades Road congestion in urban areas
Sustainability	Alternative fuels

The comprehensive analysis of projects and studies, which are either under way or are planned, identified in total 79 projects and studies, out of which:

- 37 address technical compliance/ bottlenecks
- 8 address interoperability
- 26 address capacity issues and
- 3 address sustainability.

In addition, there are 5 projects identified that address intermodality of passenger road trips.

The costs for the listed studies and works of this mode amount to EUR 15.230 billion (as far as costs are known).

As a second level of categorisation, additional information is provided per each listed project, with regard to whether it addresses a critical issue, is located in cross-border area and/ or is listed in the CEF Regulation Annex 1, as defined in section 7.1.2.

- 11 projects are located in cross-border areas (none of these addresses critical issue and one is CEF-listed);
- 7 projects address critical issues, out of which 5 are listed in CEF Regulation Annex 1;
- 4 more projects are CEF-listed, although are neither located in cross-border area nor address critical issues.

The costs for these listed projects amount to EUR 3.86 billion.

The following sections are highlighting only the above mentioned selection (2nd level of categorization), in order to highlight the key corridor road projects.

7.1.7.2 Road: Technical compliance/ Bottlenecks

The main bottlenecks identified along the OEM Road network are those related to non-compliant road class, namely roads without level-free junctions (mainly single carriageway).
Currently, in Romania and Bulgaria are 3 projects under way, which are scheduled to be completed in 2015/2016:

- 1 study and
- 2 construction works projects.

Table 132: Road projects addressing technical compliance/bottlenecks to be completed by 2015

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
		Studies						
BG308	BG A3 Blagoevgrad - Sandanski	Preparation for construction of 65 km A3 Struma motorway section	2011-2015	4.2	Co-funded by EU funds	Y	N	N
		Construction works						
RO302	RO Nadlac – Arad Motorway	Construction of new motorway (A1), section Nadlac – Arad (38.9 km)	n.a.-2015	296.8	Co-funded by EU funds	Y	N	N
BG307	BG Sandanski - Kulata	Construction of 14.7 km section A3 Struma Motorway	2012-2014	34.5	Co-funded by EU funds; State Budget	Y	N	N

The above projects consist of construction of new motorway sections with total length of some 54 km and total tentative costs of EUR 335.5 million. When finalised, these projects, together with other road projects[106] that are under way, will provide for increasing the relative share of motorway/express road sections to 97% of the total Corridor length.

[106] i.e. projects not listed in this selection as being neither listed as CB, CI nor CEF

Information on projects addressing technical compliance/ bottleneck issues, which are planned, but not started yet, is presented in the next table per time horizon.

Table 133: Road projects addressing technical compliance/bottlenecks

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
To be completed by 2020								
AT303	AT A5 Schrick – Poysbrunn	Construction of 25 km motorway section Schrick - Poysbrunn	2014/ 2015-2017	324.0	Public, State-guaranteed loans, Private	partly	N	N
AT307	AT A5 Poysbrunn - Border AT/CZ	Construction of 5km section Drasenhofen bypass, part of A5 Wien – CZ border (-Brno) motorway	2016-2018	54.5	Public, State-guaranteed loans, Private	Y	N	N
HU301	HU Border SK/HU Rajka - Hegyeshalom	Upgrading of 14 km section of M15	2016-2018	29.50	Co-funded by EU funds	Y	N	Y
DE312	DE German Motorway Network	Actions to improve safety and security on parking space for trucks	2014 - 2020	58.0	State Budget	N	N	Y
After 2020/unknown completion date								
CZ310	CZ Pohorelice – border CZ/AT	Upgrading R52 route to Austrian border; (23km)	after 2014-n.a.	380.0	TBD	Y	N	N
AT308	AT Poysbrunn - Border AT/CZ	Construction of 9 km Poysbrunn - Drasenhofen section of A5 motorway	n.a.-2030	91.0	Public, State-guaranteed loans, Private	Y	N	N
BG309	BG Blagoevgrad - Sandanski	Construction of 65 km A3 motorway section, incl. 17.35 km tunnels	2014-2021	850.0	Co-funded by EU funds; State Budget	Y	N	N
CY302	CY Lefkosia	Completion of missing link of Lefkosia South Orbital Motorway (in two phases)	After 2020	220.0	Co- funded by EU funds; State Budget	N	Y	Y

Most of these projects refer to the construction or upgrade of motorways/express roads in CZ, AT, HU, BG and CY.

The estimated costs for projects scheduled to be completed until 2020 amount to a tentative EUR 463.0 million. For the projects to be completed after 2020, the total cost amounts to EUR 1 541 million.

The projects scheduled to be completed by 2020 will solve the current non-compliant road class issues along the following sections:

- D8 Bilinka – Rehlovice (CZ)
- A5 Poysbrunn – Schrick (AT)
- M15 Rajka – Hegyeshalom (HU)
- M43 / A1 Makó (HU) - Border HU/RO – Arad (RO)
- Dupnitsa – Blagoevgrad (BG)
- Sandanski – Kresna (BG)
- Orizovo – Harmanli (BG)
- Strymoniko – Petritsi (EL)
- Lamia – Raches (EL)
- Skotina – Evaggelismos (EL)
- Korinthos – Patra (EL).

For the period after 2020, the following technical non-compliancy/ bottlenecks will remain:

- R1 Praha ring road (CZ)
- R52/A5 Pohorelice – Mikulov Border AT/CZ (CZ) - Drasenhofen – Poysbrunn (AT)S1 Wien Ring Road (AT)
- M0 Budapest Ring Road Lugoj – Drobeta Turnu Severin – Calafat (RO)
- Vidin – Montana - Vratsa (BG)
- Mezdra – Botevgrad (BG)
- Blagoevgrad – Sandanski (BG)
- Petritsi – Langadas (EL)
- Lefkosia South orbital motorway.

The study authors recommend further projects to be identified to address the insufficient supply of safe parking facilities along the following road sections:

- Berlin ring road (DE)
- Timişoara – Lugoj (RO)
- Drobeta-Turnu-Severin (RO)
- Dupnitsa – Kulata (BG)
- Orizovo – Svilengrad BG/TR border (BG)
- Promahonas – Thessaloniki (EL).

7.1.7.3 Road: Interoperability

An important operational bottleneck identified in the analysis is the missing interoperability of on-board units for freight road tolling, used in Austria, that are compliant with systems in Central European countries (Slovakia, Czech Republic, and Hungary).

The CROCODILE project is the only study under elaboration and addresses exchange of data and information between all involved public authorities and private partners. The project aims at the provision of information services to truck drivers on parking space, implementation of services for user information on safety critical traffic information, improving the efficiency of traffic flows and reduce congestion, and stimulating investment in ITS infrastructure. This project is developed with the participation of AT, CZ, DE, HU, RO.

One more project is anticipated to be completed by 2020, as presented in the next table. The Slovak project is relevant to both cross border and urban areas. The tentative budget for interoperability projects scheduled to be completed until 2020 amounts to EUR 55.9 million.

Table 134: Ongoing and Planned road projects addressing interoperability issues

No	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
To be completed by 2020								
EU301	AT, CZ, DE, HU, RO Road networks Core and Comprehensive Network	CROCODILE (Study)	2013-2015	31.4	National budget: 20.33; Action promoter: 4.8; EU support: 20%	Y	Y	Y
SK301	SK Border CZ/SK-Border SK/HU	Modernization and completion of Information and control system of motorway	2015-2018	24.5	TBD	N	N	Y

No	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
After 2020/unknown completion date								
CZ311	CZ entire motorway network	ITS on highways, limited access highways and 1st class roads (incl. operation or toll system)	2014-2023	1 272	TBD	N	N	Y
CY306	CY A1 & A2	Expanding Intelligent Transport Systems along Lefkosia - Lemesos - Larnaka	2017-n.a.	5.0	Co- funded by EU funds; State Budget	N	N	Y

Two more projects that address interoperability issues are planned to be completed after 2020. The Czech ITS project is related to data collection, traffic information services, and traffic management, electronic toll system, eCall service, while the Cyprus project refers to traffic management, road safety and freight transport in non-urban areas.

Total budget of interoperability projects scheduled for the period after 2020 amounts to about EUR 1 300 million.

The identified projects will only partially contribute to achieving interoperability of ITS and tolling systems along the Corridor. Plans for introducing traffic management systems cover limited sections of the most traffic intensive routes.

The Study authors recommend suitable measures to be identified to address the most traffic intensive sections, as identified in section 5.2.6.3.

7.1.7.4 Road: Capacity

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 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, AT, SK, and BG. In Austria, this refers to the disputed new construction of the Wien Eastern Motorway bypass that mainly serves the international traffic on the North-South direction. In addition, a number of projects address capacity bottlenecks along the Czech motorway D1, which is the main road artery of the Czech Republic.
Road projects that are planned to be completed after 2015 are presented in the next table.

Table 135: Road projects addressing capacity to be completed after 2015

No.	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
		To be completed after 2015						
SK306	SK D2 Bratislava - Border SK/HU	Study on Motorway Junction D2 Čunovo	n.a.	1.5	TBD	Y	N	N
CY303	CY A1 Lefkosia-Lemesos	Upgrading Sia Grade Separated Junction	2015-2018	1.5	Co-funded by EU funds; State Budget	N	Y	N
CY304	CY A1 Lefkosia-Lemesos	Construction of Stavrou Grade Separated Junction	2018-2020	25.0	Co-funded by EU funds; State Budget	N	Y	N

The projects scheduled to be implemented after 2015 address the main capacity bottlenecks. The tentative costs for these projects are EUR 28 million. No additional projects regarding critical issues, cross-border or CEF list are recommended.

7.1.7.5 Road: Sustainability

There are three projects identified (one in HU and two in CY) that address sustainability issues, none of these being classified as located in cross-border area, nor addressing critical issues, nor CEF-listed.

7.1.7.6 Road: Intermodality

As a general rule, intermodality is not deemed relevant to road studies/projects in this study, except special case projects as presented in the next table.

Table 136: Road studies and works addressing intermodality issues

No	Location	Project name	Timing	Cost €M	Financing sources	CB	CI	CEF
CY301	CY Lemesos	Link road connecting Lemesos-Paphos Motorway with the Lemesos Port	n.a. 2017	100.0	Co- funded by EU State Budget	N	Y	Y
CY305	CY A1 & A2 Lefkosia-Lemesos - Larnaka	Interurban Multimodal Terminals; Three Interurban Multimodal (Study)	2017-2020	15.0	Co- funded by EU State Budget Private Funds	N	Y	Y
EL301	EL Thessaloniki Node Core network	Study on connection of Egnatia/PATHE highways with Macedonia Airport of Thessaloniki	n.a. 12/2014	11.8	State budget, co-funded by EU	N	Y	N
EL306	EL Thessaloniki node	Road connection between Port of Thessaloniki and Egnatia Odos Motorway (Works)	2010-2014	30.0	TBD	N	Y	Y

7.1.8 Implementation of Air Traffic Infrastructure

The actual list of projects does not include any project with regard to the requirements of the TEN-Regulation, e.g. the capacity to provide alternative fuels for aircraft.

Though, the target of intermodal interconnection of airports through high-ranking road and rail infrastructure is listed under the respective modes of transport.

7.1.9 Summary of all measures

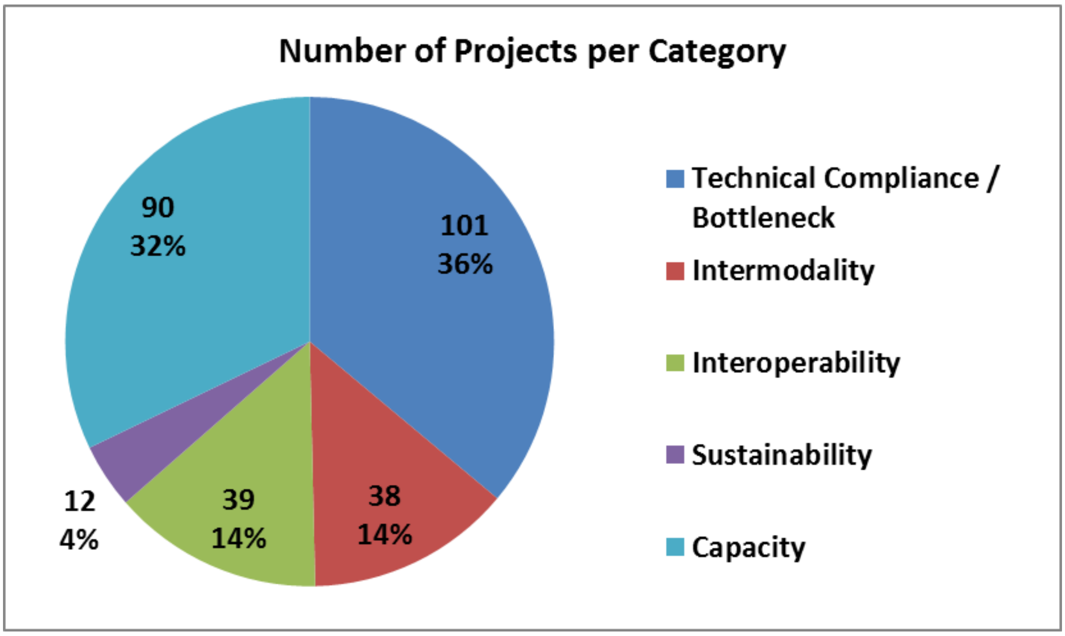
A total of 280 projects including infrastructure works and studies as well as administrative measures have been identified, which will make up a first list of measures of the Orient/East Med Core Network Corridor (OEM measures). Out of this total, a number of:

- 101 items address technical compliance bottlenecks ;
- 39 items address interoperability issues;
- 38 items address intermodality issues;
- 90 address further capacity issues[107];
- 12 address sustainability issues.

Number of Projects

This is depicted in the following graph and table.

Figure 56: Number of OEM projects per category (Total=280)



[107] For the distinction between the categories „Technical Compliance/Bottleneck‟ and „Capacity‟, see chapter 7.1.2.

Table 137: Number of projects per category and mode

OEM Number of projects per transportation mode and category	IWW & inland ports	Multimodal logistics platform	Rail	Road	Seaport & Maritime Transport	Total
Technical Compliance / Bottleneck	15	-	49	-	37	**101**
Intermodality	2	9	11	11	5	**38**
Interoperability	2	6	22	1	8	**39**
Sustainability	-	9	-	-	3	**12**
Capacity	6	21	37	-	26	**90**
Total	**25**	**45**	**119**	**12**	**79**	**280**

The majority of projects (43%) are related to Rail projects, followed by Road projects (28%) and Maritime/Seaports projects (16%), whereas IWW/Ports (9%) and Rail/Road Terminals (4%) are significantly lower (see Figure 57)
However, the size of projects varies significantly between countries and modes, what limits the statistical comparability of projects.

When looking at the 172 projects to be implemented until 2020, the share of project numbers per mode is rather similar (see Figure 58).

Figure 57: Number of OEM projects per transport mode (Total=280)

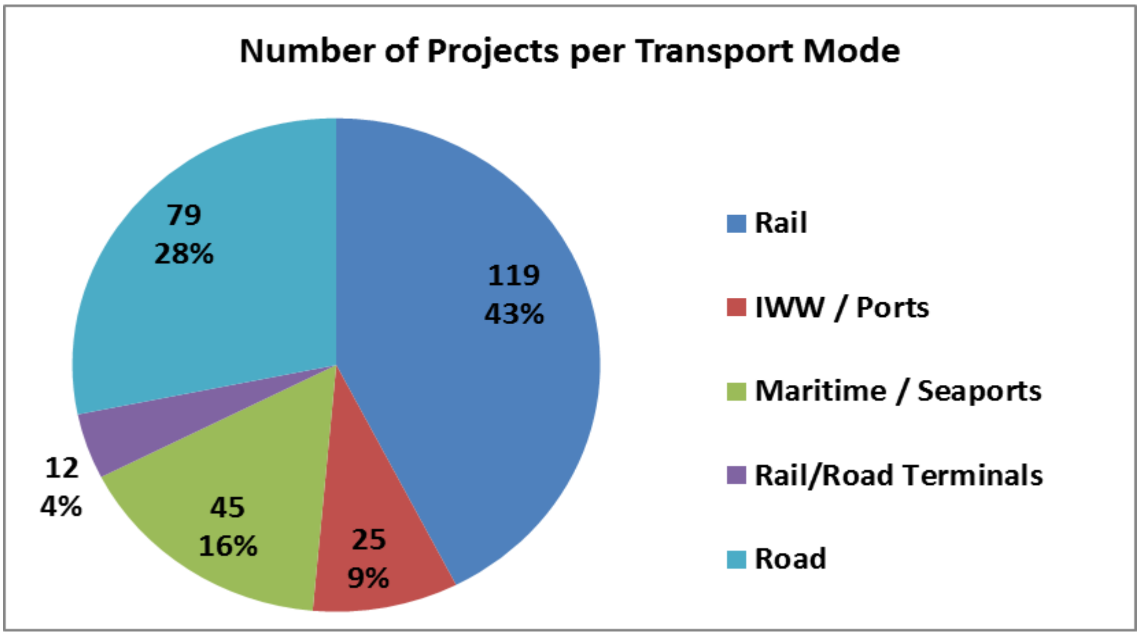
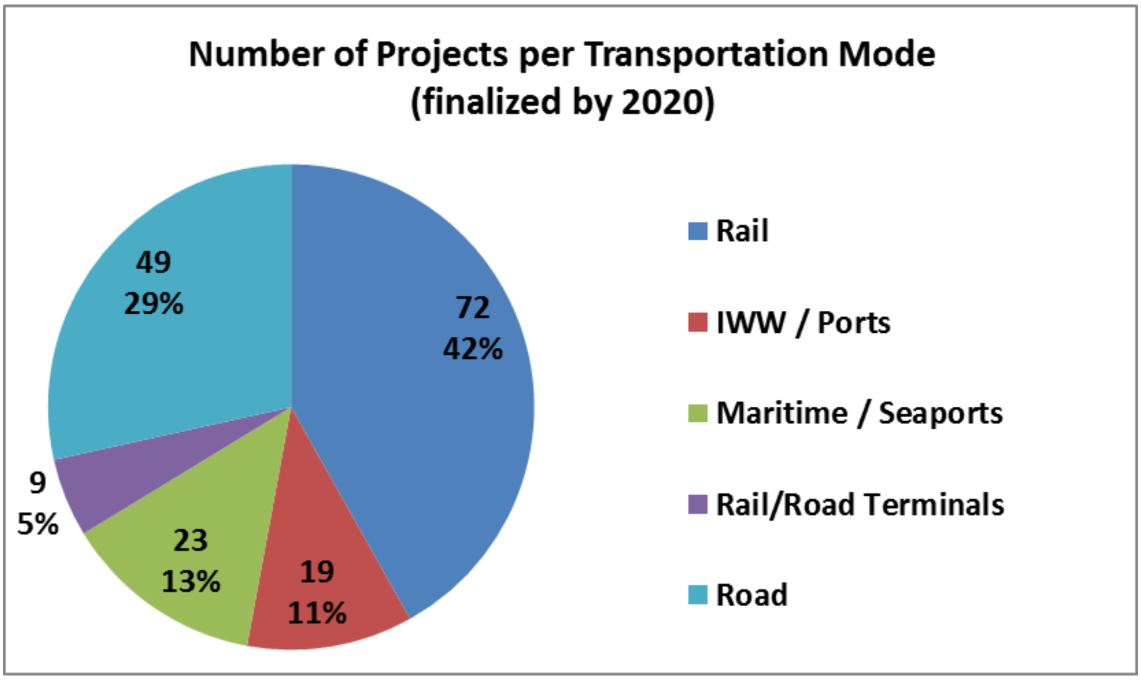


Figure 58: Number of OEM projects per mode until 2020 (Total=172)

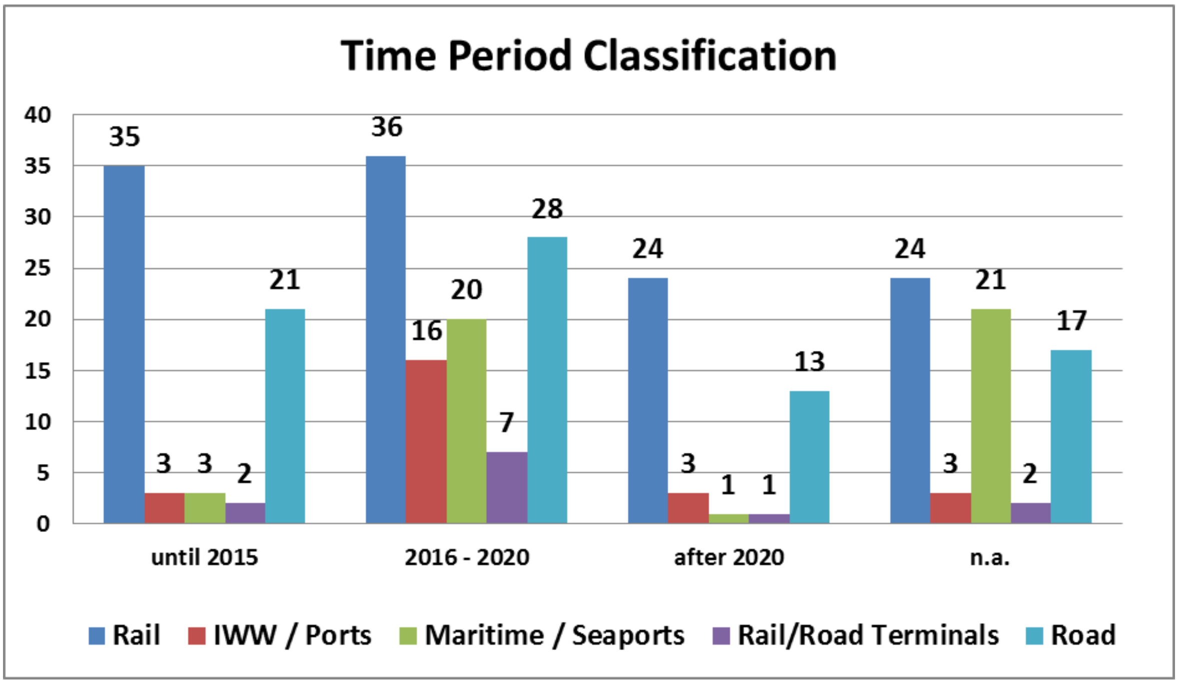


Implementation Timing

With regard to the implementation horizon of the projects (i.e. the indicative end year of study resp. end of works), 64 measures (23%) will be finalized until 2015, 107 measures (38%) between 2016 and 2020 and 42 measures (15%) between 2020 and 2030. The majority of 2016-2020 can be linked with the upcoming Multi-annual programmes in the time period 2014-2020.

A special concern are the 67 measures (24%) that are without any finalization date, indicating some implementation challenges, open financing or other needs for coordination. This especially applies to Maritime/Seaport projects of all related countries. This topic might constitute a special task of the European Coordinator of the Corridor, to schedule such projects in order to avoid any time gap at border crossing infrastructure lines.

Figure 59: Number of OEM projects per mode and timing (Total=280)



Critical issues

Measures that address the mitigation of Critical issues (as defined under chapter 5.4) sum up to 144 works or studies, which form about the half of the overall projects. Figure 60 show the modal share, highlighting the relatively high share of projects addressing critical issues for IWW (84%), Rail/Road Terminals (67%) and Rail (74%).

Cross-border projects

There are in total 54 so called cross-border measures that are in Border areas (as defined under section 7.1.2), whereas per definition seaports and airports are not constitute cross-border sections. Thus, the modal share of projects is similar to the one of overall number.

CEF pre-identified sections and projects

As shown in Figure 60, there are 163 projects (58%) answering on pre-identified sections and projects listed in the CEF Regulation 1316/2013 (Annex 1). 86% of rail projects, 84% of IWW, 56% of Maritime projects and 42% of RRT projects fall under this category. Only 13% of road projects are answering on the CEF list.

Figure 60: Number and Share of OEM projects addressing Critical issues

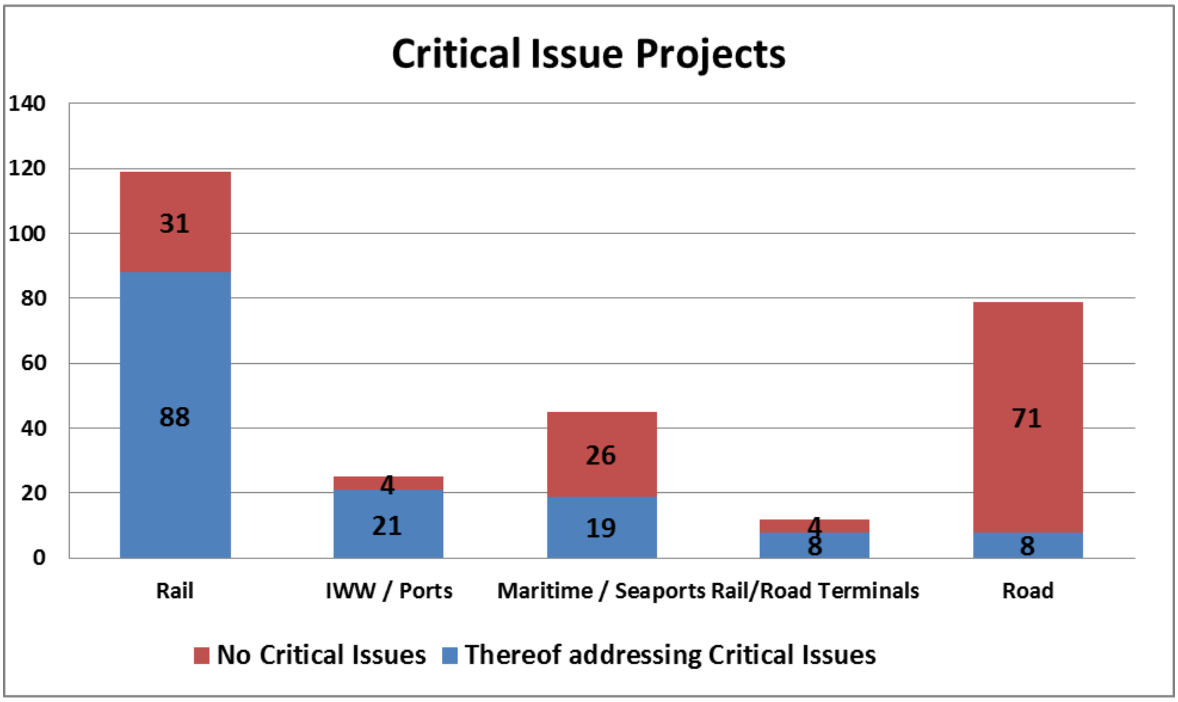


Figure 61: Number of OEM projects addressing Critical issues

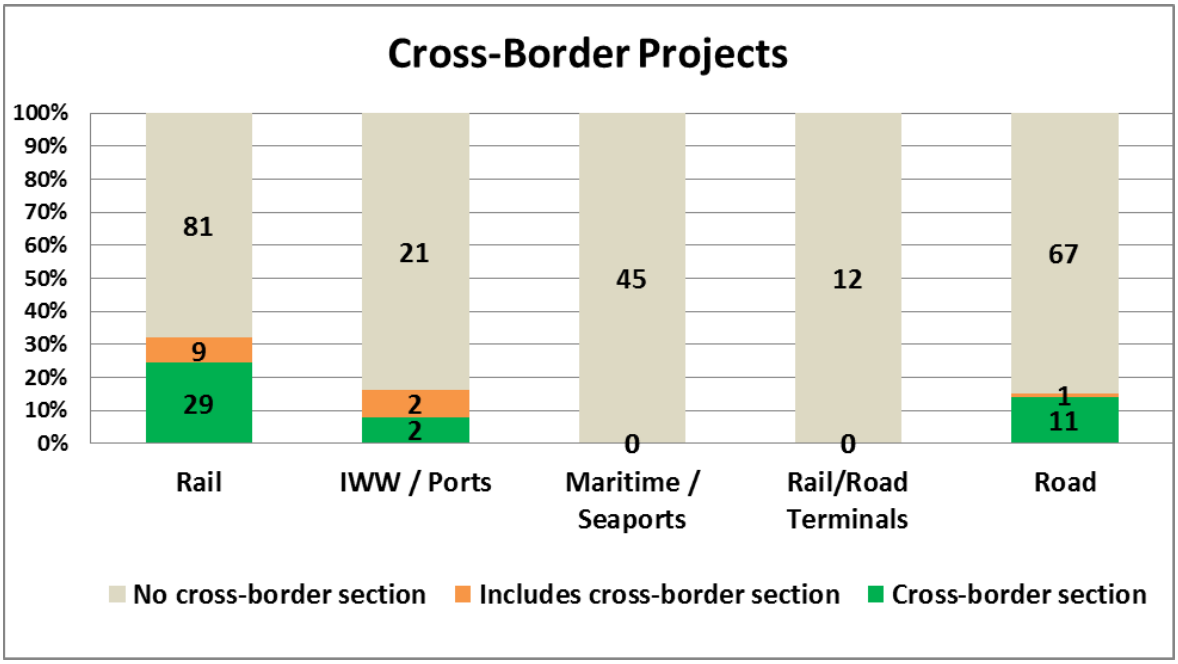
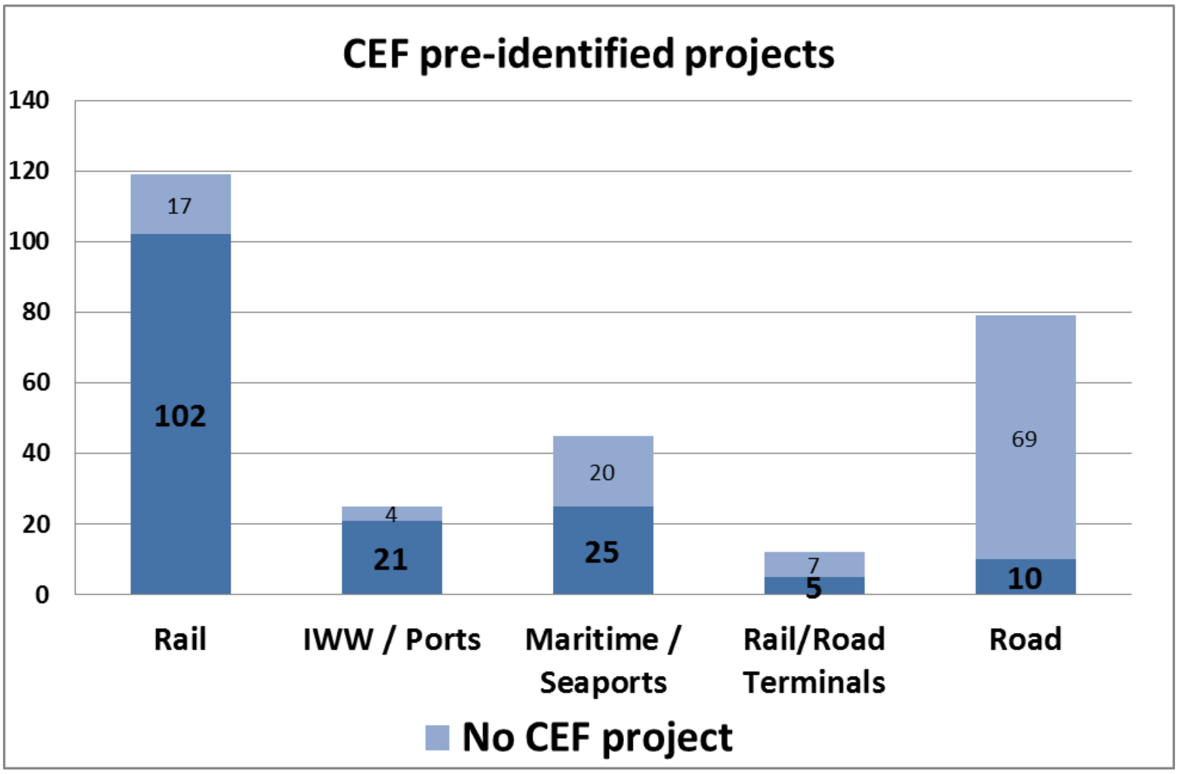


Figure 62: Number of OEM projects addressing pre-identified sections listed in CEF Regulation 1316/2013, Annex 1



Cost of Projects

The total cost of projects (as far as costs are known) amounts to approximately EUR 47.4 billion, thereof projects addressing critical issues to EUR 25.6 billion. Figure 63 depicts the cost breakdown per transport mode.

As depicted in Figure 64, the rail projects hold the biggest share of cost (88%) among the projects addressing critical issues.

Critical issues projects without known financing[108] amount to EUR 15.8 billion, thereof rail EUR 14.1 bln, and maritime project EUR 618 mln.

[108] i.e. Critical issues related projects without known financing are not marked as Works – under construction, Works partially finalized, study – in progress.

Figure 63: Preliminary Costs of OEM projects per transport mode

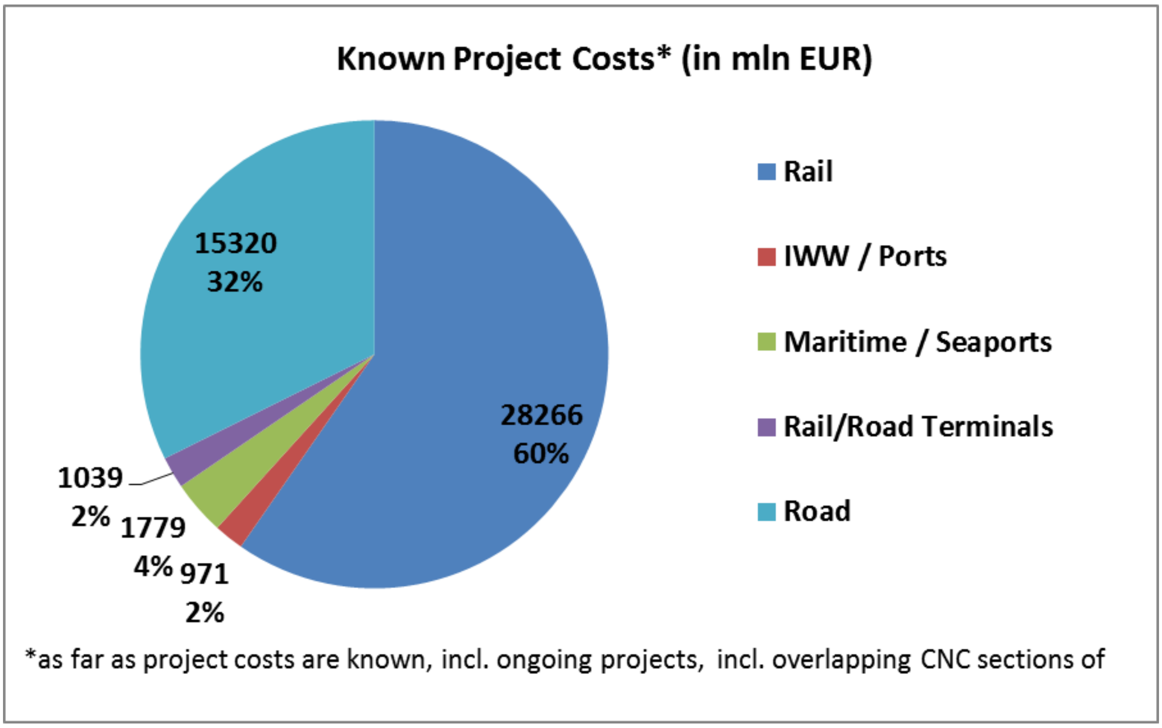


Figure 64: Preliminary Costs of OEM projects addressing critical issues per transport mode

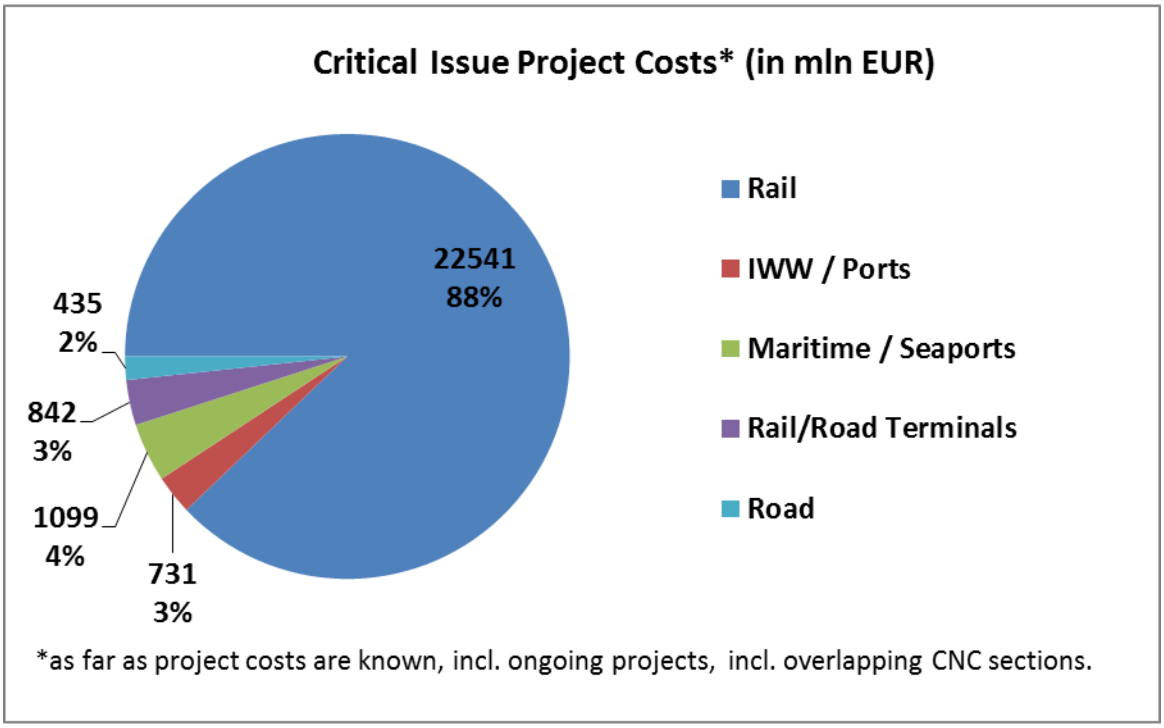


Table 138: Preliminary project costs per category and mode; in million Euro

OEM Corridor - Preliminary Project Costs per Category and Mode of Transport [mln EUR]	IWW & Inland Ports	Multimodal Logistics Platform	Rail	Road	Seaport & Maritime Transport	Total
Technical Compliance / Bottleneck	302	-	15,753	-	9,736	**25,792**
Intermodality	12	410	2,019	1,039	168	**3,649**
Interoperability	10	36	1,280	-	1,416	**2,743**
Sustainability	-	130	-	-	9	**139**
Capacity	646	1,203	9,244	-	3,991	**15,084**
Total	**971**	**1,779**	**28,297**	**1,039**	**15,320**	**47,407**

Table 139: Preliminary costs of critical issue projects per category and mode; in million Euro

OEM Corridor – Preliminary Critical Issue Project Costs per Category and Mode of Transport [mln EUR]	IWW & Inland Ports	Multimodal Logistics Platform	Rail	Road	Seaport & Maritime Transport	Total
Technical Compliance / Bottleneck	302	-	12,143	-	220	**12,665**
Intermodality	8	36	2,018	842	157	**3,061**
Interoperability	10	36	1,280	-	31	**1,358**
Capacity	410	1,028	7,100	-	27	**8,564**
Total	**731**	**1,099**	**22,541**	**842**	**435**	**25,648**

As a conclusion it can be stated:

- 144 of 280 projects are addressing the (partial) mitigation of critical issues.
- Approximately **25.6 of 47.4 billion EUR** must be spent as project costs on critical issues in the OEM corridor, as far as costs are known.
- Approximately **15.8 billion EUR** of these costs for critical issues are still to be financed.

7.1.10 Open Issues

This section addresses the question of the extent to which the entirety of listed projects is mitigating the identified non-compliant parameters of corridor sections and core network nodes along the Orient/East Med Corridor

The goal of this analysis is to present a general statement, listing explicitly the non-compliances that will require a special attention in the Corridor development, as they are either not or insufficiently addressed by any known project to present and, thus, for the time being, must be regarded as persisting bottlenecks.

This section is a summary of the Annex 9 (Overview of projects addressing critical issues) and compares the list of projects as presented in Annex 5, with the analysis of the non-compliant corridor sections and nodes (cf. section 4.7) as well as that of critical issues (cf. section 5.4) pertinent along the OEM Corridor. Being a general analysis only, the ability of projects to fully cope with the non-compliances is evaluated on the basis of the study authors' interpretation of project location and description, whereas this information has not been fully verified during the present study. Thus, a more detailed analysis together with a project impact analysis is proposed for future Corridor studies.

Open issues in Railway and RRTs

With regard to railway, the implementation of the large number of projects addressing technical compliance/bottlenecks in particular, as well as capacity and interoperability issues will eventually ensure compliance with the requirements set out in the Regulation on major sections along the OEM corridor that are currently non-compliant. This applies in particular to the eastern/south-eastern part of the OEM Corridor, where most of the deficits are located.

Consequently, following the finalisation of the on-going and planned rail projects:

- 211 km (4%) of the OEM rail network will lack electrification,
- 550 km (9%) will not be usable for freight trains with 22.5 t axle load at 100 km/h,
- 58 km (1%) can be operated with a speed <100 km/h only,
- 582 km (10%) will not be compliant with the axle load requirement (22.5 t),
- 2734 km (46%) will only permit a train length of <740 m, mainly in CZ, SK, AT, RO, BG
- 1510 km (26%) will be single-track lines and
- 1943 km (33%) will not have ETCS installed while the remaining sections are equipped and under operation.

GSM-R is expected to be installed on all lines equipped with ETCS. Due to the higher deployment rate at present, GSM-R will be available on the entire corridor.

Therefore, the remaining main obstacles that will require the attention of the European Coordinator will be:

- the limited train length along the corridor,
- the unfeasible operation of freight trains with 22.5 t axle load at 100 km/h, albeit recently possible with reduced length on the entire corridor,
- and the missing ETCS trackside equipment.

For the latter at present, there is limited information regarding the timing of deployment of ETCS on several corridor sections in Germany (cf. section 7.2).

Regarding the 77 Rail Road terminals, there is no information available for the 3 terminals currently under construction or design (Pardubice, Thessaloniki, and Patras).

Open issues in Inland Waterway

Regarding inland waterway transport and inland ports, the projects listed in section 7.1 will eventually address the majority of non-compliant infrastructure parameters and related issues along the OEM corridor in Germany and Czech Republic.

However, there are significant differences in the progress towards the implementation of concrete measures improving and ensuring navigational conditions particularly on Elbe and Vltava. While future works in Germany mainly depend on the results of the Gesamtkonzept Elbe and are, therefore, undefined at present, in the Czech Republic concrete projects (e.g. construction of locks) will be launched to address these issues.

After having implemented all projects foreseen, draught compliance will be improved, leading to a reduction of the non-compliant sections along the OEM inland waterway network to 722 km[109] (44%) in total. Bridge clearance will also be improved on Czech sections, reducing the length of non-compliance to 171 km[110] (10%).

The natural conditions on the Elbe/Vltava waterways allowing an upgrade to a certain extent only (in particular regarding costs) and requiring also protection from an environmental point of view, but also the economic importance of these inland waterways call for the special attention of the European Coordinator.

More specifically, an exception of the requirements given by the TEN-T Regulation should be checked in this case, but including the fostering of new technologies (e.g. new barges) to improve inland shipping under the given natural conditions.

With regard to inland ports, the new construction of the port in Pardubice including rail connection will ensure the integration of all OEM inland ports into the corridor rail network.

Open issues are the deployment of further RIS services in both Germany and Czech Republic. There is no concrete information, neither on timing nor on projects. Also the required provision of alternative fuels is not addressed in any of the projects known. Therefore, this is an open issue for all OEM core network inland ports, resulting in an expected non-compliance rate of 100%, which calls for special attention of the European Coordinator.

Open issues in Maritime infrastructure / Seaports

With regard to maritime transport and seaports, projects listed in Section 7.1 will eventually address the majority of non-compliant infrastructure parameters and related issues. Consequently, following the finalisation of the on-going and planned maritime projects:

- 1 seaport (Port of Patras) out of 12, will lack a Traffic Management System
- 1 seaport (Port of Igoumenitsa) out of 12, will lack a connection to the railway network
- 5 seaports (Ports of Burgas, Thessaloniki, Patras, Igoumenitsa and Heraklion) out of 12 will lack provision of alternative fuels facilities

To present, there is no information regarding the implementation of a TMS at the Port of Patras, or the provision of alternative fuels facilities in the above 5 ports. The missing rail connection to the Port of Igoumenitsa in Greece has been considered

[109] This assumes that the required minimum draught of 2.50 m can be achieved by implementing the projects. Even if this is not the case, compared to the status quo an improvement in navigability is to be expected.

[110] This assumes that the required clearance of minimum 5.25 m can be achieved by implementing the projects.

within the framework of the missing link Igoumenitsa-Ioannina-Kalambaka-Kozani and its connection to PATHE/P axis. Although a number of studies have been carried out in the last decade to examine the feasibility of the above connections, there is no concrete information on the timing of this particular project, apart from the fact that it has not been considered as a priority one until 2025.

Open issues in Road

Road projects that are either on-going or are planned would solve the issue of technical compliance in terms of expressway/ motorway availability (grade separated junctions) on 97% of the Corridor's road network, with the following two exceptions of sections, for which no project is identified:

- Lugoj – Drobeta Turnu Severin (150 km) section of future motorway A6 in Romania and
- Montana – Vratsa (38 km) section of I-1/E79 in Bulgaria.

In addition, it should be noted that a number of projects addressing the above are tentatively planned, but lack a clear implementation schedule. These projects are:

- R52 Pohořelice – State border CZ/AT (21 km) in the Czech Republic
- Vidin – Montana (90 km) and Mezdra - Botevgrad (40 km) express roads in Bulgaria
- Western Arc of Sofia Ring Road: Kakach River - North High Speed Tangent Road in Bulgaria.

In terms of availability of secure parking areas, no projects are identified for the following road sections of total length 189 km that currently lack an adequate number of related facilities:

- Drobeta Turnu Severin – Calafat (83 km) section of RN 56A in Romania
- Orizovo – Border TR (65 km) section of motorway 8/E80 in Bulgaria and
- Border BG – Thessaloniki (41 km) section of E79 in Greece.

Motorway construction works are under way on both sections in Bulgaria and Greece and thus, the parking availability shall be assessed again after the completion of the works.

Cyprus is the only OEM Corridor country that presently lacks alternative fuel provision facilities. According to the identified projects, however, alternative fuels infrastructure will be developed on the core network until 2020.

ITS is deployed in all of the 15 urban nodes, but the available regional and national ITS services are fragmentised and, in most of the cases, lack interoperability. The electronic toll charging systems that are in operation in DE, CZ, AT, SK and HU are compliant with the requirements of ITS Directive 2010/40/EU. Nevertheless the only compatible systems are the ones used in Germany and Austria.

Open issues in Air Transport Infrastructure

Connection of main airports with rail network is fundamental to achieve multimodality and interoperability objectives set by the European commission. 50% (3 out of 6) of the Core network major airports, belonging to the Orient-East Med Corridor, are currently not connected with heavy rail. Projects identified during the study should address this issue for 2 airports. It means that, among airports which must be connected with heavy rail by 2050, only the Hamburg airport is lacking of any project which foresee such connection, as a light rail connection is already in place. This results in an expected non-compliance rate of 17% in 2030 (1 of 6 main airports) for the OEM Corridor. Moreover, for 4 out of the 10 other core airports (Bremen, Timişoara, Sofia and Thessaloniki), no rail intermodality projects are known, albeit not required by the TEN-T regulation for these airports.

For the required capacity of airports to supply alternative fuels for aircrafts, no projects were identified. Therefore, this is an open issue for all 15 core network airports, resulting in an expected non-compliance rate of 100%, which calls for special attention from the European Coordinator.

7.2 Deployment plan for Traffic Management Systems

This section gives an overview of the ongoing and future implementation measures along the Orient/East-Med corridor infrastructure in the field of Traffic Management Systems (TMS), and more specifically, on the European Rail Traffic Management System and the River Information Services (RIS).

Traffic Management Systems according to the TEN-T Regulation (No. 1315/2013) comprise of a number of systems related to one or multiple modes of transport aiming at the smoother Corridor operation and improved infrastructure utilization.

7.2.1 ERTMS Deployment plan

7.2.1.1 Background

In January 2012, the European Commission adopted the Decision 2012/88/EU on the technical specifications for control-command and signalling subsystems[111]. Amongst other items, this Decision also includes requirements about 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 ETCS connection along the entire corridor is available. In contrast, neither the ETCS level nor the exact alignment is specified.

The Orient/East Med corridor shows common sections with the ERTMS corridors E and F (and shorter parts of D and B), and also with sections where ERTMS deployment is required by the European ERTMS Deployment Plan 2009 and sections of additional voluntary national development.

Through the Decision 2012/88/EU, the rail infrastructure of the corridor would have to be gradually completed by 2020, and connected to a designated list of freight terminals and ports. Rolling stock ordered after 2014 is to be equipped with ETCS.

By 2015, ERTMS implementation is required along the following sections of the OEM corridor:

- in Germany between Hannover and Elsterwerda (Corridor F), the nodes Berlin (Corridor F) and the link Rostock – Berlin
- in the Czech Republic between Děčín, Praha, Brno and Břeclav (Corridor E).
- on the entire corridor railway sections in Slovakia, Austria and Hungary (Corridor E, Corridor D: Győr - Budapest)
- in Romania, from the Hungarian border near Curtici until Arad (Corridor E).

This equals approximately 32% of the length of the entire OEM rail network.

[111] Official Journal of the European Union: Decisions 2012/88/EU: „Commission Decision of 25 January 2012 on the technical specification for interoperability relating to the control-command and signalling subsystems of the trans-European rail system (notified under document C(2012) 172) (1)”; Legislation Volume 55, 23 February 2012

Figure 65: Alignment of the ERTMS deployment corridors

Source: European Commission, 2010, corrections made by consortium

Further corridor sections, along which ERTMS equipment is required **until 2020** the latest:

- in Germany, between Dresden and Czech Border near Děčín (Corridor E), envisaged to be equipped earlier; as well as Hamburg (corridor B)
- in the Czech Republic, the line Děčín – Nymburk - Kolín (Corridor E) and the node of Lovosice
- in Romania, the residual corridor railway from Arad to Calafat/Vidin
- in Bulgaria, the lines Vidin/Calafat – Sofia – Kulata line and the Sofia – Plovdiv - Burgas line
- in Greece, the node of Piraeus (with the connection Piraeus – Athina – Thessaloniki – Promahonas/Kulata)

This equals an additional 39% of length.

Table 140 presents the ERTMS deployment and characteristics of the OEM corridor railway sections.

Table 140: Qualities of ERTMS deployment along the OEM corridor

Quality	Member States	Routing of Line (OEM part)	Length (km)	Percentage
ERTMS Corridor E (2015/2020)	CZ, SK, AT, HU, RO	Děčín - Praha – Kolín – Brno – Břeclav – Wien/Bratislava – Hegyeshalom – Budapest – Arad (until 2015)	1.178	20%
	DE, CZ	Dresden – Děčín – Nymburk – Kolín (until 2020)	213	4%
ERTMS Corridor F (until 2015)	DE	Hannover – Magdeburg – Elsterwerda; Berliner Außenring (Saarmund – Wuhlheide)	494	8%
ERTMS Corridor B (2020)	DE	Hamburg node	n.a.	n.a.
ERTMS deployment required by EDP Annex II (2015/2020)	DE,	Rostock – Berlin (by 2015)	200	3%
	DE	Elsterwerda – Dresden (by 2020)	55	1%
	RO	Arad – Timişoara – Craiova – Calafat/Vidin	489	8%
	BG	Calafat/Vidin – Sofia – Kulata/Promahonas	478	8%
	BG	Sofia – Plovdiv – Dimitrovgrad – Mihaylovo – Stara Zagora – Burgas	490	8%
	EL	Kulata/Promahonas - Thessaloniki – Palaiofarsalos – SKA – Athina – Piraeus	609	10%
Additional voluntary national development according to NDPs	DE	Rosslau – Leipzig – Dresden; Hamburg – Ludwigslust – Berlin – Elsterwerda	623	11%
	CZ	Česká Třebová – Přerov - Břeclav	204	3%
	BG	Plovdiv – Mihaylovo, Dimitrovgrad – Svilengrad – Border BG/TR	171	3%
	EL	SKA – Kiato – Patra	204	3%
Not part of deployment plan	DE	Wilhelmshaven/Bremerhaven – Bremen – Hannover	225	4%
	EL	Palaiofarsalos – Kalambaka – Igoumenitsa	255	4%

7.2.1.2 Status quo

In Austria, these requirements will be met by the end of 2014. Other Member States have either deployed only GSM-R (entire Germany and Czech corridor railway lines) or only ETCS (partly in Hungary, Bulgaria and Greece), while the other ERTMS sub-system is missing.

However, the majority of the ERTMS projects are still in the planning phase; their finalisation is expected for 2020 or later, thus, notably later than the requirements of Decision 2012/88/EU. For a number 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 legacy train control systems. In many cases, one can assume that the overall upgrade or new construction of railway lines, especially those of the High-speed network, includes the ERTMS deployment as requested in the Decision (para 7.3.3.1). Therefore, the full ERTMS deployment is also expected by the Corridor implementation target year (2030).

Nearly all ERTMS projects in the northern part (DE, CZ, AT, HU) refer to the implementation of ETCS level 2; as GSM-R is already in operation or under construction, the southern part (RO, BG, EL) deploys Level 1. In Germany and Austria, studies about the upgrade of the currently employed level 1 on testing lines are ongoing[112].

[112] In Germany either ETCS L1 LS (Limited supervision) or ECTS L2 will be installed.

The severe deployment delays in most of the Member States have been pointed out in the latest EC document of February 2014[113] indicating for Corridor E (Dresden – Constanta) national delays from 0 to 5 years, while for corridor F Germany has announced the finalization date of 2027[114].

The key hindering factors behind these delays are the following:

- Insufficient financing for deployment of ETCS trackside and on-board equipment
- Administrative barriers to implement new rail safety systems without endangering previous level of control (parallel legacy system)
- Requirements of Decision 2012/88/EU are valid, but not specified with binding infrastructure measures and deadlines.

The overall status of implementation for the rail network of the Orient /East Med corridor is given in Table 141 as a percentage of geographic line length (double track lines are counted once). This shows that 49% of rail lines are equipped and operated with GSM-R, predominantly in the northern part of Corridor including Hungary. ETCS L1/L2 is installed at only 14% of the rail lines by the end of 2014, while even less are under operation, due to testing areas not regularly operating.

In Germany, only the line Bitterfeld- Leipzig (34 km) will be equipped with ETCS Level 2 Baseline 3 until end of 2019. At present no ETCS is installed on this line. On the Rostock – Berlin link, where the contract was made in 2011, the first 35 km of trackside equipment ETCS L2 Baseline 2.3.0d were installed between Kavelstorf and Lalendorf, but are not under operation until the entire section Rostock – Berlin is set under operation with L2 Baseline 3. The date for equipping the remaining part Kavelstorf – Nassenheide as well as the implementation date for the entire section Rostock - Berlin is not scheduled. The section Berlin – Dresden shall be equipped with ETCS Level 2 Baseline 3 in future, but no implementation date has been announced so far. For the section Berlin Nordkreuz – Karow the adjustment of control and safety systems is scheduled until 2021, while the implementation date for ETCS deployment is not scheduled yet.

The same applies for Austria, whereby ETCS will fully be installed by late 2014. However, along the Wien – Hegyeshalom Line (70 km) the Level 1 system has been recently set out of operation, while a study on the ETCS upgrade is scheduled for 2015. The re-operation is expected after 2019.

In the Czech Republic, only the testing line Kolín–Poříčany (35 km) is installed, but not considered as operational for regular trains. In the Slovak Republic, no ETCS is in place yet in the Bratislava node and along the OEM related railways.

Hungary has ETCS L1 in operation on the line Hegyeshalom – Budapest, while ETCS and GSM-R still needs to be installed in the eastern part of country which is scheduled until end of 2016. At the Romanian – Bulgarian border with the new Danube Bridge near Vidin / Calafat, ETCS L1 is installed on a 42 km length from Golenţi (RO) to Vidbol (BG), albeit not in operation. In Bulgaria, the Stara Zagora – Burgas section (188 km) is in operation with ETCS L1, while GSM-R but not ETCS is installed on the segment Plovdiv – Dimitrovgrad.

The following table and figure are indicating the deployment status of GSM-R and ETCS along the OEM corridor.

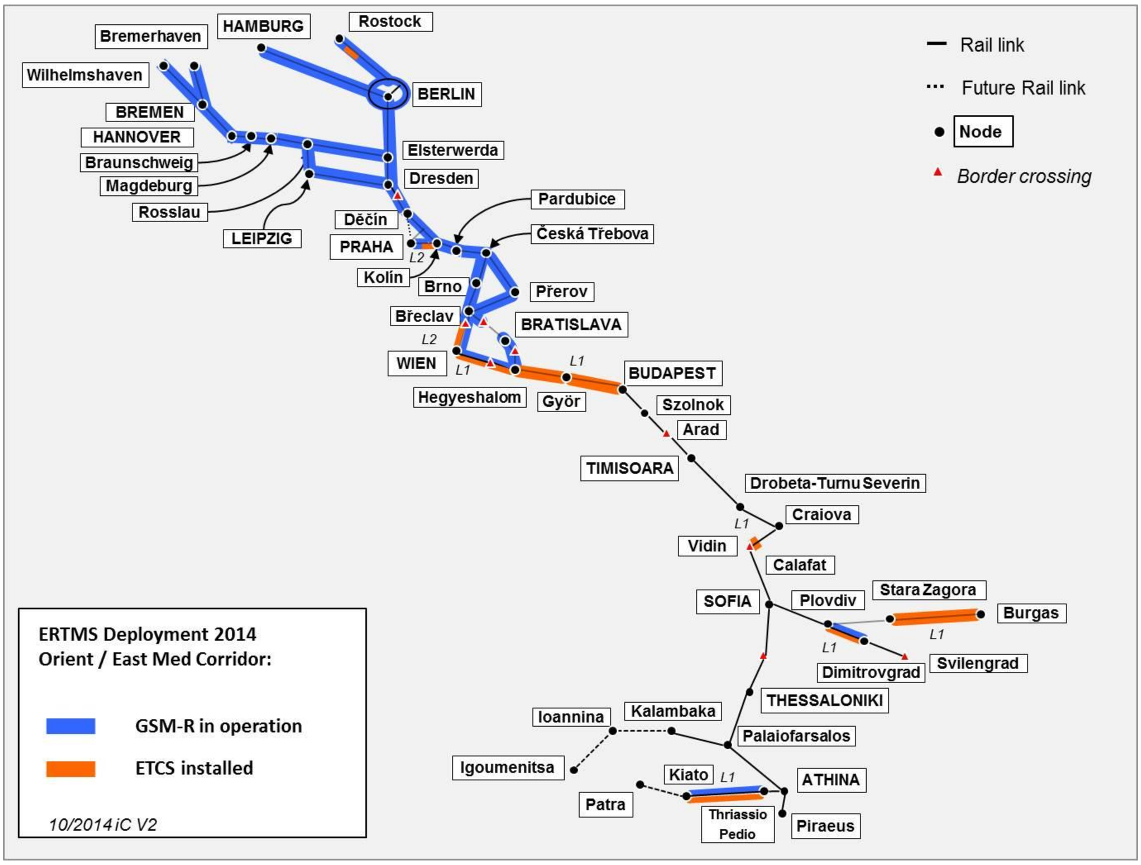
[113] European Commission: Commission Staff Working Document on the state of play of the implementation of the ERTMS Deployment Plan, SWD (2014) 48, of 14.02.2014

[114] The German Infrastructure Manager DB Netz emphasizes that such announcement was not given.

Table 141: Status of ERTMS deployment on the Orient/East-Med corridor by end of 2014

Member State	Length of OEM railway network [km]	Length of GSM-R deployed lines [km]	GSM-R deployment rate at OEM	Length of ETCS L1/L2 installed lines [km]	ETCS L1/L2 installation rate at OEM	Length of ETCS L1/L2 lines under operation [km]	ETCS L1/L2 operation rate at OEM[115]
DE	1.650	1.650	100%	33	2%		0%
CZ	840	840	100%	24	3%		0%
AT	160	160	100%	160	100%	90	56%
SK	114	45	39%		0%		0%
HU	412	13	3%	183	44%	183	44%
RO	506	-	0%	18	4%		0%
BG	1.140	80	7%	288	25%	187	16%
EL	1.068	100	9%	105	10%	105	10%
Total	**5.890**	**2.888**	**49%**	**811**	**14%**	**565**	**10%**

Figure 66: Status of ERTMS installation in 2014



Source: Consortium

115 For 2013 the benchmarks as given under the KPI benchmarks (cf. section 6.3) are 49% for GSM-R operation and 11% for ETCS operation due to changes in Austria.

7.2.1.3 Analysis of ERTMS related projects

According to the list of identified projects along the Orient/East Med corridor, at least 52 projects / measures directly or indirectly related to ERTMS deployment have been identified, that are presented in the following per each Member State. It needs to be emphasized that this list is not exhaÚstíve, especially as regards ERTMS deployment projects scheduled after 2020.

Table 142: Statistic Overview on future ERTMS projects on the Orient/East-Med corridor

Member State	ERTMS related studies and works			
	Amount	Length	Length share	Period
DE	5	327	20%	n.a.
CZ	5	420	50%	2023+
AT	5	160	100%	2019
SK	2	114	100%	2020+
HU	5	412	100%	2016
RO	4	107	21%	2025
BG	17	1029	90%	2020+
EL	10	1068	100%	n.a.
Total	**53**	**3131**	**53%**	

The statistic overview presented in Table 142 above shows that half (53%) of OEM corridor rail network lines are addressed with a study or works project regarding ETCS or GSM-R. As the list of measures is not fully exhaÚstíve, the a.m. value is not fully corresponding to the recent implementation rate of 49% for GSM-R and 14% of line length for ETCS.

ERTMS Measures Germany:

- Upgrade of the German Pilot line Berlin - Bitterfeld - Leipzig from the existing ETCS Level 2 equipment, SRS version 2.2.2+, to the interoperable SRS version 2.3.0d /Baseline 3, until 12/2019.
- Upgrade of Rostock – Berlin line, ETCS implementation date: unknown.
- Electronic Interlocking project, overall network of DB Netz AG, without finalization date
- Berlin Nordkreuz – Berlin Karow: Upgrading of signalling systems (LST) until 2021, ETCS implementation date: unknown.
- Wünsdorf – Elsterwerda: ETCS Level 2 Baseline 3: unknown implementation date

ERTMS Measures Czech Republic:

- ETCS on railway line Přerov - Česká Třebová– Břeclav, 204 km, no implementation date, study finalized
- Equipment for traffic control on the railway infrastructure: modernization of signalling and communication devices as a condition of securing interoperability of state wide routes (including ETCS/GSM-R); Rationalization; Removal or ensure of rail road crossings, 2015-2023
- Modernization of the line Ústí nad Orlici – Choceň, 14 km, until 2023.
- Optimization of the line Pardubice – Kolín, 42 km, after 2020.
- Optimization of the line Děčín – Všetaty – Lysá nad Labem – Kolín, 160 km until 2021.

ERTMS Measures Austria

- Study Project on ETCS Upgrade Variant (L1 with new baseline or L2) along Wien – Hegyeshalom segment. On this line a pilot line for ETCS L1 with baseline 2.3.0 was implemented, but is out of operation in 2014. Study between 2014 and 2015.

- Integration of ECTS Level 2 (including GSM-R) along Wien – Hegyeshalom segment. GSM-R is under operation. Implementation after 2019.
- Integration of ECTS Level 2 including GSM-R along Břeclav – Wien segment, works completed until Sept 2014
- "CEE goes ETCS": ETCS retrofit of 7 locos SGP 2143 and 5 locos Siemens ES64U4 with ETCS Level 2, Baseline 2, Release 2.3.0d (IUs: CargoServ, RTS). Field / off-site tests to demonstrate compatibility of OB equipment with trackside equipment of baseline 2.3.0d in AT, DE, HU, CZ and SI (ERTMS corridors B,D,E), until 12/2015.
- UNIFE ERTMS deployment study, EEIG ERTMS Users Group / UNIFE; Facilitating and speeding up ERTMS deployment (involved: BE, ES, DE, FI, IT, AT, FR, UK, DK, SE, PL), Study 2011-2014.

ERTMS Measures Slovakia

- ERTMS on corridor IV: Kúty-Bratislava (ETCS L2 + GSM-R), 71 km, 2015-2019
- Study on Modernisation of the railway infrastructure in the node Bratislava incl. Interoperability (ETCS) and TSI parameters, Implementation after 2020.

ERTMS Measures Hungary

- GSM-R deployment on all HU corridor lines (596 km, thereof 412 km for OEM corridor), 12/2013 – 2016, project managed by NISZ.
- Hegyeshalom – Rajka ETCS L1 baseline 2.3.0d deployment, 13 km, 06/2014 - 10/2015, Project managed by GYSEV
- Budapest – Gyoma ETCS L2 baseline 2.3.0d deployment, 153 km, 11/2013 - 12/2015, project managed by NIF
- Gyoma – Lökösháza ETCS L1 / L2 deployment baseline 2.3.0d, 68 km, 10/2013 - 03/2016, project managed by NIF, Gyoma – Békéscsaba: L2, Békéscsaba – Lökösháza: L1.
- Budapest – Győr – Hegyeshalom Border AT/HU: ETCS L2, 2015 – 2018, NIF

ERTMS Measures Romania

- Rehabilitation of Railway line Border HU/RO – Curtici – Arad – Deva – Simeria; Railway line rehabilitation for train speed increase to 160 km/h, incl. ERTMS and GSM-R deployment, implementation until 2017.
- Craiova - Calafat Railway line rehabilitation for train speed increase to 160 km/h; until 2025; incl. ERTMS and GSM-R deployment, 2018 – 2025
- Modernization of Arad – Timişoara – Caransebes Rail Line for higher speeds, no implementation date
- Modernization of Caransebes – Drobeta Turnu Severin – Craiova Rail Line for higher speeds, no implementation date

ERTMS Measures Bulgaria

- Studies on Modernisation of Vidin - Sofia railway line; Vidin - Medkovets and Medkovets - Ruska Byala, Ruska Byala - Stolnik sections, includes installation of Electronic Supervisory systems (SCADA), ETCS (level 1) and GSM-R, until 2015 and 2018,
- Modernisation of Vidin - Medkovets section, until 2020
- Modernisation of Medkovets - Ruska Byala section, until 2025
- Modernisation of Ruska Byala - Sofia section, until 2025
- Modernisation of Sofia – Pernik Razpredelitelna - Radomir section, without finalization date
- Modernisation of Radomir - Kulata line, without finalization date
- Study on Modernisation of Sofia - Plovdiv railway line, Sofia - Elin Pelin and Elin Pelin - Septemvri sections, until 2015
- Modernisation of Sofia - Plovdiv railway line, Sofia - Elin Pelin section, until 2020
- Modernisation of Sofia - Plovdiv railway line, Elin Pelin - Septemvri section, until 2020
- Modernisation of Septemvri - Plovdiv section, until 09/2015

- Reconstruction of Dimitrovgrad – Svilengrad, until 2015
- Study on Rehabilitation of Plovdiv - Burgas railway line; Phase II; until 01/2016
- Rehabilitation of Stara Zagora –Zimnitsa and Tserkovski – Burgas section, until 2015
- Rehabilitation of Plovdiv - Burgas railway line; Phase II, until 2020
- Installation of GSM-R along all main TEN-T lines till 2020
- Infrastructure Works for modernization of Sofia Railway Node, without finalization date
- Infrastructure Works for modernization of Burgas Railway Node, without finalization date

ERTMS Measures Greece

- Installation of ETCS Level 1 trackside in the main railway lines of Athina - Thessaloniki-Promahonas corridor. New high-speed railway (PATHE/P corridor), developed within the framework of the national rail network modernization program. The trackside subsystem will be designed as an overlay to the existing signalling system, the basic principles of which remain unchanged. Works under construction, 2007-2017.
- Installation of GSM-R modern radio coverage system along PATHE/P rail corridor. The project contributes to the development of a modern, fully operational and integrated data transmission system along PATHE/P rail corridor. 2006-2015.
- Construction of the New Double-Track High-Speed Railway Tithorea – Lianokladi – Domokos; 1997-2017; 106 km, new alignment designed for speeds of 160-200 km/h.
- New double-track line, 71 km long, in the section from the new Railway Station of Kiato to Rododafni (part of Athina SKA – Patra) and equipped with signalling, telecommanding, telecommunications and electrification. 2006 – 2017.
- Construction of a new double-track railway line, 27.6 km long, in the Rododafni - Rio section of the Athina - Patras corridor, equipped with signalling -telecommanding, telecommunications and electrification. 2007 – 2017.
- Study on the Construction of new double-track railway line Rio – Patra (in progress).
- Construction of new Kalambaka- Ioannina- Igoumenitsa line, approximately 175 km long as part of the Greek western railway axis. The line will be equipped with signalling and telecommanding, telecommunications and electrification.
- Thriassio Pedio RRT 2nd Operational Phase: construction of additional electrified tracks inside the Complex; construction of buildings, signalling and telecommanding, supply and installation of special equipment.
- Rail connections to the Port of Igoumenitsa (related to the PP29 rail link Igoumenitsa)
- Rail connection to the Port of Thessaloniki.

7.2.1.4 Implementation Schedule of GSM-R and ECTS

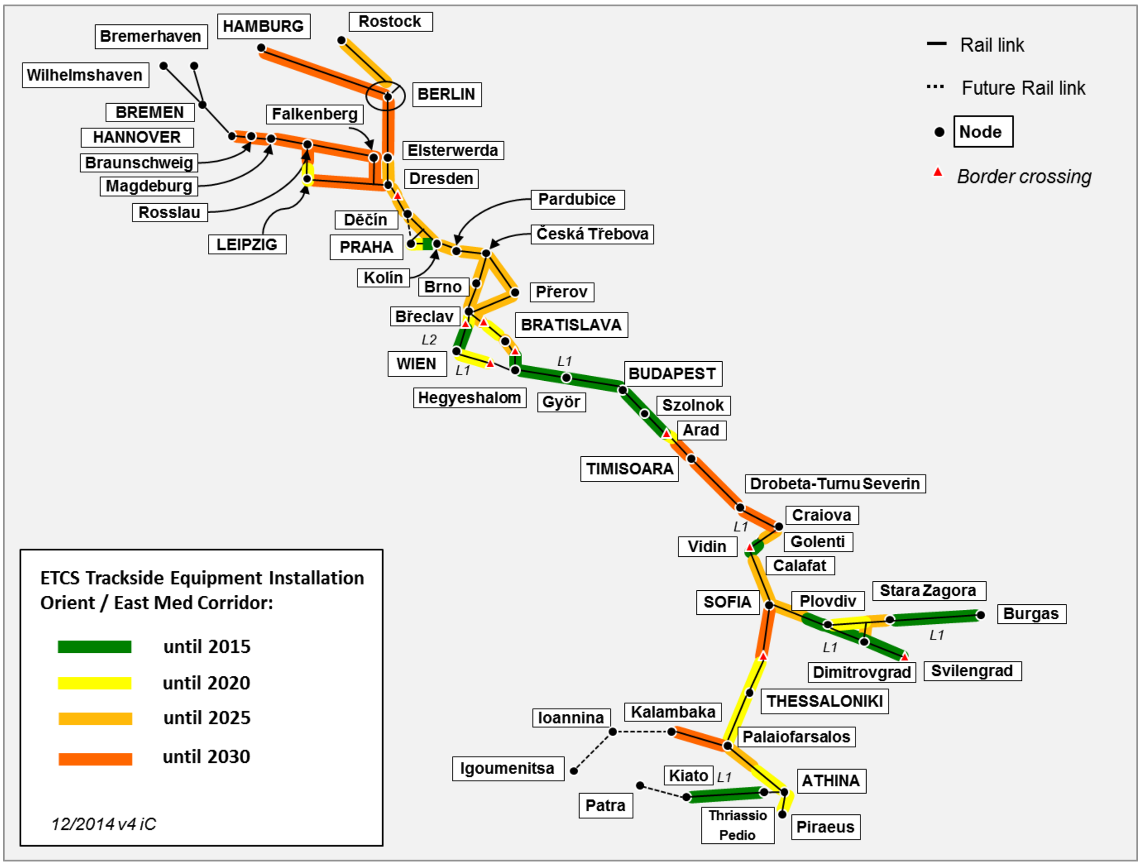
The table in Annex 6 presents information on the future implementation of ERTMS per corridor section, as far as available.

Generally, the information on national ERTMS deployment schedules is only sparsely available or is imprecisely dated.

GSM-R technology for train communication needs to be installed mainly in Hungary (east of Budapest), Romania, Bulgaria and Greece. It is supposed that ETCS and GSM-R is at least installed by a common deadline. ETCS is usually implemented as part of projects related to the reconstruction/modernisation of infrastructure. This is why the process is relative slow. GSM-R does not depend on railway infrastructure and thus, such systems could be deployed independently and earlier than ETCS.

The following graph indicates the expected ETCS deployment per section by time horizons between 2015 and 2030.

Figure 67: Preliminary ETCS Deployment schedule for 2015-2030



Source: Consortium

7.2.1.5 Deployment Coherency

From the perspective of the present year of the OEM Study (2014), the cross-border points have been analysed with regard to coherent development as presented in Table 143.

Table 143: Analysis of coherent development at Rail Cross-border points along OEM Corridor.

MS border points	Analysis of ETCS	Analysis GSM-R
DE/CZ:	ETCS installation in Czech Republic might be up to 10 years ahead;	under operation
CZ/AT:	ETCS installation in Austria might be 5 years ahead;	under operation
AT/HU:	ETCS L1 operation out of operation 2014-2019, after 2 years of joint operation	operation to be achieved until 2015
CZ/SK:	no secured information on ETCS operation start	
SK/HU:	ETCS operation in Hungary might be 4 years ahead	under operation
HU/RO:	ETCS and GSM-R in Hungary might be 2 years ahead	
RO/BG:	ETCS installed in 42 km cross-border section (Golenţi – Vidbol), but not in operation	no secured information
BG/EL:	ETCS and GSM-R in Greece might be 4 years ahead	

Source: Consortium

The analysis indicates that none of the cross-border points shows a fully operating ERTMS system on both sides of the border. GSM-R is operated on both sides of DE/CZ and CZ/AT and SK/HU borders. The previously operated ETCS L1 system at

Hegyeshalom (AT/HU) has been recently set out of service by the Austrian IM and is considering the level of upgrade during the next years, while implementation is scheduled until 2019. At the newly built Calafat / Vidin cross-border bridge, ERTMS is installed on a respectively longer branch in Romania and Bulgaria, but is not under operation yet. On the additional 5 out of 8 border crossing points, deployment time gaps of 2 until 10 years are potentially.

Based on the actions set out by the European Coordinators for the Orient/East Med Corridor and the ERTMS, the Consultant expects a finalization of the ERTMS deployment (ETCS and GSM-R) until 2030, which are in line with the overall line infrastructure upgrades and the modernization and centralization of signalling and train control infrastructure, as well as the clarification of legacy issues and investment safety among the Member States.

It is assumed that the ERTMS Breakthrough Program 2015/2016, presented by the European Coordinator Mr Karel Vinck during the 4th Corridor Forum meeting, will be a suitable tool to accelerate the ETCS and GSM-R deployment along the Orient/East Med corridor.

7.2.1.6 Source documents

The following documents are deemed as most valid sources for this analysis:

- Decision 2012/88/EU on technical specifications for control-command and signalling subsystems
- UNIFE: World Deployment Map of the European Traffic Management System[116], (as of July 2014)
- European Commission: European Deployment Plan, C (2209) 5607, Commission Decision of 22.07.2009
- European Commission: Commission Staff Working Document on the state of play of the implementation of the ERTMS Deployment Plan, SWD (2014) 48, of 14.02.2014
- National Development Plans 2006-2009 (source: EDP Website at DG MOVE[117])
- Recent National information (mainly National Transport Strategy)
  - Austria: ÖBB Infra "Streckenausrüstung mit ETCS" , 26.05.2014
  - Germany: DB Netz AG, "Leistungs- und Finanzierungsvereinbarung Infrastrukturzustands- und -entwicklungsbericht 2013", April 2014
  - Germany: "European Train Control System (ETCS) bei der DB Netz AG"
  - Hungary: Report on the Timeline of implementation of ERTMS Corridors D and E on the territory of Hungary, 2013
  - Hungary: Supplementary report on the Changes in 2013 to the timeline of implementation of ERTMS corridors D and E on the territory of Hungary, 2014
  - Romania: Ministry of Transport ERTMS Development and implementation plan in Romania, 2007
  - Bulgaria: National ERTMS deployment strategy and TSI implementation strategy 2010. (updated version 2013)

7.2.2 RIS Deployment plan

7.2.2.1 General Remarks

This Deployment Plan for River Information Systems and Services (in short: RIS deployment plan) is part of the Work Plan for the Orient/East Med Core Network Corridor under the target of implementation of Transport Management Systems for all modes of transport as set out in the TEN-T Regulation No.1315/2014. Based on the

[116] ERTMS World Deployment Map: http://www.ertms.net/?page_id=55#
[117] Map is available under http://ec.europa.eu/transport/modes/rail/interoperability/ertms/edp_map_en.htm

analysis of the status quo (cf. section 5.2.3) of RIS implementation, the plan shall indicate the further development of River Information Services until 2030 and potentially show requirements of coherent implementation of such services on all sections in both riparian Member States.

This RIS deployment plan for the Orient/East Med Corridor considers only the Member States Czech Republic and Germany[118]. In this Deployment plan, the IWW sections of the Orient/East Med Corridor are analysed based on latest sources[119].

7.2.2.2 Legal Obligations for RIS deployment

The European Parliament and Council Directive 2005/44/EC of 7 September 2005 on harmonized river information services on inland waterways in the Community defines the implementation and use of RIS on all European inland waterways of CEMT class IV or higher, in order to enhance the safety, efficiency and environmental friendliness of inland waterway transport, as well as to ensure compatibility and interoperability with other modes of transport.

Apart from the RIS Directive, the following European regulations are in force, jointly forming the legislative framework:

- Implementation guidelines, RIS guidelines: no. 414/2007
- Notices to Skippers: 415/2007
- Tracking and Tracing: 416/2007 and 689/2012
- Electronic reporting: 164/2010
- Electronic chart display and information system for inland navigations (inland ECDIS): 909/2013
- Directive 2013/49/EU amending Annex II to Directive 2006/87/EC addressing the issues related to the Unique European Vessel Identification Number (ENI) and the European Hull Database.

Germany transposed the RIS Directive by internal administrative decrees. According to German administration, the non-published decrees are regarded by the European Commission as the ones to ensure the implementation of the Directive. The four decrees define the organizational measures within the administration to establish the required infrastructural measures, the implementation of technical measures and the approval of public budget for implementation of the Directive. The German Waterways and Shipping Administration (WSD) is responsible for RIS implementation and operation. The decrees state how applications have been implemented/will be implemented.

With respect to the installation of AIS land based infrastructure, an amendment of the inland navigation task act is in preparation in order to regulate applications and related requirements for the administration. In 2009, Federal States have amended the port regulations to consider RIS in obligations arising from the EU directive.

While the German Waterways and Shipping Administration is responsible for the implementation of RIS on waterways, port authorities are responsible for the provision of RIS application related to inland ports, which are part of the RIS Directive 2005/44/EC. Obligations for inland ports include the electronic publication of Notices to Skippers, provision of electronic navigation charts and provisions for electronic reporting, if reporting is mandatory. The Waterways and Shipping Administration supports RIS activities of inland ports. According to the RIS implementation survey

[118] RIS deployment on the OEM corridor related section of the Danube River (AT, SK, HU, RO, and BG) is dealt within the Rhine-Danube Core Network Corridor Work Plan only.

[119] Sources: "RIS implementation survey and policy evaluation" - Panteia, July 2014; Platina II SWP 4.1 Vol. 1 and 2 (2014); • River Information System Website, www.ris.eu, August 2014

and policy evaluation, inland ports are rather reluctant to use the support and implement RIS.

In the **Czech Republic,** the Ministry of Transport is responsible for RIS legislation, strategy and implementation. The Waterways Directorate of the Czech Republic (RVC CR), an agency of the Czech Ministry of Transport, is responsible for technical solutions and implementation. The RIS Directive 2005/44/EC is to a large degree transposed in public Czech legislation by the amendment of the Inland Navigation Act (Law No. 114/1995) and by the establishment of the implementing decree No. 356/2009 on River Information Services, in force since January 2009. The Czech State Navigation Authority (SPS, Státní Plavební Správa) is determined as the RIS operator by the legislation.

According to Czech officials, additional amendments are required regarding the provisions for international data exchange.

7.2.2.3 RIS services in operation

As presented in section 5.2.3 , the national systems ELWIS (in Germany) and LAVDIS (Czech Republic) are in place along the corridor IWW network.

Table 144 provides a summary overview of the technical implementation of 20 RIS elements in Germany and Czech Republic.

It must be noted that from the 7 RIS technologies analysed, only two (ENC, NtS) are fully or almost fully deployed in both countries. In 5 out of 20 RIS elements, there are existing cross-border incompliances (WRM, AIS-OBU, ERIRSP, Correct RIS index use; MIB operational).

Table 144: Technical implementation of RIS elements in DE and CZ

RIS Technologies	Elements	Germany			Czech Republic	
		Availability (2013)	Depl. Year		Availability (2013)	Deployment Year
ENC / ECDIS	Coverage	100% of CEMT V and above (2014); 30% of CEMT IV			All waterways of CEMT IV and above, since 2009	
	Provision free of charge	Yes			Yes	
Notices to Skippers	Fairway & Traffic Messages (FTM) Lock Information	Yes ELWIS operation since 1999; adjusted 2009 to NtS standards			Yes (since 2009)	
	Water Related Messages (WRM)	Yes			Yes (since 2009)	
	Ice Message (ICEM)	Yes			Yes (since 2011)	
	Weather Related Messages	No, but linkage to DWD Meteorological Service	n/a		Yes (since 2011)	
	Method of diffusion	Online or e-mail subscription			Online or e-mail subscription	
AIS	AIS infrastructure	Only ship-ship communication available; landside infrastructure in preparation	n/a		No	under IRIS Europe III project (until 12/2014)
	On-board equipment	Almost complete (90% of the fleet)	n/a		No	Equipment program included in IRIS III for 100 vessels
	Exchange	No	n/a		No	n/a
Electronic Ship reporting	ERINOT	Yes			Yes (pilot)	2013
	ERIRSP	No	n/a		expected to be fully operational	
	BERMAN and PAXLISTS	Not mandatory	n/a		No	n/a
	Exchange	Not with CZ (only at Rhine)	n/a		No [120]	n/a
Hull database	Exchange with European hull database	No	n/a		Pilot phase 2011 (amendments required regarding Czech privacy laws)	n/a
	Vessels have ENI	Yes			Yes	
RIS index	Correct use	Partially	n/a		Yes	
	Synchronization with ERDMS	No	n/a		Pilot phase 2011	under IRIS Europe III project (until 12/2014)
Traffic manage-ment	Traffic Management Service	Plans for traffic management	n/a		No	n/a
On board equipment	ERI	MIB operational			n/a	n/a

Source: RIS Implementation Survey and Policy Evaluation, Panteia et al.; 2014

[120] The missing connection with Germany is regarded as a barrier for wider use of electronic reporting

Electronic chart display and information system for inland navigation (inland ECDIS)

Electronic navigational charts (ENC) for inland waterways of CEMT-class Va and higher are available for 100% in Germany, which sum up to 3642 km of inland waterways. In addition, the ENC coverage of CEMT-class IV waterways is approximately 30% in Germany. Electronic navigational charts are available via ELWIS.de. In addition the e-mail subscription was enhanced by a message being sent whenever an Inland ENC is updated. Charts for inland ports are partly available, but the provision of electronic navigational charts for inland ports is under preparation.

Depending on the installation of DGPS receiver, ECDIS could be used in navigation mode, as Germany is covered by DGPS signals. About 15% of vessels use ECDIS in navigation mode.

In the Czech Republic, electronic navigational charts are available for all waterway of CEMT class IV and higher since 2009. The charts are available free of charge on the LAVDIS webpage. Moreover, a web portal displaying electronic navigation charts and charts in PDF files are available. Charts with depth data have been elaborated within the IRIS Europe II project, which are particular valuable on the section of the river Elbe between Ústí and Labem and the German border.

If the vessel is equipped with GPS and DGPS receiver, ECDIS can be used in navigation mode.

In the IRIS Europe III project, the establishment of a central point for European ENC download is planned.

Notices to Skippers (NtS)

The German Waterways and Shipping Administration publishes Notices to Skippers (NtS) via ELWIS, which cover the mandatory information services. These include fairway and traffic messages, water related messages and ice messages according to CCNR standard 3.0 and data and facts on infrastructure (technical data, berth places and lock information). There exist no plans to establish weather related messages, but information is available via hyperlink to the German Meteorological Service (DWD).

The implementation of Notices to Skippers regarding inland ports is not completed yet. Although several Federal States have considered RIS in relevant regulations, only a few inland ports provide NtS in an electronic format.

Specific information for the Elbe/Weser/Mittellandkanal is not available.

In the Czech Republic, Notices to Skippers are provided for all relevant waterways in an electronic format including mandatory fairway & traffic messages, water related messages, ice messages and weather related messages (according to NtS standard 3.0). The information is provided by LAVDIS. Inland ports do not provide NtS in electronic format.

Data exchange of NtS between the Czech Republic and Germany is planned, but hampered due to different technological applications.

Vessel tracking and tracing systems (Automated Identification AIS)

In Germany AIS is with a few exceptions limited for facilitating navigation by displaying tactical traffic image and ship-ship communication. AIS communication ship-shore and shore-ship requires an installation of shore based AIS infrastructure stations and additional repeaters. Such landside infrastructure is under preparation at selected inland waterways. From 2009 to 2011, Germany (together with the Netherlands) carried out an AIS equipment support programme supported by the European Union with EUR 5mn. In 2012, 92% of vessels were equipped with AIS transponders, 71% of vessels display AIS on ECDIS viewer and 49% refer to ECDIS in information mode.

The legal base for the use of AIS data is the Inland Navigation Task Act and is limited to the tasks of the administration (calamity abatement, improvement of safety and ease of navigation, considering the issue of data protection). AIS information for logistical purposes is not regarded as a task of the administration.

German Authorities do not see a legal base for international data exchange and data storage in a central database without further regulation, especially for data privacy reasons. The need for international data exchange and related applications, such as the European Position Information System (EPIS) will be defined within the CoRISma project[121].

In the Czech Republic, AIS is not implemented yet, but started within the TEN-T project IRIS Europe III (until 12/2014). Two shore based AIS stations and the installation of AIS transponders on up to 100 vessels are planned.

Electronic ship reporting

In Germany, voyage reporting is only required on certain rivers, but not for vessels on waterways of the OEM corridor.

In the Czech Republic, reporting is obligatory for all large vessels and commercial passenger vessels. The data is managed by the RIS centre and forwarded from lock to lock. It is used for traffic monitoring and the infrastructure allows electronic reporting of ERINOT and ERIRSP.

The missing interconnection with Germany is regarded as barrier for the wider use of electronic reporting. Although Germany is currently upgrading its electronic reporting infrastructure, due to missing reporting obligations and low traffic volume towards the Czech border, data exchange does not have a high priority.

Hull Database

German authorities maintain a national hull database (acc. to Dir. 2006/87/EC) and since 2007, the European Vessel Identification Number (ENI) is assigned to vessels at time of certification.

There is no exchange between the German hull database and the European Hull Database (EHDB), since the German Vessel Inspection Commission does not have an authorisation basis for an exchange. Due to data privacy concerns, its implementation is not realised. Germany will participate in the European Hull Database, if a sufficient enable clause exists.

A Czech national hull database (acc. to Dir. 2006/87/EC) exists and is used for RIS applications too. The international exchange of minimum hull data set with EHDB was in operation in 2011. Legislation for assignment of ENI numbers according to Dir. 2008/87/EC is in force, but there is a transition period as vessels get an ENI number at the next technical inspection. Assignment of ENI numbers according to Reg. 164/2010 is in force.

RIS index

The Germany Waterways and Shipping Administration maintains an index with approximately 6.000 objects, coded according to the standard published in Reg.164/2010. The codex is applied to Notice to Skippers messages. In case a RIS index would be mandatory according to the current version of the RIS Index Encoding Guide, Germany was required to add 20.000 additional objects to the index. If hectometre marks of waterways would be required to be added, further 80.000 items were to include. Apart from elaboration, maintenance would also require extensive

[121] TEN-T RIS enabled European IWT Corridor Management (CoRISMa), 01/2013 - 12/2015, funded under TEN-T 2007-2013 (2012-EU-70004-S)

resources. Therefore, a method to generate the RIS Index automatically from basic data sources is under development.

Germany does not provide its RIS index to the European Reference Data Management System (ERDMS), which is not required according to the regulation.

In the Czech Republic, the RIS index according to Reg.164/2010 is in use. The index is based on the ENC and available for download on the LAVDIS webpage. The exchange between Czech RIS index and ERDMS was in pilot operation in 2011 and its implementation is planned for the IRIS Europe III project.

7.2.2.4 Future Development

From the analysis of RIS services in place, there is a clear need for development in both countries. However, a deployment schedule was not available to the Consultant, except from the one by the IRIS Europe III project. The objectives and ongoing RIS projects are listed in the following:

Germany

Objectives:

- Continuous improvement of the ELWIS system (user-friendliness, enhancement of functionalities)
- Development of new RIS applications for lock management and calamity abatement support based on AIS data
- AIS is the focus of RIS projects by German administration

Ongoing Projects:

- RIS enabled European IWT corridor management (01/2013 - 12/2015)
- The aim is to develop the definition and implementation of a RIS corridor approach to strengthen the position of inland navigation within the transport chain (Establishment of a structured dialogue between public and private stakeholders across national borders, investigating how to foster the interoperability and compatibility between the different deployed technologies). The aim is to deploy intelligent infrastructure in order to enable the efficient RIS implementation at corridor level. (www.ris.eu)
- PRISE: Port River Information System Elbe – Information platform for the port of Hamburg
- This is an IT platform with all information about incoming and outgoing maritime and inland vessels from involved terminals, pilots, shipping companies, tugs and the port administration.

Finished projects:

- RISING – RIS Services for Improving the Integration of Inland Waterway Transports into Intermodal Chains (www.rising.eu) (02/2009 – 01/2012), ISL Bremen; co-funded by FP7 RTD
- AIS pilot project / Feasibility Study along the Mittelweser between Minden and Bremen, 2010[122]
- Full deployment AIS Transponders Germany/The Nederlands (06/2008 – 12/2012; 2008-EU-70000-P)

The objective is the installation of inland AIS transponders on all vessels longer than 20 metres or vessels operating commercially on main waterways (class IV and

[122] Implementation of AIS into River Information Services For Inland Navigation
Stefan Bober; Wilfried Rink, German Federal Waterways and Shipping Administration,Traffic Technologies Centre; IALA 2010; Maximising the Potential of AIS; Paper p. 3 – 13; Source: http://www.hksoa.org/contents/attachments/technical/IALA%20papers/5%20Maximising%20the%20Potential%20of%20AIS/proceedings%205%20MAXIMISING%20THE%20POTENTIAL%20OF%20AIS.pdf

higher). By doing so, real-time tracking and tracing according to the RIS guidelines will be enabled. (www.ris.eu)

Czech Republic:

- IRIS Europe III
  IRIS Europe III is a multi-beneficiary TEN-T project focusing on the further enhancement and fine-tuning of RIS key technologies, services and applications; in particular, the implementation of new harmonised RIS services. (www.iris-europe.net)

7.2.2.5 Challenges

Germany has implemented a wide range of RIS applications, in general of high quality. The progress with the implementation of a few applications or its roll-out to the complete waterway network will be delayed, as cost-benefit evaluations of certain applications regarding data collection, storage and use were considered.

The German Waterways and Shipping Administration responsible for RIS implementation is limited to applications, which facilitate either its tasks or contribute to safety and ease inland navigation. Another problem for RIS implementation is the limited personnel resources. AIS is in the focus of German RIS applications, aiming to facilitate inland navigation, especially in critical and narrow waterway sections, and increasing safety. At present, AIS is mainly used on spot (i.e. at the site of the bottleneck) for ship-ship communication in order to facilitate coordination of passing arrangements.

To enlarge the area of supervision from spot to larger waterway sections, it has been decided, after a pilot project on the Mittelweser (installed in 2010/2011 and in operation since then), to install an AIS shore base station along selected waterways. This should enable skippers amongst others to coordinate the passing of longer sections with narrow fairways. For OEM Inland waterway sections (Mittellandkanal and Elbe-Seitenkanal), the landside AIS implementation is foreseen until the middle of 2015, while no implementation is foreseen on the Elbe due to ongoing discussion on national classification of the Elbe as inland waterway. The introduction of an obligation for the use of AIS and ECDIS is planned presumably from 2016, so the implementation of the respective infrastructure is mandatory[123].

Another challenge is the RIS implementation in inland ports. A number of inland ports have still not set out necessary steps regarding RIS implementation, although German federal states have amended port regulations in correspondence with the EU RIS Directive. Only a few ports have implemented some services, e.g. Mannheim and Cologne.

There is no specific information available for the Orient/East Med Corridor core network ports in Germany (Hamburg, Bremerhaven, Bremen, Hannover, Braunschweig, and Magdeburg). However, along the Orient/East Med Corridor, authors from the ports of Hamburg, Bremen and Bremerhaven are registered in ELWIS and can publish messages which are relevant for traffic and transport via ELWIS platform.

In the Czech Republic, basic RIS applications have been implemented, but LAVDIS services, such as NtS provision, suffer from the reliability of their operation. A barrier for RIS development is the funding, since public budget for inland waterway and navigation is cut year by year and apart from RIS, other IWW related investments are required, regarded as more important. In addition, vessel operation is rather limited

---

123 Information received from Federal Ministry of Transport, Department Technique of waterway infrastructure and RIS

and vessels have outdated equipment, which reduces potential RIS benefits and hampers the jÚstífication of RIS expenses.

For the Czech core network ports (Děčín, Mělník, Praha) no further RIS development plans are known.

7.2.3 Other TMS Deployment

Other known deployment of Traffic Management Systems concern:

VTMIS Burgas (BG) Phase III; related to the Extension of coverage and functions of VTS, establishment of a national centre for electronic maritime transport data exchange (single window), upgrade of GMDSS; Status: works under construction. Project Manager: State Company for Port Infrastructure; Envisaged finalisation: 12/2014; Cost MEUR 20.0; Funding: Co-funded by EU (ERDF; 2007-2013), State Budget

VTMIS Burgas (BG) Phase IV; Works for implementation of vessel traffic management system / to improve the safety and efficiency of navigation in ports, in accordance with the latest requirements of IMO, IALA and EC; Project Manager: State Company for Port Infrastructure; Scheduled 2015-2018; Costs: MEUR 9.2; Funding: Co-funded by EU, State Budget

Port of Burgas (BG) Port Community System; Study and Works for development of system for management, optimization and automation of logistic processes and multimodal transport; Project Manager: State Company for Port Infrastructure; Scheduled 2015-2019; Costs: MEUR 5.1; Funding: Co-funded by EU, State Budget

Port of Heraklion (EL) - Deployment of VTMIS system; Deployment of Management and Information System plus electronic, services for shipping, including "single-window" and other communications, systems relevant customs information. No timing, Project Manager: Port Authority of Heraklion; Cost: MEUR 1.5; Funding: TBD.

Port of Lemesos - Port Community System; Cyprus Port Authority aims to achieve optimal efficiency in their operation. Along this strategy an integrated Port Community System is considered as crucial component of this strategy. This will simplify and streamline the management of freight especially transhipment and allow exchange of data and interoperability between ICT Systems with other ports. Additionally such systems will enable exchanging data between ports and road network to better manage freight especially hazardous cargo, Envisaged finalization: 2017; Project Manager: Cyprus Port Authority; Cost unknown; Funding: State Budget, EU-cofunding.

For VTMIS deployment, see also chapter 5.2.5.3.

7.3 Other elements

7.3.1 Organizational Recommendations

From an organizational point of view, the practice established by the EC of continuously sharing with the Member States along the Core network corridor the state of project progress, including the outcomes of relevant studies carried out, has proven to be very effective and, thus, should be maintained in the future. Furthermore, the various projects presented by the Member States could be accompanied not only by traffic forecasts and a cost-benefit analysis, but also by:

- A statement of defined commitments made by the Member states on the relevant accompanying measures necessary to meet the traffic targets (in particular for freight);
- An outline of alternative solutions to the proposed projects, each one indicating the specific investment required, as well as maintenance costs and operational benefits (e.g. travel time savings, capacity increase etc.). Indeed, only an increased awareness of the concrete operational effects can help in evaluating the pertinence of the investment and the likelihood of the expected traffic level;
- Southern Corridor's Countries are advised to develop a supporting rail policy on terminal development and on intermodal policy, while establishing a rail freight market open to newcomers.

In addition, the definition of the investments needed should take in consideration the freight-oriented nature of the Corridor: rail freight interoperability investments that allow for fluid freight traffic may be rendered more appropriate than investments focused on reaching high levels of speed.

7.3.2 Recommendations to Resilience and Environmental Impacts

Climate change is expected to increase the intensity and frequency of extreme weather events at global level in the next decades. In particular, heat waves are predicted to be more severe, storms will likely be more intense and sea level rise might amplify storm surges in coastal areas. These changes in the long-term weather patterns may negatively affect transportation systems in Europe as well as globally, increasing the risk of damages, disruptions and delays and failures on roadways, railways, air and marine transport infrastructure. Some impacts might be the following:

- **Roadways:** Higher temperatures may cause pavement to soften and expand, leading to rutting, potholes and stressed bridge joints. As a result, the cost to build and maintain roadways could increase. Increased heavy rains and storms may lead to flooding and result in disrupt traffic, delay construction activities and weaken the soil that supports roads and bridges. As a consequence, roads' life expectancy may shorten and more frequent maintenance and repairs could be required in the future.
- **Railways:** High temperatures are responsible for rail tracks to expand and buckle, requiring track repairs or speed restrictions to avoid derailments. Delays and disruption are predicted to occur also due to heavy precipitations.
- **Air transportation:** periods characterised by extreme heat are expected to cause cargo restrictions, flight delays and cancellations to airplanes, while flooding may result in damaged facilities (e.g. airstrips).
- **Marine transportation:** Sea level rise may be able to accommodate larger ships along shipping lanes, reducing shipping costs, but it will reduce clearance under water bridges while flooding could close shipping channels.

Climate Change is predicted to show its consequences at global level. However, some regions of the world will be more affected than others, while some areas might be positively affected by the changes in the weather pattern. Mitigation and adaptation measures should be taken in advance by Member States and local agencies to protect transportation systems from climate change impacts. In general terms, some adaptation approaches to this end might include:

- Raising awareness about critical infrastructure protection issues;
- Changing construction and design standards of transportation infrastructure;
- Abandoning or rebuilding important infrastructure in less vulnerable areas.
- Performing risk analysis and specify related adaptation to climate change measures

8 Appendix

Annex 1: Fulfilment of TEN-T Technical Parameters
Annex 1a: Rail Infrastructure Compliance Test 2013
Annex 1b: IWW Infrastructure Compliance Test 2013
Annex 1c: Road Infrastructure Compliance Test 2013

Annex 2: Lists of Reviewed Documents
Annex 2a: List of Multinational Projects and Studies
Annex 2b: Documents related to CEF Projects
Annex 2c: List of National Projects and Studies

Annex 3: Maps of the Corridor

Annex 4: Review of Port Demand studies

Annex 5: List of Projects per Transport Mode

Annex 6: ERTMS Deployment Plan

Annex 7: Review of most important corridor related studies

Annex 8: List of Stakeholders

Annex 9: Bottleneck Mitigation Analysis